

**United States Army  
Northern Warfare Training Center**

**Cold Weather (CWLC, CWOC & CWIC)  
Student Handout**

**Winter 2015-2016**



***“Battle Cold and Conquer Mountains”***

*Version 1 September 2015*

## Table of Contents

|                 | <i>Subject Area</i>  | <i>Page Number</i> |
|-----------------|--|--------------------|
| <b>Lesson #</b> | <b>Lesson Title</b>  |                    |
| 699-8010        | Analyze Terrain in Cold Regions  | 1                  |
| 699-8011        | Analyze Weather in Cold Regions and Mountainous Terrain  | 15                 |
| 699-8012        | Protect Yourself and Fellow Soldiers in Extreme Cold Weather   | 36                 |
| 699-8013        | Prevent Cold Weather Injuries  | 69                 |
| 699-8014        | Prevent Altitude Illness   | 89                 |
| 699-8015        | Prevent Environmental Injuries   | 96                 |
| 699-8016        | Evacuate a Hypothermic Casualty  | 103                |
| 699-8017        | Manage Risk in Cold Regions Operations   | 108                |
| 699-8018        | Plan a Small Unit Movement Over Snow Covered Terrain   | 120                |
| 699-8019        | Move Over Snow on Snowshoes  | 138                |
| 699-8020        | Employ an Ahkio Sled   | 143                |
| 699-8021        | Operate a Space Heater Arctic  | 151                |
| 699-8022        | Employ an Arctic Ten Man Tent  | 168                |
| 699-8023        | Operate a Squad Stove  | 174                |
| 699-8034        | Operate a Squad Lantern  | 182                |
| 699-8024        | Operate a H-45 Space Heater  | 185                |
| 699-8025        | Occupy a Patrol Base in Cold Regions   | 200                |
| 699-8026        | Construct Improvised Shelters  | 215                |
| 699-8027        | Move Safely in Avalanche Terrain   | 224                |
| 699-8028        | Perform Weapons Maintenance in Extreme Cold Weather  | 258                |
| 699-8029        | Employ Individual Camouflage in a Snow Covered Environment   | 266                |
| 699-8030        | Engage Targets in a Snow Covered Environment   | 270                |
| 699-8032        | Construct a Fighting Position in a Snow Covered Environment  | 280                |
| 699-8033        | Operate a Military Vehicle in Extreme Cold Weather   | 289                |
| 699-8001        | Pack a Rucksack  | 298                |
| Appendix A      | Ahkio components and Army Approved Heaters   | 301                |
| Appendix B      | NSN's of Cold Weather Equipment  | 305                |
| Appendix C      | USARAK REG 750-1 Maintenance of Supplies and Equipment   | 308                |
| Appendix D      | USARAK REG 750-4 Cold Weather Lubricants   | 328                |
| Appendix E      | Tire Chain Placement   | 335                |
| Appendix F      | Install Tire Chains on HMMWV   | 336                |
| Appendix G      | SUSV Winch Operation.  | 340                |
| Appendix H      | CG Policy Letter 14  | 343                |
| Appendix I      | USARAK Nine Line MEDEVAC   | 346                |
|                 | Cold Regions Application:<br><a href="https://play.google.com/store/apps/details?id=com.mcoe.coldregion">https://play.google.com/store/apps/details?id=com.mcoe.coldregion</a><br>(Android)                        |                    |
|                 | Tent & Stove Drill Application:<br><a href="https://play.google.com/store/apps/details?id=com.mcoe.tentandstove">https://play.google.com/store/apps/details?id=com.mcoe.tentandstove</a><br>(Android)              |                    |
|                 | Soldier Sustainment Application:<br><a href="https://play.google.com/store/apps/details?id=com.mcoe.soldiersustainment">https://play.google.com/store/apps/details?id=com.mcoe.soldiersustainment</a><br>(Android) |                    |
|                 | Warrior University link:<br><br><a href="https://www.warrioruniversity.army.mil/training-wiki/-/wiki/main/mcoe+apps">https://www.warrioruniversity.army.mil/training-wiki/-/wiki/main/mcoe+apps</a>                |                    |
|                 | Center for Army Lessons Learned website:<br><a href="http://usacac.army.mil/core-functions/lessons-learned">http://usacac.army.mil/core-functions/lessons-learned</a>  |                    |

**SECTION II. INTRODUCTION**

**Motivator** You must understand the significant impact that the terrain in cold regions can have on military operations in winter months and the significant impact that this terrain can have on your ability to maneuver throughout the year. 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.

**Terminal Learning Objective**

|                  |   |
|------------------|---|
| <b>ACTION</b>    | Analyze Terrain in Cold Regions   |
| <b>CONDITION</b> | In a classroom or field environment in a cold region, and a map sheet of the route/location.                                      |
| <b>STANDARD</b>  | Analyze the 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 for classroom instruction.

**Environmental Considerations:** None

**Evaluation:** You will be tested on your knowledge of cold regions 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 block of instruction provides you with the tools to conduct terrain analysis of cold regions.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Define the acronym OAKOC.

a. 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.

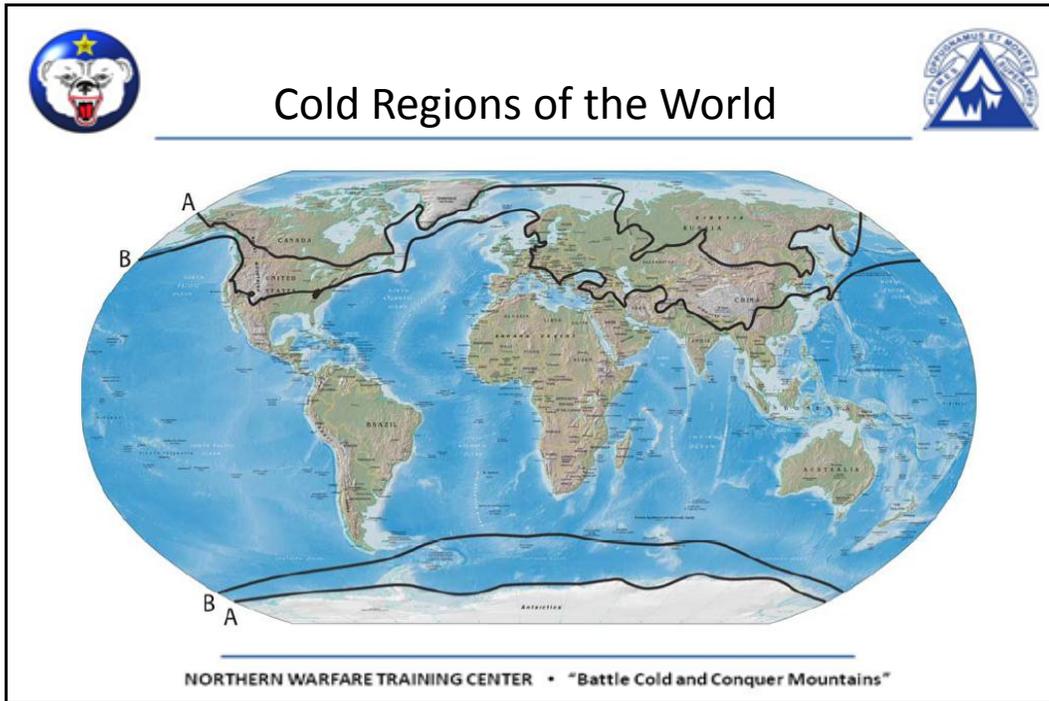
(b) Concealment might be provided by terrain features, vegetation (such as wood, underbrush, or cultivated vegetation), or any other feature that denies observation. Concealment does not necessarily provide cover.

b. Cold regions have peculiar terrain features that can affect military operations. We must understand these features before we can effectively analyze terrain in cold regions.

**Learning Step/Activity 2 – Define cold regions.**

a. About one quarter of the Earth's land mass may be termed severely cold. This is indicated by the area above line A in the Northern hemisphere and below line A in the Southern Hemisphere. Mean annual air temperatures are below freezing, maximum snow depths exceed 60 cm and lakes and rivers are ice covered for more than 180 days each year. Another quarter of the Earth is termed moderately cold (including most of the United States and Eurasia) where mean temperatures during the coldest month are below freezing.

b. Many methods have been used to define the limits of cold weather areas. The description I just provided is one used by research scientists at the Cold Regions Research and Environmental Laboratories (CRREL). **For military purposes, cold regions operating environment is defined as any region where cold temperatures and snowfall have a significant effect on military operations for one month or more each year.**



c. The army groups cold temperatures into five zones..

(1) **Wet Cold +39 to +20**, This zone is characterized by heavy wet snow and rainfall. Freeze/thaw cycles are near constant. As a result mobility can be challenging because of muddy conditions. Soldiers will be wet for long periods of time which can make immersion syndrome and hypothermia a frequent occurrence. Maritime zones are usually cold-wet.

(2) **Dry Cold +19 to -4**, Dry cold is easier for Soldiers to live in. The snow is lighter and usually dry and freeze thaw cycles are less frequent. This keeps Soldiers from staying wet and allows vehicle movement. Continental areas are dominated by dry cold

(3) **Intense Cold -5 to -25** The ground is usually frozen until springtime. Soldiers will begin to lose attentiveness as the temperatures drop. "Cocooning" will begin to take over. Equipment will also suffer not only from the cold but by neglect.

(4) **Extreme Cold -25 to -40** Comfort and survival become the focus. Leadership is seriously challenged.

(5) **Hazardous Cold below -40** Units must scrutinize all operations. These operations may be limited to life-support functions.

**Learning Step/Activity 3 – Describe the terrain and weather characteristics of the arctic, sub-arctic and temperate sub-regions.**

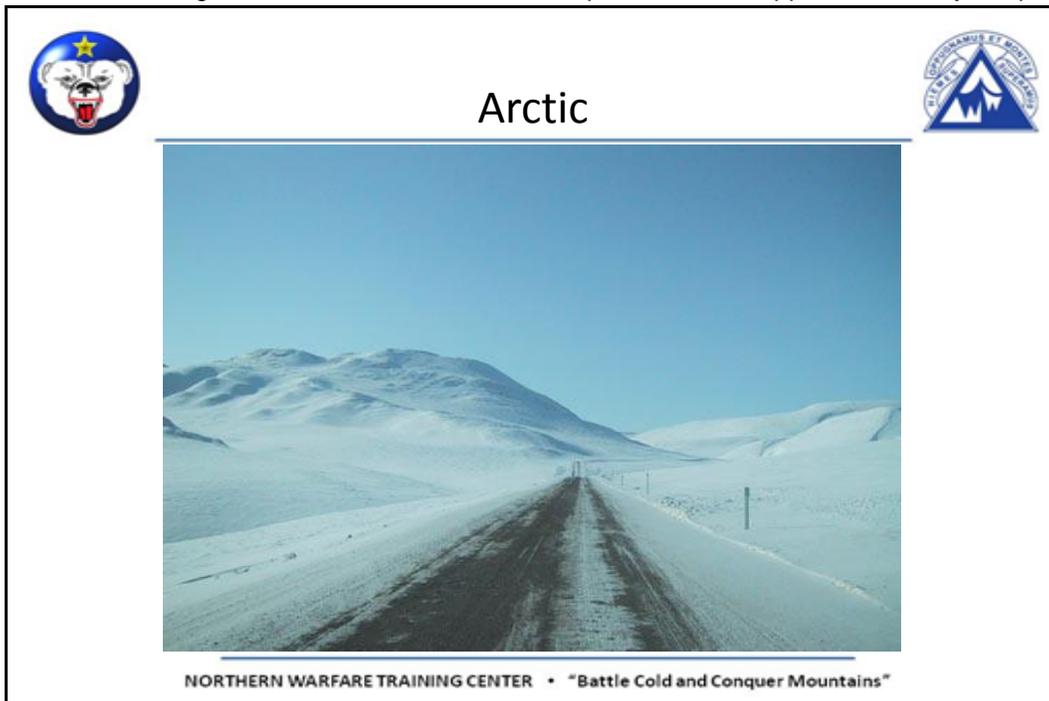
a. Cold regions are present in both the Northern and Southern Hemispheres. The Southern Hemisphere includes Antarctica, Patagonia and the Andes. In the Northern Hemisphere, cold regions are broken down into three sub-regions – **temperate, sub-arctic and arctic**. These sub-regions are military simplifications of biomes (a classification system that is based on latitude and climate that is commonly recognizable on a global scale), that include arctic, sub-arctic, and temperate cold biomes.

The Arctic Circle is an arbitrary line located at 66 ° 33' N latitude that defines the southernmost portion of the arctic sub-region.

b. Mountains can be found in all three sub-regions and can significantly complicate operations in cold regions. All mountains and mountainous regions that receive a predictable amount of snowfall should be treated as a cold region.

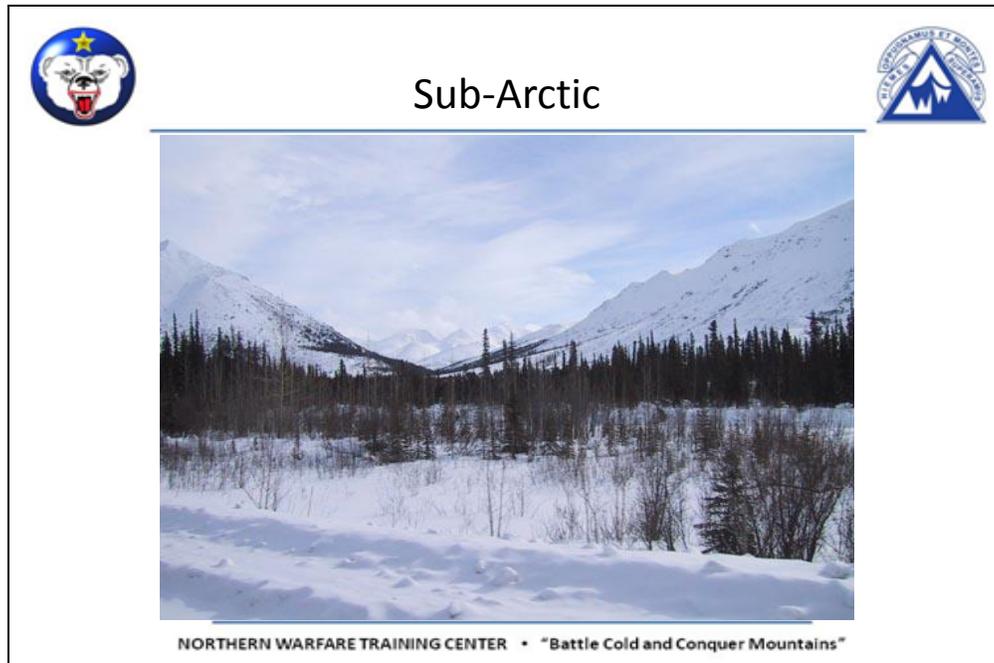
c. In winter, the arctic is a cold dry climate, with sparse snow cover that lasts up to nine months each year. The arctic is characterized by vast treeless areas, few roads or urban areas, and extensive bog areas, lakes and rivers. During the midwinter months, the sun never rises; in the summer months there are 24 hours of daylight. Sustained high winds and blowing snow are common. Winter temperature range is -19° to -26° F. Summer temperature range is 44°-51° F. Summers experience cold-wet conditions.

d. A typical view of the Arctic region in late winter/early spring. Note the single lane road and rolling terrain with no visible vegetation. Also note that the snow pack does not appear to be very deep.

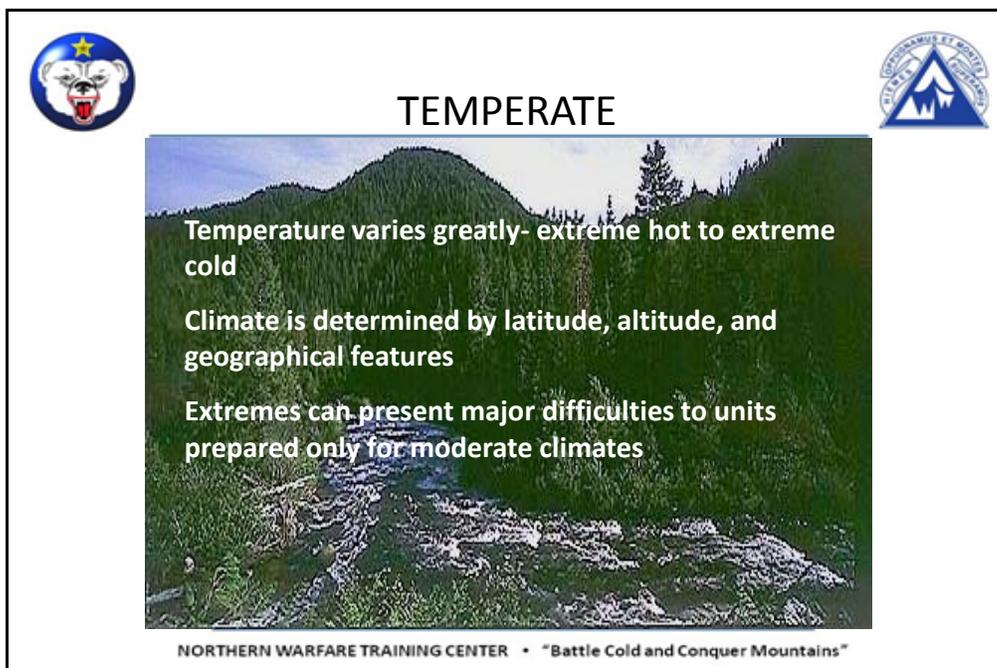


e. The sub-arctic is the area south of the Arctic Circle typically characterized by dense boreal forests, limited road networks and urban areas and extensive bog area, lakes and river networks. Winter temperature ranges are from -15° F to -19° F, with a North American record low of -81° F (Snag, Yukon Territory). Low winter temperatures are affected by the lack of sunlight with only four hours of sun on the shortest day. Snow cover exists for at least 6 months in the lowlands; surrounding mountains can have perennial snow cover. Summer temperatures range from 66°-73° F. Strong winds are common.

f. This is an area just south of the Black Rapids Training Site (sub-arctic) taken in late winter. Note the mountainous terrain in the background, the dense spruce forests and deeper snow pack.



g. The temperate sub-region varies greatly and includes maritime and continental zones, heavily forested areas, mountain ranges, deserts and plains areas. The effects of cold on military operations in this region are generally short term, but these effects can be catastrophic for unprepared units.



h. Mountains can be found in all three sub-regions and can significantly complicate operations in cold regions. All mountains and mountainous regions that receive a predictable amount of snowfall should be treated as a cold region. Mountains are obstacles to transportation and communication. Delays to re-supply operations or casualty evacuation are common due to frequent bad weather. Small unit operations are more effective; however, they need to be more self-sufficient due to the difficulty of re-supply, casualty evacuation etc.



## Mountainous Terrain

**Compounds the difficulties of fighting in cold regions**

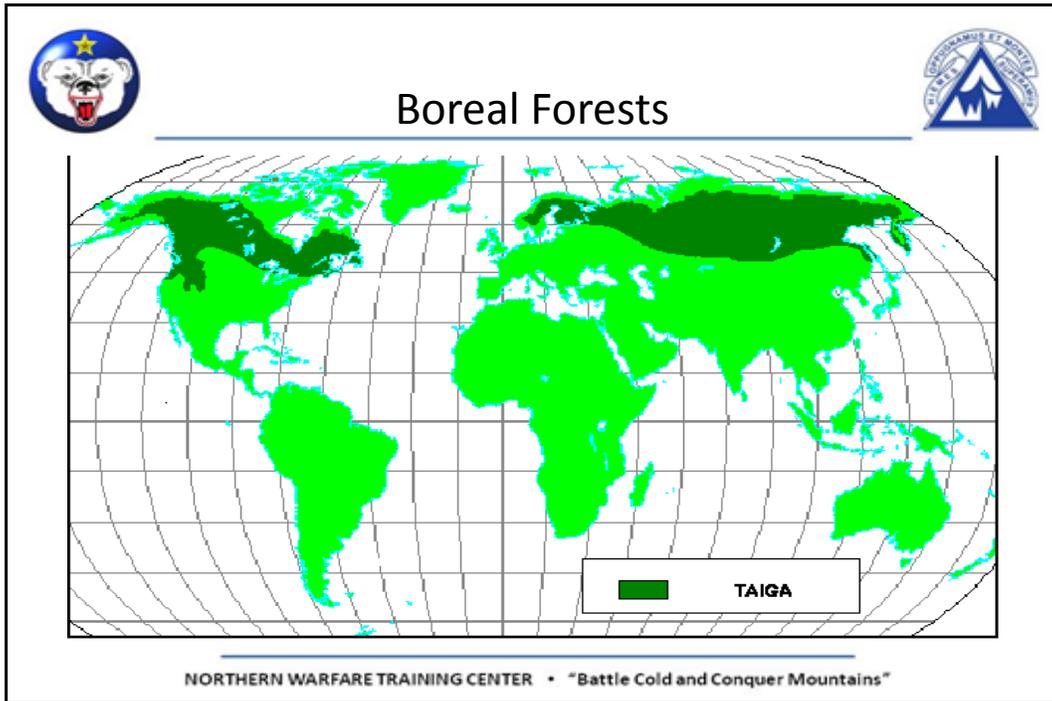
- Weather is difficult to predict**
- Presents obstacles to ground and air operations**
- Re-supply and casualty evacuation are often not possible by air or vehicle**
- Best terrain for small, self-supported units**



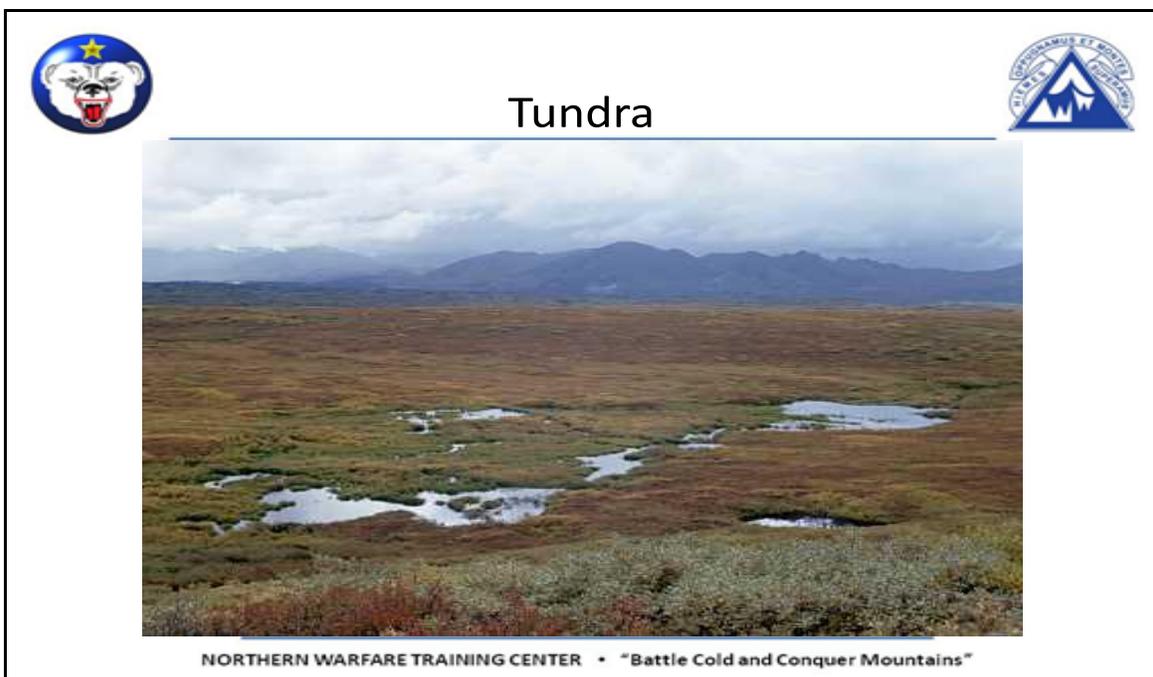
NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

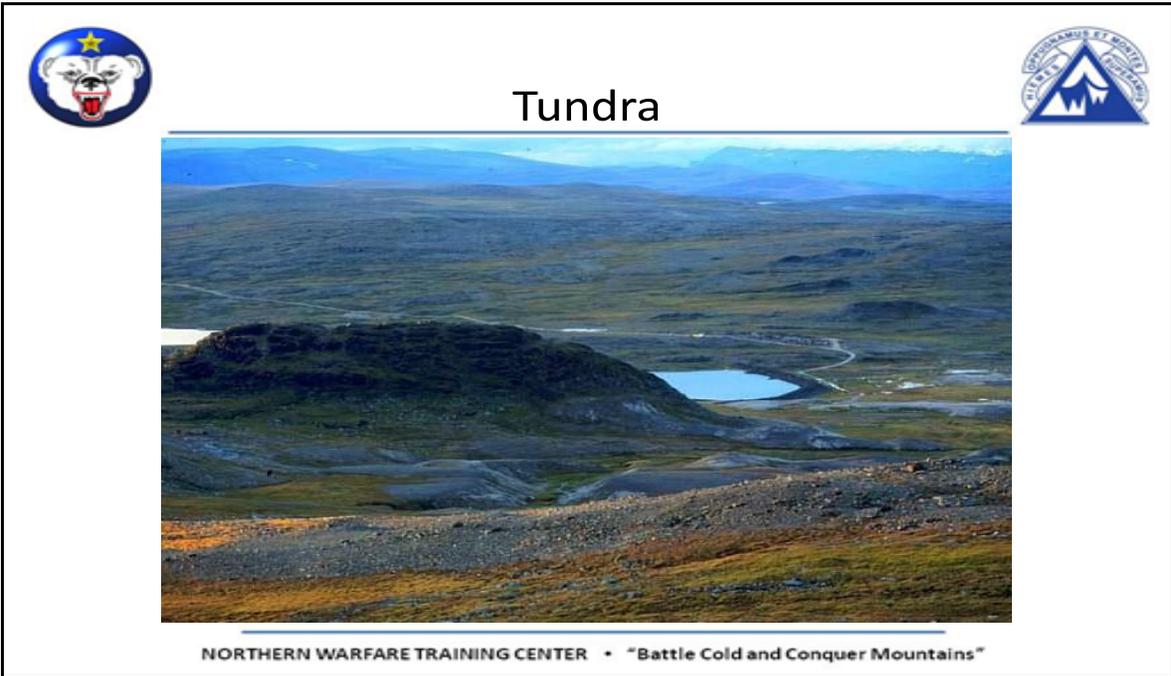
i. The arctic and sub-arctic have unique terrain characteristics that can significantly impact military operations.

j. Thick **boreal forests**, also known as **Taiga**, are vast areas in which evergreen spruce and firs are the dominant plant life; it is also the northernmost area where trees can exist. Boreal forests exist in both the arctic and sub-arctic. The extent of these forests diminishes the further one moves north. Also, the tree line (with respect to elevation) is generally very low and transitions to treeless areas can occur at elevations as low as 2,000 feet. Treeless areas are generally characterized as tundra.



k. **Tundra** is an area where tree growth is hindered due to low temperatures and a short growing season. Tundra is the norm in the arctic. It covers much of the arctic region in lieu of forests. In the sub-arctic it exists where the elevation increases. Tundra is made up of various grasses and mosses. Vegetation often develops into clumps with standing pools of water between them –these are known as **tussocks** and make mounted and dismounted movement extremely difficult during the summer and during freeze thaw periods. The tundra has been known to swallow vehicles as they sink into the swampy ground. Movement is easier in the winter when the ground is frozen. Even with the frozen ground of winter, vehicular movement is generally restricted to roads; movement on tundra can quickly turn into a vehicle recovery operation. Drainage in these areas is typically poor due to the permanently frozen ground that exists under the tundra – this is known as **permafrost**.





l. Permafrost is permanently frozen ground that occurs when the ground temperature is 32°F or colder for 2 or more years. It is continuous in the Arctic, discontinuous in the sub-arctic, and non-existent in the temperate region.

m. The thickness of permafrost varies from a few feet to over a thousand feet in depth. Tundra prevents the thawing of permafrost. In areas where permafrost is present fighting positions will have to be built above ground unless engineer support is available. The frozen ground prevents the draining of water, contributing to the formation of muskeg.

n. Muskeg is a type of bog or wetland found in poorly drained areas underlain with permafrost. Muskeg develops in areas with abundant rainfall and cool summers. Trapped by underlying permafrost, water moves little or not at all. Acid from slowly rotting plants accumulates in stagnant water and lowers soil pH. Black spruce (mainly in the sub-arctic), sphagnum moss, and sedges thrive in this cold, wet, acidic soil. Sedges replace grasses which prefer warmer, dryer conditions. The ground is usually soft and spongy or it can be a vast shallow swamp.

Again movement is difficult in the summer but gets easier in the winter when the ground is frozen. These areas are often difficult to detect in early or late winter when the ground is only partially frozen, and can become traps for vehicles that attempt to move through them.

o. This helicopter landed on what looked like a trail. It was a muskeg swamp used in winter as a trail. Temperatures were below freezing, but as it was early winter the ground was not frozen completely. The helicopter sunk into the muskeg and became stuck. Temperatures dropped overnight and the helicopter froze into the muskeg. It took significant effort to free the stuck helicopter.



A crane was used to hoist the helicopter out after chainsaws were used to cut the frozen muskeg and ice around the helicopter.



Stryker stuck in muskeg.



p. Glaciers are rivers of ice and snow that develop by the perennial accumulation of snow in a valley or draw. The accumulated snow turns to ice through compression forces over time. The flow or movement of glaciers is caused by gravity; they glide over a layer of melt-water between the underside of the glacier and the underlying surface of the earth. Glaciers and polar icecaps cover 10% of the earth's surface. Alaska contains 2% of the total glaciers and glaciers are typically found in mountainous regions of the sub-arctic and temperate areas. Glaciers are the highway into the mountains, normally being easier and safer to negotiate than the surrounding ridges and peaks however specialized training and equipment is required to safely negotiate glaciers.

q. The Kahiltna and surrounding glaciers.



## Glaciers and Ice Caps



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

r. Rivers found in cold regions may aid movements or be major obstacles, depending upon the time of year. Arctic/Sub-Arctic rivers are usually glacier-fed, with many braided channels and swift currents. Glacier-fed rivers change course frequently, making river navigation difficult, and rendering map data suspect. 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 freeze from the bank to the center and thaw opposite. Thicker ice is generally close to the banks and areas with slower water flow. Overflow must be considered.



## Rivers



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"



## Rivers



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

s. Overflow ice occurs where a layer of ice ruptures and water underneath it flows up through to the surface. Two conditions must exist for overflow to occur. First temperatures must be below freezing and the water under the ice must be under pressure.. As a water source freezes it does so from the top down. This can reduce the space for water and create pressure which forces water to come through a weak spot and flow across the surface of the ice. This can occur throughout the winter, despite extremely cold temperatures. It can re-freeze and rupture many times creating layer upon layer of ice and as it flows toward the edge of the ice it builds outward. This can create a significant obstacle along roadways requiring Engineer support to clear. Snow can also mask the presence of overflow and create a significant hazard. Sometimes the snow will have a grayish appearance and you can scrape it away and find liquid water. In very cold temperatures there may be a bit of steam rising off the ice. This is a sure sign of overflow.



This creek is only 3 feet wide and approximately 1 foot deep under normal flow conditions in the summer. Overflow has caused the area to swell to 70 feet wide and approximately 2 feet of ice built up.

**SECTION IV. SUMMARY**

Your ability to analyze the terrain will help you to plan an effective mission and manage risk in the cold weather environment. You now have a basic understanding of some of the hazards and terrain peculiarities in cold regions; this knowledge will be important to you in later lessons as you learn to move, shoot and communicate in the cold weather environment.

**Check on Learning.**

1. In the arctic and sub-arctic, what obstacles are typically present?

Muskeg, tundra, permafrost, glaciers swift, glacial fed rivers, deep snow pack.

2. What Cover and Concealment/Observation Fields of Fire possibilities exist in the arctic and sub-arctic?

In the arctic, tundra offers little cover or concealment. Intravisibility lines (IV lines), and drainages may be the only cover or concealment available. Arctic and sub-arctic areas of boreal forest can offer excellent concealment possibilities and average cover depending upon the types of trees present.

Observation and field of fire is typically excellent in the arctic except where boreal forests exist. To achieve good observation/fields of fire in boreal forests, it may be necessary to gain high ground.

## SECTION II. INTRODUCTION

**Motivator** *“Climate is a dynamic force (in the Russian expanse); the key to successful military operations. He who recognizes and respects this force can overcome it; he who disregards or underestimates it is threatened with failure or destruction. In 1941 the Wehrmacht did not recognize this force and was not prepared to withstand its effects. Crisis upon crisis and unnecessary suffering were the result. Only the ability of German soldiers to bear up under misfortune prevented disaster. But the German Army never recovered from the first hard blow.”*

*Former German Army Group Commander, Eastern Front WWII*

### Terminal Learning Objective

|                  |  |
|------------------|--|
| <b>ACTION</b>    | Analyze Weather in Cold Regions and Mountainous Terrain  |
| <b>CONDITION</b> | Given a training mission that involves a specified route or location on the ground or a map in a cold 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. |
| <b>STANDARD</b>  | 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.  |

**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 of weather. Weather information can be hard to come by in cold 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 to prepare your Soldiers for the worst.

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

**Risk Assessment:** Low for classroom instruction.

**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.

### SECTION III. PRESENTATION

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

a. Weather Basics: The earth is surrounded by an atmosphere that is divided into several layers. The earth'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

b. **The Sun** 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.

c. **Air Movement.** 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.

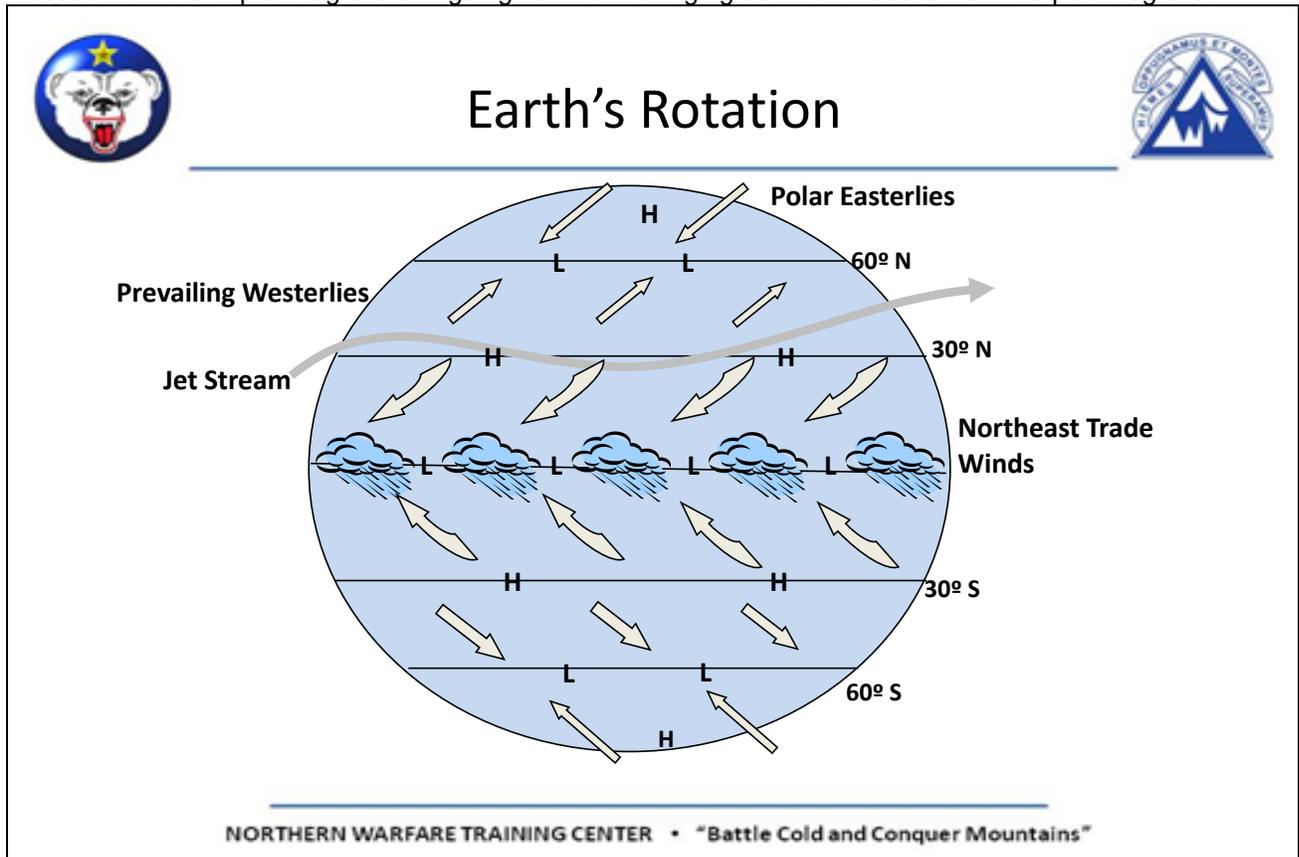
(7) The higher in altitude you go, the lower the air pressure will be.

d. **The Earth's Rotation.** (Picture 1) 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.



Picture 1

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

- (1) Maritime – over water
- (2) Continental – over land
- (3) Polar – north of 60 degrees north latitude
- (4) Tropical – south of 60 degrees north latitude

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

- (1) Continental polar – cold, dry air mass
- (2) Maritime polar – cold, wet air mass
- (3) Maritime tropical – warm, wet air mass
- (4) Continental tropical – warm, dry air mass

g. For general planning purposes, you should consider if the area is influenced by a large land mass or a large body of water.

(1) **A maritime zone** is influenced by a large body of water, be it an ocean or large lake. Typically, maritime zones have 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.

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

i. **Fronts.** 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.

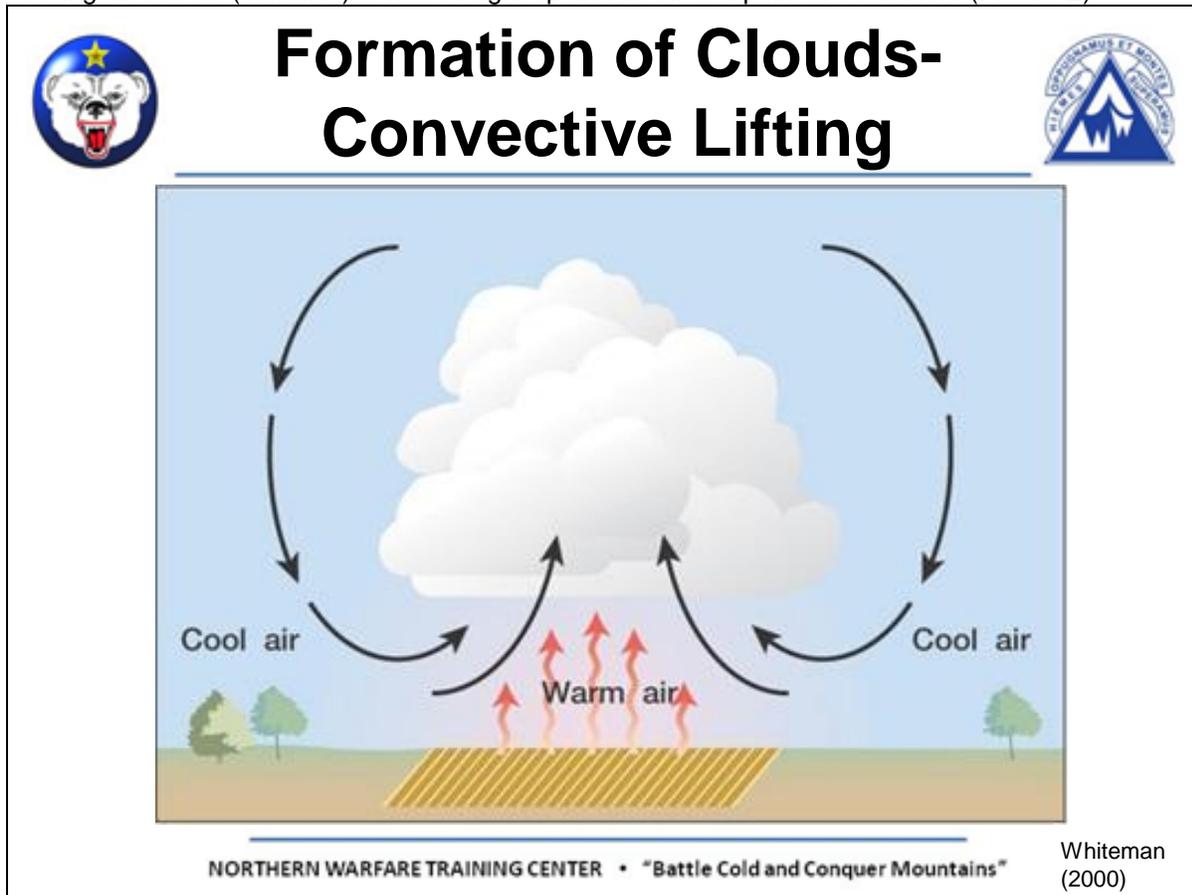
j. **Clouds** are indicators of weather conditions. By reading cloud shapes and patterns, you can forecast weather without any extra equipment. Any time air is cooled or lifted beyond its saturation point (100 percent relative humidity), clouds are formed.

(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 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 68° F, but if the air is dry and does not hold much moisture, dew may not form until the temperature drops to 32 ° F or even below freezing in which case you see frost.

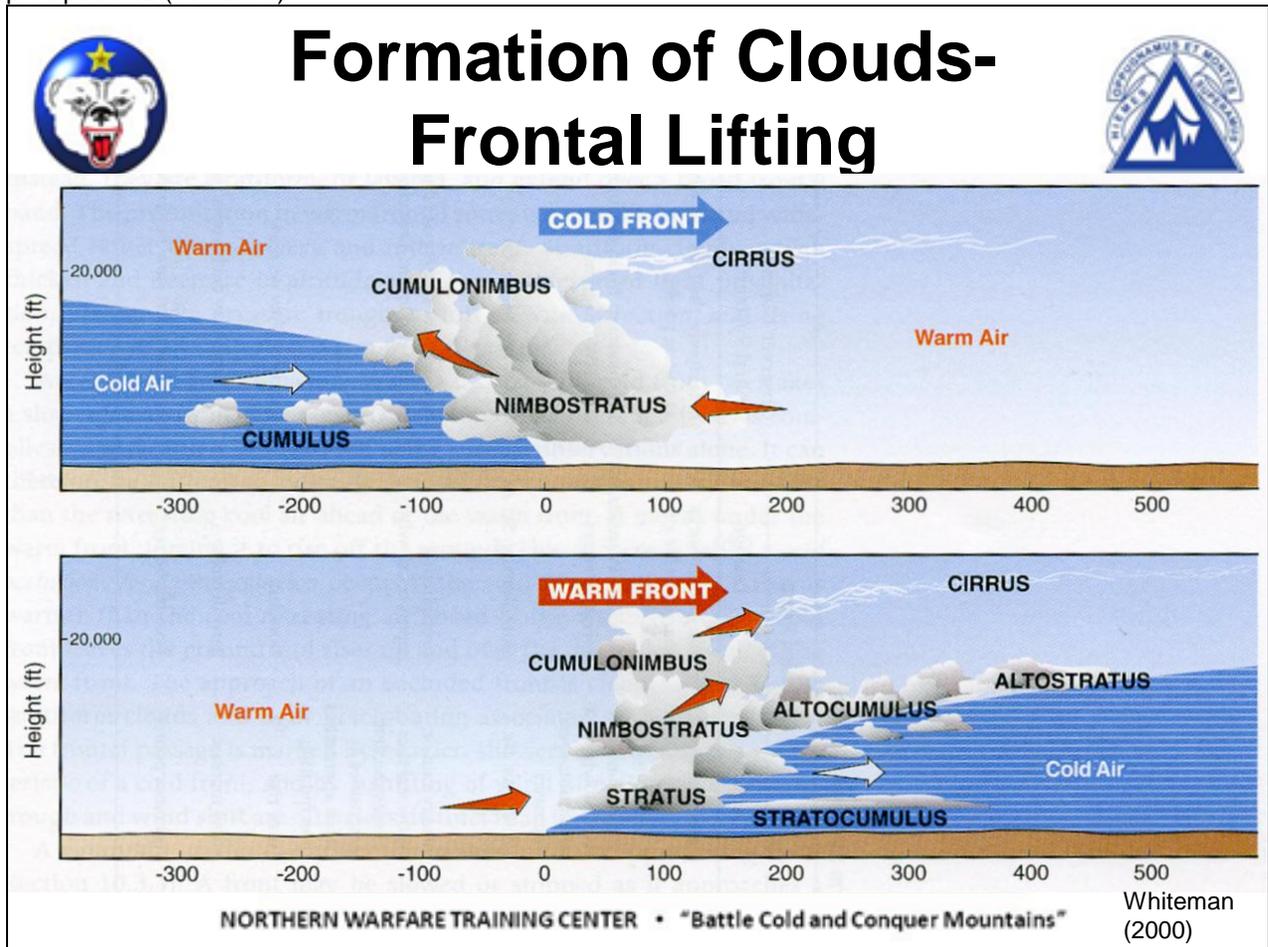
k. The four ways that clouds are formed are:

(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. (Picture 2)



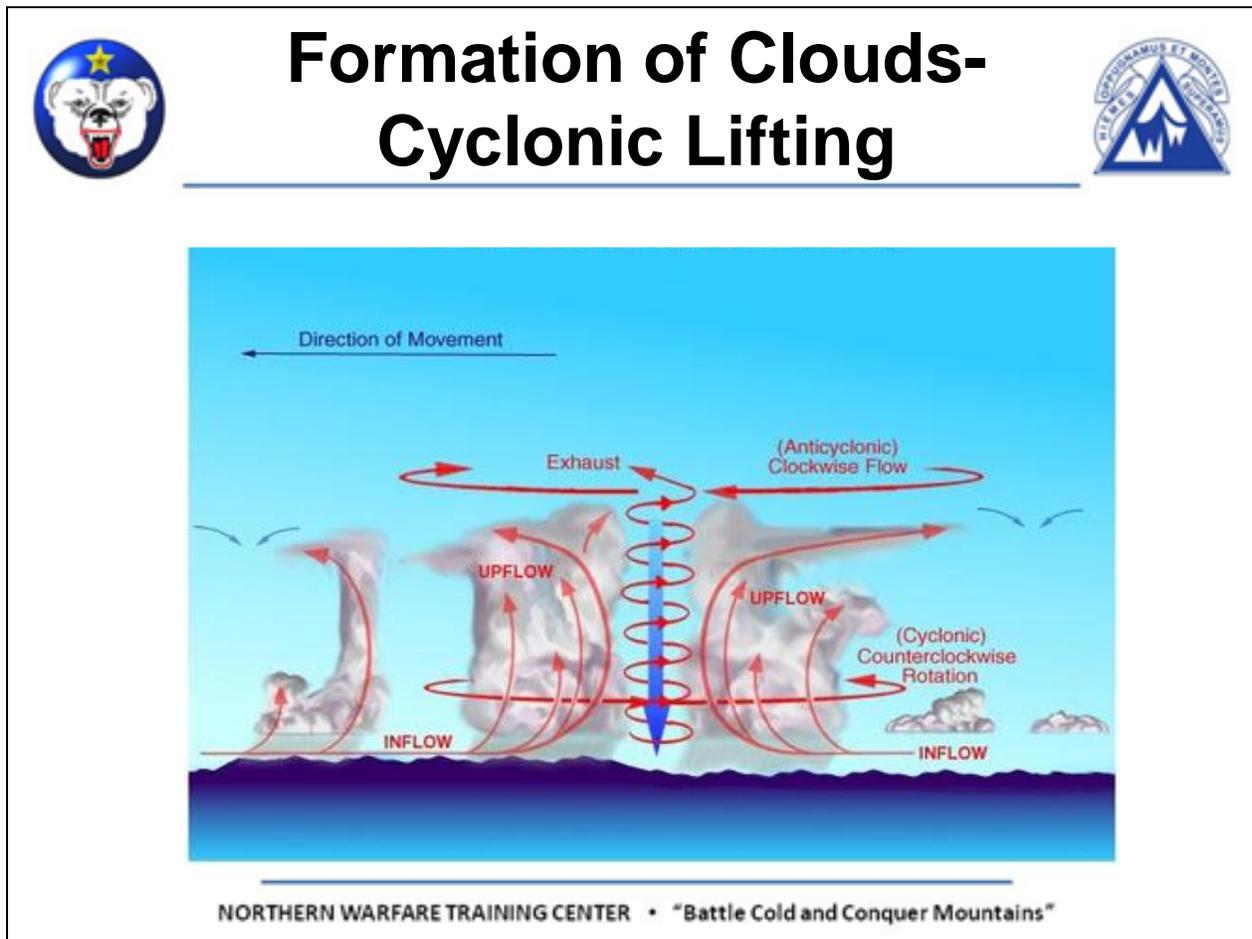
Picture 2

(2) **Frontal Lifting.** A front is formed when two air masses of different moisture content and temperature collide. Air masses will not mix, so 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. (Picture 3)



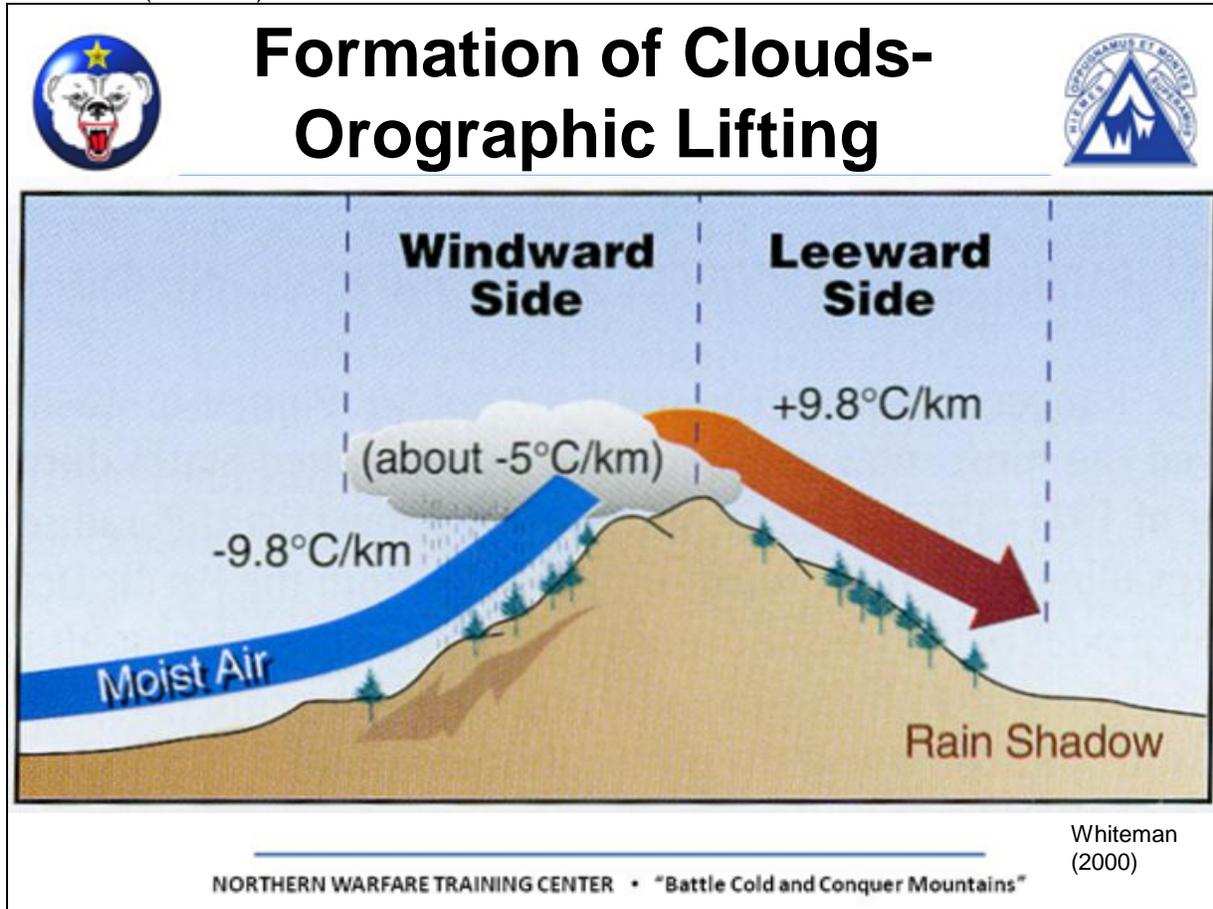
Picture 3

(3) **Cyclonic Lifting.** An area of low pressure pulls air into its center from all over in a counterclockwise direction. When 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. (Picture 4)



Picture 4

(4) **Orographic Lifting.** 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. (Picture 5)



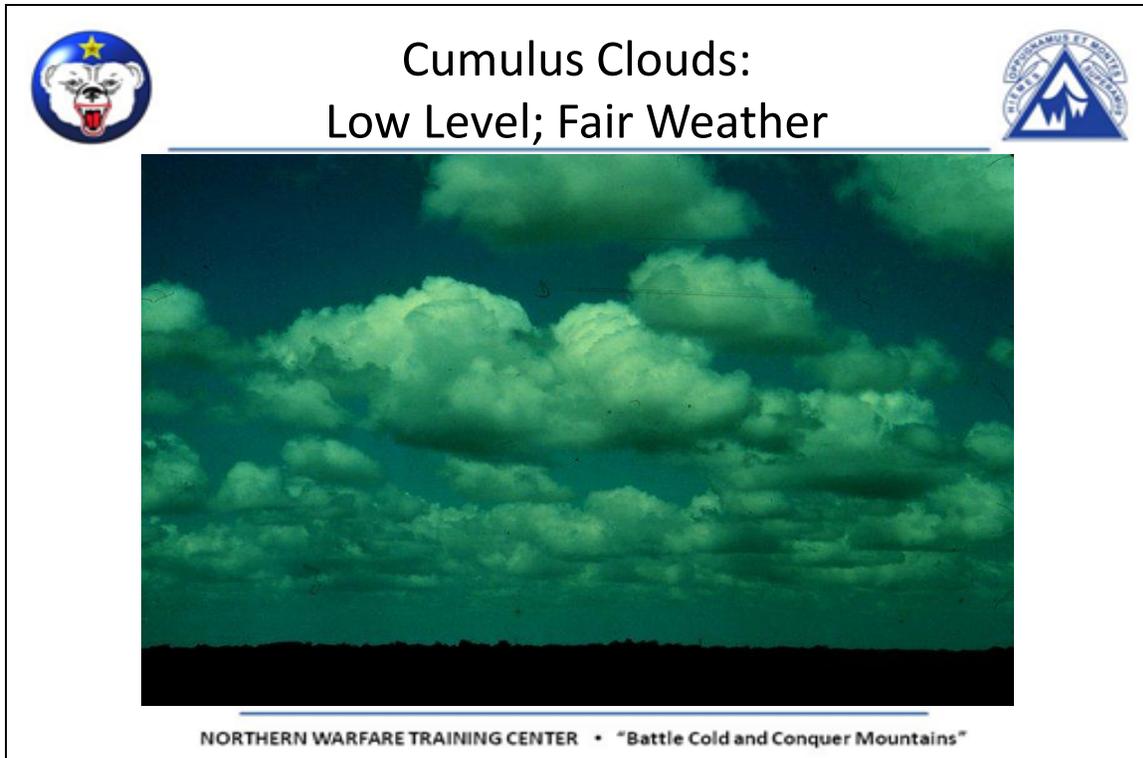
Picture 5

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

a. 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.

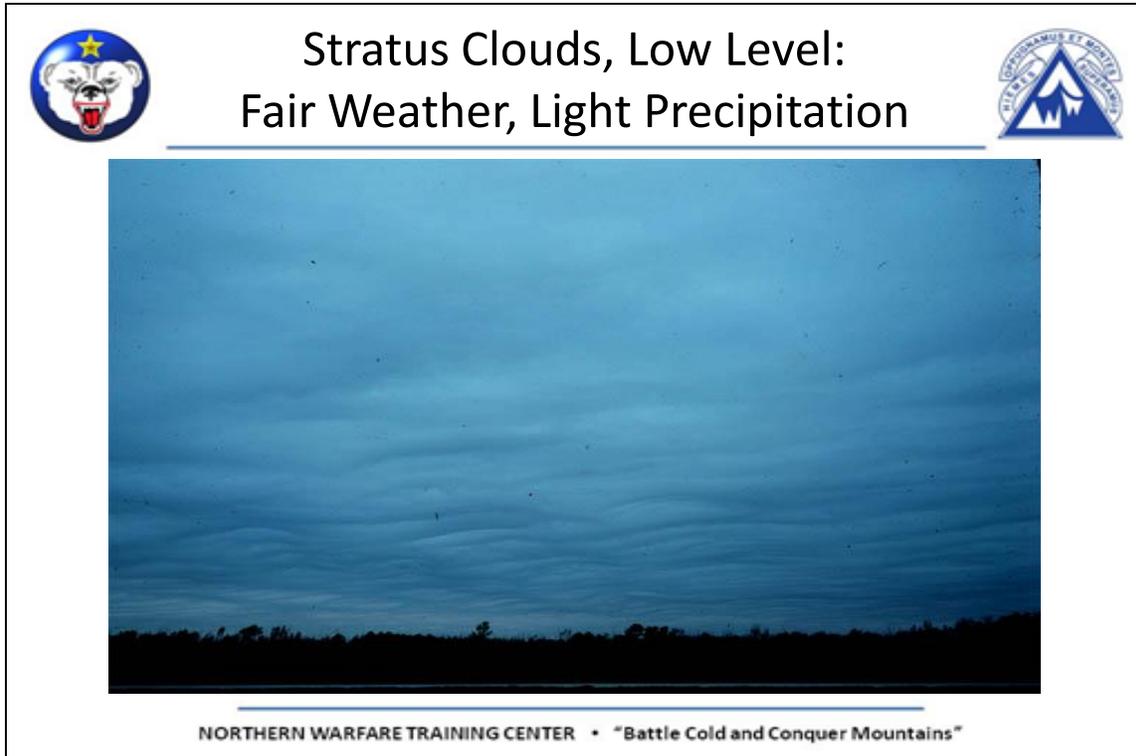
b. **Low level clouds** (0-6,500 feet) are either cumulus or stratus. Low-level clouds are composed mainly of water droplets since their bases lie below 6,500 feet. When temperatures are cold enough, these clouds may also contain ice particles and snow. Low-level clouds may be identified by their height above nearby surrounding relief of known elevation. Most precipitation originates from low-level clouds 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.

(1) **Cumulus clouds** (Picture 6) indicate fair weather. These clouds resemble cotton balls.



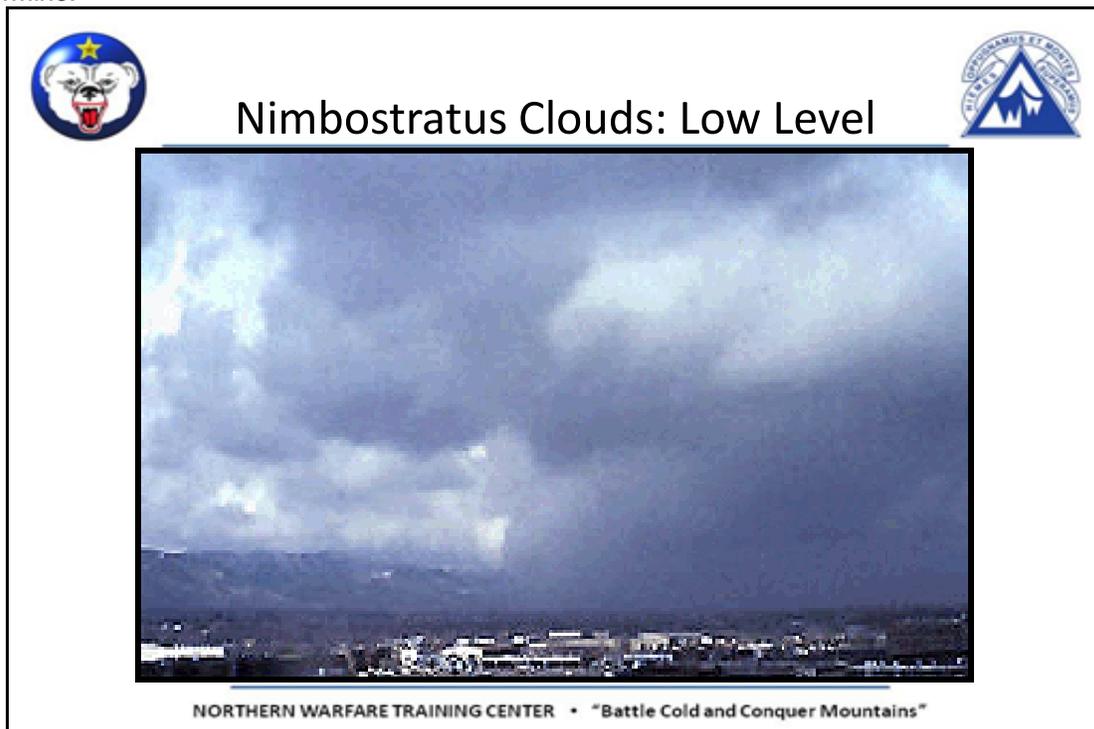
Picture 6

(2) **Stratus clouds** (Picture 7) indicate fairly stable weather. These clouds resemble a sheet thrown over the sky.



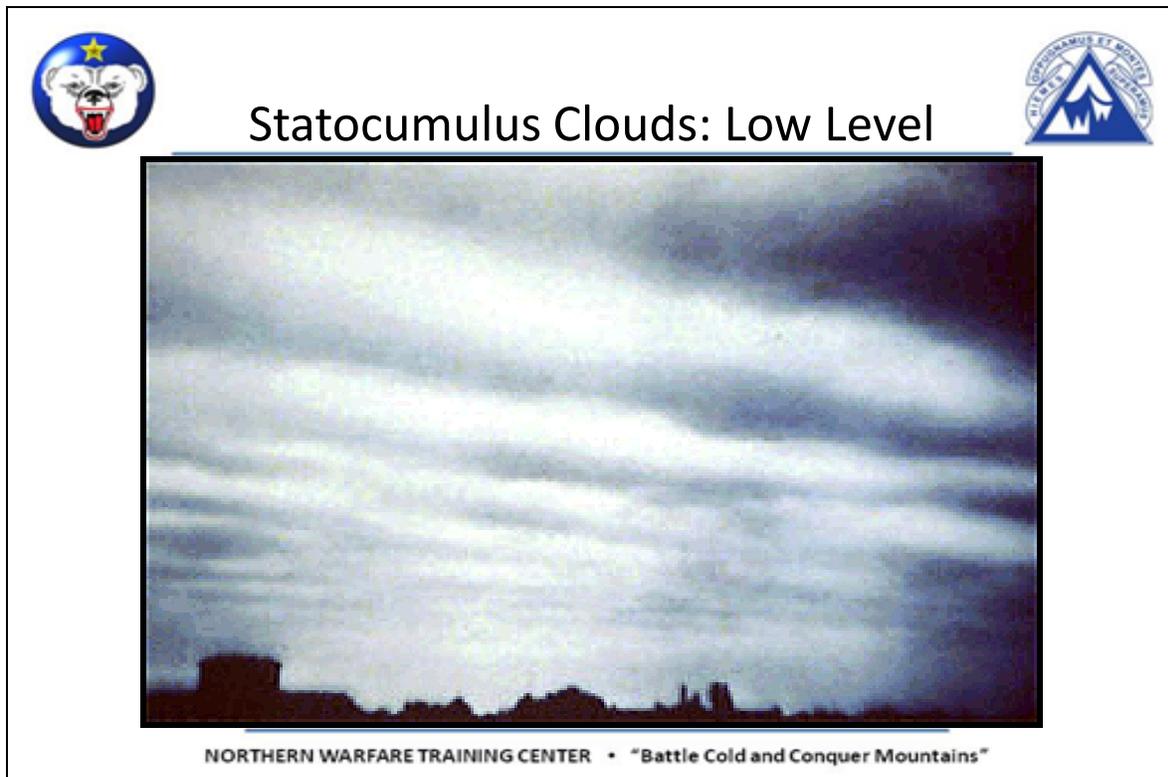
Picture 7

(3) **Nimbostratus clouds** (Picture 8) 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.



Picture 8

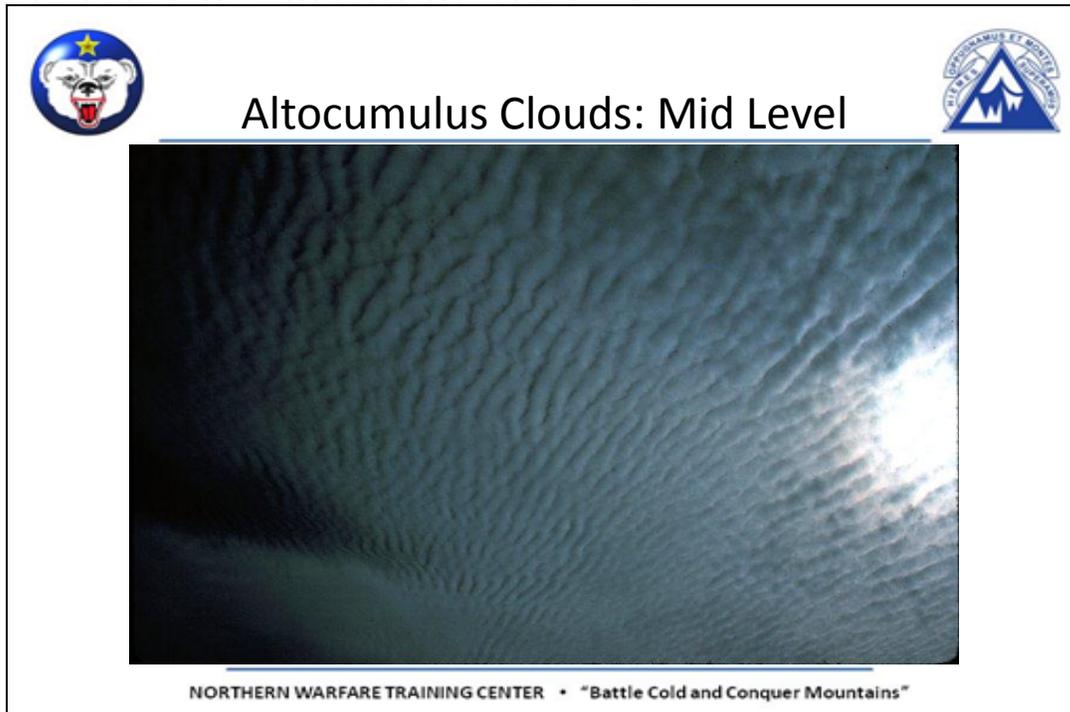
(4) **Stratocumulus clouds** (Picture 9) generally appear as a low, lumpy layer of clouds that are sometimes accompanied by weak precipitation. Stratocumulus vary in color from dark gray to light gray and may appear as rounded masses with breaks of clear sky in between. Because the individual elements 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.



Picture 9

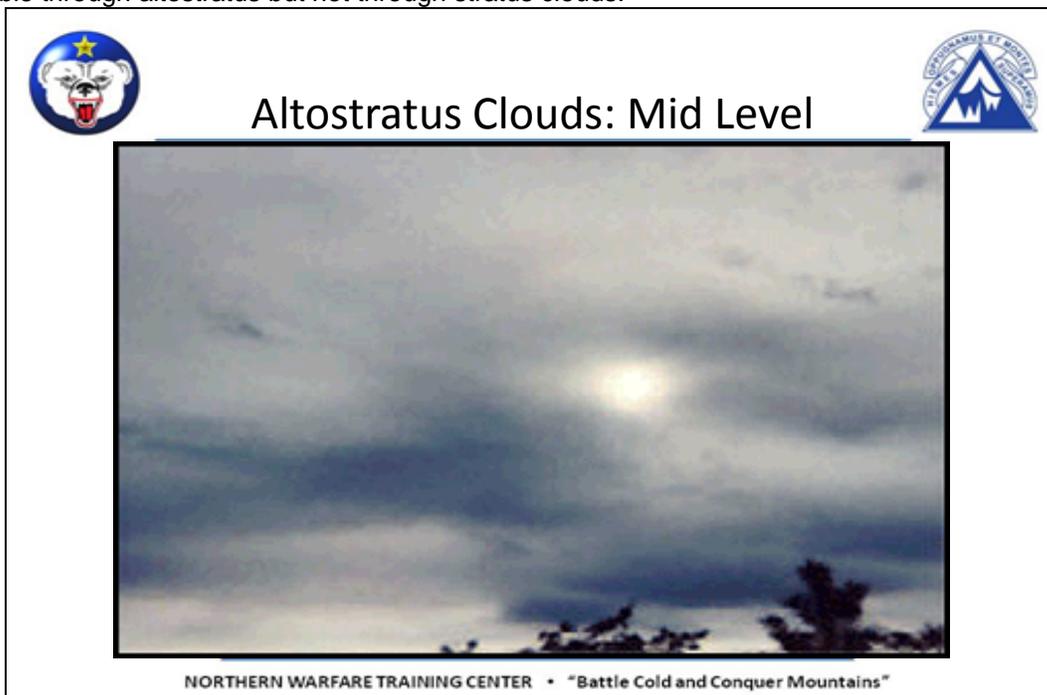
c. **Mid-level clouds** (between 6,500 to 20,000 feet) have a prefix of alto. Middle clouds appear less distinct than low clouds because of their height. Alto clouds with sharp edges are warmer because they consist of water droplets. Cold clouds, composed mainly of ice crystals and usually colder than – 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.

(1) **Alto cumulus clouds** (Picture 10) can appear as parallel bands or rounded masses. Typically a portion of an alto cumulus cloud is shaded, a characteristic which makes them distinguishable from high-level cirrocumulus. Alto cumulus clouds usually form in advance of a cold front. The presence of alto cumulus clouds on a warm humid summer morning is commonly followed by a thunderstorm later in the day. Alto cumulus clouds that are scattered, rather than even, often suggest the arrival of high pressure and clear skies. These clouds resemble a fish fillet.



Picture 10

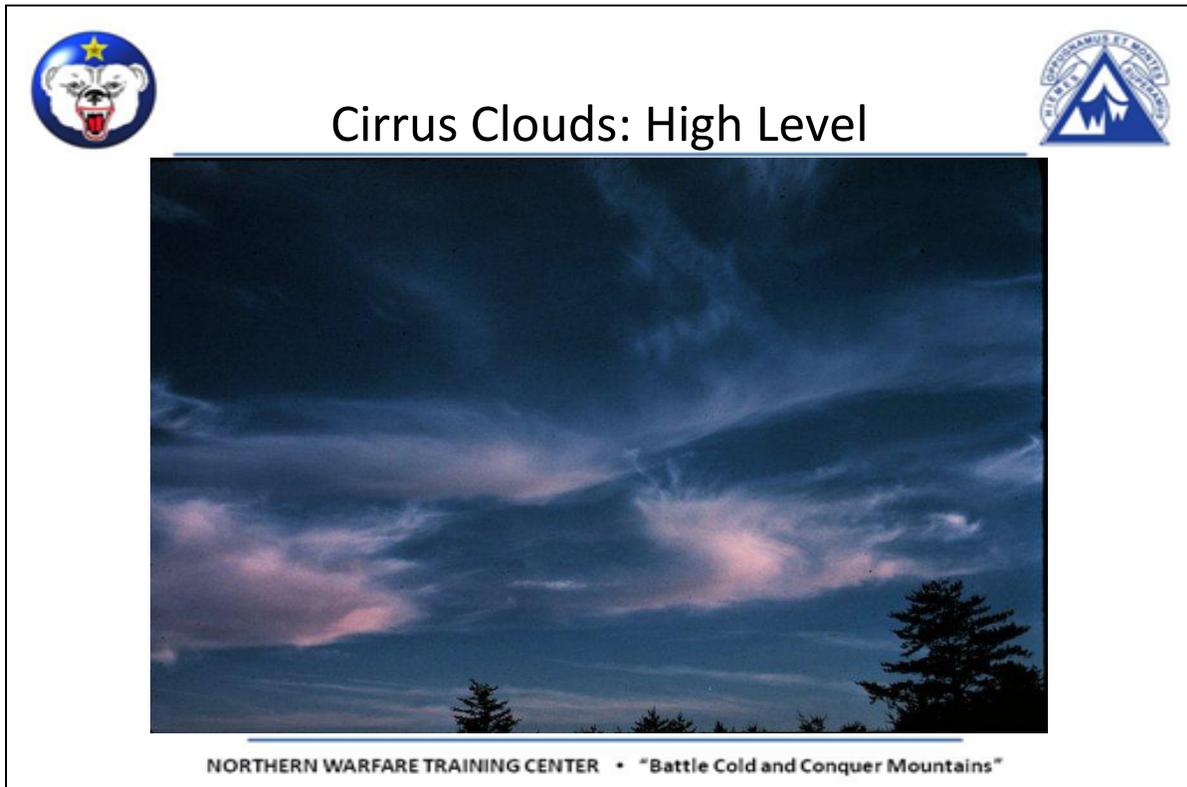
(2) **Altostratus clouds** (Picture 11) are often confused with the high level cirrostratus clouds. The one distinguishing feature is that a halo is NOT observed around the sun or moon with altostratus. Also, with altostratus the sun or moon is only vaguely visible and appears as if it were shining through frosted glass. These clouds resemble stratus clouds (bed sheets). The main difference is that the sun IS visible through altostratus but not through stratus clouds.



Picture 11

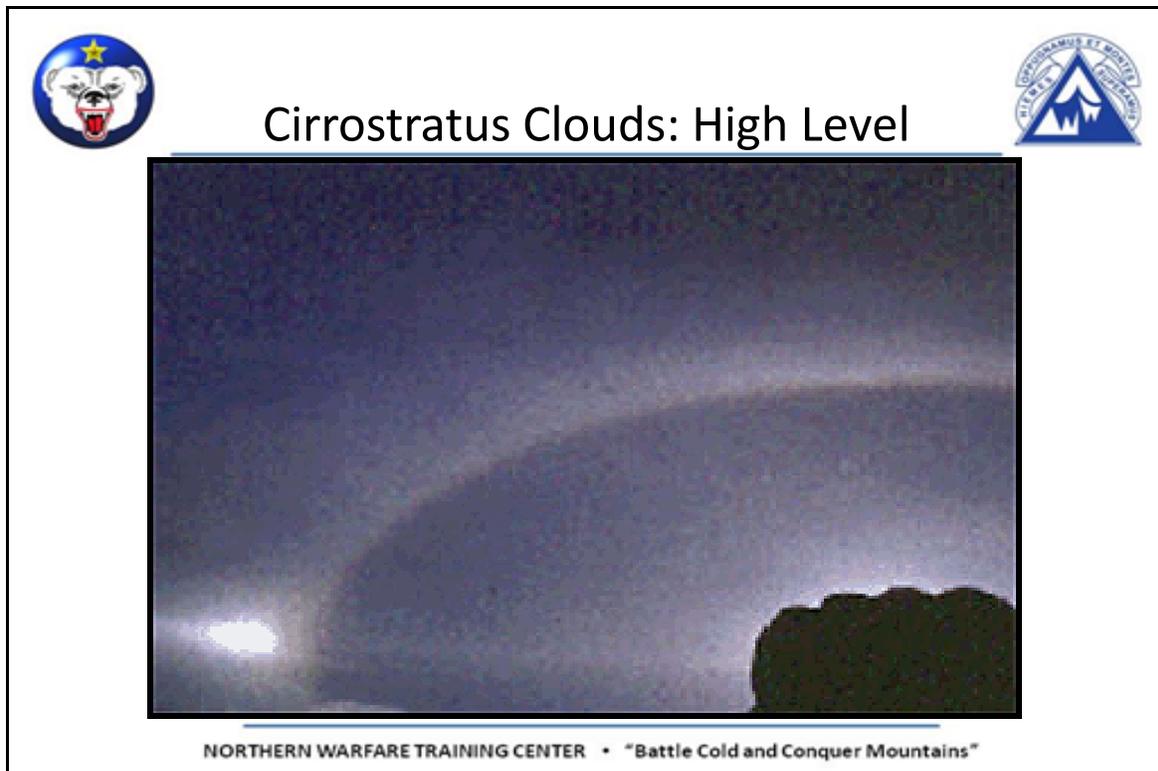
d. **High level clouds** (more than 20,000 feet above the ground) are usually frozen clouds, indicating air temperatures below -30 degrees Fahrenheit, with a fibrous structure and blurred outlines. The sky is often covered with a thin veil that partly obscures the sun; at night high-level clouds can produce 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.

(1) **Cirrus clouds** (Picture 12) are the most common of high-level clouds. Typically found at altitudes greater than 20,000 feet, cirrus clouds 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. These clouds are often referred to as Mare's Tails.



Picture 12

(2) **Cirrostratus clouds** (Picture 13) 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. Precipitation is generally on the way in the next 24-36 hours when these are observed.



Picture 13

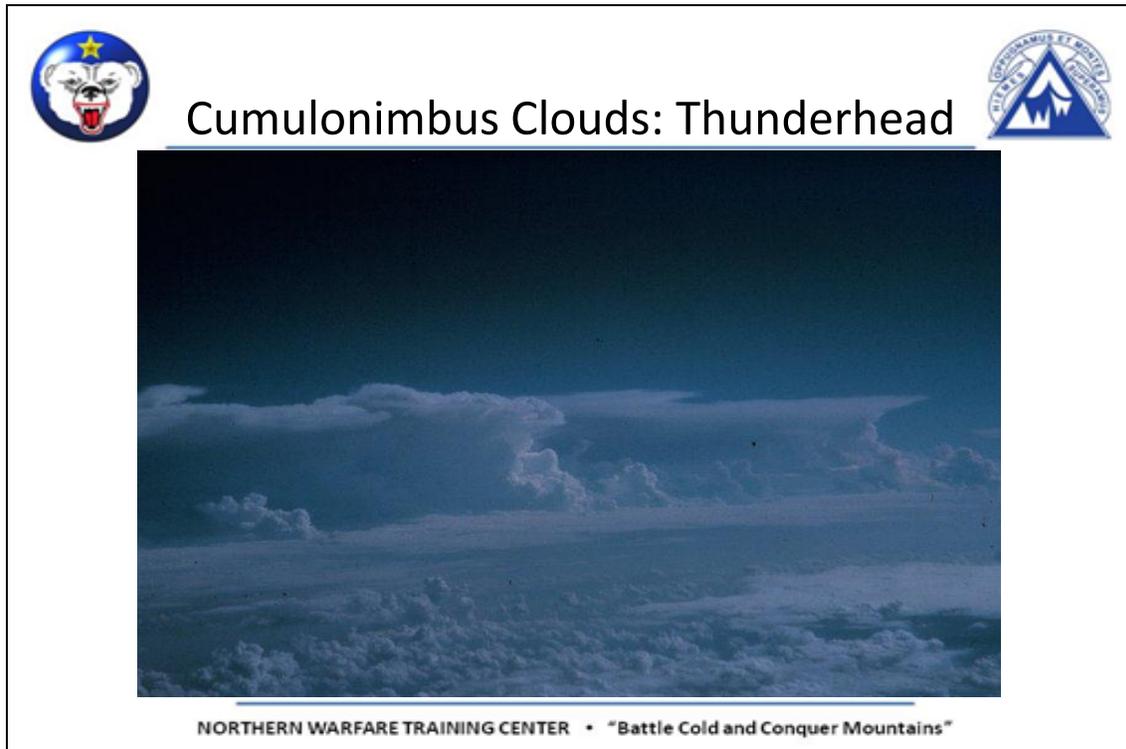
e. **Clouds with vertical development** can grow to heights in excess of 39,000 feet, releasing incredible amounts of energy. The two types of clouds with vertical development are fair weather cumulus and cumulonimbus.

(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. The cloud will begin to erode and eventually disappear without a continued supply of rising air.

(2) **Cumulonimbus clouds** (Picture 14) 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.

(3) Cumulonimbus clouds are often referred to as thunderheads. Thunderstorms are produced by these clouds.



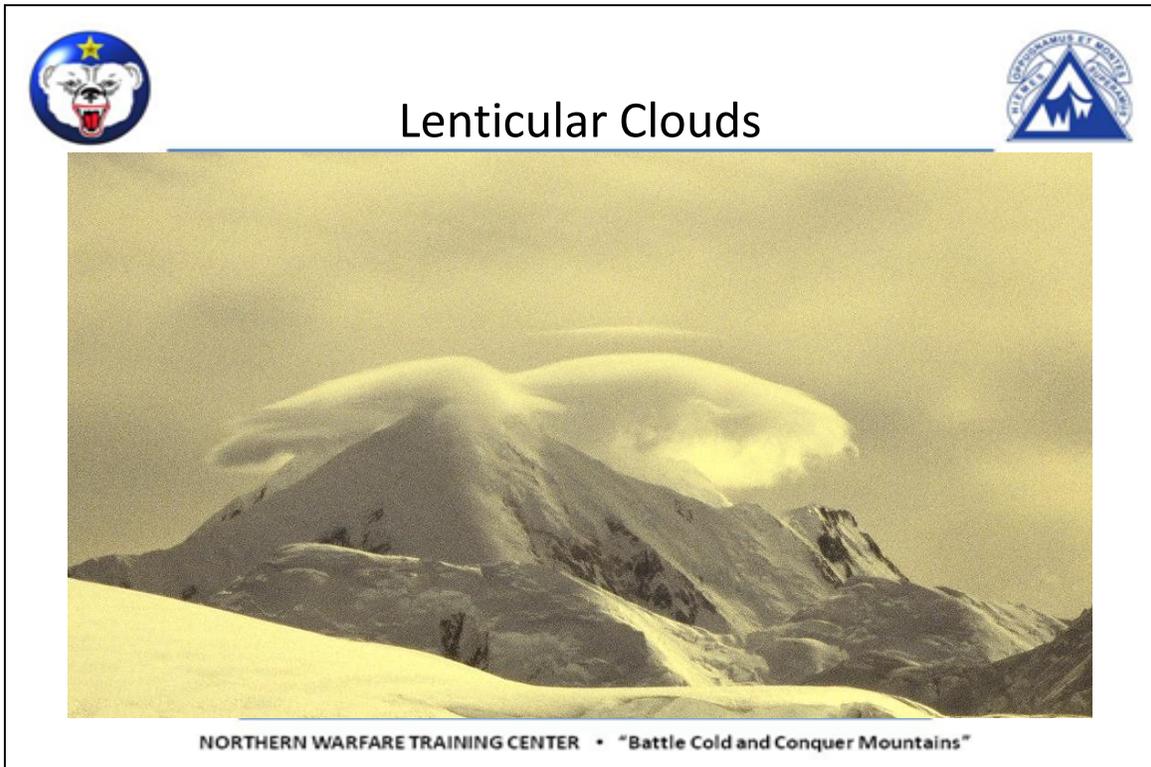
Picture 14

f. 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.

(3) **Lenticular** (Picture 15, 16) clouds often cap mountain peaks and indicate high winds; they can indicate an approaching storm if they lower and grow over time.



Picture 15

(4) Lenticular clouds can also form in the sky and look like flying saucers or waves. Again these indicate high winds.



## Lenticular Clouds



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 16

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

a. You can make a number of general observations that can give you a sense of what the weather will do. You can determine the probability that weather will effect your operation by combining your knowledge of winds, clouds and noting temperature changes, and changes in air or barometric pressure. Inclement weather is not an excuse to stop training or halt operations; 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 (cirrostratus clouds), 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. If you have access to an altimeter it can be used to predict weather. If you are in a stationary position, watch the altimeter for changes – if the altitude appears to increase and you have not changed positions, the pressure is falling and may indicate an approaching storm (low pressure) system. The opposite is also true. If you are in a position and the weather has been poor, watch the altimeter. If the altitude decreases over time and you have not changed positions, a high pressure system is approaching and the weather should improve.

(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.

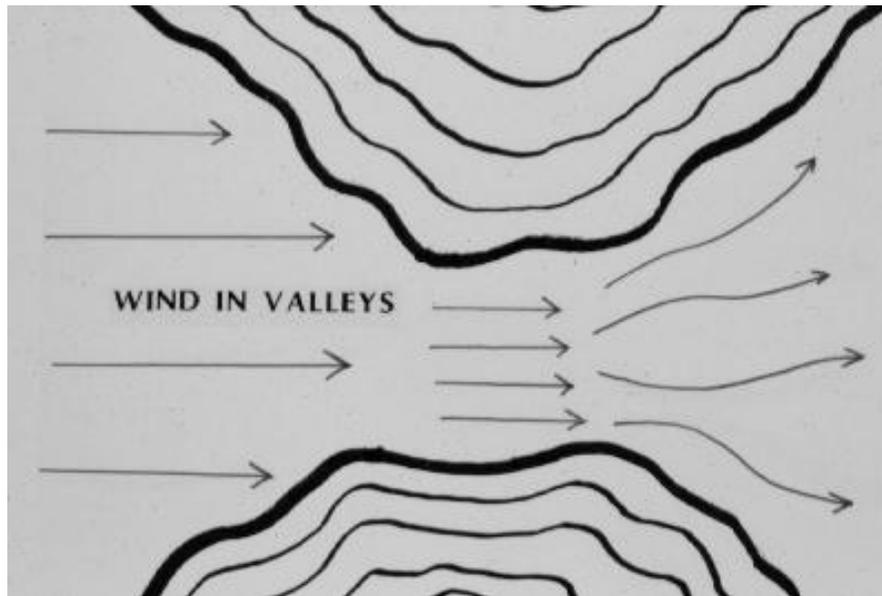
(8) Contrails that do not dissipate within 2 hours.

**Learning Step/Activity 4 – Describe weather characteristics, hazards and phenomena that can affect military operations in cold and mountain regions.**

a. In temperate climates it is rare to have weather or terrain conditions that shut down training or actual military operations. Planners simply figure out a work around and execute the mission. In cold regions, there are hazards and phenomena that can regularly degrade operations to a level that makes the meeting mission unrealistic and/or brings the mission to a level of risk that is unacceptable. You should look at current and anticipated weather hazards and evaluate how they will affect visibility, survivability and mobility.

b. Extreme cold temperatures can be managed with appropriate training, clothing and equipment. When strong winds are added to the equation, wind chill temperatures can easily freeze flesh within minutes or seconds. 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 called the Venturi effect, the wind may blast with great force on an exposed mountainside or summit. (Picture 17) Usually, the local wind direction is controlled by topography.

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

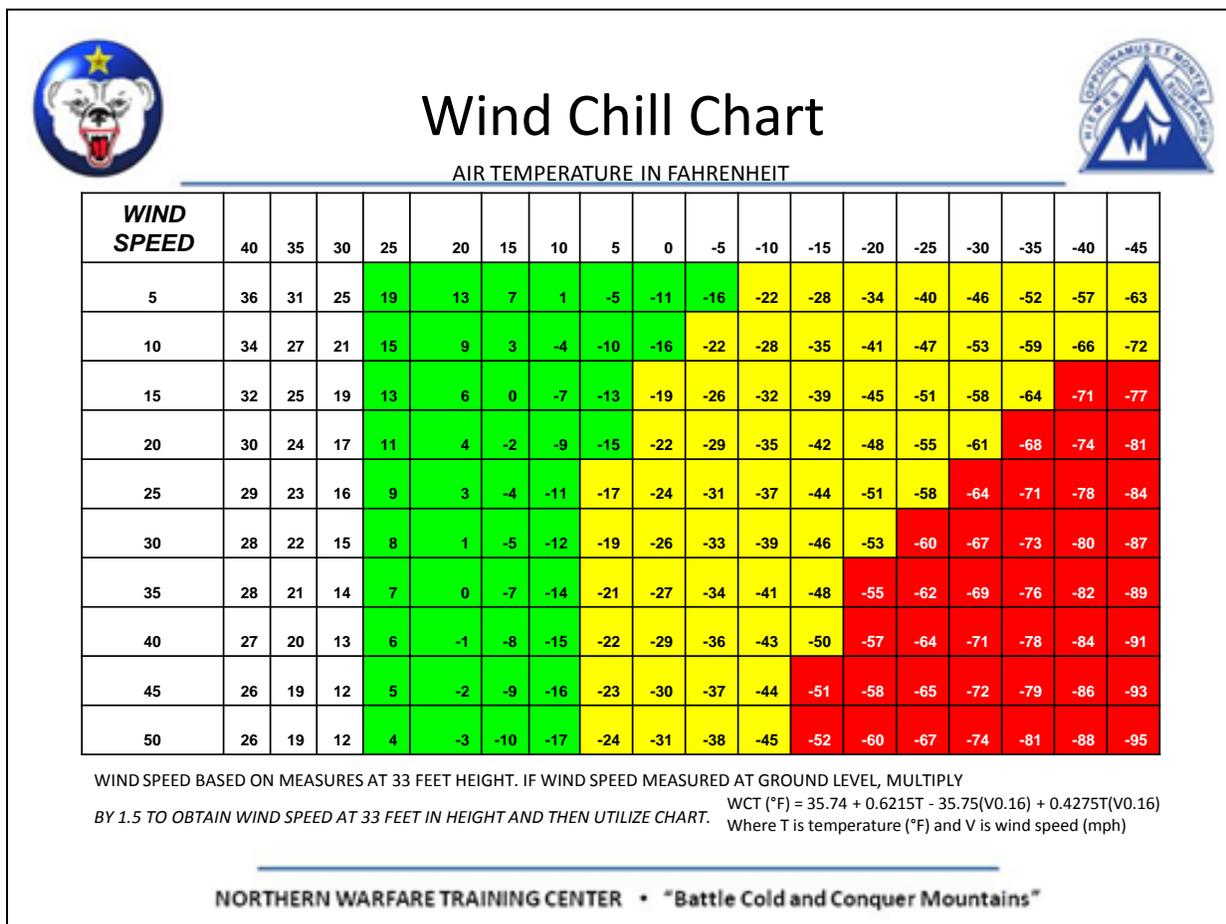


Picture 17

(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.

**Wind chill** is the combined cooling effect of ambient temperature and wind on exposed skin. It is possible to 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. Simply cross reference the ambient air temperature with the current wind speed to find the equivalent wind chill temperature. (Picture 18)



Picture 18

c. **Ice fog** occurs when three things are present: temperatures of  $-30^{\circ}F$  or colder a heat or vapor source, and still air conditions. Open water on a partially frozen body of water can produce localized ice fog. The moisture from the heat source crystallizes in the air, forming fog. Firing a weapon can create ice fog producing a lasting signature and making alternate firing positions a necessity for both target acquisition and concealment. Stationary running vehicles can also produce ice fog creating a signature around them noticeable for miles.

d. A **blizzard** indicates that the following conditions will exist for a period of 3 or more hours: sustained winds or frequent gusts to 35 miles per hour or greater and considerable falling and/or blowing snow, reducing visibility to  $\frac{1}{4}$  mile or less. **Ground blizzards** involve winds moving snow that is already on the ground. This hazard is common in the arctic and mountains and can last for days.

e. A **whiteout** is caused by sunlight being diffused through an unbroken cloud layer onto an unbroken snow surface. The horizon effectively disappears and individuals experience a loss of depth perception and an inability to distinguish irregularities in terrain. Whiteout is often referred to as 'flat light'. Travel under whiteout conditions is difficult and dangerous and units should restrict or cease movement until the condition clears.

f. Normally, as elevation increases, temperature decreases. For mountainous areas, the general rule is for every 1,000 feet of elevation gained, the temperature decreases  $3-5^{\circ}F$ . This is known as the **adiabatic lapse rate**. When cold, calm, clear conditions exist, temperature inversions are the exception to this rule. During a troop movement or climb started in a valley, higher temperatures may often be encountered as altitude is gained. This reversal of normal cooling with elevation is called

**temperature inversion.** Temperature inversions are caused when the mountain air is cooled by snow, ice and heat loss through thermal radiation. The cooler air settles into valleys and low areas. The inversion continues until the sun warms the surface of the earth or a moderate wind causes a mixing of the warm and cold air layers. Temperature differences can be as much as 20 degrees higher on hills or mountainsides that are just a few hundred feet from the valley floor. Sometimes from a height advantage you can look into a valley and see fog indicating colder temperatures in it.

g. **Looming** is an optical illusion where objects appear closer and taller than they actually are. This condition exists in cold still air and can make range estimation inaccurate.

h. **Chinook winds** are warm dry winds that occur in the lee of high mountain ranges. In a few short hours, these winds can produce complete thaws in cold regions that typically do not see a thaw until the summer months. The conditions will mimic the spring break-up period typical of cold regions. Mud and flooding on roads and trails may make them impassable and frozen rivers and lakes may partially thaw, making them unreliable as transportation routes. Chinook winds typically last less than a week and can be followed by a severe temperature drop.

i. The **Aurora Borealis** (Picture 19) are caused by charged particles produced by the sun (Solar Wind), deflected by the Earth's magnetic field and drawn towards the poles. This causes a light show in the sky, being most visible on cold clear nights and occurring throughout the year. They have been reported as far south as Mexico City. They disrupt AM communications but can enhance FM comms. In the southern hemisphere they are known as Aurora Australis.



Picture 19

j. **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

Severe static electricity is a precursor to lightning. If your hair stands up, 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.

#### **SECTION IV. SUMMARY**

You now have a general understanding of some of the weather hazards and phenomena that affect military operations in cold regions. During the remainder of this course, other lessons require you to use this knowledge to manage risk in the cold weather environment.

#### **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** 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

|                  |  |
|------------------|--|
| <b>ACTION</b>    | Protect Yourself and Fellow Soldiers in Extreme Cold   |
| <b>CONDITION</b> | In field in conditions that range from 50° to -60° F. 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. |
| <b>STANDARD</b>  | Analyze current weather conditions to choose a ECWCS layer combination appropriate to the conditions and work load. Does not allow fellow Soldiers to sustain a cold weather injury.   |

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

**Risk Assessment:** Low

**Environmental Considerations:** None

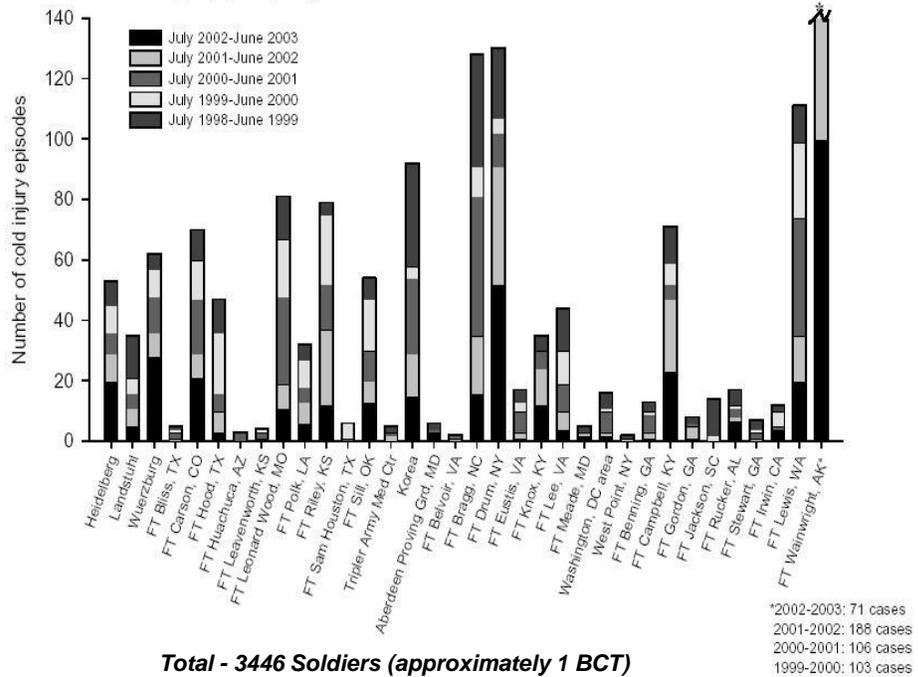
**Evaluation:** You will be tested on your knowledge of cold weather clothing during a quiz (see training schedule for date and time. You need to score a 70% on this quiz in order to receive a GO. There are also questions related to this lesson on the final written examination (CWLC only; see training 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** 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, July 1998-June 2003.



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

## SECTION III. PRESENTATION

### Learning Step/Activity 1 - 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) 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. 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. Wear Generation III ECWCS (7 layer system).

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

(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

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 1

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

(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

**NORTHERN WARFARE TRAINING CENTER • “Battle Cold and Conquer Mountains”**

Picture 2

(3) Wear Level 3: Fleece Jacket (Picture 3)

(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 form 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, in USARAK and during all NWTTC 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.

Not authorized for use as an outer garment in USARAK as it provides very little protection in wind or precipitation and snow clings to it readily.

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 17

(4) Wear Level 4: Wind Cold Weather Jacket. (Picture 4)

(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

**NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"**

Picture 4

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

(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 19° 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

Increased 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 19° F.

**NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"**

Picture 19

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

(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 19° 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 19° F and alternating between freezing and thawing

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 7

(7) Wear Level 7: Extreme Cold Weather Parka and Trousers. (Picture 8)

(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 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 any other layers being worn; 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

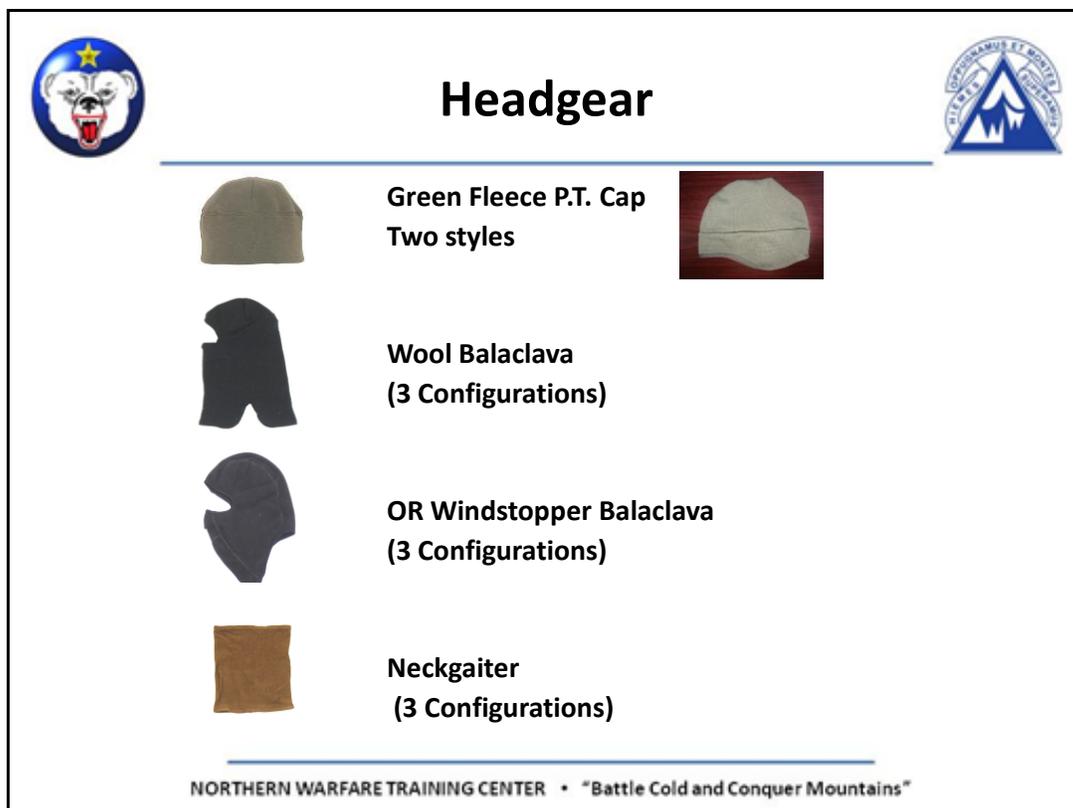
For extreme cold weather climates; the outer most layer of protection. Meant for static positions

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 9

c. Wear the Wool balaclava, and/or OR Windstopper Balaclava. (Picture 10) 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. Note that doing this repeatedly will stretch the fabric and reduce its ability to stay over your nose when you need it.
- 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 #0-14.



Picture10

d. Wear gloves and mittens. (Picture 11 ) ***At a minimum, always wear a contact glove when working in the cold.***

- Avoid using the wool/nylon liners without the shell. Snow sticks to them very easily and their thinner construction makes them susceptible tearing. The liners provide no protection from the wind.
- Wear the Intermediate Cold/Wet glove (old style black leather) with the issued brown liners. The new style green nylon do not come with these liners. Either glove is suitable for cold/wet conditions as an outer layer.
- USARAK fielded brown leather/nylon glove is suitable for use as a outer layer.



## CONTACT GLOVES



---

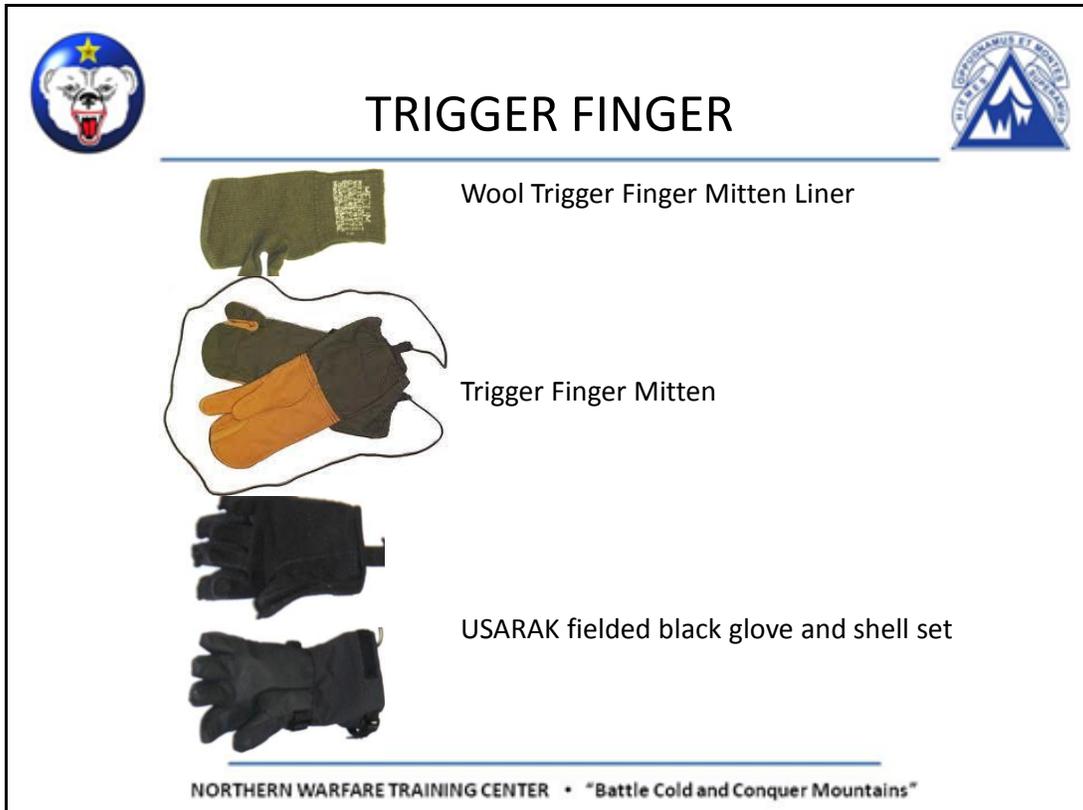
|   |  |
|---|--|
|    | Wool/nylon Liners ( minimum contact glove)                     |
|   | Intermediate Cold/Wet Glove (old style) (rated for 10 degrees) |
|  | Intermediate Cold/Wet Glove (new style) (rated for 10 degrees) |
|  | Brown Leather OR Glove (USARAK fielding)                       |

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

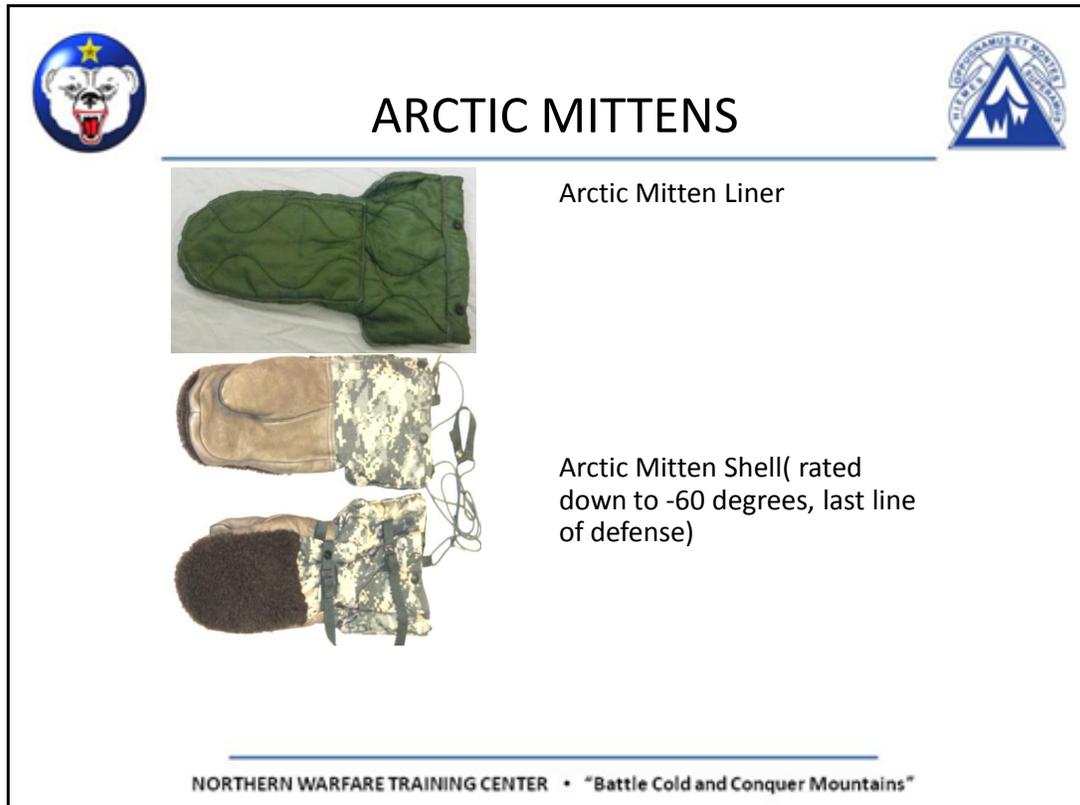
Picture 11

- The trigger finger mittens (Picture 12) are made of canvas with 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. Inserts are ambidextrous.
- Avoid wearing the liners without the shell. The liners are made of wool and snow sticks to them very easily and provide no protection from the wind.
- Pull the liner out to facilitate faster drying.
- The USARAK fielded black glove and liner worn together the same as the trigger finger mitten set.



Picture 12

- Arctic mittens (Picture 13) 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. Remove the liner from the shell to facilitate faster drying. Avoid wearing the liners alone as they provide no protection from the wind.
- Use in conjunction with trigger finger liners, wool/nylon liners or black OR liners. When used in this manner the mittens should fit your hand comfortably.



Picture 13

- 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. DO NOT wear mittens attached behind your back. The mittens will fill with snow and/or will be cold when you place your hands in them.
- 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.

e. Wear issued cold weather boots. (Picture 14)

- Intermediate Cold-Wet Boots (ICWB) with removable liners (tan) NSN 8430-01-527-8274, are rated from 68° F to +14° F. You should receive two pairs of liners with this boot. When donning this boot with the liners, place the liners on your feet first and secure the Velcro. Then insert your foot into the boot. Ensure there is no bunching as this will cause blisters. When fitting this boot

ensure you are wearing the sock type you will use in the field and that the boot fits like your street shoes.

- 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 32° F.



## BOOTS



---



Summer/Desert Boot (Not to be worn below 32 degrees)



Temperate/Desert Boot (Not to be worn below 32 degrees)



Intermediate Cold Weather Boot Liner



Intermediate Cold Weather Boot (rated 14 degrees w/ liner)

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 14

- Extreme Cold Weather Boots (ECWB) NSN 8430-00-655-5535. (Picture 15) They are also known as White Vapor Barrier boots, VB boots, or bunny boots. They are rated 14° F to -60° F and are for use in cold dry environments. Some VB boots have a pressure relief valve. The valve is used for equalizing air pressure; when you change altitude rapidly, open the valve **briefly** to equalize pressure and then close the valve. Wipe VB boots out at least once daily and change socks at the same time.
- When fitting the boot wear the same sock type you will use in the field. The boot should fit like your street shoe.
- Black Vapor Barrier Boots are rated to -20° 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 II Dry Cold 19° F to -4° 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.



## VAPOR BARRIER BOOT





**Rated from 14 down to -65 degrees**

**Insulation Layer**

**Weight**

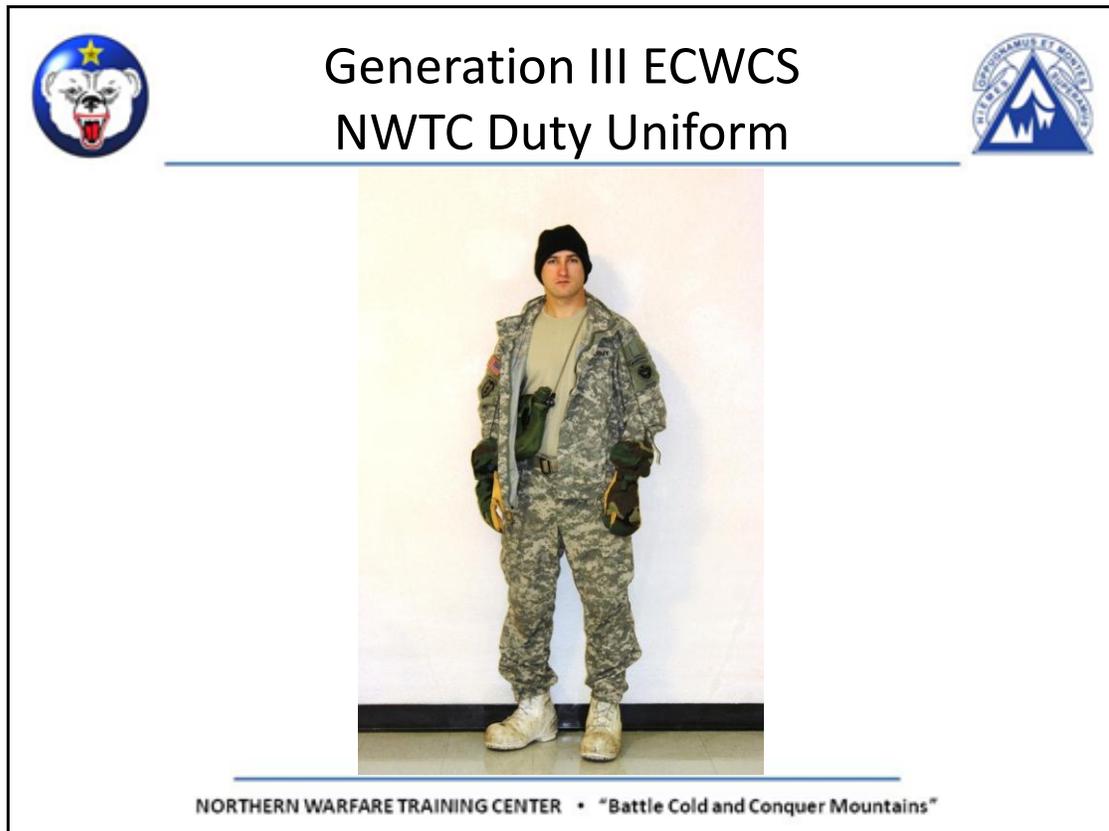
**Pressure Equalization Valve**

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 15

f. NWTC Winter field uniform.(Picture 16) Level 5 Soft shell, VB Boots, Level 1-2 Baselayer (minimum), Level 3 and 7 as needed, 2qt canteen close to body, trigger finger mittens with contact gloves, arctic mittens under shell layer and balaclava.



Picture 17

f. Use the issued sleep system.

(1) The Modular Sleep System (MSS) (Picture 18) is designed for a temperature range of +50° F to -50° 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. ALWAYS give the bag a vigorous shaking before you get in it. This restores the loft of the insulation.

(a) Use the patrol bag (Green/Foliage Green) when temperatures are above 30° F. If you do not have a shelter, use it with the bivouac cover. In extreme temperatures you may notice frost on the inside of the bivy cover. This is normal from your body heat during the use of the sleep system. Brush the frost out before stowing your bag.

(b) Use the Intermediate cold weather bag (Gray-Green) from 30° F to -10° F. If you do not have a shelter, use it with the bivouac cover.

(c) In temperatures below -10° F, insert the Intermediate Cold Weather bag into the patrol bag and snap them together. Use this inside the bivouac cover for a temperature rating of -30° F.

(d) Additional layers, Level III Fleece, Level 5 Softshell can be used when temperatures exceed -30. Be careful not to overdress as sweating can accumulate in the bag/clothing.

(e) Additional insulation layers (Level 3 Fleece) can be put in the foot box of the sleeping bag to warm the feet and keep the insulation layer warm for use at the end of the rest cycle.

(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 50° F to 30° F
- Intermediate Cold Weather Bag is rated 30° F to -10° F
- Vapor Permeable GORE-TEX® Bivouac Cover
- Intermediate Cold Weather bag goes inside the Patrol Bag which goes inside the Bivouac Cover.
  
- Protection to -30 when wearing Level I-II Baselayers
  
- Beyond -30 additional layers may become necessary. **TAKE CARE NOT TO OVERDRESS**

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 18

g. 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 (90° 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 130° 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 2 - 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. Layer 7 parka should be directly under the flap of the rucksack. You can get a hold of it quickly and stow it quickly.

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 3 – 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 4 – Prevent cold weather injuries during PT.**

(1) Follow the guidelines set forth in Appendix E: USARAK CG/CofS Policy Letter #0-14 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 5 – 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.

**Learning Step/Activity 6.** Wear FREE system.

1) Wear Level 1: Underlayer (Picture 19)

(a) Short sleeve top and boxer garments constructed out of silk-weight moisture wicking fire resistant knit blend material. The material aids in the movement of moisture from the skin to the outer layers both while the wearer is moving or static.

(b) Worn next to skin or with Layers 2, 3 for added insulation and to aid the transfer of moisture.



 **FREE System: Under Layer** 

T shirt and Boxers

- Worn as the base layer in all configurations
- Material aids in movement of moisture from the skin to the outer layers

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 19

(2) Wear Level 2: Base Layer Light Weight (Picture 20)

(a) Long sleeve top and full-length bottom garments constructed out of Nomex/Lycra mesh knit blend material. The mesh knit creates spaces to trap air close to the body to provide insulation when used with another layer. The material provides flame resistance.

(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 over Layer 1 or next to skin.



 **FREE System Level 2:  
Base Layer Light Weight** 

Light-Weight Cold Weather Shirt and  
Drawers

Long sleeve top and full-length bottom  
garments constructed out of  
Nomex/Lycra mesh.

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

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 20

(3) Wear Level 3: Mid weight layer( Picture 21)

- (a) Worn over Layer 1, 2.
- (b) Mock turtle neck with  $\frac{3}{4}$  zipper for ventilation.
- (c) Thumb holes in sleeves.
- (d) Longer tail to prevent the shirt riding up.



## FREE System Level 3: Mid Weight Layer





High loft double velour fleece for use in moderately cold conditions.

Worn over layer 1-2.

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 21

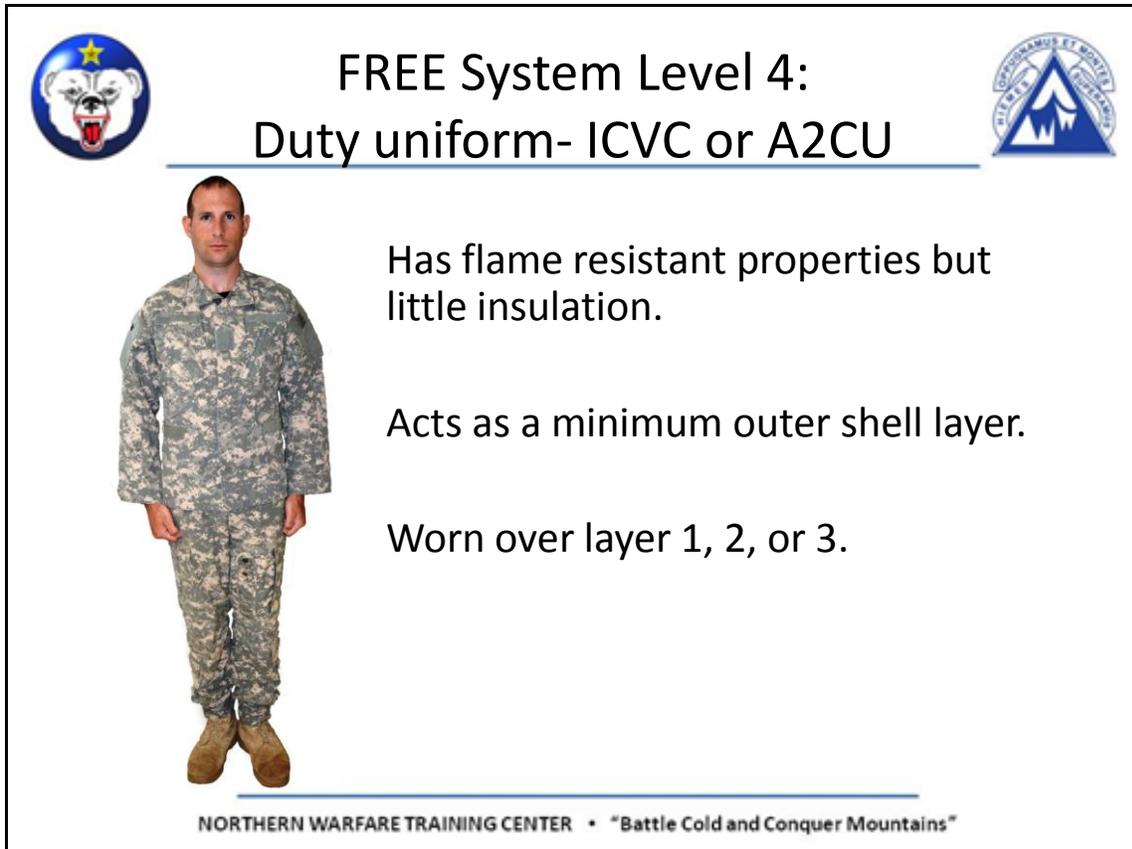
(4) Wear Level 4: A2CU or ICVC (Picture 22)

(a) Made of Nomex flame resistant material. Acts as a minimum outer shell layer, improving the performance of underlying layers.

(b) Has minimal wind and water resistance.

(c) Integral part of the whole FREE system.

(d) Fits over Layers 1, 2, 3.



**FREE System Level 4:  
Duty uniform- ICVC or A2CU**

Has flame resistant properties but little insulation.

Acts as a minimum outer shell layer.

Worn over layer 1, 2, or 3.

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

(5)

Picture 22

Wear Level 5: Light Weight Outer Layer (LWOL). (Picture 23)

(a) Made of a fire, water and wind resistant material that increases moisture vapor transfer over current hard shell garments.

(b) Pants have 1 back pocket, 2 zippered front pockets and 2 calf pockets. Knee length zippers ease donning/doffing with boots on- "Boot Friendly"

(c) Jacket has 1 zippered pocket on the left upper arm, 1 zippered pocket on right chest, 2 hand warmer and 2 forearm pockets. There is a panel across the tops of the shoulder to accommodate the safety harness.

(d) Light fleece lining provides insulation.

(f) Designed to be worn over Layers 1, 2, 3 and A2CU/ICVC. In this configuration the temperature range is +60 to 0F depending on level of activity.



## FREE System Level 5: Elements Light Weight Outer Layer (LWOL)





Cold Weather Jacket and Trousers

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

Inner lining of fleece for insulation.

Worn over Layers 1, 2, 3,CVC/A2CU.

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 23

(6) Wear Level 6: Intermediate Weather Outer Layer (IWOL) (Picture 24)

(a) Material is similar to LWOL except that the fleece lining is heavier.

(b) The pocket and zipper configuration is the same as the LWOL.

(c) Additional layer vest has 2 hand warmer pockets and 1 zippered pocket on the chest as well as the panel on the shoulders. The vest is being phased out of future issue of the FREE.

(c) Worn over Layers 1, 2, 3, A2CU/ICVC. The garments are not sized to fit over Layer 5. In this configuration the temperature range is 0 - -40F depending on activity.



## FREE System Level 6: Intermediate Weather Outer Layer (IWOL)





Pants, Jacket and Vest.

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

Inner lining of fleece for insulation.

Worn over Layer 1, 2, 3, ICVC/A2CU.

Vest with jacket for additional core protection.

**NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"**

Picture 24

(7) Wear Level 7: Extreme Weather Outer Layer (EWOL). (Picture 25)

(a) Cloth material similar to LWOL/IWOL but with a Gore-Tex membrane to provide water and wind proofing. This membrane makes the EWOL a dual purpose outer shell.

(b) When used in an extreme cold environment (below -20F), Layers 1, 2, 3, A2CU/ICVC IWOL or LWOL are worn under the EWOL. Note that IWOL and LWOL are not worn together. The fleece liner may be zipped and snapped into the EWOL jacket.

© When used in a cold wet environment (above+14F) the EWOL shell is the outer shell to guard against rain.

© The jacket has a zip off or roll away hood, 2 pockets on the upper arm and 2 hand warmer pockets closed with Velcro. The fleece layer can be zipped and snapped into the jacket for more warmth. Pit zips add ventilation and the panel across the shoulders allows the safety harness to be worn.

(d) The fleece has the same shoulder panel as the other layers. Reinforced elbows and no pockets.

(e) The pants have front PassThru pockets as well as cargo pockets on both thighs. Belt loops and suspender loops with a draw string on the waist. Knee length zippers and Velcro closures on the ankles.



## FREE System Level 7: Extreme Weather Outer Layer (EWOL)





Pants, Jacket and Fleece liner jacket

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

Fleece snaps inside Jacket

Worn over Layer 1,2,3, ICVC/A2CU, 5 OR 6.

Outer shell for Cold /Wet conditions.

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 25

(8) The FREE is a system that by its very design is flexible. Layers can be moved as needed based on the activity and conditions present. Avoid getting wrapped up in an arbitrary temperature. Remember that the A2CU/ICVC is to be worn in all configurations.

c. Wear the Wool balaclava, **and/or** OR Windstopper Balaclava same as GEN III

d. Wear gloves and mittens. Wear issued flight/CVC gloves during crew operations. Other times use the same as GEN III.

e. Wear issued cold weather boots.

- Mukluk (Picture 26) with the upgraded wool felt liners are the approved boot for extreme cold for Aviators.



Picture 26

f. Care for the FREE.

- Layer 1 and socks- Machine or hand wash in WARM water and mild detergent. Turn socks inside out before washing. Tumble dry on low.
- Layer 2, 3 and 7 FLEECE- Machine or hand wash in COLD water. Dry on low or hang dry out of direct sunlight.
- Layer 5 and 6- Turn inside out, machine wash in cold water. Dry on delicate or hang dry out of direct sunlight.
- Layer 7- Machine or hand wash in warm water with POWDERED detergent. Dry on cotton/sturdy setting.
- Glove liner and belt- Machine or hand wash in cold water using liquid detergent. NO HAND/DISH SOAP. Hang dry out of direct sunlight or lay flat.

g. Repair FREE.

- Cuts, frays or damage to fabric/stitching warrant DX. Turn into Central Issue Facility at earliest opportunity.
- Do Not use seam sealer or duct tape
- Hand sew with fire resistant thread
- Refer to TM 10-8415-237-10-PMC

**Learning Step/ Activity 7- Wear GEN II ECWCS (Supplemental Slides)**

**NOTE: NWTC no longer teaches this section on GEN II ECWCS as part of its curriculum. It has been left in the lesson plan as a product to other units that may want the information.**

**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 supplemental A) 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

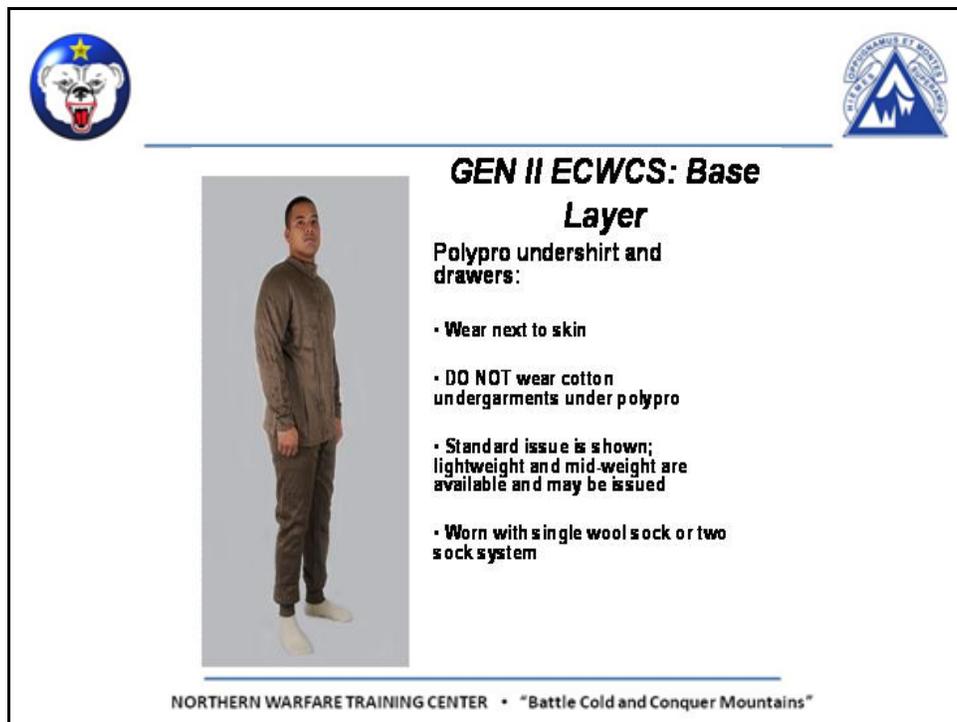
(c) Wear the polypro next to your skin. DO NOT wear cotton undergarments under polypro. DO NOT wear ACUs on top of the base layer in the field. Cotton absorbs and traps moisture. Wear a pair of nylon shorts as an alternative to cotton underwear. Women should wear a nylon sports bra.

(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.



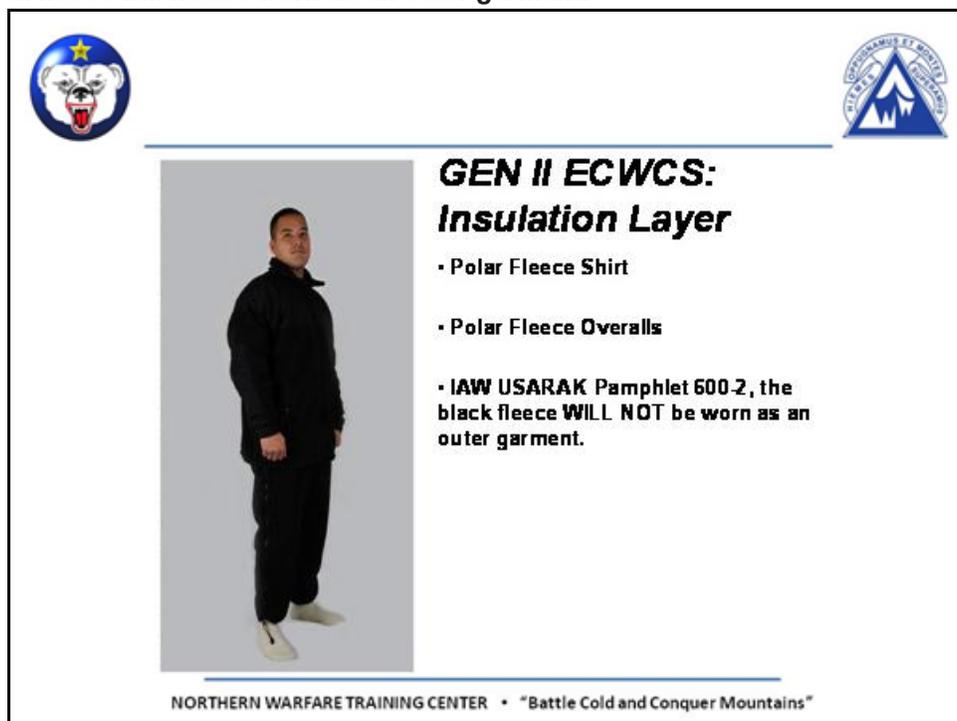
Slide supplemental A

## (2) 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) ( Slide supplemental C)

- 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**

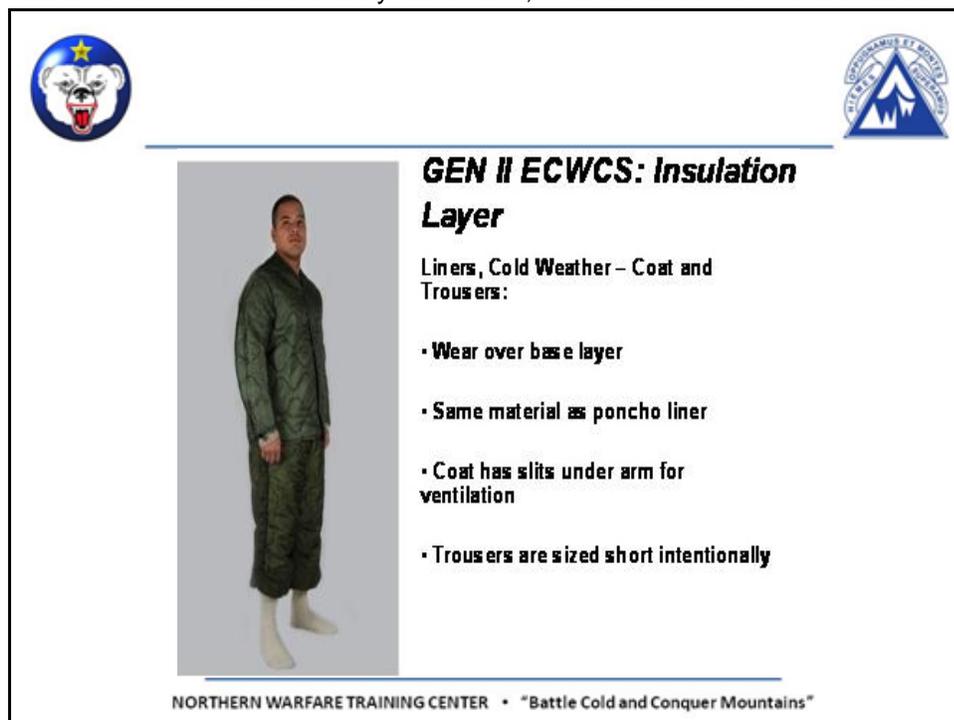
- Polar Fleece Shirt
- Polar Fleece Overalls
- **IAW USARAK Pamphlet 600-2, the black fleece WILL NOT be worn as an outer garment.**

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Slide supplemental C

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

- 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:**

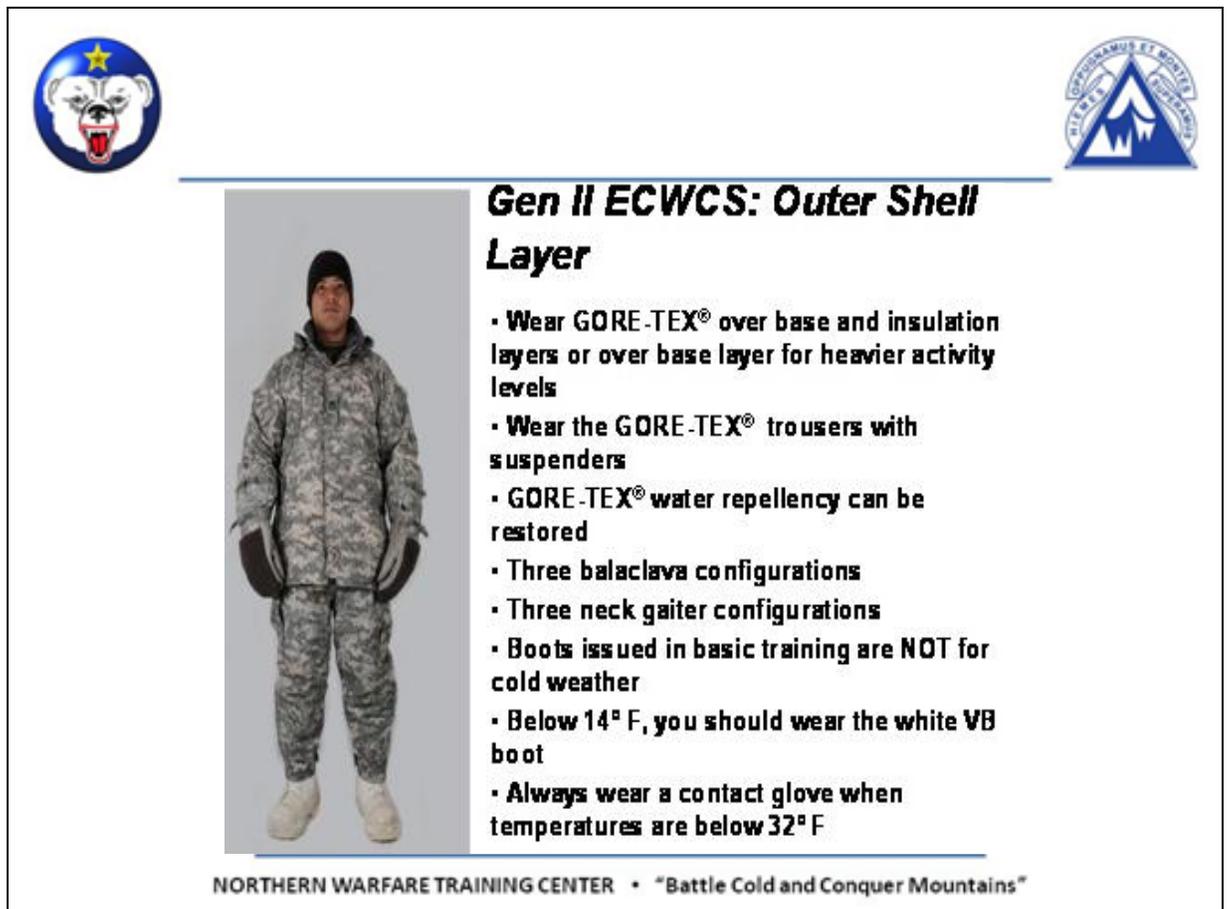
- Wear over base layer
- Same material as poncho liner
- Coat has slits under arm for ventilation
- Trousers are sized short intentionally

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

(3) (Slide supplemental E) 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.



**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 14° F, you should wear the white VB boot**
- **Always wear a contact glove when temperatures are below 32° F**

NORTHERN WARFARE TRAINING CENTER • “Battle Cold and Conquer Mountains”

Slide supplemental E

- 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 130°) 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) Head and hand wear is the same as discussed in LSA 8 paragraph c-e.

#### **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. The Level III fleece should be used as an outer garment for what reason?

It has no wind stopping properties, snow will stick to it and it does not shed rain.

2. What does a shell do?

Protects other layers from the elements

## SECTION II. INTRODUCTION

**Motivator** 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

|                  |  |
|------------------|--|
| <b>ACTION</b>    | Prevent Cold Weather Injuries  |
| <b>CONDITION</b> | In a field environment in conditions that range from 50° to -60° F. Given the Extended Cold Weather Clothing System (ECWCS), Modular Sleep System (MSS) with insulating pad, access to a warming shelter and the requirement to protect yourself and your fellow Soldiers against cold injuries. |
| <b>STANDARD</b>  | 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

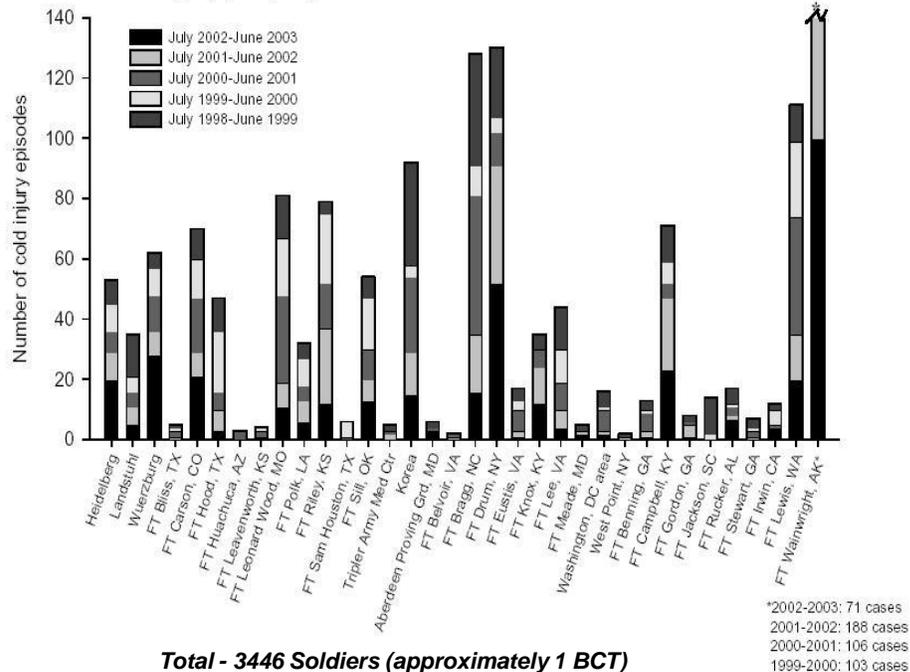
**Evaluation:** You will be tested on your knowledge of cold weather injuries during a final written examination (CWLC only; see training schedule for date/time of exam). You must score a 70% on the written exam in order to receive a GO. If you fail the written exam, you will be given a second exam after 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** 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. If you notice yourself or fellow Soldier beginning to have a problem, DO SOMETHING ABOUT IT NOW. Do not wait till later, do not try to suck it up and be a tough guy. 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, July 1998-June 2003.

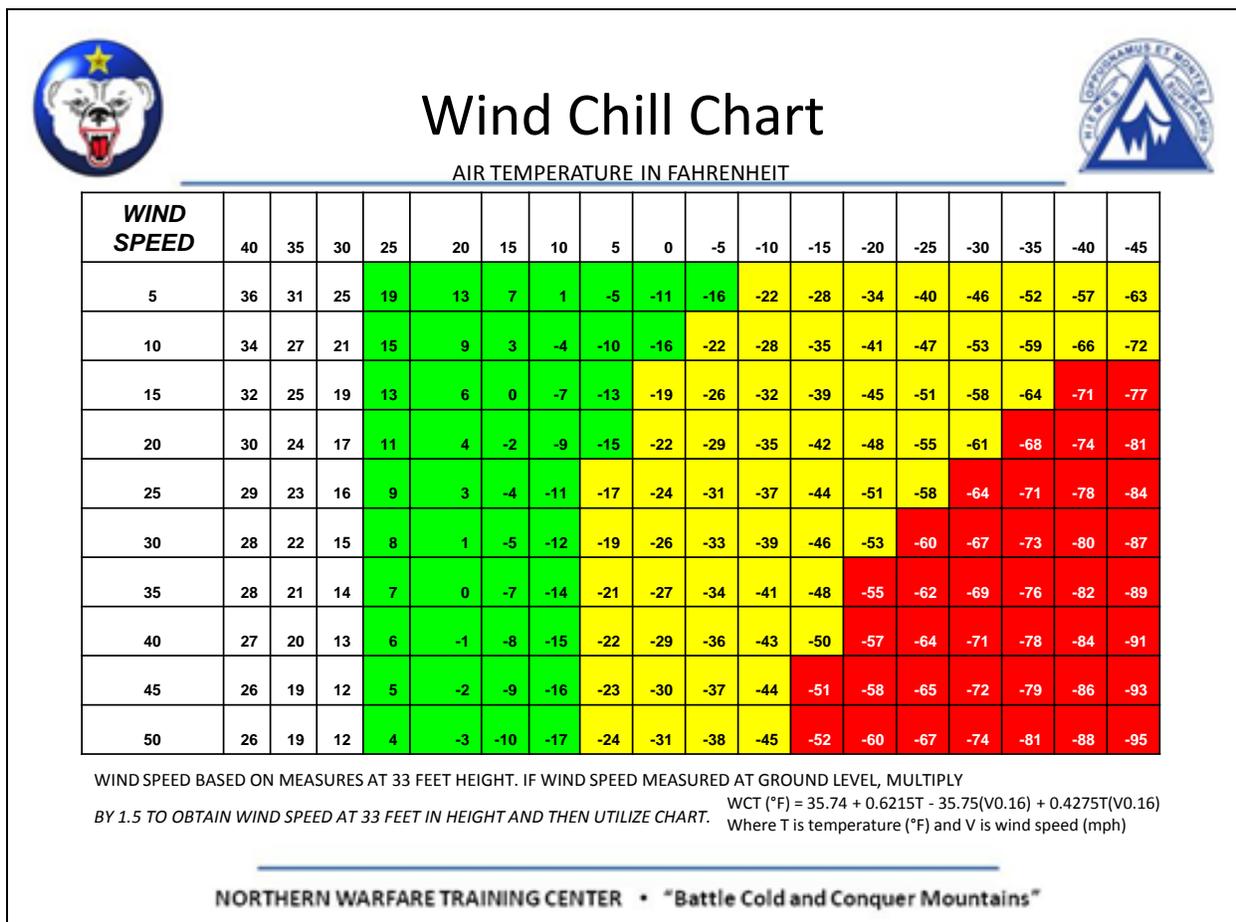


NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

### SECTION III. PRESENTATION

#### Learning Step/Activity 1 – 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. Meteorologists calculate wind speed at 33ft above ground level for official forecasts. To convert your ground speed measurement simply take the measured wind speed at ground level and multiply by 1.5. This convert it to a height of 33ft which will allow you to utilize the wind chill chart.
- c. Determine the equivalent wind chill temperature using the wind chill chart (Picture 1). Find the current ambient temperature in the top row and the calculated wind speed in the left column. Where these two values intersect is the wind chill factor. 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? \_\_\_\_\_



Picture 1



# 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*

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

**Learning Step/Activity 2 - 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)?

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

a. 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 -20° 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. 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. 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 US Army Alasaka (USARAK) Regulation 350-1, Cold Weather Indoctrination and Certification (CWIC) is the minimum cold weather training requirement for all Soldiers in USARAK. Cold Weather Leaders Course (CWLC) graduates are the trainers for CWIC and serve as unit subject matter experts. The Cold Weather Orientation Course (CWOC) provides senior leaders and staff with 'what right looks like' for CWIC.

(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.

#### **Learning Step/Activity 4 - Identify and treat cold weather injuries.**

##### **a. Identify Chilblain.** (Picture 2)

(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 50° 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 in cold-wet conditions below 50° F
- Small, red, itchy or painful lesions appear on the skin
- No long lasting effects



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 2

b. 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. **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 32° F for this injury to occur. ***If the ambient temperature is above 32° F, but is below 32° 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 32° 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.

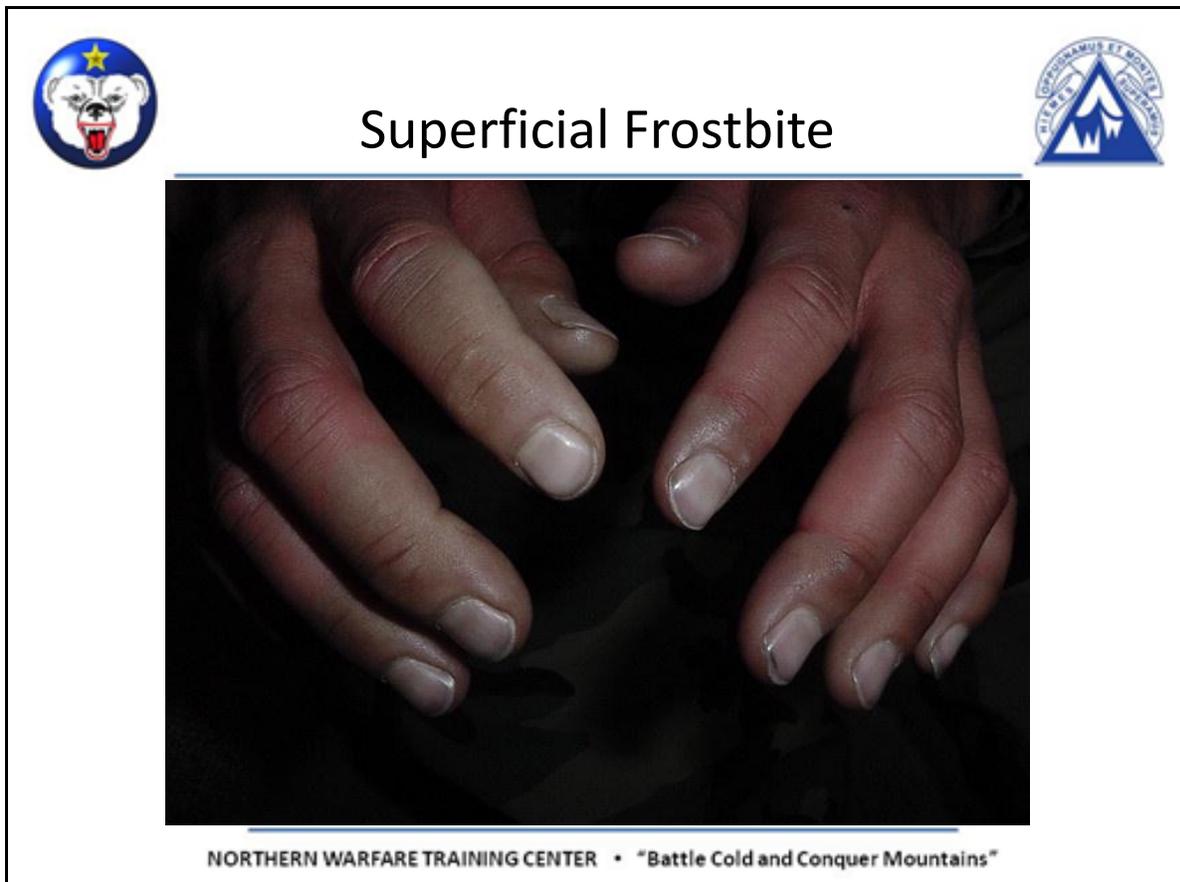
**Note: For field identification and treatment, frostbite can be classified as superficial or deep.**

d. Identify **Superficial frostbite**. (Picture 3, 4, 5)

(1) Presents as white, waxy and pale in lighter skin types; red, pale in darker skin types.

(2) Numbness

(3) Skin moves over the underlying tissue. When dented skin will rebound.



Picture 3



## Superficial Frostbite



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 4



## Superficial Frostbite



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 5

e. 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.
  - Blebs (Picture 6, 7) may form upon re warming. This is normal and part of the healing process. Do not pop them. If they rupture cover as any other open wound.

(2) If possible, submerge the affected part in water heated to 99-102° 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.**

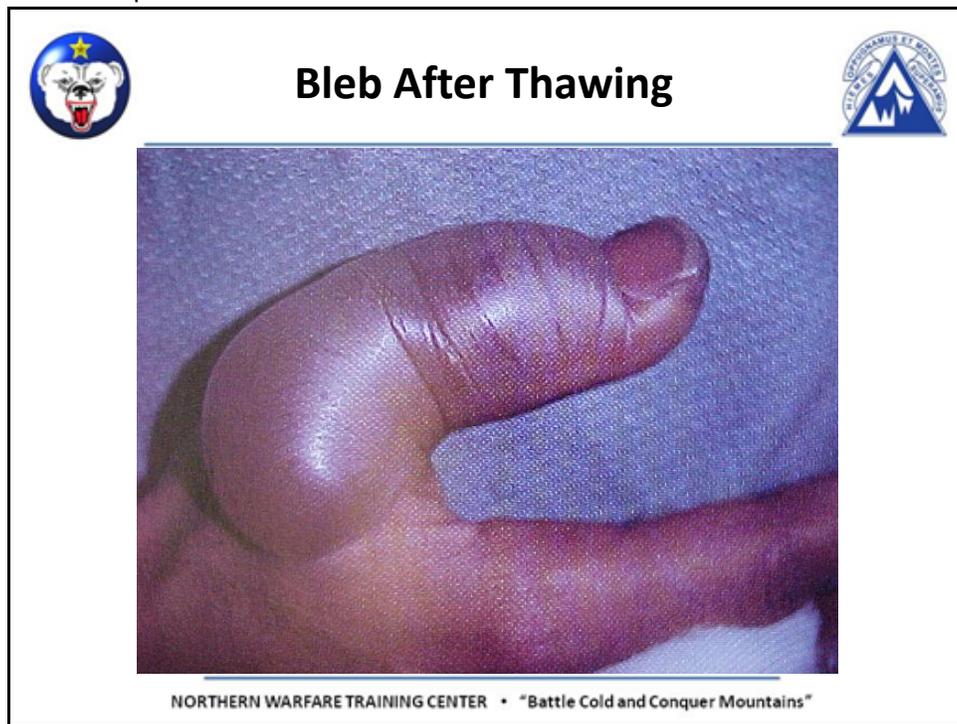
(5) **DO NOT rub or massage the affected area.**

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

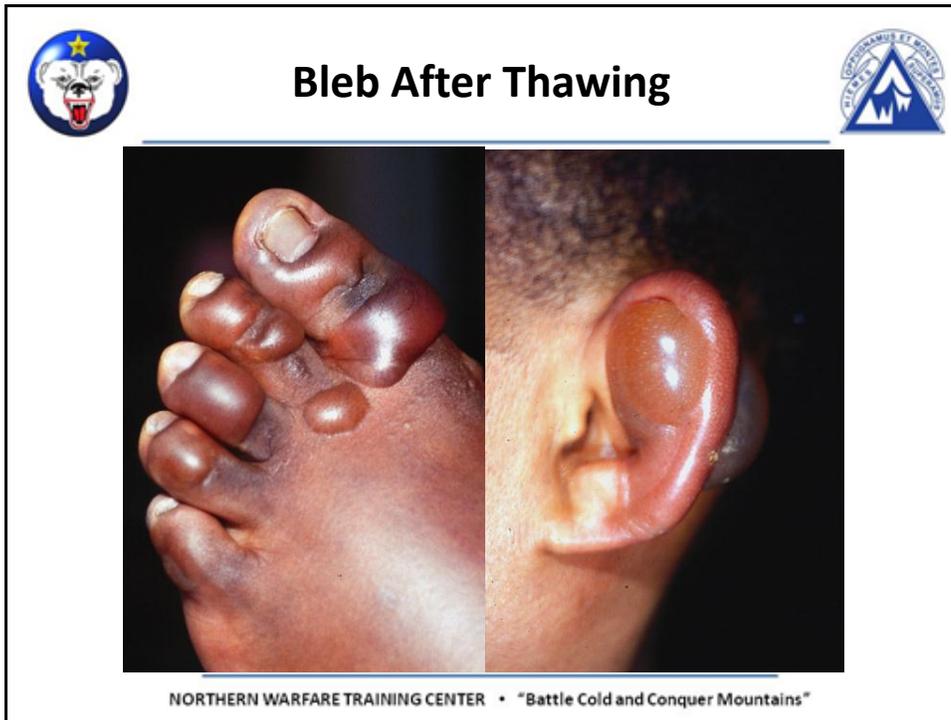
(7) **DO NOT allow tobacco or alcohol use.**

(8) Aloe can help with the healing process

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



(Picture 6)



Picture 7

**f. Identify Deep frostbite.**

- (1) Skin coloration presents in much the same manner as superficial frostbite.
- (2) No tactile sensation at all. Patient might describe it as feeling "wooden".
- (3) Skin does not move over the underlying tissue. When dented the skin will not rebound. May feel hard to the touch.
- (4) After re-warming a layer of dark colored skin may form over the affected area (Picture 8, 9)..



## Necrosis after Deep Frostbite



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 8



## Necrosis after Deep Frostbite



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 9

g. Perform first aid for deep frostbite.

- (1) Treatment steps are the same as superficial frostbite.
- (2) Protect any 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.**

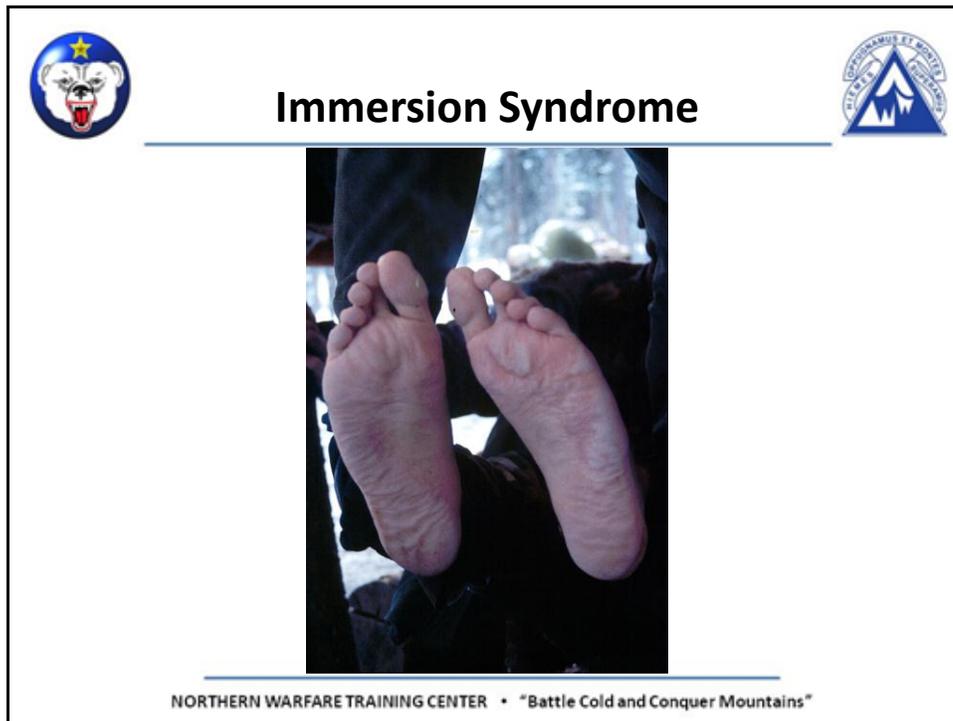
h. Identify **Immersion syndrome** (Picture 10, 11, 12).

(1) Non freezing injury that usually involves the feet.

(2) Known as Immersion foot or trench foot.

(3) Requires prolonged exposure to cold/wet conditions- at least 12hrs but usually 4-5 days.

(4) Blood flow is restricted to the extremity by cold and tightness of the boots.



Picture 10



## Immersion Syndrome



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 11



## Immersion Syndrome



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 12



Picture 13

i. 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 99-102° 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. Identify **Hypothermia**.

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

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

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

(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” – fumbles, stumbles, tumbles, grumbles, mumbles. Fine motor skills (fumble with tasks that require manual dexterity such as manipulating a rifle). Next gross motor skills function (stumble just walking). Finally, intellectual and 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

k. Perform first aid for mild and moderate hypothermia.

- (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 if able to tolerate.
- (6) Exercise mildly hypothermic patients.
- (7) Package a moderately hypothermic casualty in a hypothermia wrap.

**NOTE: All cases of hypothermia must be evacuated to a medical facility for treatment. Refer to 699-8016 Package a Casualty for information on hypothermia wraps**

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 – Develop controls that reduce the risk of cold weather injury.**

a. Use the Temperature Zone Guidance in USARAK 385-4, Appendix A and B to determine special requirements and recommended actions for the current and forecast temperatures.  
[http://www.wainwright.army.mil/nwtc/Classes/NWTC\\_Risk\\_Management\\_Mountain\\_Operations\\_FY14.pdf](http://www.wainwright.army.mil/nwtc/Classes/NWTC_Risk_Management_Mountain_Operations_FY14.pdf)

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 6 - Take steps to prevent cold weather injuries during the mission/training event.**

a. Wear the cold weather uniform properly. See 699-8012 Protect Yourself and Fellow Soldiers in Extreme Cold for guidance on wearing your issued cold weather clothing and equipment.

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.

**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** 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

|                  |  |
|------------------|--|
| <b>ACTION</b>    | Prevent Altitude Illness   |
| <b>CONDITION</b> | 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), Modular Sleep System (MSS), insulating pad, access to a warming shelter, and the requirement to protect yourself and your fellow Soldiers against altitude illness. |
| <b>STANDARD</b>  | 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. 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. 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. 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. 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. 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 O<sub>2</sub> are bad. These readings may be what are normal for the Soldier at a given altitude.**

## **Learning Step Activity 2 – Identify the signs and symptoms and perform first aid for altitude illness.**

a. 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. 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. 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. 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) 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. 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. 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.

(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.

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.

## 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

|                  |   |
|------------------|---|
| <b>ACTION</b>    | Prevent Environmental Injuries  |
| <b>CONDITION</b> | In a field environment in temperatures that range from 50° to -60° F. You are given the Extended Cold Weather Clothing System (ECWCS), Modular Sleep System (MSS) with insulating pad, access to a warming shelter and the requirement to protect yourself and your fellow Soldiers against environmental injuries. |
| <b>STANDARD</b>  | 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 final written examination Cold Weather Leaders Course (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 Commandant).

**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. (Picture 1)

a. 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 over the counter pain medications.

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



Picture 1

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

a. What is it? Carbon monoxide (CO) 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) 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. 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. 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. 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 administer intravenous fluid.

- (3) Rest.
- (4) 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. What is heat stroke? Heat stroke is the opposite of hypothermia – body core temperature is elevated above 104° 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. 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.

---

## 699-8016: Evacuate a Hypothermic Casualty

---

### 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

|                  |  |
|------------------|--|
| <b>ACTION</b>    | <b>Evacuate a Hypothermic Casualty</b>   |
| <b>CONDITION</b> | In a field environment on terrain no greater than Class 2 given a simulated non-ambulatory hypothermia patient, a SKEDCO litter, 60M static climbing rope, 4 locking carabiners, sleeping bags, ponchos, insulating pads, Hypothermia Prevention & Management Kit (HPMK), and a requirement to move a simulated hypothermia casualty to a suitable LZ for air evacuation; while wearing Fighting load carrier, ballistic helmet, and weapon. |
| <b>STANDARD</b>  | Squad: <ul style="list-style-type: none"><li>- Packaged a casualty for transport in a hypothermia wrap within 10 minutes.</li><li>- Packaged a casualty for transport in a SKEDCO in vertical orientation within 10 minutes.</li><li>- Established a simple belay.</li><li>- utilized the nine line medical evacuation protocol to call for a MEDEVAC within 15 minutes.</li><li>- met all critical performance measures.</li></ul>          |

**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- Package a hypothermic casualty. (Hypo Wrap)

- a. Use Hypothermia Prevention & Management Kit (HPMK) NSN 6515-01-532-8056.
  - (1) Open kit by tearing at the red notched markings.
  - (2) Remove the Self Heating Shell Liner from its packaging to allow it to begin warming. The Liner is activated when it comes in contact with air.
  - (3) Remove any wet clothing from the casualty and replace with dry clothing if possible.
  - (4) Remove the Heat Reflective Shell from the kit and place the casualty inside. Place the hood in position over the casualty's head.
  - (5) Place the Self Heating Shell Liner on top of the casualty.  
WARNING- THE LINER SHOULD NOT COME INTO DIRECT CONTACT WITH THE CASUALTY'S SKIN.
  - (6) Wrap and secure the Heat Reflective Shell around the casualty. This will effectively retain the heat generated by the Self Heating Shell Liner.
  - (7) Continue to monitor the casualty during evacuation. The casualty can be reassessed by opening the Heat Reflective Shell to evaluate injuries or interventions.
  
- b. Make a hypo wrap from commonly available items.
  - (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 if able to tolerate.
  - (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.
  
  - (8) Place the whole package into a SKEDCO or other litter for evacuation.

### Learning Step/Activity-2 Package a Casualty in a SKEDCO.

a. 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](http://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. (Manufacturers instructions show the rope passing through the sewn portion. NWTC will teach rope passing through the doubled webbing portion.)
- 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.

b. **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:** The end of the belay rope is attached to the head of the stretcher with a large steel locking carabiner. One individual moves to the top of the pitch and establishes an anchor. He will then attach the belay rope using a Munter hitch and signals "Belay On". Personnel at the bottom are used 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. This method is only used on simple terrain that is moderately steep or conditions are such that if the litter is dropped it will run away from the evacuation team. Additional personnel at the top belay can be used to pull the rope and the patient up, but they must not interfere with the belay.

(2) **Descending:** The end of the belay rope is attached to the head of the stretcher with a large steel locking carabiner. One individual establishes an anchor. He will then attach the belay rope using a Munter hitch and signals "Belay On". The litter team lift the patient off the terrain and move him down the pitch while the belay rope is kept fairly snug on the litter.. When the patient reaches the end of the rope, he is secured and the process is repeated. This method is only used on simple terrain that is moderately steep or conditions are such that if the litter is dropped it will run away from the evacuation team.

(3) High angle rescue (raising and lowering systems) is discussed Lesson 699-9041: Evacuate a casualty in high angle mountain terrain. These systems are complex and require additional equipment and training.

## USARAK 9-Line Medevac Request

| 9-Line MEDEVAC Request               |  |
|--------------------------------------|--|
| 1. Location of Pickup Site           | 7. Method of Marking Pickup Site   |
| 2. Radio Frequency / Call Sign       | A. VS-17 Panel   |
| 3. Number of Patients by precedence: | B. Pyro  |
| A. Urgent                            | C. Smoke   |
| B. Urgent Surgery                    | D. IR Light  |
| C. Priority                          | E. None  |
| D. Routine                           | 8. Patient Nationality & Status  |
| E. Convenience                       | A. US Military   |
| 4. Special Equipment                 | B. US Civilian   |
| A. None                              | C. Foreign Military  |
| B. Hoist                             | D. Foreign Civilian  |
| C. Extraction Equipment              | 9. Terrain Description   |
| D. Ventilator                        | Hills  |
| 5. # Patients by type                | Power Lines  |
| L. Litter                            | Buildings  |
| A. Ambulatory                        | Landing Surface  |
| 6. Number and type of wounds         |  |

**ON FEDERAL TRAINING LANDS**  
(FWA, YTA, DTA, JBER, TFTA, etc)

- Contact Range Control: Primary FM 38.30  
Secondary FM 40.50  
Contingency 907-353-7535  

- Relay 9-Line MEDEVAC Request on the back of this card.
- Contact Your Unit with SITREP.
- Continue to provide medical care until MEDEVAC arrives or ground EVAC completed.

**OFF FEDERAL TRAINING LANDS**  
(Parks HWY, Richardson HWY, Glenn HWY, etc)

- Dial 911
- Inform 911 Operator of the location and injuries.  
(Refer to 9-Line)
- Contact Your Unit with SITREP.
- Continue to provide medical care until EMS or MEDEVAC arrives.



## **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. What is the purpose of the hypo wrap?

Lessen the further loss of body heat.

## SECTION II. INTRODUCTION

**Motivator:** 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.

Risk Management (RM) is the Army's principle risk-reduction process to help protect the force. RM 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

|                  |   |
|------------------|---|
| <b>ACTION</b>    | <b>Manage Risk in Cold Regions Operations</b>   |
| <b>CONDITION</b> | In a classroom or field environment given USARAK Pamphlet 385-4, Risk Management Guide for Cold Weather Operations.   |
| <b>STANDARD</b>  | Use the control measures in USARAK Pamphlet 385-4, Risk Management Guide for Cold Weather Operations to mitigate risks for daily training events. Supervise and evaluate controls and adjust the plan as necessary. |

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

**Risk Assessment:** Low for classroom instruction. For field training during the remainder of the course risk level will be determined by the squad instructor based upon the current conditions.

**Environmental Considerations:** None

**Evaluation:** You will conduct a practical exercise 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:** Risk Management (RM) is everyone's responsibility. The NWTC has produced a pocket guide to allow you to integrate RM into the planning and execution of any operation, training or off-duty activity. This block of instruction will introduce you to the RM process and provide instruction on the use of USARAK Pamphlet 385-4, Risk Management Guide for Cold Weather Operations. During this course, you will have repeated opportunities to use the guide and the RM process as you learn about the hazards associated with cold weather operations and the tactics, techniques and procedures to reduce or eliminate these hazards. By the time you leave this course, RM should be second nature to you.

## SECTION III. PRESENTATION

### Learning Step/Activity 1- Identify the principles of Risk Management (RM).

a. RM 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 RM are as follows:

- (1) Integrate RM into all phases of missions and operations.
- (2) Make risk decisions at the appropriate level. RM 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 RM process cyclically and continuously.
- (5) Do not be risk averse. Identify and control hazards- then complete the mission.

### Learning Step/Activity 2 – Identify the five steps of the RM process.

a. The 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: Orient students to the contents of the pamphlet. USARAK Pamphlet 385-4, Risk Management Guide for Cold Weather Operations is a pocket guide for RM that you can use for cold weather training and operations.**

### Learning Step/Activity 3 – 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. Risk levels are low, moderate, high or extremely high. In a moment we will use the Risk Assessment Matrix for Cold Weather Operations to come up with a score that corresponds to a risk level. This matrix and the corresponding worksheet on pages 7-8, 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. Use the risk assessment matrix and worksheet on pages 7-8 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 and 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 type of event with the task organization of the unit performing the mission.

(3) Terrain: Compare the traffic ability with the type of terrain.

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

(5) Soldier Endurance: Consider the preparedness of your Soldiers vs. the amount of time your soldiers have spent operating in the environment.

(6) Soldier Selection: Compare the level of experience of the Soldiers to the type of task that they will be conducting.

(7) Rest and Maintenance: Compare the equipment status and how well rested you and your Soldiers are.

e. 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 – Develop controls and make risk decisions.**

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

(1) Use USARAK Pam 385-4, Appendix A: 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 – 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 – 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.

All of this information is recorded on the DD 2977 Deliberate Risk Assessment Worksheet

**Learning Step/Activity 7 – Use DD Form 2977, Deliberate Risk Assessment Worksheet.**

DD 2977 is the Risk Management Worksheet. It allows you to document the RM 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.

| <b>DELIBERATE RISK ASSESSMENT WORKSHEET</b>  |           |  |                        |   |                                    |
|--|-----------|--|------------------------|---|------------------------------------|
| <b>1. MISSION/TASK DESCRIPTION</b>   |           |  |                        | <b>2. DATE</b> (DD/MM/YYYY)                       |                                    |
| <b>3. PREPARED BY</b>  |           |  |                        |   |                                    |
| a. Name (Last, First, Middle Initial)  |           |  | b. Rank/Grade          | c. Duty Title/Position                            |                                    |
| d. Unit  |           | e. Work Email  |                        | f. Telephone (DSN/Commercial (Include Area Code)) |                                    |
| g. UIC/CIN (as required)   |           | h. Training Support/Lesson Plan or OPORD (as required) |                        | i. Signature of Preparer                          |                                    |
| Five steps of Risk Management: (1) Identify the hazards      (2) Assess the hazards      (3) Develop controls & make decisions<br>(4) Implement controls      (5) Supervise and evaluate      (Step numbers not equal to numbered items on form) |           |  |                        |   |                                    |
| 4. SUBTASK/SUBSTEP OF MISSION/TASK   | 5. HAZARD | 6. INITIAL RISK LEVEL                                  | 7. CONTROL             | 8. HOW TO IMPLEMENT/ WHO WILL IMPLEMENT           | 9. RESIDUAL RISK LEVEL             |
|  |           |  |                        | How:<br>Who:                                      |                                    |
| Additional entries for items 5 through 9 are provided on page 2.   |           |  |                        |   |                                    |
| <b>10. OVERALL RESIDUAL RISK LEVEL</b> (All controls implemented):<br><input type="checkbox"/> EXTREMELY HIGH <input type="checkbox"/> HIGH <input type="checkbox"/> MEDIUM <input type="checkbox"/> LOW   |           |  |                        |   |                                    |
| <b>11. OVERALL SUPERVISION PLAN AND RECOMMENDED COURSE OF ACTION</b>   |           |  |                        |   |                                    |
| <b>12. APPROVAL OR DISAPPROVAL OF MISSION OR TASK</b> <input type="checkbox"/> APPROVE <input type="checkbox"/> DISAPPROVE   |           |  |                        |   |                                    |
| a. Name (Last, First, Middle Initial)  |           | b. Rank/Grade  | c. Duty Title/Position |   | d. Signature of Approval Authority |
| e. Additional Guidance:  |           |  |                        |   |                                    |



| <b>Instructions for Completing DD Form 2977, "Deliberate Risk Assessment Worksheet"</b>   |   |
|---|---|
| <p><b>1. Mission/Task Description:</b> Briefly describe the overall Mission or Task for which the deliberate risk assessment is being conducted.</p>  | <p><b>10. Overall Risk After Controls are Implemented:</b> Assign an overall residual risk level. This is the highest residual risk level (from block 9).</p>   |
| <p><b>2. Date (DD/MM/YYYY):</b> Self Explanatory.</p>   | <p><b>11. Supervision Plan and Recommended Course of Action:</b> Completed by preparer. Identify specific tasks and levels of responsibility for supervisory personnel and provide the decision authority with a recommend course of action for approval or disapproval based upon the overall risk assessment.</p>   |
| <p><b>3. Prepared By:</b> Information provided by the individual conducting the deliberate risk assessment for the operation or training .<br/><b>Legend:</b> <b>UIC</b> = Unit Identification Code; <b>CIN</b> = Course ID Number; <b>OPORD</b> = operation order; <b>DSN</b> = defense switched network; <b>COMM</b> = commercial</p> | <p><b>12. Approval/Disapproval of Mission/Task:</b> Risk approval authority approves or disapproves the mission or task based on the overall risk assessment, including controls, residual risk level, and supervision plan. Space provided for authority to provide additional guidance; use continuation page if needed.</p>  |
| <p><b>4. Sub-task/Sub-Step of Mission/Task:</b> Briefly describe all subtasks or substeps that warrant risk management.</p>   | <p><b>13. Risk Assessment Review:</b> Should be conducted on a regular basis. Reviewers should have sufficient oversight of the mission or activity and controls to provide valid input on changes or adjustments needed. If the residual risk rises above the level already approved, operations should cease until the appropriate approval authority is contacted and approves continued operations.</p> |
| <p><b>5. Hazard:</b> Specify hazards related to the subtask in block 4.</p>   | <p><b>14. Feedback and Lessons Learned:</b> Provide specific input on the effectiveness of risk controls and their contribution to mission success or failure. Include recommendations for new or revised controls, practicable solutions, or alternate actions. Submit and brief valid lessons learned as necessary to persons affected.</p>   |
| <p><b>6. Initial Risk Level:</b> Determine probability and severity. Using the risk assessment matrix (page 3), determine level of risk for each hazard specified. probability, severity and associated Risk Level; enter level into column.</p>  | <p><b>15. Additional Comments or Remarks:</b> Preparer provides additional comments, remarks, or information to support the risk assessment. If block 15 is used as a continuation of block 14, strike through the block number and title.</p>  |
| <p><b>7. Control:</b> Enter risk mitigation resources/controls identified to abate or reduce risk relevant to the hazard identified in block 5.</p>   | <p><b>Additional Guidance:</b> Block 4-9 continuance page may be reproduced as necessary for processing of all subtasks/ substeps of the mission/task. If a complete page is not utilized, write "NOTHING FOLLOWS" on the first unused row, immediately after the final item assessed.</p>  |
| <p><b>8. How to Implement / Who Will Implement:</b> Briefly describe the means of employment for each control (i.e., OPOrd, briefing, rehearsal) and the name of the individual unit or office that has primary responsibility for control implementation.</p>  |   |
| <p><b>9. Residual Risk Level:</b> After controls are implemented, determine resulting probability, severity, and residual risk level.</p>   |   |

**Learning Step/Activity 8 – 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 the Platoon Leader for 1st Platoon, B Company, 1-24 IN, 1/25 SBCT. You have been tasked with conducting a 12 mile snow shoe ruck march for physical training with a 40lb ruck. The terrain is mostly flat with slightly undulating terrain during small portions of the movement. You have had 5 weeks to prepare for this mission, have received a full OPOD, and your Soldiers have conducted several shorter ruck marches to prepare. You will be starting the march at 0400 in mid January and the weather is expected to be between -30 and -40 degrees. Over half of your Platoon has never been through a winter in Alaska, but are physically fit and motivated. All of your equipment including vehicle heaters are FMC and your Squad Leaders have been through CWLC. Recent snowfall and chilling conditions has allowed snow and ice to accumulate to about 1 foot off roads or where snow is typically packed down.

**Learning Step/Activity 9 – Apply the RM process to this scenario. Record your results on DD 2977 Deliberate Risk Assessment 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 Arctic Warlord, a major NATO winter exercise in northern Norway designed to measure your unit's war fighting capabilities on a cold, snow covered battlefield. Your company completed a forced ski march about 6 hrs. 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 operation a full hour ahead of the rest of the battalion. It appears your pre-exercise training back at Ft. Freezmo has paid off. Your Soldiers have been eating and drinking well, but some appear to be a little run down from the march. It is now 2030 hrs. At 2300 (about two hours after racking out) you are wakened by the S-3 and told B 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 snowshoes and move cross country linking up with 1st Battalion just south of the airfield. From there you will take all orders from the 1st Battalion commander until you are relieved by another unit the following day. You must provide your own food, ammo, and other mission essentials, however your ahkios will be sent forward by SUSV later in the day. Though you don't 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 B Company is full of highly qualified, cold weather warriors who have been training in these -20° to -30°F temperatures since the beginning of last month. You decide the troops can sleep until 0500; 4 hours will be sufficient time to prepare for the mission. The temperature is expected to rise about 20 degrees by morning; however the winds are also expected to pick up within the next six hours, gusting up to 20 mph. The terrain from your present location to the airfield is relatively flat with barren ground and very few trees.

## **SECTION IV. SUMMARY**

You are required to develop a written risk assessment for all outdoor related 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:** During the Russo Finnish war of 1939-1940 the Finns were vastly outmanned and outgunned. Battalions were led by Captains, Divisions sometimes led by Colonels. Their artillery was from the previous century. They had a very small and outdated air force. The Russians threw 26 Divisions at a force of just 9 Finnish Divisions. Besides fighting on their home ground the Finns had a major advantage over the Russians: they could move on the snow and could live in it. In the battles away from the main defensive line (Mannerheim Line) the Finn army was free to maneuver where and when it pleased because they were on skis and did not depend on vehicles to move them or their supplies. They allowed the Russians to have the road network, while building their own trails through the forest. The Russians depended on trucks and horses while the Finns used sleds and native reindeer. The Finns would ski 20-30 kilometers a night to encircle and cutoff the Russians. In one battle, Suomussalmi, two Russian divisions totaling more than 48,000 men and 100 tanks were destroyed in detail by a Finn force of less than 17,000 with no tanks. In the end the Russians won only by sheer numbers and still only took less than half of Finland. One Russian General was quoted as saying "... we have won enough ground to bury our dead..."

### Terminal Learning Objective

|                  |   |
|------------------|---|
| <b>ACTION</b>    | Plan a Small Unit Movement Over Snow Covered Terrain  |
| <b>CONDITION</b> | In a classroom or field environment given a map of the area of operations and available imagery.                |
| <b>STANDARD</b>  | Plan a 5km movement over snow covered terrain for a squad sized element with a solution plus or minus one hour. |

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

**Risk Assessment:** Low for classroom instruction. For field training during the remainder of the course risk level will be determined by the squad instructor based upon the current conditions.

**Environmental Considerations:** None

**Evaluation:** You will be tested on your knowledge of planning considerations for over snow 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. In addition to the written test, you will conduct a written practical exercise.

**Instructional Lead-In:** This lesson will give you some basic planning considerations for moving small units over snow covered terrain.

### SECTION III. PRESENTATION

#### Learning step/Activity 1 - Identify the advantages / disadvantages of wheeled, tracked, and over-snow vehicles for movement over deep snow or steep terrain.

a. (Picture 1) There are several different modes of travel on snow. Over the next few slides we will discuss a few. The most preferred method of movement in a snow covered environment is a helicopter. However air mobility has its limitations, one of those being maintenance. It also suffers from periods of reduced visibility due to the lack of daylight and blizzard conditions associated with this type of environment. Altitude will also lessen the capability of helicopters. Troop compartments in aircraft should be kept cool to prevent Soldiers dressed for cold weather operations from sweating profusely during air movements.



Picture 1

b. (Picture 2) Another method of travel is wheeled vehicles. Wheeled vehicles have their drawbacks due to maintenance and their severe inability to move off-road. The cold regions of the world generally have very limited road networks. For example in Alaska there are only about 14,000 miles of roads, of these 2,500 are paved and in the winter only about 60% are passable. Smaller trails, sometimes no wider than a single lane are often quite prevalent and may become decisive to an operation



Picture 2

c. (Picture 3) An alternative type of transportation, is the snow machine. It can travel over almost any type of snow covered terrain. The drawback to a snow machine is the number of personnel it can carry. It is best suited to scout units and re-supply operations. It can skijor up to 3 personnel. Planning radius of a snow machine is approximately 100 miles.



## Snowmobile





**Fast and maneuverable**  
**Can tow an Ahkio or three skiers**  
**Noisy and operator is exposed to wind**

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 3

d. (Picture4) The last type of transportation for maneuver elements is the M973 Small Unit Support Vehicle (SUSV). Being a tracked vehicle it will go places that wheeled vehicles will not. The SUSV is commonly used in support of maneuver elements due to its lack of armor. The SUSV can move 180 miles on a full tank of fuel. It can carry up to 13 Soldiers depending on the configuration of the front compartment. There are the troop carrier, cargo and ambulance versions. The SUSV can also skijor up to 30 personnel depending on the length of rope in use.



Picture 4

**Learning step/Activity 2 - Identify the advantages/disadvantages of snow-shoeing, skiing, sled (ahkio) hauling, and skijoring.**

a. All motorized transportation has limitations. Individual over snow movement techniques are the most reliable form of transportation in cold regions. You should understand the three major individual movement techniques (skiing, snowshoeing and skijoring), the planning considerations for each of them, and the advantages and disadvantages of each. Later in the course you will have the opportunity to develop some of these techniques. This will allow you to develop a training plan at your unit that will allow you to meet training objectives in the field. For infantry Soldiers, snowshoeing should be considered the minimum skill that all Soldiers in the unit possess. **Your flotation is equally as important as your weapon. Do not separate your Soldiers from their weapon, pack or flotation.**

b. Skiing. Skiing is harder to learn than snowshoeing but requires less work when mastered. You don't need to pick your feet up or walk with your legs farther apart than normal. Even on flat or moderate uphill sections, a properly trained skier Soldier will be able to glide; on downhill sections the Soldier will have

very little physical work to do. Ski training is very time intensive and some Soldiers will never be proficient enough to use the skill. This is covered in Lesson 699-8020 Military Skiing.

c. This is an overview of what a ski training program should provide to your Soldiers. These lessons have been adapted from the PSIA manual. They are a guideline for you to provide training to your Soldiers, should you determine that ski techniques are needed for your unit. As an alternative, the cross country techniques can be taught to Soldiers and utilized for physical training during the winter months. This puts Soldiers outdoors during the winter months for PT and additionally teaches them to deal with the cold and trust their cold weather clothing and equipment.

- Ski Lesson 1: Nomenclature, Maintenance and Fitting, Introduction to Movement
- Ski Lesson 2: Hill Climbing and Gentle Descents
- Ski Lesson 3: Basic Cross Country
- Ski Lesson 4: Wedge Turns; Intermediate Cross Country
- Ski Lesson 5: Basic Nordic Downhill
- Ski Lesson 6: Intermediate Nordic Downhill and Advanced Cross Country
- Ski Lesson 7: Advanced Nordic Downhill

d. Snowshoeing. Snowshoeing is easy to learn, however snowshoeing requires more physical effort than skiing or skijoring. Snowshoeing still requires less effort than post holing without any flotation in deep snow. When you walk on snowshoes you have to pick your feet up and walk with your legs farther apart than normal due to the width of the snowshoe. Because of their size snowshoes are easier to maneuver through heavy brush. Their ease of use also makes them better suited for rough terrain. Some Soldiers will remove their tails because they are on hard snow a lot. The point of snowshoes is flotation. When your tails are not on, you have reduced the surface area available. You will now have to either stop movement and reattach or continue the movement and suffer.



## Snowshoeing



**KEEP THE TAILS ON YOUR SNOW SHOES!**

**YOU WILL LEAVE THE HARDPACK AT SOME POINT**

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

e. This is an overview of snowshoe training. Hands on training is provided in Lesson 699-8019.

- Nomenclature, Maintenance and Fitting of Snowshoes.
- Use of ski poles.
- Walking, Running, Turning and Breaking Trail

f. Skijoring. Skijoring is a method of pulling individuals on skis with a snow machine or SUSV. It takes very little energy to hold onto the rope and be pulled along. Skijoring by SUSV can move up to 30 Soldiers at a time. ENSURE ALL EXPOSED SKIN IS COVERED! Things to remember – Just because a Soldier has had 40 hours of ski training, does not mean he/she should be allowed to skijor – there still may be Soldiers that are not proficient enough to attempt skijoring. During training events, a written risk assessment is mandatory.

### **Learning Step/Activity 3 - Identify route planning considerations for over snow movement.**

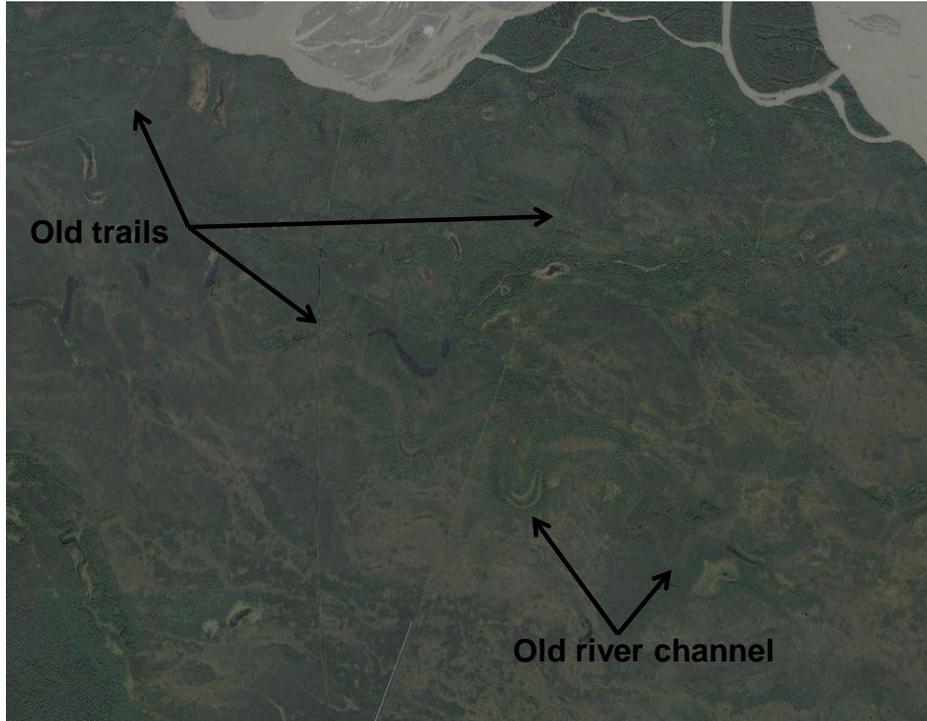
a. General considerations. In addition to the normal considerations regarding the tactical situation leaders must take into account the following when selecting a route across cold/snow-covered terrain:

(1) Conduct a map/imagery reconnaissance.

- Going around terrain features may be faster than going over them; check the contour, and select a route which involves the minimum amount of ascending and descending.
- Old trail networks are more prevalent than you may think. These can be nothing more than a footpath through the woods or single lane vehicle paths. Areas around population centers usually have trails for many miles in the surrounding countryside. These may not be on any map, but will show up on readily available imagery. Control of trails has proven to be decisive in the past.
- Old river channels can be used as well. The vegetation may be less dense or easier to move through. Keep in mind that rivers in cold regions tend to meander a lot and this will add distance.
- Vegetation can be estimated by the color. Dark green areas tend to be mature trees, White Spruce, Pine, Birch, Cottonwood etc. These are quite common immediately adjacent to river channels. They may have an understory of dense brush- Alder or Willow. Light green areas tend to be lower brush, Black Spruce, Alder, Willow and smaller birch.
- Pay attention to the contour interval on your maps. A 20 meter interval can hide a lot of very significant relief.
- Wide open areas with little or no relief must be addressed as navigation can get difficult without landmarks.
- Consider where the sun is and how the shadows fall. The south side of open areas has longer shadows that will help conceal tracks.



# Using Imagery



**Old river channels may not be on maps.**

**Dark green areas are mature forest.**

**Light green/tan is lower brush.**

**Old trails may not be on maps.**

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

(2) Are your personnel on skis or snowshoes? How proficient are they, and are they more capable of negotiating the terrain along the route with one or the other?

(3) Will your Soldiers be carrying heavy rucksacks or pulling sleds? What will the temperatures be during movement?

(4) Do you have any vehicles attached, and if so, what type of terrain/snow depth are they capable of negotiating?

(5) How will you camouflage your tracks? Do you need to? In barren areas, or areas above the tree line tracks may be difficult if not impossible to conceal.

(6) Will the route be feasible during conditions of limited visibility?

(7) Will the route cross any potential avalanche areas?

(8) What obstacles can be anticipated? Will streams and other bodies of water be sufficiently frozen to support troops/vehicles? Will plowed roads perpendicular to your route have high banks of plowed snow? Will the water level in streams be so low that your Soldiers will have to negotiate high banks?

b. Open terrain. In open terrain you want to break only one set of tracks. Aircraft flying over or elevated OPs can more easily spot several tracks than they can a single set of tracks. Follow the tree line as much as possible, this will aid in concealment from the ground as well as help hide your tracks from the air. The sun stays in the southern sky for most of the winter. This will produce very long shadows on the southern side of open areas that can be used to conceal tracks.



## Route Planning Considerations: Open Terrain





**THIS WILL BE SEEN FOR A  
LONG WAY FROM A HIGHER OP**

**HUG THE TREELINE TO CONCEAL TRACKS**

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

c. Hill or mountain terrain. When negotiating hills or mountains use gentle traverses to ascend or descend. This makes it less fatiguing on your Soldiers so they will be able to fight when they reach the objective. As far as avalanche prone slopes are concerned avoid them at all costs. Very specialized training is required to even come close to negotiating them safely. During the avalanche awareness class you will learn some warning signs to be aware of in snow covered mountainous terrain.



## Route Planning Considerations: Hills / Mountains



- Use gentle traverse to ascend or descend
- Follow contours once elevation is gained
- Avalanche considerations



---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

d. Water routes. Water routes are generally excellent for navigation. They can be superb avenues for movement after freeze-up. However you must physically check the ice thickness by cutting a hole and measuring it .Very detailed reconnaissance is required before attempting to move on water routes. When you move on water routes treat them as an open area and stay close to the shore. Again this will help to conceal you and your tracks. Overflow is a condition common to most bodies of water where the water flows onto the ice.

**WARNING: Failure to conduct a very thorough reconnaissance of a route over ice can lead to loss of life and equipment.**

- Steam coming off the surface of the snow indicates that there is open water. You may also see isolated patches frost on the trees adjacent to the water way. This indicates that there was open water there and the ice around that area may be thin.



## Route Planning Considerations: Water Route Hazards



**Steam rising indicates open water.**

**Look for frost on trees.**



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

- “Frost flowers” form as a result of water vapor condensing on ice or snow. This came from exposed water. When a open lead freezes over these flowers form on the ice. This ice is quite thin but may be strong to support a load of snow thus concealing its presence. Avoid any depression in the snow while on a water route. Listen for the sound of flowing water and hollow sounds.



## Route Planning Considerations: Water Route Hazards



**“Frost flowers”**



Frost flowers form as a result of water vapor condensing. Usually found on thin refrozen ice and in holes.

- As the winter progresses the water under the ice begins to drop. This sometimes leaves an air space. Ice is no longer supported by water and may collapse. Again check for hollow sounds and the sound of flowing water.



## Route Planning Considerations: Water Route Hazards



**Water level under the ice drops through the winter resulting in a space that cannot support weight.**

**Check for hollow sounds and the sound of flowing water.**

**Hole may refreeze just enough to support snow. Avoid depressions.**

e. This chart show ice depth thickness required for different modes of travel.



## Load Bearing Capacity of Waterborne Fresh Water Ice



| Minimum Ice Thickness (Waterborne) |                       |                     |                        |
|------------------------------------|-----------------------|---------------------|------------------------|
| Load                               | Minimum One Time Only | Normal Repeated Use | Distance Between Units |
| Soldier on skis                    | 1.5 inches            | 2 inches            | 5 meters               |
| Soldier on foot                    | 3 inches              | 4 inches            | 5 meters               |
| HMMWV                              | 10 inches             | 13 inches           | 27 meters              |
| SUSV                               | 10 inches             | 13 inches           | 27 meters              |
| UH-60/CH-47                        | 15 inches             | 18 inches           | 80 meters              |

**At 16INCHES, one additional inch will support 1 ton. Waterborne ice only.**

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

**Note: Rule of thumb for armored vehicles: 16 inches of waterborne ice support 16 tons, and each additional inch supports one additional ton. This does not apply for ice thicknesses under 16 inches. For example three inches of ice will not support three tons.**

**Note: If ice is not supported by water (waterborne) because the water level has dropped, it will be too weak to support heavy loads.**

**Note; In temperatures above 14° F, add 25% to all required ice thickness'.**

f. Night movements. Almost everybody has conducted some sort of night movement. You all know about breaks in contact and how long it can take to regain contact and continue movement. In temperate regions this is usually an annoyance that slows movement. In the cold weather environment, long halts can produce cold weather injuries. Due to this fact, the route should follow the easiest terrain possible. The route should also be well marked and guides placed where appropriate. Maximize the use of reconnaissance teams and well defined travel lanes and checkpoints. Reconnaissance teams may also be tasked to put up heated shelters along longer routes.

## Learning Step/Activity-4 Identify trail breaking procedures.

### a. Dismounted Trail Breaking.

(1) Trail breaking will consume considerable time, effort and energy. The first Soldier in line will become fatigued quickly depending on the load carried and the depth of snow. One third of the unit is allocated to this task. The trail breaking party departs one hour earlier for each kilometer to be traveled. The leader is responsible for:

- Setting a course that will maintain tactical security to the larger unit while maintaining ease of movement. The general trace should be set using a map and aerial imagery. Every effort should be made to stay in mature forest and avoid areas that are choked with brush. These areas will make movement excruciatingly slow and the noise generated by clearing a route or just moving through it can easily alert the enemy.
- Ensuring trail marking SOP is adhered to. Side trails or back-tracking trails must be cordoned off to prevent units from taking a wrong turn.
- Provide guides if necessary.
- Ensure pioneer tools are available. The tools in an Ahkio group are enough for a squad to cut trail. If water routes are to be used additional tools such as augers and depth sticks must be brought along.

(2) The procedure for the lead squad is as follows:

- The Squad Leader designates the direction and the lead Soldier begins moving, establishing the initial track.
- The second in line does not step into the firsts' tracks. He will step opposite and flatten the track.
- The third and fourth Soldiers will offset their steps left and right by at least one snowshoe width. This widens the trail to allow Ahkios to be brought along. Should it become necessary, these Soldiers are also the "cutters". Each one carries a machete to clear brush on the sides of the trail. Care must be taken to lop branches close to the main trunk so they do not become spears.
- The Squad Leader's primary focus is navigation. A march table (see LSA-5) should be kept in order to keep track of where the unit is. GPS should not be relied on solely as batteries are easily drained in the cold. He will ensure the two teams are rotated as necessary.
- The trail team will clean up the trail by filling in low spots with snow, moving brush trimmings, and marking the trail for following units. They also bring along the squads' Ahkio.
- An additional fire team can be assigned to provide security for the trail breaking squad.

### b. Mounted Trail Breaking.

(1) The M 973 Small Unit Support Vehicle is quite capable of cross country travel under most snow conditions. The planning procedures are much the same for mounted travel as they are for dismounted. The leader will

- Ensure that there are at least two vehicles travelling together and that the crews are well versed in recovery.
- Ensure that fuel is topped off and additional cans are carried.
- BIL is present and serviceable. Recovery equipment such as winches, tow cables and snatch blocks are essential. Wheeled vehicles MUST have tire chains.
- Route, number of personnel, time of departure is understood and logged with command center.
- Passengers have adequate equipment to sustain overnight as a minimum.
- Leader has navigational equipment, maps, compasses, overlays and imagery, GPS.

(2) The procedure is as follows:

- The lead vehicle will set the initial track staying as concealed as much as possible.
- The second vehicle will offset their track to flatten out the trail. This keeps a hard ridge from forming in the center of the trail that can high center other vehicles.
- Following vehicles will also offset as much as practicable to widen the trail. This also serves to harden the snow thus easing the passage of other vehicles.
- A series of tripods can be set up quickly to mark the trace of a trail through open areas. They should be spaced so that from one tripod, the next in line can be easily seen.

(2) Trail maintenance will become a task repeated often in order to maintain lines of communications and supply. A significant snowfall or wind event can totally obliterate any trace of a trail. A well maintained and marked trail is far easier to re open than breaking a new one.

### Learning Step/Activity 5 - Plan movement rates over snow covered terrain.

a. Planning rates of movement

(1) The normal planning rate for troops on hard packed, gently rolling terrain is 4 km per hour. When you add snow or hilly terrain in there is a formula to help you judge the rate of march.

(2) You will notice looking at this table that the movement rate on foot with less than 1 foot of snow is the same as on snowshoes with more than 1 foot of snow. You will also notice that skis are shown to be faster than snowshoes; this is due to the fact that they require less work to use. Finally skjoring doesn't show a time for an unbroken trail, this is because you are behind a vehicle and it is breaking trail for you. The table assumes there is no work required to clear a trail.



## Movement Mode and Speed

| Movement Mode                          | Unbroken Trail | Broken Trail |
|--|----------------|--------------|
| On foot-<br>less than one foot of snow | 1.5 to 3 kph   | 2 to 3 kph   |
| On foot-<br>more than one foot of snow | .5 to 1 kph    | 2 to 3 kph   |
| Snow Shoeing                           | 1.5 to 3 kph   | 3 to 4 kph   |
| Skiing                                 | 1.5 to 5 kph   | 5 to 6 kph   |
| Skjoring                               | N/A            | 8 to 24 kph  |

**(expected rates of march for troops carrying rucksacks over gently rolling terrain)**

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

(3) Now let's take a look at the effects of terrain on movement. When you gain elevation you must add 1 hour for every 1000ft you move up. This takes into account the extra time required to traverse and the more frequent halts that will be required. Moving downhill you will have to add 1 hour for every 1600ft you move. This is generally accepted for foot or snowshoe movement; proficient skiers will take significantly less time to move downhill. More injuries occur descending than ascending. These injuries are normally lower leg injuries.

(4) A march table is a useful tool to keep track of your movement along a route. A sample and a blank are provided below.

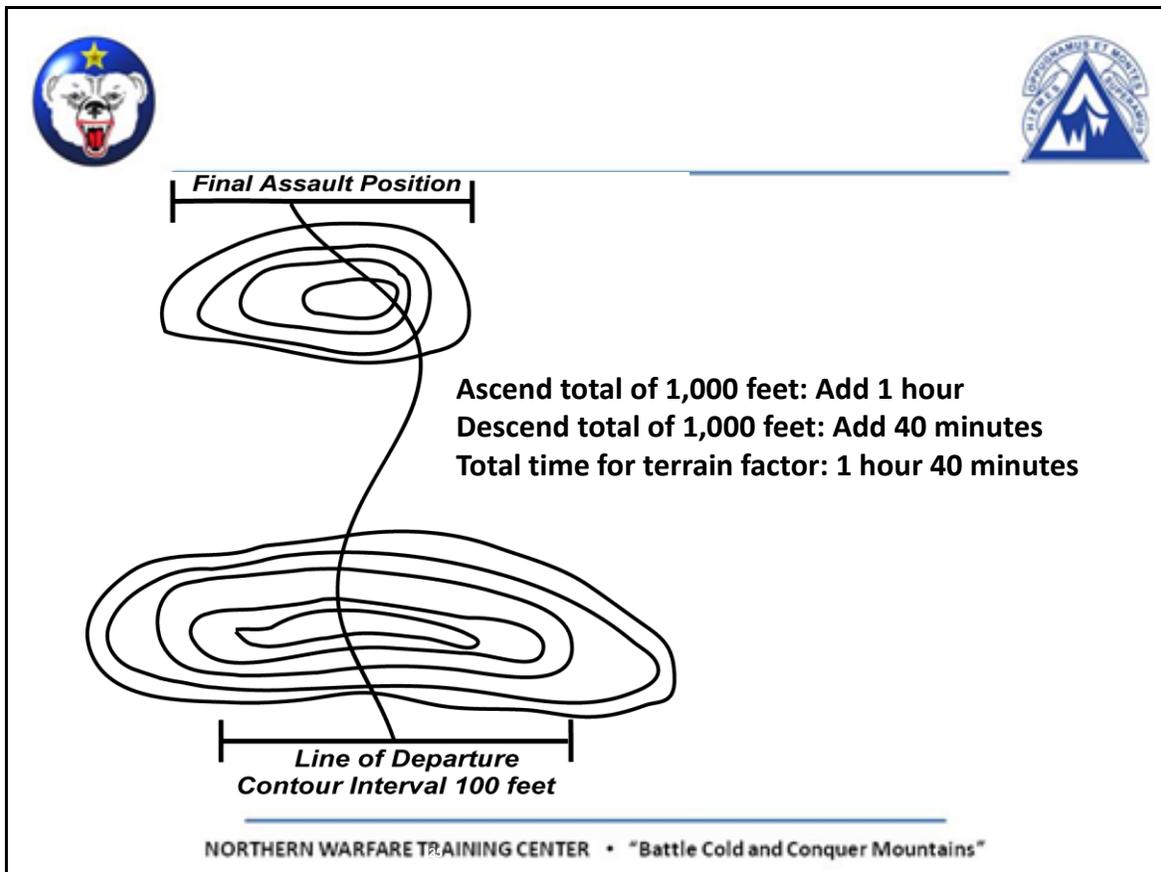
| Day <u>  1  </u> From Grid <u>  WF 560508  </u> Altitude <u>  2250  </u> To Grid <u>  WF 573444  </u> Altitude <u>  2300  </u>                  |             |            |                |          |              |                  |        |                 |
|---|-------------|------------|----------------|----------|--------------|------------------|--------|-----------------|
| Start Point   | Degree Grid | Degree Mag | Terrain        | Distance | End Leg Grid | End Leg Altitude | Change | End Leg Terrain |
| WF560508  | 26 0        | 241        | CREEK/ROAD     | 1750M    | WF 531500    | 2100             | -200   | CREEK JUNCTION  |
| WF 531500   | 180         | 159        | CREEK JUNCTION | 1975M    | WF 534484    | 4500             | +940   | SPUR            |
| WF 534484   | 180         | 159        | SPUR           | 2970M    | WF540454     | 5500             | +1000  | HILLTOP         |
| WF 540454   | 100         | 79         | HILLTOP        | 3200M    | WF 573444    | 2250             | -3250  | BRTS            |
| Total Distance: <u>  9895M  </u> Total Elevation Change: <u>  -200  </u>  |             |            |                |          |              |                  |        |                 |
| Day <u>    </u> From Grid <u>                    </u> Altitude <u>          </u> To Grid <u>                    </u> Altitude <u>          </u> |             |            |                |          |              |                  |        |                 |
| Start Point   | Degree Grid | Degree Mag | Terrain        | Distance | End Leg Grid | End Leg Altitude | Change | End Leg Terrain |
|   |             |            |                |          |              |                  |        |                 |
|   |             |            |                |          |              |                  |        |                 |
|   |             |            |                |          |              |                  |        |                 |
|   |             |            |                |          |              |                  |        |                 |
|   |             |            |                |          |              |                  |        |                 |
| Total Distance: <u>                    </u> Total Elevation Change: <u>                    </u>   |             |            |                |          |              |                  |        |                 |

(4) Use the scenario to plan your movement:

- Your mission is to conduct a deliberate attack. The distance from your LD to assault position is 5KM.
- Your route follows an unbroken trail crossing two ridges. The first is 550 ft above the surrounding terrain and the second is 450ft.
- There is 18 in. of snow on the ground and your Soldiers are on snowshoes.

(5) PE solution

- Terrain Effect:
  - You ascend a total of 1,000 feet so add one hour.
  - You descend 1,000 feet so add 40 minutes.
  - This gives you a total time of 1 hr and 40 minutes just for the terrain effects.
- We used a planning figure of 1.5km per hour. This gives a total of 3 hours and 20 minutes for the 5km. Add the time for the 5km, (3 hours 20 minutes) to the time for terrain effects (1 hour 40 minutes) this gives you a total time of 5 hours to move 5 km, whereas on hard packed, gentle terrain it would have taken 1 hour 15 minutes.



#### SECTION IV. SUMMARY

You now know how to plan a unit movement over snow. You will conduct several over snow movements during the remainder of this course using the techniques described in this presentation. This will assist you with planning and execution of training at your unit.

#### Check on Learning.

1. Which is more efficient skis or snowshoes?  
Skis are more efficient as long as the Soldier is proficient.
2. Which is easier to learn skis or snowshoes?  
Snowshoes are easier to learn.

## SECTION II. INTRODUCTION

**Motivator:** One of the keys to successful operations in a snow-covered environment is mobility. This has been proven many times on the battlefields of Europe and Korea. Some vehicles have been designed to operate on snow-covered terrain and air mobile operations offer a big advantage. The means of mobility, however, is limited by terrain and weather. Specialized vehicles and air support will not always be available to you. In a short period of time, you can learn to use snowshoes to efficiently move over snow covered terrain.

### Terminal Learning Objective

|                  |   |
|------------------|---|
| <b>ACTION</b>    | Move Over Snow on Snowshoes   |
| <b>CONDITION</b> | In a field environment given the military snowshoe with bindings, ski poles, rucksack (with a minimum load of sleeping bag, sleeping pad, extra pair of socks, extra pair of mitten inserts, additional packing list items may be prescribed by unit), while wearing ECWCS, ballistic helmet, fighting load carrier, weapon and a 5/10 kilometer snow-covered course with varied terrain. |
| <b>STANDARD</b>  | Complete a 5/10 kilometer snowshoe movement Meet all critical performance measures IAW the student evaluation plan.   |
| <b>NOTE:</b>     | CWOC completes a 5K, CWLC completes a 10K   |

**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 to watch for cold weather injuries. Squad leader is responsible for taking breaks in warming shelters as required.

**Risk Assessment:** Dependent upon current conditions. Squad instructor will conduct a thorough risk assessment prior to any field training.

**Environmental Considerations:** None

**Evaluation:** You will be tested on your ability to negotiate varied terrain on snowshoes throughout CWLC and CWOC as most training is dismounted and walking is required to get to the training area. You will also be tested on your knowledge of snowshoe movements 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:** During this period of instruction you will learn the nomenclature, maintenance and fitting of your snowshoes. Once your snowshoes are fitted you will learn the techniques to use them in varied snow covered terrain.

### SECTION III. PRESENTATION

**Note: You may think that just because you are on packed snow you can remove your snowshoe tails. Keep in mind that you will leave the security of the packed trail and you will either have to stop the entire unit to reinstall your tails or continue the movement without adequate flotation. The whole point of snowshoes is flotation and removing your tails drastically reduces the surface area available.**

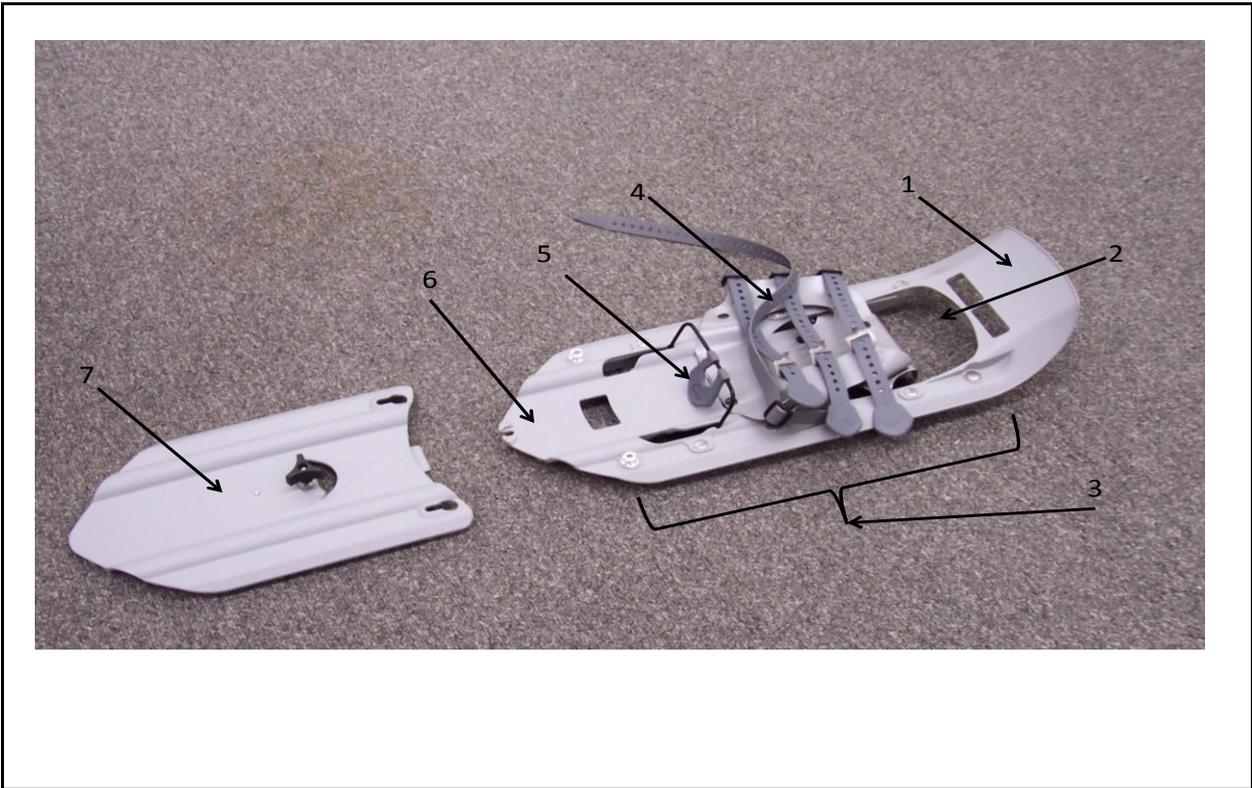
**YOUR FLOTATION IS EVERY BIT AS IMPORTANT AS YOUR WEAPON AND CLOTHING.**

#### **Learning Step/ Activity 1 - Fit and maintain the MSR Military snowshoe.**

The MSR Military Snowshoe is light and durable. It will provide you with flotation in snow. The snowshoes consist of a hard plastic deck with steel crampons and bars to aid in traction. They are approximately 22" long and 8" wide, without flotation tails, and weigh approximately 3 lbs 10 oz. Ordering information is located in Appendix C of this manual.

##### a. Nomenclature of the MSR Military Snowshoe. (Picture 1)

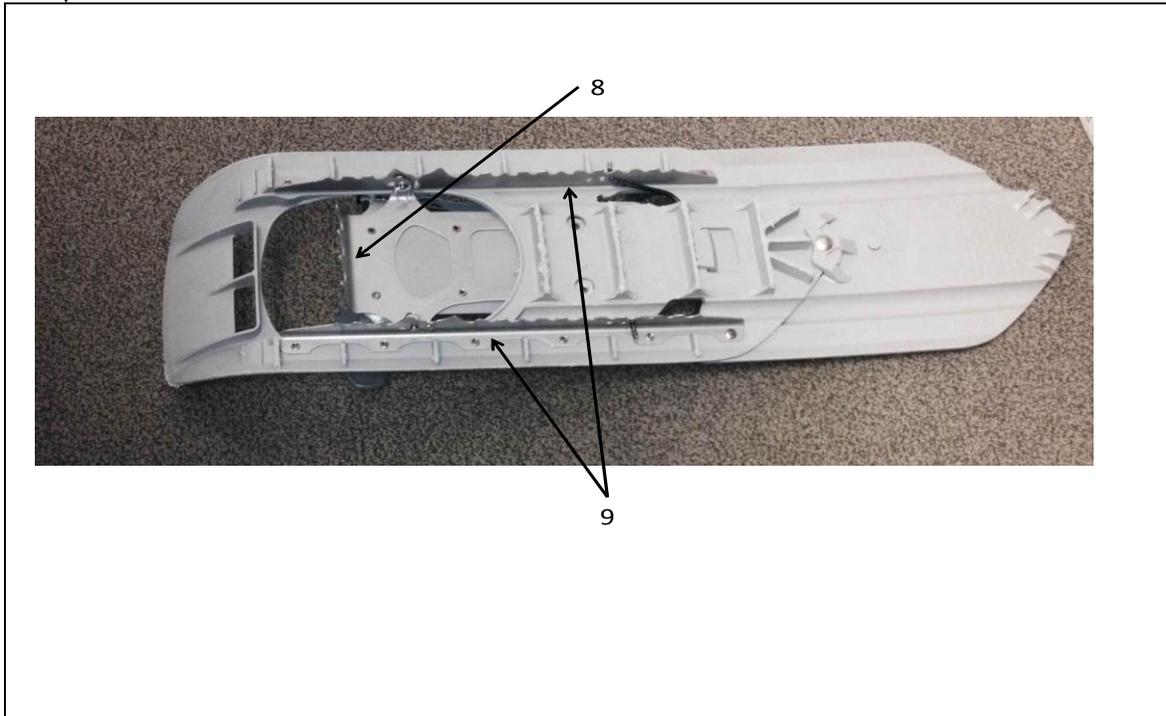
- (1) Shovel- the upturned front portion of the snowshoe designed to help it ride toward the surface of the snow.
- (2) Window- opening of the snowshoe that allows the toe of the boot to pivot for added traction and give the user natural movement of the feet while walking.
- (3) Deck- Middle flat portion of the snow shoe.
- (4) Bindings- allow for the attachment of the snowshoes to the boot.
- (5) Elevator Tabs- Metal bars that raise the wearer's heel to decrease the angle of the wearer's foot when climbing steep terrain.
- (6) Tail- elongated rear of the snowshoe designed so that the snowshoe will track in a straight line while walking.
- (7) Flotation Tails- Detachable additional decking at rear of snowshoe that provides greater flotation for powder snow.



Picture 1

(8) Crampon- Metal structure under deck, directly under boot, that aids in traction on ice and hard-packed snow.

(9) Steel Bars- Serrated edges run the length of the shoe on both sides that aid in traction on ice and hard-packed snow.



## Picture 2

### b. Fit the MSR military snowshoe.

(1) Lay the snowshoes on the ground. The running end of the heel strap should be to the outside of your foot.

(2) Place one boot underneath the toe straps until the front of the boot is between 1/2 to 2/3 into the window.

(3) Starting with the front toe strap, tighten each toe strap until it is snug against the boot. Take care not to cut off circulation or over-tighten to the point that the strap breaks.

(4) Secure the heel strap to your boot, just above the heel lug. The running end of the heel strap should be on the outside of your boot to prevent you from tripping over it.

(5) Repeat with the other snowshoe.

### Learning Step/Activity 2 – Move on snowshoes.

**Note: This is a practical exercise performed outside.**

#### a. On flat or rolling terrain:

(1) Walk with your feet apart slightly wider than normal to prevent stepping on or catching the other snowshoe.

(2) Raise the toe of the snowshoe just high enough with each step to clear the snow as the tail slides over it.

#### b. On gentle slopes climb straight up hill or descend directly downhill.

c. On steep terrain, ascend by traversing. Try to pack a level trail as you traverse the slope. You can descend steep terrain using the same technique or you can move directly down the slope.

#### d. To change directions you can:

(1) Make a **step turn**. Simply move the outside snowshoe a few inches towards the desired direction of travel. Then move the other snowshoe until it is parallel to the one you first moved. Continue the process until you are facing the desired direction of travel.

(2) Make a **kick turn**. Use kick turns to turn around in tight or steep terrain:

- Lift one foot and place the tail vertically on the ground next to the window of the stationary shoe.
- Maintaining balance, allow the snowshoe to fall backwards so the feet are pointing in opposite directions. Do not place the snowshoes on top of each other.
- Bring the other snowshoe around and place next to the first one.

#### e. Additional considerations.

(1) Use ski poles as an aid to balance, especially when carrying heavy loads and/or moving uphill.

(2) Try to step over obstacles. Place the snowshoes parallel to the obstacle and straddle it one leg at a time. If a large obstacle cannot be avoided step directly on it with as much contact as possible.

(3) Do not try to bridge depressions with the snow shoe as it will place undue stress on the frame and may break it.

(4) MSR military snowshoe is suited for most conditions. In all cases, the first individual will break a trail and will work harder than those behind him. For this reason you must rotate trail breakers.

(5) 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.

#### **SECTION IV. SUMMARY**

You should now understand how to set-up, maintain and use your snowshoes. You should also understand the advantages and the disadvantages of using snowshoes.

#### **Check on Learning.**

1. Why should you step directly on to logs or other obstacles with the snowshoe?

To prevent excess stress on the snowshoe frame.

2. What is one of the advantages to using snowshoes?

Snowshoes are easier to use, and require little training to be proficient.

---

## 699-8020: Employ an Ahkio Sled

---

### SECTION II. INTRODUCTION

**Motivator:** The Ahkio sled can carry a load of 200 pounds over difficult terrain and is used for carrying tents, stoves, fuel, rations and other necessary items of each tent group. They are also used for carrying weapons and ammunition. They may be used as firing platforms for machine guns in deep snow and are particularly useful in the evacuation of casualties. Without the availability of an Ahkio you will either have to carry the equipment on your back or have to survive without it.

#### Terminal Learning Objective

|                  |  |
|------------------|--|
| <b>ACTION</b>    | <b>Employ an Ahkio Sled</b>  |
| <b>CONDITION</b> | In a field environment on snow covered terrain, given an Ahkio with unit prescribed sustainment equipment, four traces, and four harnesses while wearing Extended Cold Weather Clothing System (ECWCS) appropriate to weather conditions, ballistic helmet, fighting load carrier, weapon. |
| <b>STANDARD</b>  | Packed unit prescribed sustainment equipment into the Ahkio so balance is maintained. Hauled the Ahkio over a designated course.   |

**Safety Requirements:** Soldiers dressed for current weather conditions. Daily Risk Assessment conducted. OIC/NCOIC must have medical evacuation plan ready for Soldiers injured during this training.

**Risk Assessment: Moderate.** Dependent upon current conditions. Squad instructor will conduct a thorough risk assessment prior to any field training.

**Environmental Considerations:** None

**Evaluation:** You will be tested on your knowledge of sled hauling 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 learn different techniques for moving unit equipment with the scow sled.

### SECTION III. PRESENTATION

#### Learning Step/Activity 1 – List the components of the tent (Ahkio) group.

a. Tent group equipment is designed for use by a rifle squad; however, it can readily be structured to accommodate any task-organized unit, regardless of that unit's size or mission. This section will discuss equipment you will need to be intimately familiar with before undertaking field training in a cold weather environment. The tent group equipment is also commonly referred to as the Ahkio group, as the tent and the Ahkio are the two key items among all the equipment that constitutes the group.

b. Table 1 is a list of typical tent group equipment recommended for a light infantry squad operating in cold regions: Table 2 is recommended repair parts. Figure 1 is a photo of the components

Table 1: Tent (Ahkio) Group Contents

| ITEM  | # | NSN or ordering information   |
|---|---|---|
| Scow-sled, 200 lbs. capacity (Ahkio)                              | 1 | 3920-00-273-8211  |
| Tent 10-man Arctic, complete with pole board                      | 1 | 8340-00-262-3684<br>Steel stakes 8340-00-823-7451   |
| Pole Board  | 1 | Cut a 1'x1' piece of plywood. Cut a second 5"x5" piece of plywood. Bore a hole that is slightly larger than the tent pole diameter into the center of the 5"x5" piece and glue it to the center of the 1'x1' piece. |
| Door Poles  | 2 | Cut two 6 foot poles that are 2-3 inches in diameter  |
| Space Heater Arctic (SHA)   | 1 | 4520-01-444-2375  |
| Stove board   | 1 | Cut a piece of plywood 3' x 2', rip it lengthwise in half, cover top side with galvanized sheet steel and re-join the two pieces with hinges. This allows you to fold it in half for storage.                       |
| Five gallon fuel can  | 1 | 7240-01-337-5268  |
| Five gallon water can   | 1 | 7240-00-089-3827  |
| D-handle coal shovels   | 2 | 5120-00-188-8446  |
| Machetes (with sheath)  | 2 | 5110-00-813-1286  |
| Squad cook sets   | 2 | 7360-01-613-6851  |
| Squad stoves  | 2 | 7310-01-578-6413  |
| Fuel bottles  | 2 | 7240-01-351-2133  |
| Bow saw   | 1 | 5110-00-340-3276  |
| Ax  | 1 | 5110-01-416-7827  |
| Hammers 2 lb.   | 2 | 5120-00-203-4656  |
| 50 or 60m static rope OR Army 120' Greenline                      | 1 | 4020-01-577-8714 (cut this spool into 1x18' and 4x9' traces; 1x 60m. One spool will complete 3 squads   |
| Trace, Ahkio pulling, 9 ft  | 4 | Cut from static rope  |
| Tow Rope 18 feet  | 1 | Cut from static rope (join with 1x9' to make a 27' tow rope   |
| Harnesses, Man's, Sled (Ahkio towing)                             | 4 | 8465-00-255-8413  |
| Aluminum oval carabiners (used for towing and rescue systems)     | 8 | 8465-01-578-8906  |
| Aluminum Locking Pear Shaped Carabiners (used for rescue systems) | 2 | 8465-01-578-8898  |
| 25' 1 inch tubular nylon webbing (used for rescue systems)        | 1 | 8305-00-268-2455  |
| 6' 7mm cordelette   | 2 | 4020-01-577-8686  |
| Fire extinguisher   | 1 | 4210-00-165-4703  |
| Lantern, gasoline*, with case                                     | 1 | NWTC utilizes a Coleman Brand White Gas Lantern   |

**\*CAUTION: THE USE OF PROPANE-FUELED LANTERNS DURING COLD WEATHER OPERATIONS IS NOT RECOMMENDED. PROPANE TURNS TO LIQUID AT APPROXIMATELY – 40°F. IN THIS LIQUID STATE IT MAY SPRAY FROM ITS' CONTAINER WHEN THE VALVE IS OPENED, CREATING AN EXTREMELY HAZARDOUS CONDITION.**

Table 2: Recommended Repair Items

| ITEM                               | NSN              |
|------------------------------------|------------------|
| CLIP, LINER                        | 8340-00-242-7872 |
| CLOTH, DUCK, 5 YARDS (Ahkio Cover) | 8305-00-926-6171 |
| D-RING, ONE INCH BRASS             | 5390-00-260-1414 |
| LINER, TENT                        | 8340-00-262-3698 |
| PEAK PLATE                         | 8340-00-965-4432 |
| PIN, TENT, STEEL                   | 8340-00-823-7451 |
| POLE, TENT                         | 8340-00-188-8413 |
| SLIP, TENT LINE                    | 8340-00-205-2759 |
| TENT LINE, 12' 6"                  | 8340-00-262-3658 |
| TENT LINE, 19'                     | 8340-00-262-6911 |



Figure 1:

c. The scow sled, 200 lb. capacity, commonly known as the Ahkio, is the infantry squad's primary means of transporting tents and other sustainment equipment in a cold weather environment. It is a 38 pound fiberglass sled with an attached canvas cover, and has a carrying capacity of 200 pounds. In addition to its' primary function of transporting the tent group equipment, the Ahkio is excellent for transporting weapons, rations, and ammunition, providing a stable firing platform for crew-served weapons in deep snow, and for casualty evacuation.

## Learning Step/Activity 2 – Pack the Ahkio.

a. Place tent pins in bottom center of Ahkio with the heads opposite each other. Place hammers on floor of sled on either end of the tent pins, heads opposite one another.

b. Place bow saw on top of tent pins.

c. Place stove board on top of bow saw.

d. Place fire extinguisher, center pole, axe, two MSR fuel bottles and machetes on either side of the stove board, along the sides of the sled, ensuring that the weight is distributed evenly.

e. To the rear of the stove board, place fuel can and water can. Fuel can opening is up and to the rear and is double bagged with HAZMAT pads for transport.

f. Lantern (in case) is placed in front of stove board, perpendicular to the long axis of the sled. Two cook sets are placed in front of the lantern.

g. Place repair kit (ammo can) in front of the lantern. Place squad stoves on the either side of the sled next to the cook sets.

h. Place the pole board in front of the repair kit. Place the 120 foot rope, traces and harnesses on top of the pole board.

i. Place SHA on top of and slightly to the rear of the stove board.

j. Place the tent with shovels (so that the apex is toward the front of sled) on the SHA).

k. Fold two canvas ends of Ahkio sled over sled contents. Fold sides of canvas over sled contents.

l. Place the tripod and door poles on top of canvas (field expedient poles only). The manufactured tripod and collapsible door poles should be secured inside the sled with the center pole. Secure the contents of sled with the lashing rope from rear to front.

b. Additional considerations

(1) This is a way to pack the Ahkio. It is the standard used in NWTC courses and should be used when conducting CWIC. However, units may tailor the load and packing order for their specific mission.

(2) Proper weight distribution is essential when packing the Ahkio. Heavy items should be placed in the bottom and slightly to the rear of center. Loading lighter equipment toward the top will prevent the Ahkio from becoming top-heavy. The load should be packed in a manner which results in the lowest possible profile, again, to avoid a top heavy condition. If the center of gravity is too high, the sled will be difficult to pull, and will tend to roll over, especially when moving parallel to a slope. Tools such as shovels, axes, saws, and machetes should be packed on the sides or top for easy access when breaking trail or clearing bivouac sites.

### **Learning Step/Activity 3 – Prepare to haul the Ahkio sled.**

a. It is easiest to pull an Ahkio with snowshoes. You may use skis; if skis are used they must be waxed for more grip than glide or climbing skins should be utilized.

b. Secure the following equipment:

(1) 27 foot tow rope (Two sections-one 9ft the other 18ft. Has a snap hook or carabiner at each end and a metal attachment ring in the middle)

(2) 3 each 9 foot traces. Each trace has a snap hook or carabiner at each end.

(3) 1 each 50-60m climbing rope

(4) 4 harnesses

c. If you will be wearing a rucksack, put it on now.

d. Drape the harness over your head and fasten the metal buckle in front. The D shaped ring in the rear of the harness is the connection point for pulling; the ring in front is for braking. If the rucksack rides below the connection point, remove the harness and make attachments directly to the rucksack.

e. Additional Considerations.

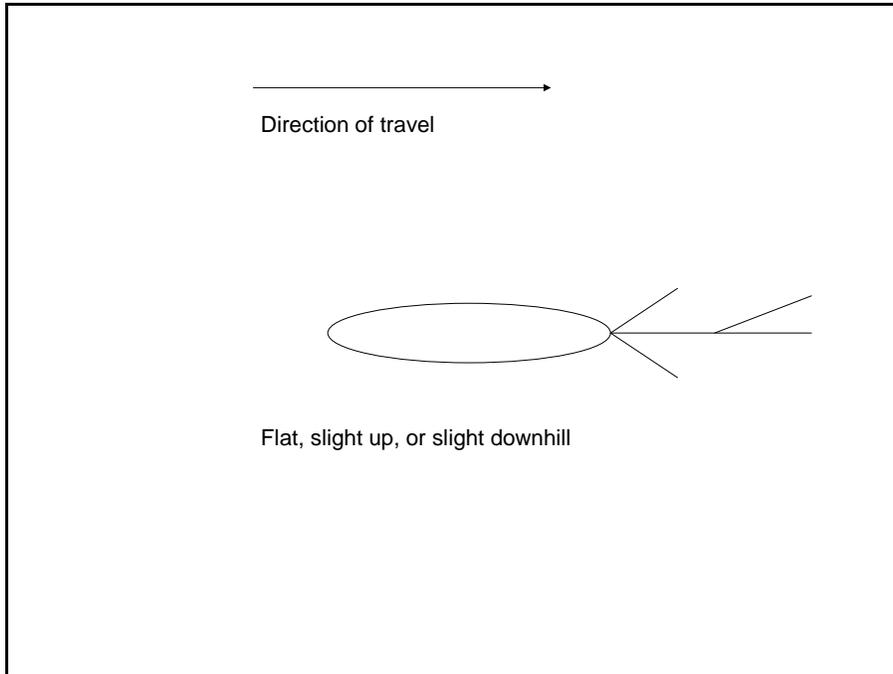
(1) Movements of the Ahkio pulling team are coordinated by one team member.

(2) Ahkio pulling teams must be rotated frequently to avoid exhaustion

(3) The trail should be broken by a trail breaking team prior to attempting to pull sleds. Heavy brush and forest can make pulling a sled a near impossibility.

(4) Pullers should stay close to the 27ft tow rope. This helps pack the snow allowing the sled to slide easily and not dig in.

**Learning Step/Activity 4 – Haul a scow-sled (Ahkio) on flat or gently sloped (rolling) terrain. (Picture 1)**



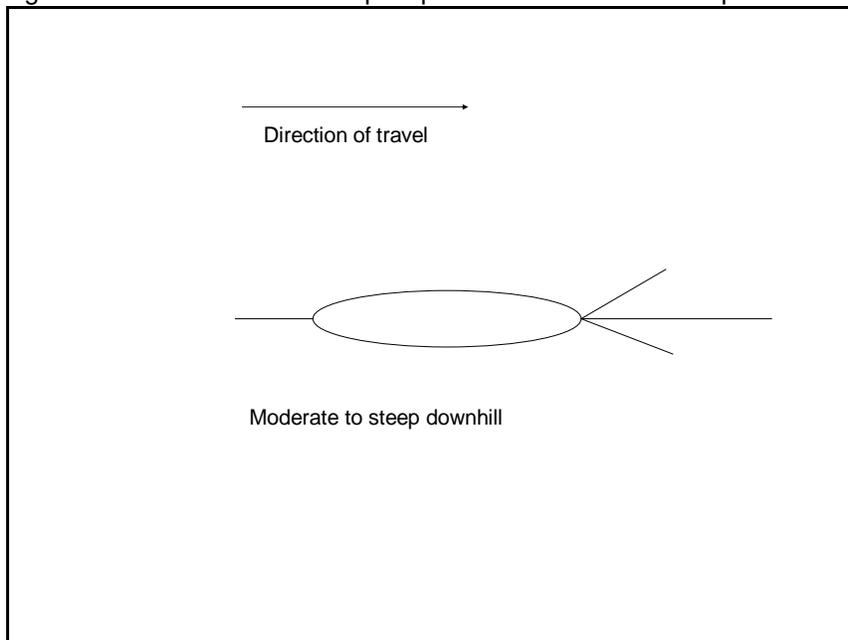
Picture 1

a. Hook the 27 foot tow rope to the front of the sled with the 9 ft section closest to the sled. Hook one of the 9 foot traces to the ring on the tow rope. The remaining two traces can be hooked to the sled or one to the sled and one to the ring.

b. Pull in unison.

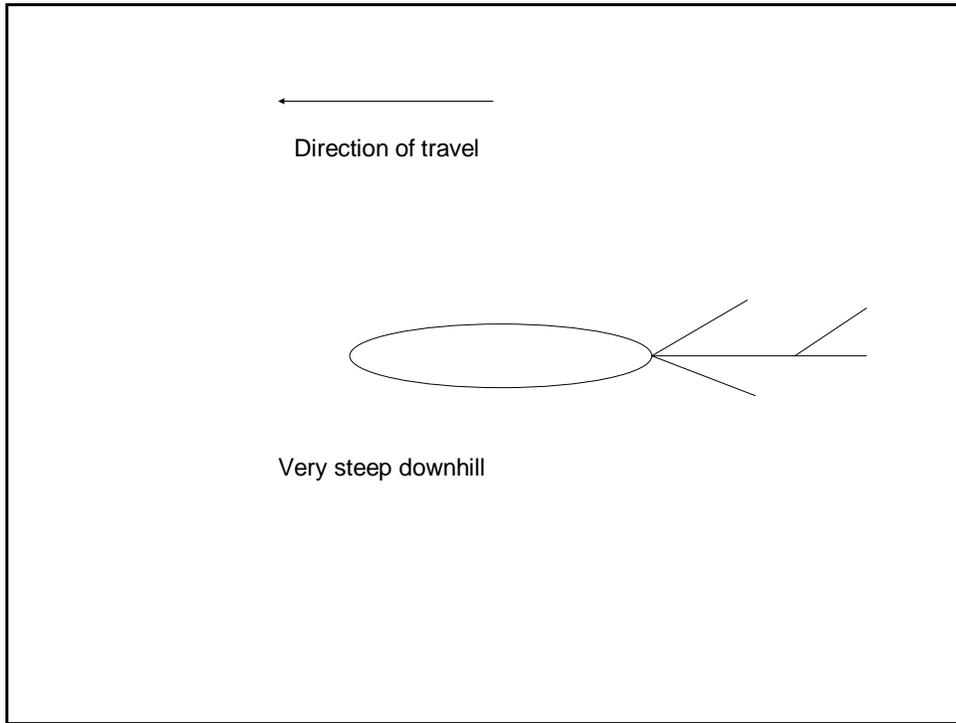
**Learning Step/Activity 5 – Haul scow-sled (Ahkio) on moderately sloping to steep downhill. (Picture 2)**

a. Use this configuration for moderate to steep slopes. One man in the rear provides a brake.



Picture 2

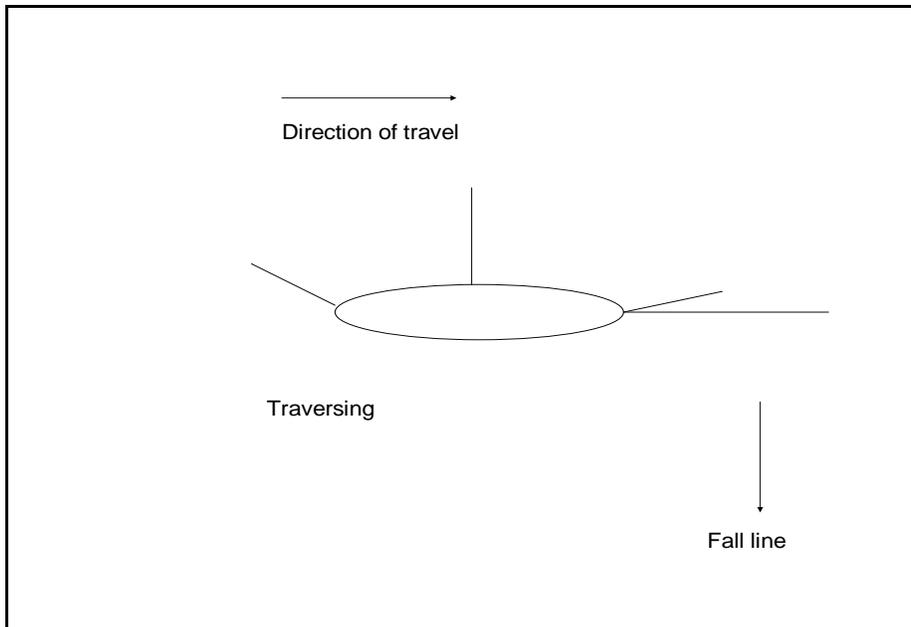
b. Use this configuration for steep slopes; you are essentially allowing gravity to move the sled and controlling the speed of the sled from the rear. When terrain gets steep enough that Soldiers can not brake effectively, a short rope can be tied to the two D-rings on the side walls passing the rope under the sled. The sled can be belayed using the 120ft rope as well. (Picture 3)



Picture 3

**Learning Step/Activity 6 – Traverse a hill with a scow-sled (Ahkio). (Picture 4)**

a. The ropes are hooked to the sled as in LSA-3, except that one or two soldiers are hooked to the uphill side, and the rear soldier is off set to the uphill side. This prevents the sled from tumbling downhill.



Picture 4

## **SECTION IV. SUMMARY**

The Ahkio sled is a useful tool for hauling the necessary tools for a squad to survive for extended periods of time. Now you have the skills set necessary to move this equipment over snow.

### **Check on Learning.**

1. What is the preferred man-powered mode of transporting an Ahkio?

Answer - Snowshoes

2. If using skis how should they be waxed?

Answer - More grip than glide.

---

## 699-8021: Operate a Space Heater Arctic

---

### SECTION II. INTRODUCTION

**Motivator:** Operating in a cold weather environment puts extreme environmental stresses on you. It will take you a great deal longer to perform even routine tasks and you will fatigue far faster than you would under ordinary circumstances. Performance will improve if you can quickly prepare a heated shelter where you have the opportunity to change your clothes, prepare hot water and food and conduct personal hygiene.

#### Terminal Learning Objective

|                  |  |
|------------------|--|
| <b>ACTION</b>    | <b>Operate a Space Heater Arctic (SHA)</b>   |
| <b>CONDITION</b> | In a field environment given a serviceable SHA, five gallon can of JP8, lighter and tissue paper.  |
| <b>STANDARD</b>  | Assemble and light the SHA using liquid fuel within 15 minutes. Disassemble and stow the SHA within 5 minutes. Meet all critical performance measures IAW the student evaluation plan. |

**Safety Requirements:** Daily risk assessment conducted; adjustments made to clothing and warming shelter breaks/CWI checks based upon current conditions. Per the requirements of USARAK Regulation 420-1 a serviceable 5lb ABC fire extinguisher will be present and a serviceable smoke detector will be placed at the highest portion of the tent.

**Risk Assessment:** Medium (Reference USARAK Pamphlet 385-4)

**Environmental Considerations:** POL products are utilized during this instruction. Ensure adequate measures are taken to prevent spills and that adequate materials are on hand to clean up any spills that do occur.

**Evaluation:** You will be tested on this lesson IAW the student/instructor evaluation guide. You will be evaluated as a squad on the tent and stove drill procedure. You will be tested on the operation of the SHA. You will be asked to find deficiencies in a ten-man tent with SHA that has been erected by NWTC instructors. You will also be tested on your knowledge of tent and stove drill 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 now learn how to assemble, operate and disassemble the Space Heater Arctic (SHA).

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Explain the characteristics of the Space Heater Arctic (SHA).

#### a. General Characteristics.

(1) The SHA is used to heat the ten man tent. The SHA can burn both liquid and solid fuels, although operation with solid fuels requires some minor modification. The SHA and component parts weigh approximately 41 pounds.

(2) The SHA provides heat in the range of 15,000 to 25,000 BTU/hour. The Thermoelectric Fan (TEF) will help to circulate the heat generated by the SHA.

(3) *Approved liquid fuels are JP5, JP8, DF-A-1-2, Kerosene and Jet A; approved solid fuels are wood and coal.*

**CAUTION: Gasoline, JP-4, used motor oil, solvents or other unauthorized fuels should NEVER be used. Using unauthorized fuels will create a fire danger and potential for explosion.**

(4) One 5-gallon can of approved liquid fuel will burn for approximately 15 hours at the maximum firing rate. Operating temperatures are -60 degrees F to +50 degrees F. Operating elevations are to 0-6,000 feet above mean sea level. It is possible to operate the SHA at higher elevations, but the stove will require more frequent cleanings and inspections.

(5) A piece of plywood, slightly larger than the base of the stove and sheathed in tin or aluminum, should always be carried as part of the tent group equipment. This "stove board" provides a firm base for the stove to stand on, as well as reducing the fire hazard when the stove is operated in a tent where the floor is covered with grass, leaves, or other potentially combustible material.

(6) When disassembled for transport, all of the components with the exception of the stove board will fit inside the stove body, reducing the space required to pack the stove in the ahkio.

### Learning Step/Activity 2 – Describe the major components of the SHA. See Figure 1.

a. Stack cap assembly (1). The Stack Cap Assembly is installed on the top of the nested stack assembly (4) to prevent down-drafts from entering the heater during operation. It also prevents rain, leaves, and other debris from entering the stack assembly. Guy lines (2), secured to three wire ropes (3), lead to tent lines that stabilize the entire stack assembly (4) in an upright (vertical) position during heater operation.

b. Nested stack assembly (4). Consists of six pipe sections (middle sections not shown) of decreasing diameter. When assembled, the sections form a cone-shaped stack with the largest diameter section at the base and the smallest diameter at the top. Each section is flanged on its smaller end in order to fit into the next higher section. The assembly (4) seats in the stack adapter assembly (5), allowing combustion gases to discharge outside the tent during operation. When disassembled, the sections fit inside each other for storage in the upper portion of the heater body (6).

c. Heater body assembly (6). Basic shell of the heater.

d. Lid assembly (7). The lid assembly (7) fits into a circular opening on the top surface of the heater. The built-in sight glass (8) allows the user to monitor the burner flame. It also permits access to the burner down tube assembly (9) when igniting liquid fuel. The lid assembly (7) is stored in the upper portion of the heater body (15).

e. Door assembly (10). Hinged door is secured with a slide latch. When opened, it allows access to install and remove the solid fuel grate (11) and burner cover assembly (12). It permits adding and igniting fuel in solid fuel operation. A built-in sliding draft gate (13) allows burn rate control during solid fuel operation only.

f. Burner cover assembly (12). During solid fuel operation, this cover (12) is positioned on top of burner shell (18) to prevent ashes, coals, and embers from falling into the burner shell. During liquid fuel operation, the cover (12) is positioned in the frame of the door assembly, and held in position by the closed door (10), to achieve a tight air seal.

g. Solid fuel grate (11). Elevates solid fuel while it burns to allow for air circulation and to provide an area for ash deposits. The Solid Fuel Grate MUST be removed prior to liquid fuel operation. Rear door (14). The Rear Door fits on the rear of the heater and acts to contain the parts which may be stored in the storage enclosure (15) while the heater is not in use.

h. Rear storage enclosure (15). Accessed through the rear door (14) and used to stow all loose parts that will not fit inside the heater body during transport of the heaters. Items stored in this area include the Fuel Flow Control Valve (16), Stack Cap Assembly (1), and Gravity Feed Adapter (26).

i. Burner shell assembly (17). Area of combustion in liquid fuel mode. Consists of a perforated burner shell (18), high fire ring (19), and up-tube (20) which is welded into the base of the burner shell (18). It permits fuel vapors to flow into the down-tube assembly (9) during operation.

j. Down-tube assembly (9). A capped down tube which is positioned on the up-tube (20) and removable through the lid assembly (7). A super-heater ring is located on the exterior for heat transfer. During operation, fuel flows into the up-tube (20), where its level is gravity-maintained with the fuel flow control valve (16). Fuel vaporizes due to combustion heat and fuel vapor is expelled from the up-tube (20), down through the down tube and into the burner shell (18) where it ignites. The down-tube (9) and up-tube (20) are cleaned with the reaming tool (21), which is kept inside the heater body during storage (15). The reaming tool (21) should be stored in an accessible yet protected location when not in use.

k. Fuel flow control valve (16). Mounts to a "T" shaped bracket (22) and slides into position on the right side of the heater body (6). The valve (16) functions safely with the liquid fuels specified in this work package. When set properly, internal orifices match the viscosity of the fuel being used to meter the correct fuel flow to the burner. The cup/cable assembly (23) is attached to the bracket and is used for measuring fuel to prime the heater in liquid fuel mode.

l. Fuel can stand, collapsible (24) (optional item). Allows the fuel can (25) to be mounted in an inverted position to permit gravity fuel feed to the fuel flow control valve (16). (Note: The Fuel Can Stand is available as Additional Authorized Item as detailed in WP0045).

m. Gravity feed adapter (26). Threads onto fuel can (25). Hose (27) allows during operation. The automatic vent (28) permits air to vent into the can for proper fuel flow to the heater. Fuel hoses (29) (30). Fuel supply hose (29) allows fuel flow from fuel can (25) through the gravity feed adapter (26) to the fuel flow control valve (16), through the hose to the burner up-tube (20). An overflow hose (30) drains fuel outside the tent in the event of a malfunction of the Fuel Flow Control Valve (16). Hoses, (29) and (30), connect with quick-disconnect couplings. The fuel control outflow hose (31) delivers fuel from the control valve to the burner assembly. The fuel supply hose (29) and overflow hose (30) are both stored in the upper portion of the heater body (15).

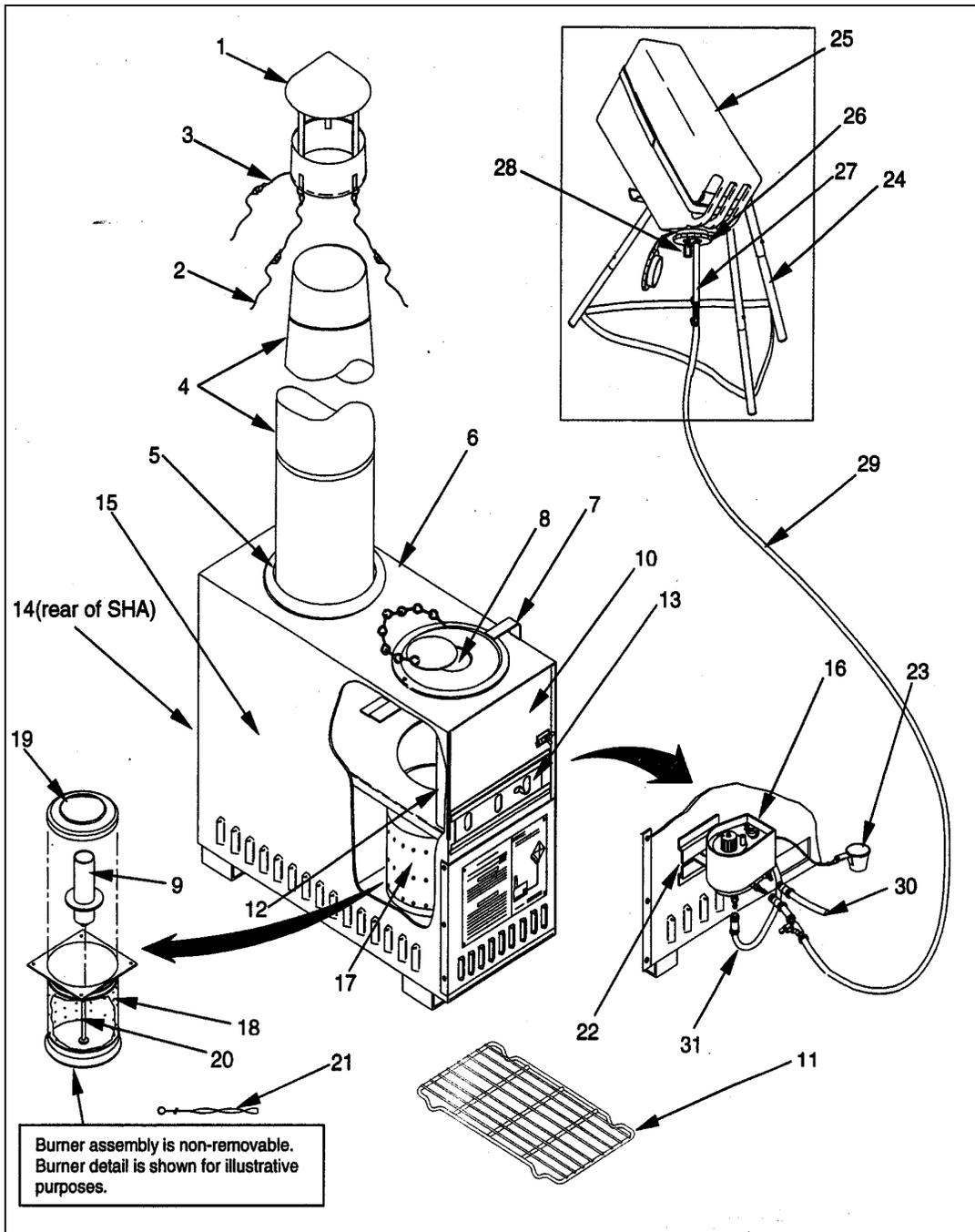


Figure 1: Location of Major Components

### **Learning Step/Activity 3 – Assemble the Space Heater Arctic.**

a. Before setting up the stove, inspect the tent to ensure that no conditions exist which would make operation of the stove unsafe. Ensure that the stove pipe opening in the tent roof is serviceable, with no cracks or tears in the silicone rubber coated ring. Next, ensure that the stove pipe opening flaps are rolled and securely tied, and that each flap can be tied at both the top and the bottom.

**CAUTION: THE LEADING CAUSE OF TENT FIRES ARE LOOSE STOVE PIPE OPENING FLAPS COMING INTO CONTACT WITH HOT STOVE PIPES**

**CAUTION: INSURE ALL FUEL SPILL CONTROL MEASURES ARE IN PLACE BEFORE USING THIS STOVE.**

b. The SHA utilizes the area inside its shell for the storage of components during movement and storage. Some of the components are stored behind the front door while others are stored behind the rear door (See Figure 2). To unpack the SHA:

(1) To unpack the SHA, press down on the spring-tensioned Rear Door (1) and remove the Fuel Flow Control Valve (2), Stack Cap Assembly with Tent Lines (3), and Gravity Feed Adapter (4).

(2) Reinstall the Rear Door (1) by placing the bottom edge of the door in the slot at the bottom of the heater frame. Press down on the door and swing it into position in the heater frame until the pin on the frame engages with the small slotted hole on the top edge of the rear door. Release the Rear Door. (3) Slide the front door latch (5) to the left and open the front door (6). Remove the Burner Cover Assembly if it is installed in the door frame.

(4) Remove the Fuel Overflow Hose (7) (stored inside the Nested Stack Assembly), Fuel Supply Hose (8), Nested Stack Assembly (9), Burner Reaming Tool (10), Lid Assembly (11) and Solid Fuel Grate (12).

(5) Install the Burner Cover Assembly (refer to next section for details). Close and latch the Front Door (6).



the front door (3); ensure that the solid fuel grate (10) is not installed. The Burner Cover Assembly (1) must be installed in the door frame (2), blocking the area behind the front door (3). When the Burner Cover Assembly (1) is installed, close and latch (4) the front door (3).

- For Solid Fuels: When preparing to use the heater in solid fuel mode, the Burner Cover Assembly (1) should be installed over the Burner Assembly opening (5). To install the Burner Cover Assembly for solid fuel operation, slide the front door latch (4) to the left and open the Front Door (3). If the Burner Cover Assembly is currently installed in the door frame (2), remove it and allow it to hang from its retaining chain (6). If the Solid Fuel Grate (7) is installed, remove the grate and install the Burner Cover Assembly (1) smooth side down over the Burner Assembly opening (5). Slide the cover back toward the rear of the heater until its back edge (8) engages in the Burner Cover retaining clip (9). Install the Solid Fuel Grate (7) in position over the installed Burner Cover Assembly (1) making sure to install the grate with its feet (10) down on the deck (11) of the upper heater area.

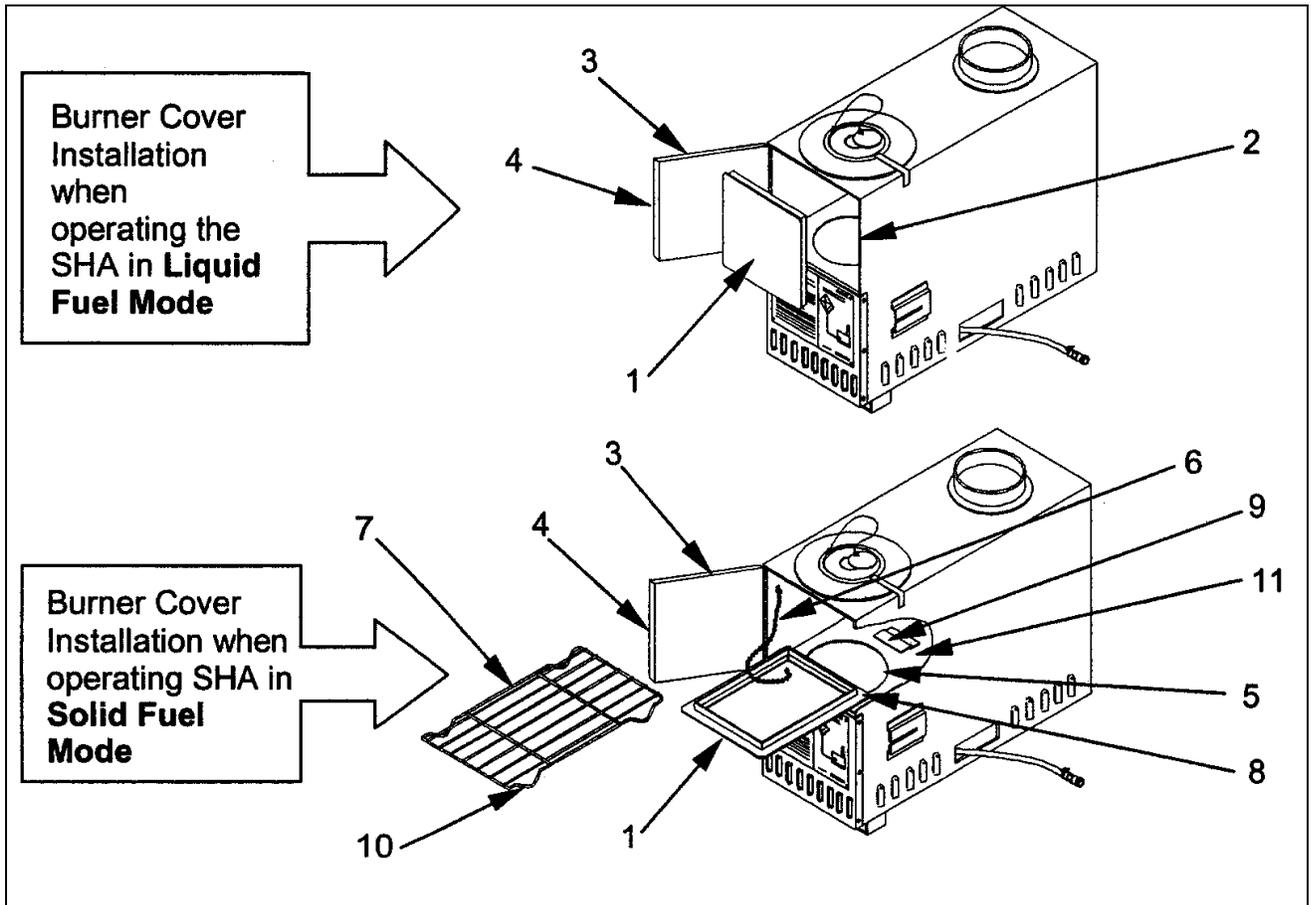


Figure 3

**WARNING: DO NOT USE UNAUTHORIZED FUELS ONLY APPROVED LIQUID AND SOLID FUELS MAY BE USED. USING UNAUTHORIZED FUELS IN THE SHA WILL CREATE A FIRE DANGER AND POTENTIAL FOR EXPLOSION**

**CAUTION: IF FUEL FLOW CONTROL VALVE ASSEMBLY IS IMPROPERLY POSITIONED OR IF BRACKET IS BENT, A FUEL OVERFLOW COULD OCCUR INSIDE BURNER SHELL ASSEMBLY AND CAUSE A FIRE OR EXPLOSION.**

**CAUTION: FOR SAFE OPERATION, BE SURE TO ALLOW AT LEAST TWO FEET OF SPACE BETWEEN THE HEATER AND THE SHELTER WALL. NEVER RE-LIGHT A HEATER WHEN IT IS STILL HOT. BE SURE TO ALLOW THE HEATER TO COOL COMPLETELY BEFORE ATTEMPTING TO RE-LIGHT. DO NOT ATTEMPT TO REPLENISH THE FUEL SUPPLY WHILE THE HEATER IS IN OPERATION.**

(7) Before operation perform the "Before Operation PMCS" on all SHA system components as outlined in the TM, prior to preparing the heater for use. All scheduled maintenance must be performed on the heater and its associated equipment prior to use.

(8) Set up the heater inside its operating space (shelter). The area selected must be level and free of debris and flammable materials.

(9) Assembly of the stack assembly:

- (See Figure 4) Securely roll and tie exhaust opening closure flap (1) so it will not touch stack assembly during heater operation. Assemble stack section (See Figure 6), (8) and (9) (stamped 1 and 2), ensuring that the seams are lined up. Place the largest diameter stack section (stamped 1), into the heater. Set the heater directly under the shelter exhaust opening.

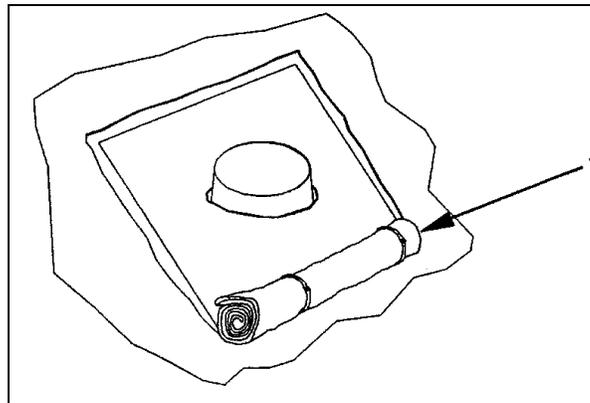


Figure 4

- First time set up only. (See Figure 5) Tie one end of each shelter line (1) to each wire rope (2) on stack cap (3). Set this assembly aside.

**CAUTION: FOR SAFE OPERATION, ALL SIX STACK PIPES AND THE STACK CAP ASSEMBLY MUST BE INSTALLED.**

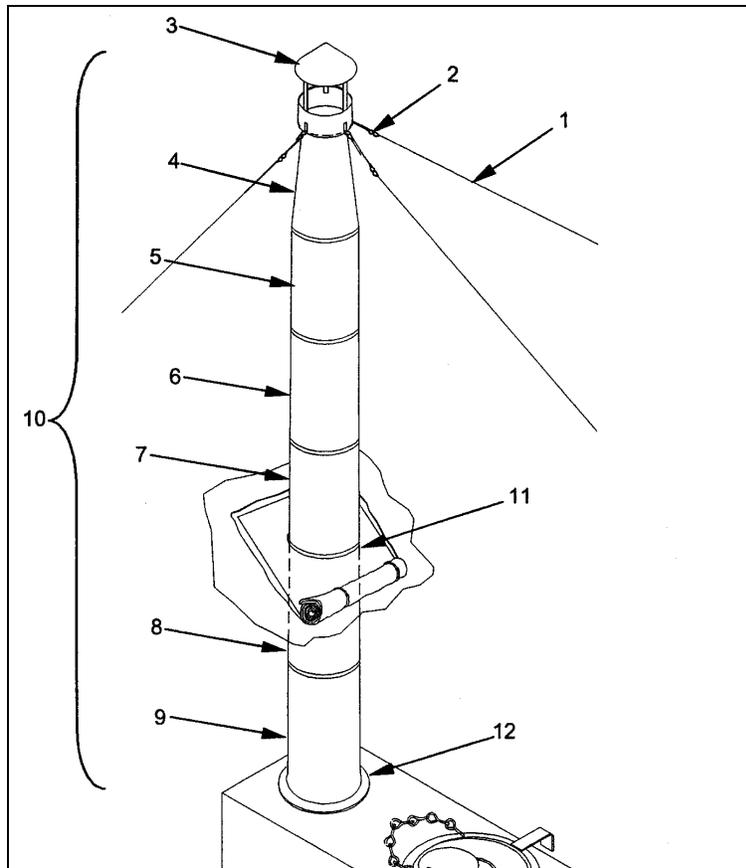


Figure 5

- Separate the stack assembly and assemble stack sections (4-7), in order of decreasing size, onto the crimped end of each adjoining stack section. Each stack section is stamped on the side with a number. Add the stack cap (3). Ensure that the seams on all pipes are aligned. Lift the assembled exhaust stack (3-7) and pass it through the exhaust opening (11).
- Insert stack section (3-7) onto stack section already on the stove (8, 9). Again, ensure the seams line up.
- Making sure that the assembled exhaust stack (10) is positioned straight, tie the stack cap guy lines to the closest corresponding tent line, where the tent line attaches to the tent eave.

**CAUTION: DO NOT CONNECT THE GUY LINES TO FIXED OBJECTS SUCH AS TREES OR ADDITIONAL TENT PINS. IF THE TENT IS MOVED BY WIND OR AS THE RESULT OF PERSONNEL BUMPING AGAINST IT, THE STOVE AND PIPES MUST BE FREE TO MOVE WITH IT. IF NOT, THE STOVE COULD COLLAPSE RESULTING IN A TENT FIRE.**

**NOTE: If you will be operating the stove with liquid fuels, go to Learning Step/Activity 7. If you will be operating the stove with solid fuels, go to Learning Step/Activity 8.**

#### Learning Step/Activity 4 – Place the SHA into operation utilizing liquid fuel.

- a. Install the fuel flow control valve (See Figure 6):

**WARNING: FIRE OR EXPLOSION CAN RESULT. IF FUEL FLOW CONTROL VALVE ASSEMBLY IS IMPROPERLY POSITIONED OR IF BRACKET IS BENT, A FUEL OVERFLOW COULD OCCUR INSIDE BURNER SHELL AND CAUSE A FIRE OR EXPLOSION.**

**CAUTION: WHEN LIGHTING OR REFUELING THE STOVE, ALL PERSONNEL IN THE TENT MUST BE AWAKE AND PREPARED FOR EMERGENCY EXIT. A FIRE GUARD MUST BE STANDING BY WITH A FIRE EXTINGUISHER AT THE READY.**

**CAUTION: WHEN THE STOVE IS IN OPERATION, A FULLY DRESSED, ALERT FIRE GUARD MUST BE MONITORING THE STOVE AT ALL TIMES. THIS FIREGUARD MUST BE LICENSED ON THE STOVE.**

(1) Slide fuel flow control valve from front to back fully into the sleeve on the right side of the heater. Be certain that the control valve is fully seated in the sleeve, does not bind in the sleeve, and is level with heater when installed.

(2) Reach into the cutout area on the right side of the SHA and pull out the fuel control outflow hose.

(3) Connect overflow hose Quick Disconnect (QD) to fuel discharge fitting on base of control valve.

(4) Connect fuel supply hose to fuel inlet fitting.

- b. Preparing A Fuel Supply Site:

(1) Select a level fuel supply site, free of debris and open flame, at least seven feet from shelter.

**NOTE:** Open end of overflow hose should discharge to a safe, outside location along a *downslope* and below the level of the fuel flow control valve. A piece of commercial petroleum absorbent material, such as New Pig's Stat-Mat roll, will be placed under the end of the overflow hose to catch any fuel that may spill. Additional commercial products are available to contain large spills, such as New Pig's Absorbent Sock.

(2) Route the overflow hose and fuel supply hose outside the shelter to the fuel supply location. Ensure the fuel line is routed away from the stove body to prevent it from coming in contact with the stove body.

(3) The overflow hose should discharge to a safe, downward sloping, outside location below the level of the fuel flow control valve. Place a petroleum absorbent mat under the open end of the hose.

**WARNING: DO NOT USE ANY UNAUTHORIZED FUEL. USE OF UNAUTHORIZED FUEL MAY RESULT IN FIRE AND/OR EXPLOSION.**

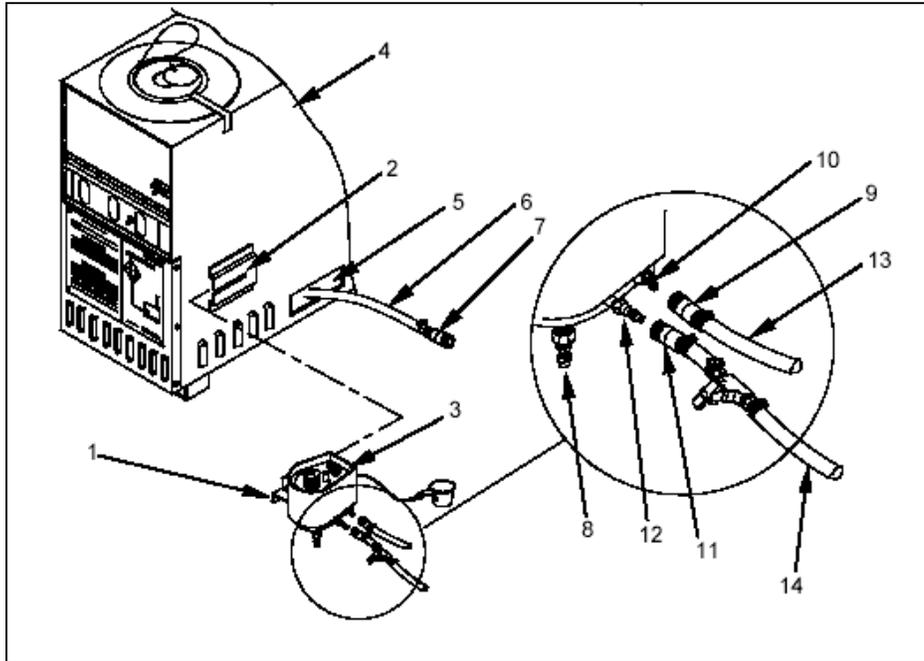


Figure 6

(4) Install Gravity Feed Adapter In Fuel Can (See Figure 7)

- At the fuel supply site, install a gravity feed adapter on a full fuel can as follows:

**WARNING: GRAVITY FEED ADAPTER KIT MUST BE FULLY SEATED TO PREVENT FUEL LEAKAGE AND FIRE.**

- Set fuel ON/OFF control on the fuel flow control valve to the OFF position.
- Remove cap from mouth of fuel can and replace with gravity feeder adapter. Screw the adapter into the fuel can securely.
- Attach male end of fuel supply hose to gravity feed adapter fitting. Set the assembled fuel can aside.
- At the fuel supply site, set up fuel can stand with fuel can level or slightly above heater as detailed in the next section.

**NOTE: If fuel can stand is unavailable, invert fuel can with installed gravity feed adapter on a stable support so that the bottom of the fuel can is two feet (61 centimeters) to three feet (91.5 centimeters) above fuel flow control valve.**

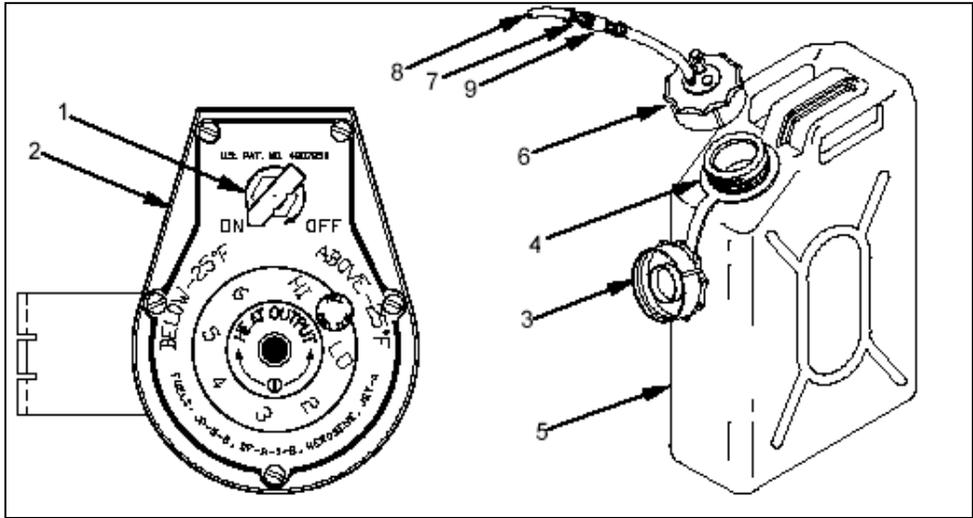


Figure 7

(5) Setting up the Fuel Can Stand (See Figure 8)

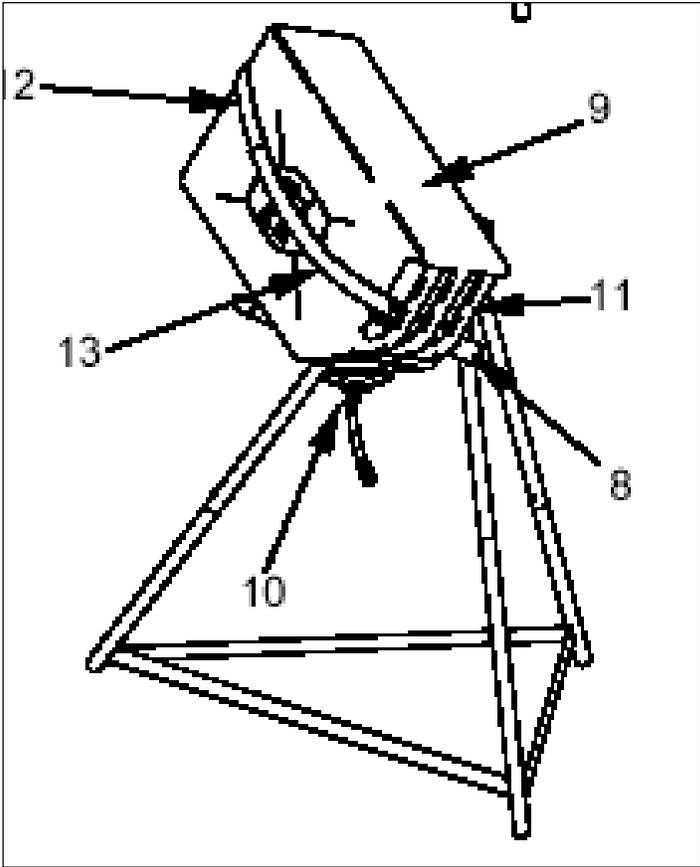


Figure 8

- If liquid fuel is to be used, the fuel can stand (optional item; the fuel can stand is available as an Additional Authorized Item) must be assembled in order to mount the fuel can in the

proper position. The fuel can, outfitted with a fuel can gravity feed adapter, must be mounted to the stand with the gravity feed adapter facing down. The design of the fuel can stand places the fuel can 2-3 feet above the fuel flow control valve. See Figure 9 below for an improvised support stand.

- Insert the bottom leg assembly into the top leg assembly until each leg is locked in place. Be sure to orient each bottom leg so that the stabilizing straps are positioned toward the inside of the stand. Ensure that the straps are not twisted.
- Spread the assembled leg assembly until the stabilizing straps are fully extended and the stand is stable. The leg assembly straps are designed to ensure the stand is stable, but are also designed to prevent the stand from sinking into snow.
- Lower the left and right support arms so that each is at a right angle to its attached leg. Place the tripod brace under the top bracket of the stand and clip into position over the front of the top bracket.

NOTE: Ensure that the Fuel Can Gravity Feed Adapter is fully seated and secured to avoid leaking.

- Invert the fuel can with installed gravity feed adapter and mount on the assembled fuel can stand so that the gravity feed adapter faces the ground. Slide the right support arm through the handle of the fuel can. Wrap the left support strap over the bottom of the fuel can. Feed the right support strap through the fuel can handle up across the front of the fuel can body, and over the left support strap. Secure the right strap to the left strap. The strap helps secure a partially filled fuel can to the fuel stand during windy conditions.
- After raising and securing the fuel can, place a drip interceptor loop in the fuel supply hose approximately 1 foot away from the fuel can. Do this by creating a loop in the fuel supply hose and securing it with rope, wire, 550-cord etc. The purpose of this loop is to prevent fuel dripping from the fuel can from traveling down the fuel supply hose and saturating the tent with fuel (thus creating a major fire hazard).
- A trash bag with HAZMAT pad should be placed under the fuel can to catch any dripping fuel.
- Alternately, construct a fuel can tripod with three poles approximately 4.5 feet long (Figure 9). Tie these together about two-thirds of the length from the bottom, with nylon cord, rope or wire. Use a sling rope to secure the fuel can to the tripod. The height of the poles may need to be adjusted to ensure that the fuel can is two to three feet above the fuel flow control valve. If the fuel can is too high or too low, it may interfere with proper flow of fuel into the stove.

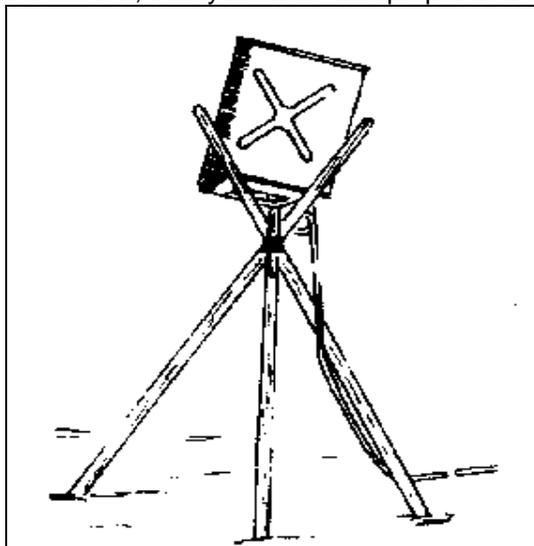


Figure 9

c. Setting The Fuel Flow Control Valve:

(1) Lift fuel selector control knob on the Fuel Flow Control Valve and set in accordance with the outside temperature. There are two positions, ABOVE -25° F and BELOW -25° F. Pull the knob and rotate it to the desired position. Release the control knob, making sure that the knob locks in the indentation for the desired position.

(2) Set fuel ON/OFF control to ON.

(3) Set flow adjustment knob to HI; wait 2 to 5 minutes in order to allow the fuel flow control valve and burner up-tube to fill with fuel. This step should only be performed under conditions below -25° F (-32° C), degrees below zero. Under warmer conditions it will not be necessary to wait 2-5 minutes.

(4) Shake or tap hoses to clear any air bubbles that may be trapped in the hoses.

(5) Open the door assembly and verify that the Burner Cover Assembly has been installed in the door frame. Shut and latch the door.

d. Lighting the stove:

(1) Open the heater lid.

(2) Be sure that the down-tube is securely fitted over the up-tube inside the burner.

(3) Hold the priming cup under priming valve on fuel supply hose. Open the valve slowly and fill the cup with fuel. Shut valve when cup is full.

(4) Pour fuel into the bottom of burner. If the outside temperature is below -25° F (-32° C), pour an additional cup of fuel into the bottom of the burner.

(5) Take a short length of tissue or paper, rolled into a ball, and soak up any excess fuel that may remain in the cup. Do not discard the paper.

(6) Light the fuel soaked toilet tissue and toss it into the bottom of the burner.

(7) Use the cleaning tool, if necessary, to make sure that the burning tissue reaches the bottom of the burner where it can ignite the priming fuel. Make sure that the burning tissue remains down in the burner. Close the Lid Assembly.

(8) When the heater has warmed up sufficiently and begins to give off heat (approximately 5-10 minutes), gradually adjust the flow adjustment knob to desired heat output.

NOTE: In extremely cold conditions, if the firing rate on Hi setting is not generating sufficient heat output, tap the control valve and shake the hoses to eliminate any air that may be trapped. If output is still insufficient, turn the heater control valve to LO for 5-10 minutes, which will heat the bottom of the burner. Then turn the control valve back to the Hi position.

e. Refueling

(1) Set fuel ON/OFF control to OFF to shut down heater.

**WARNING: DO NOT ATTEMPT TO REFUEL A HOT SPACE HEATER. ALLOW THE SHA TO COOL COMPLETELY BEFORE HANDLING OR REFUELING.**

(2) Remove fuel can from fuel can stand and replace with a full fuel can as detailed earlier in the chapter.

(3) Restart heater.

g. Shutdown From Liquid Fuel Operation

(1) Set fuel ON/OFF control to OFF.

(2) Remove fuel can from fuel can stand.

(3) Allow equipment to cool down.

**Learning Step/Activity 5 – Place the SHA into operation utilizing solid fuels.**

a. Preparation For Solid Fuel Operation:

(1) Ensure that all components have been unpacked as discussed earlier in this work package. Ensure that the heater is positioned properly in the shelter and that the stack assembly has been installed as described in the section entitled "Assembling the Stack Assembly" found earlier in this work package.

(2) Open front door and verify that the burner cover assembly is installed over the burner. If the burner cover assembly is installed in the door frame, remove it from the door frame, lift the solid fuel grate and put the burner cover in position over the burner.

(3) Make certain that the solid fuel grate is in position on its feet.

b. Preheating The Flue: To help ensure that no smoke blows back into the shelter on heater startup, the flue should be preheated by opening the door and placing 2 or 3 crumpled pieces of paper on the solid fuel grate. Ignite the paper with a match, close and latch the front door and open the draft gate. When the paper has burned completely, add solid fuel and start the heater as described below.

c. Adding solid fuel and starting the heater:

**WARNING: DO NOT USE ANY TYPE OF ACCELERANT (GAS, KEROSENE, JET FUEL ETC.) TO HELP IGNITE SOLID FUEL - EXPLOSION OR UNCONTROLLED FIRE MAY RESULT.**

**WARNING: STACK FIRE POSSIBLE. WHEN OPERATING THE HEATER IN SOLID FUEL MODE, A BUILDUP OF CREOSOTE CAN ACCUMULATE ON THE INSIDE SURFACE OF THE STACK ASSEMBLY THAT MAY RESULT IN A FIRE INSIDE THE STACK. TO PREVENT CREOSOTE BUILDUP WHEN OPERATING WITH SOLID FUEL, THE STACK ASSEMBLY SHOULD BE CLEANED DAILY. FAILURE TO DO SO MAY RESULT IN A FIRE CAUSING SEVERE INJURY OR DEATH.**

**CAUTION: WARPING OF HEATER. HEATER COMPONENTS MAY WARP FROM EXCESSIVE HEAT CAUSED BY AN OVER FUELED FIRE. WOOD AND COAL CAN BURN EXTREMELY HOT DEPENDING ON THE TYPE AND SIZE OF FUEL USED. DO NOT OVER-FUEL FIRE AND CLEAN ASHES FREQUENTLY. IF COAL IS BEING USED AS A FUEL, ADD ONLY A SMALL AMOUNT OF COAL AT A TIME. COAL IS VERY DENSE AND PROVIDES HIGH HEAT OUTPUT. OVERFILLING THE HEATER WITH COAL WILL CAUSE THE HEATER TO RUN EXTREMELY HOT AND IT WILL BE VERY DIFFICULT TO CONTROL THE HEATER'S TEMPERATURE OUTPUT.**

(1) After preheating the flue as described above, open the front door and position enough crumpled paper on solid fuel grate to cover it. If using wood as a solid fuel, stack four to five pieces wood

approximately ¼ to ½ inches in diameter (kindling) in a crisscross fashion on top of paper. If using coal as a solid fuel, place 10 to 12 pieces of coal that are approximately 2 inches in diameter on top of the paper.

(2) Light the paper with a match. When kindling begins to burn steadily, place 2 to 3 larger pieces of wood or a small amount of additional coal on top of kindling. Fuel may be fed either through lid or front door assembly.

(3) Shut/latch door. Keep door and lid assemblies shut except when fueling fire or removing ashes.

(4) Adjust sliding draft gate (open more to increase burn rate and close more to decrease burn rate). Monitor flame through the sight glass on the lid.

(5) Remove ashes frequently with a small pack shovel or scoop (not included with SHA) so that the ashes do not accumulate up above the solid fuel grate.

#### d. Adding Additional Solid Fuel

(1) Open door. Using a piece of wood or the cleaning tool, push the live burning fuel back into heater and position new fuel in front. Allow the new fuel to ignite before adding more. Add fuel until desired burn rate is reached, but do not over-fuel. It will take 5 or 10 minutes for the heater to operate at maximum after adding additional fuel. It may take some time to become familiar with the heater's burn rate as different types of wood and coal have varying moisture levels.

(2) After adding fuel, shut and latch door. Keep lid and door assemblies shut except when fueling fire or removing ashes.

#### e. Shutdown From Solid Fuel Operation

(1) Shut sliding draft gate on door until fire is extinguished.

(2) Allow the equipment to cool down. Perform "After Operation" PMCS.

#### f. Remove Ashes And Unburned Fuel

(1) After operating the SHA in Solid Fuel mode, any ashes and/or unburned fuel must be removed from the heater. To remove ashes from the interior of the heater, slide the latch to the left and open the front door.

(2) Remove the solid fuel grate and empty any ashes and unburned fuel into an approved container with a small pack shovel or scoop (not included with SHA). Clean all ashes that have accumulated on the burner cover assembly or upper deck; empty into the container. Dispose of all ashes in an approved manner.

### **Learning Step/Activity 6 – Recover the SHA and prepare for movement.**

a. All of the component parts will fit into the stove body of the SHA with the exception of the stove board and TEF. After the stove has been shut off and has cooled completely:

(1) Ensure that the fuel flow control valve is in the "OFF" position.

(2) Remove the fuel can from the tripod. Remove the gravity feed adapter from the fuel can.

(3) Remove all fuel lines and purge them of fuel. The fuel supply hose can be connected back to itself to prevent excess fuel from leaking out.

(4) Remove the fuel flow control valve from the heater and purge of any fuel. It will be very difficult to remove all fuel from this assembly, and it is therefore recommended that the fuel flow control valve be placed in a plastic bag with a HAZMAT pad.

**NOTE: The fuel flow control valve should be stored in the “ON” position to prevent the valve from sticking to the body. This is not noted in the TM, but has been put out by the manufacturer.**

(5) Remove and nest stove pipes in sequence taking care to NOT align the seams.

(6) Place component parts inside stove so that door and stove body openings close and lock.

(7) Return stove to Ahkio for packing.

#### **SECTION IV. SUMMARY**

Heat and shelter are essential requirements for successful cold weather operations. You now understand how to provide shelter and heat for a squad sized element using the ten-man arctic tent and Space Heater Arctic.

#### **Check on Learning.**

1. Is JP-4 or gasoline an authorized fuel in any of the stoves described above?  
No.

**SECTION II. INTRODUCTION**

**Motivator:** Operating in a cold weather environment puts extreme environmental stresses on you. It will take you a great deal longer to perform even routine tasks and you will fatigue far faster than you would under ordinary circumstances. Performance will improve if you can quickly prepare a heated shelter where you have the opportunity to change your clothes, prepare hot water and food and conduct personal hygiene.

**Terminal Learning Objective**

|                  |   |
|------------------|---|
| <b>ACTION</b>    | <b>Employ an Arctic Ten Man Tent</b>  |
| <b>CONDITION</b> | In a field environment given a serviceable Arctic ten-man tent, and an area large enough to set up the tent. Perform lesson with a squad/team of no less than 5 personnel. While wearing ECWCS appropriate to weather conditions. Fighting load carrier, ballistic helmet and weapon may be grounded within easy reach. |
| <b>STANDARD</b>  | Erected tent within 15 minutes. Recovered the tent within 10 minutes. Meet all critical performance measures IAW the student evaluation plan.   |

**Safety Requirements:** Daily risk assessment conducted; adjustments made to clothing and warming shelter breaks/CWI checks based upon current conditions. Per the requirements of USARAK Regulation 420-1 a serviceable 5lb ABC fire extinguisher will be present and a serviceable smoke detector will be placed at the highest portion of the tent.

**Risk Assessment:** Medium (Reference USARAK Pamphlet 385-4)

**Environmental Considerations:** POL products are utilized during this instruction. Ensure adequate measures are taken to prevent spills and that adequate materials are on hand to clean up any spills that do occur.

**Evaluation:** You will be tested on this lesson IAW the student/instructor evaluation guide. You will be evaluated as a squad on the tent and stove drill procedure. You will be tested on the operation of the SHA. You will be asked to find deficiencies in a ten-man tent with SHA that has been erected by NWTC instructors. You will also be tested on your knowledge of tent and stove drill 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 now learn how to set-up, live in and strike the arctic ten man tent.

### SECTION III. PRESENTATION

#### Learning Step/Activity 1 – Describe general characteristics of the ten-man arctic tent. See Figure 2

a. This six-sided pyramidal tent, supported by a center pole, normally accommodates ten soldiers with their individual equipment. When necessary, it can accommodate additional personnel if their equipment is stored outside. It may also be utilized as a command post, aid station, or storage shelter. The tent has a liner and two doors, each of which is provided with a series of toggles and loops around their outer edges. When additional space is required, these toggles and loops allow two or more tents to be joined together with unrestricted access from one to another.

b. A snow cloth is attached to the bottom of the tents' side walls; it is used to seal the tent to the ground in order to conserve heat in exposed or wind swept areas. This is accomplished by placing insulating material such as spruce boughs, brush, cardboard or other suitable material between the ground and the snow cloth.

**CAUTION: NEVER ALLOW THE SNOW CLOTH TO FREEZE TO THE GROUND. IN THE EVENT OF A FIRE, PERSONNEL MUST BE ABLE TO ROLL OUT FROM UNDER THE WALLS OF THE TENT; THERE WILL NOT BE ENOUGH TIME FOR PERSONNEL IN THEIR SLEEPING BAGS TO GET UP AND FILE OUT OF THE TENT DOOR.**

c. The tent is ventilated in four locations by built-in ventilators on opposite sides near the apex, or top, of the tent. Four drying lines are rigged inside the tent, on which personnel can hang wet clothing and equipment. The total weight of the tent, liner, telescoping center pole and tent pins is approximately 76 pounds. It is quite bulky and very heavy, but is easy to set up, with few parts; attempts to design new tents have resulted in more complex designs that are not blackout capable and weigh as much or more than the ten-man arctic tent.

**Ten-Man Arctic Tent**

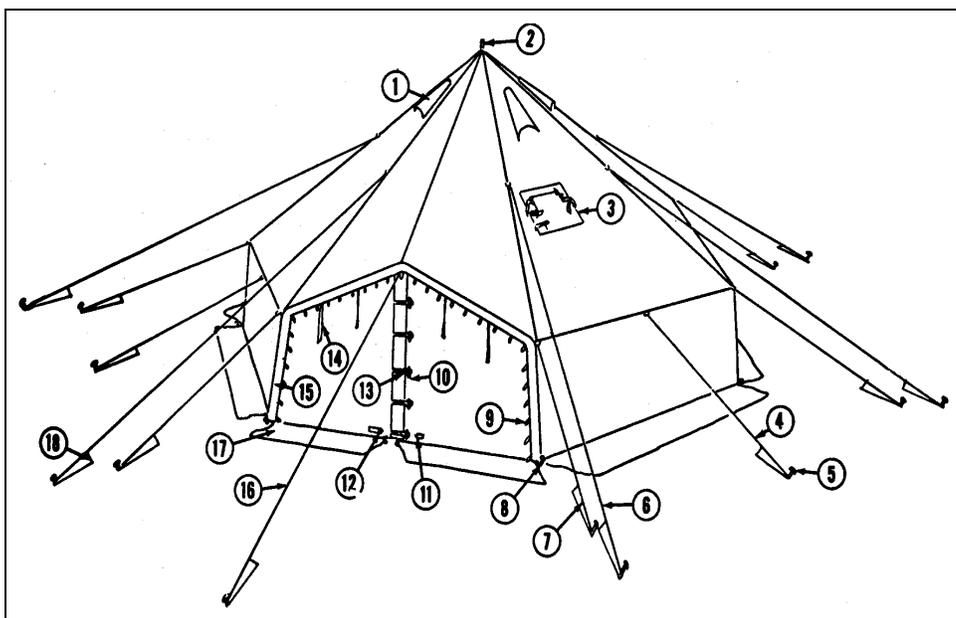


Figure 3

- |  |                          |
|--|--------------------------|
| 1. Ventilator                                      | 10. Wood toggle          |
| 2. Telescopic tent pole                            | 11. Chape snap           |
| 3. Stovepipe opening (silicone rubber molded ring) | 12. D-ring               |
| 4. Tent line, eave                                 | 13. Toggle loop          |
| 5. Steel tent pin                                  | 14. Tie tape             |
| 6. Tent line, corner                               | 15. Tent lug             |
| 7. Tent line, corner eave                          | 16. Tent line, door eave |
| 8. Foot stop                                       | 17. Snow cloth           |
| 9. Becket  | 18. Tent slip            |

## Learning Step/Activity 2 – Pitch the ten-man arctic tent.

a. This shelter is easily erected by six soldiers. One technique is to designate a soldier to manage the contents of the ahkio while the other soldiers set up the tent and stove. This man readies items for use and prevents items from being lost in the snow. Another man sets up the stove while the tent is erected. Use the following procedures to set-up the tent:

(1) Dig the snow to ground level or pack the snow down firmly, in the area to be occupied by the tent.

(2) Extend the tent out:

- Unfold the tent and position it on the cleared site. Remove the daisy chain from the corner eave lines
- One soldier grabs the apex of the tent. Three Soldiers each grab two corners. If more Soldiers are available each Soldier can grab a corner.
- The Soldier at the apex throws the apex straight up while the other three Soldiers move out and away.
- Rotate the tent so that the main door is positioned at an angle of 45° away from downwind. The main entrance is the tent door located closest to the stove pipe opening in the roof of the tent. Prevailing wind directions may be determined by examining the drift patterns of snow in the immediate area. In areas having variable winds, a windbreak may be constructed to shelter the main entrance.

(3) Zip both door entrances (to include liner) shut. If the tent zipper is unserviceable, use the metal clip and D-ring, located at the bottom edge of the door to hold the door shut while the tent is erected. If the tent is erected while the doors are open, you may not be able to zip the doors shut once all the tent lines are tightened.

(4) Fully extend all corner eave lines. The corner eave lines are located on opposite sides of the tent, where the roof meets the walls and the walls form corners. Altogether there are six corner eave lines. Corner eave lines must be inline with the corresponding seams of the tent.

(5) Mark spots on the ground approximately six feet, (two steps), from each corner of the tent. This is where the corner eave lines will be anchored.

(6) Drive tent pins on the marks. Angle the tent pins slightly away from the tent; this will prevent the lines from slipping off the pins and/or pulling the pin out of the ground. Attach the corner eave lines to the pins but leave them slack for now.

(7) Extend the center pole to a length between 6 and 8 feet and lock it in this position. One soldier, "pole man", crawls under the tent with the center pole and pole board. Place the stud at the top of the center pole through the hole in the perforated metal plate at the roof apex. Hold the pole vertically and place the pole board underneath the base of the pole.

**NOTE: ALTHOUGH THE GROUND UNDER THE TENT MAY BE FROZEN UPON TENT ASSEMBLY, AFTER A PERIOD OF TIME WITH THE HEATER FIRED, THE SURFACE WILL THAW AND THE POLE MAY SINK WITHOUT THE BASEPLATE.**

(8) Tighten the corner eave lines:

- The pole man maintains the vertical position of center pole.
- Two Soldiers take up a position at opposite corner eave lines. Each Soldier pulls on his corner of the tent (not on the lines) at the same time to tighten the corner eave lines. Continue tightening the remaining corner eave lines. The pole man can exit the tent after all the corner eave lines are tightened.

(9) Unroll the six corner lines. They are located on the seams between the corner eave lines and the tent roof apex. Attach the corner lines to the tent pins securing the corner eave lines. Tighten the

corner lines. Ensure that the corner eave line and the corner line at each corner are in line with their corresponding seams.

(10) Mark spots approximately six feet from the eave lines. Drive tent pins on the marks. Attach and tighten the four eave lines.

(11) Anchor the two door eave lines:

- For each door, drive a tent pin in the surface approximately six feet from the tent.
- Hold the door pole vertically about three feet from the tent door, between the driven pin and the door eave line.
- With the door eave line, position a clove hitch approximately five feet up on the door pole and secure and then tighten the end of the line to the pin. The door pole raises the effective door height to about four feet, allowing more clearance for entering and exiting the tent.

(12) Spread the snow cloth on the ground outside the tent. The snow cloth should not be weighted down; doing so could prevent soldiers from rolling out of the tent in the event of a fire. The snow cloth should not be spread inside the tent for the same reason.

**CAUTION: IF THE SNOW CLOTH IS SPREAD INSIDE THE TENT, IT MAY PREVENT PERSONNEL FROM ROLLING OUT IN THE EVENT OF A TENT FIRE.**

(15) Open the four ventilators from the inside by pushing them outward.

(16) Position the fire extinguisher at the center pole.

(17) If you will be using a stove to heat the shelter, roll open the stove pipe opening flaps and secure them in this position.

b. Additional considerations.

(1) Getting a shelter up with the stove running should be rehearsed prior to going to the field. CWIC training is the ideal time to do this. Rehearsals should include putting the tent up with Arctic mittens on.

(2) Digging in the tent is preferred, as it reduces the tents' profile, and the tent is better protected from the wind. Digging in also provides some protection from enemy observation as well as from small arms fire. In open areas a snow wall should be constructed to protect the tent from the wind. This will facilitate heating of the tent, as well as reduce the likelihood of the tent being blown down. Allow a minimum of 6.5 feet clearance between the walls of the tent and the walls of the snow pit; in the event of a fire, personnel must have room to roll out from under the tent walls in order to escape the flames.

(3) Pins do not hold well in snow, and may be difficult or impossible to drive into frozen or rocky ground. In wooded areas, tent ropes may be rapidly and securely anchored by attaching lines to trees, branches, logs, or stumps whenever possible. If natural anchors such as trees are unavailable and difficulty is encountered driving tent pins, suitable anchors may be established in snow using "deadman" anchors.

- A deadman anchor is simply any object with a large surface area which can be dug into the ground or snow with the long axis of the object perpendicular to the end of the tent line. The tent line is then attached to the center of the object, and the hole filled with the removed dirt or snow. The looser the material from the hole, the more surface area the object will require to be an effective anchor.
- On rocky ground, tent lines may be tied off to large rocks, or weighted down with piles of stones. Occasionally, tents may be pitched on ice. Ice pitons or screws may be used in place of tent pins. If ice pitons or screws are unavailable, an anchor may be established by chopping a small hole into or through the ice, and placing a stick or pole into the hole.

- The object placed in the hole may freeze in place permanently. To prevent damage to the tent lines, attach a separate rope or wire to the object in the ice hole and secure the tent line to this material. If you are unable to chop completely through the ice, water may be poured into the hole after the stick is placed into it, causing the object to freeze in position, creating a much more secure anchor.

### **Learning Step/Activity 3 - Strike the Ten-Man Arctic Tent.**

a. The squad leader should warn the other tent occupants 30 minutes prior to move out time. To strike the tent:

- (1) 30 minutes prior, pack personal gear.
- (2) No later than fifteen minutes prior all rucksacks and personal gear should be placed outside the tent, far enough out of the way that it will not hinder soldiers striking the tent. This gear should be kept organized, to preclude the danger of losing items in the snow.
- (3) No later than fifteen minutes prior, the stove is shut off (using the above procedure) to allow it to cool.
- (4) Remove all tent group equipment and pack into the ahkio. The last two items out of the tent are the lantern and the fire extinguisher; as long as a flame-producing device is operating in the tent, the fire extinguisher must be present.
- (5) As soon as the stove body is cool enough to touch, disassemble and pack stove. Care should be taken to keep stove components out of the snow; even if the stove is cool enough to touch, it is probably still warm enough to melt snow on contact. This melted snow will re-freeze, coating the stove component(s) with ice, making it difficult, if not impossible to set up/light at your next stop.
- (6) Remove all corner and eave lines, roll and secure them. As each line is undone, its corresponding tent pin should be pulled from the ground and placed into the ahkio; failure to do so may result in their becoming lost in the snow.
- (7) Zip both the liner and tent doors fully closed.
- (8) Remove the tent pole and pole board. Collapse the pole and place it and the pole board in the ahkio.
- (9) Remove the corner eave lines from their anchors and fully extend them. Remove remaining tent pins and placed them into the ahkio.
- (10) Shake the tent out to remove ice, snow and debris. Spread the tent out by pulling the apex. Fold the tent accordion-style.
- (11) Daisy chain the six corner eave lines together, and place them on top of the tent.
- (12) Fold the tent in half lengthwise, with the "daisy-chain" folded inside.
- (13) Place the two shovels opposite one another in the center of the tent. Fold the tent into thirds and place it next to the ahkio.
- (14) Remove any remaining equipment and/or trash from the tent site.

## **SECTION IV. SUMMARY**

Heat and shelter are essential requirements for successful cold weather operations. You now understand how to provide shelter and heat for a squad sized element using the ten-man arctic tent and SHA.

### **Check on Learning.**

1. Is JP-4 or gasoline an authorized fuel in any of the stoves described above?

No.

2. If the stack assembly is sticks too far out of the top of the tent opening can you remove some of the sections to make it fit better?

No. All stack sections must be used in order for the stove to operate properly.

3. How should you store the fuel flow control valve? The fuel flow control valve should be stored in a plastic bag with a HAZMAT pad. The ON/OFF valve should be stored in the "ON" position to prevent it from sticking the valve body.

---

## 699-8023: Operate a Squad Stove

---

### SECTION II. INTRODUCTION

**Motivator:** Operating in a cold weather environment puts extreme environmental stresses on you. It will take you a great deal longer to perform even routine tasks and you will fatigue far faster than you would under ordinary circumstances. Performance will improve if you can quickly prepare a heated shelter where you have the opportunity to change your clothes, prepare hot water and food and conduct personal hygiene.

#### Terminal Learning Objective

|                  |  |
|------------------|--|
| <b>ACTION</b>    | <b>Operate a Squad Stove.</b>  |
| <b>CONDITION</b> | In a field environment given a serviceable squad stove and one liter of fuel, while wearing Extended Cold Weather Clothing System (ECWCS) appropriate to weather conditions.       |
| <b>STANDARD</b>  | Assembled and lit the squad stove within 10 minutes. Disassembled and stowed the squad stove in 5 minutes. Meet all critical performance measures IAW the student evaluation plan. |

**Safety Requirements:** Daily risk assessment conducted; adjustments made to clothing and warming shelter breaks/CWI checks based upon current conditions. Per the requirements of USARAK Regulation 420-1 a serviceable 5lb ABC fire extinguisher will be present and a serviceable smoke detector will be placed at the highest portion of the tent.

**Risk Assessment:** Low (Reference USARAK Pamphlet 385-4)

**Environmental Considerations:** POL products are utilized during this instruction. Ensure adequate measures are taken to prevent spills and that adequate materials are on hand to clean up any spills that do occur.

**Evaluation:** You will be tested on this lesson IAW the student/instructor evaluation guide. You will be tested on the operation of the squad stove. You will assemble, light, disassemble and stow the squad stove.

**Instructional Lead-In:** You will now learn how to set-up, live in and strike the arctic ten man tent. You will also learn how to assemble, operate and disassemble the squad stove.

### SECTION III. PRESENTATION

#### Learning Step Activity 1 – Assemble a squad stove (MSR Whisperlite™).

a. As with any stove that burns fossil fuels, you must be wary of the possibility of carbon monoxide poisoning, especially when such stoves are used in small relatively airtight shelters such as snow caves or thermal shelters. Virtually all of your cooking and snow-melting tasks are accomplished using the squad stove, and one stove is adequate for the needs of from two to five soldiers. It is ideal for opening in forward or remote areas where heavy/bulky equipment could be an impediment. The squad stove is small, compact, light, and will operate on either white gas, MOGAS or kerosene. See Figure 1

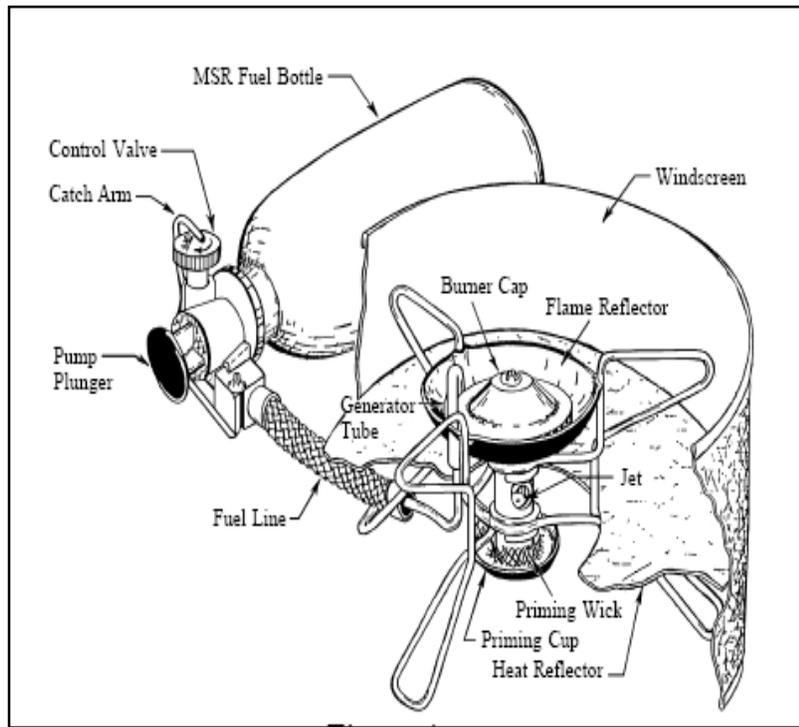


Figure 1

b. To assemble the Whisperlite™ stove: See Figure 2

- (1) Pour fuel into fuel bottle leaving a 2" air space at the top.
- (2) Screw pump snugly into the fuel bottle.
- (3) Pump 15-20 strokes to pressurize bottle; Do not over-pressurize the fuel bottle.
- (4) Unfold heat reflector and insert fuel line through center hole. Guide reflector over bottom of legs.



Figure 2

(4) Unfold heat reflector and insert fuel line through center hole. Guide reflector over bottom of legs. See Figure 3

(5) Rotate legs clockwise until they snap into the slots on the flame reflector. Do not move leg containing fuel line.

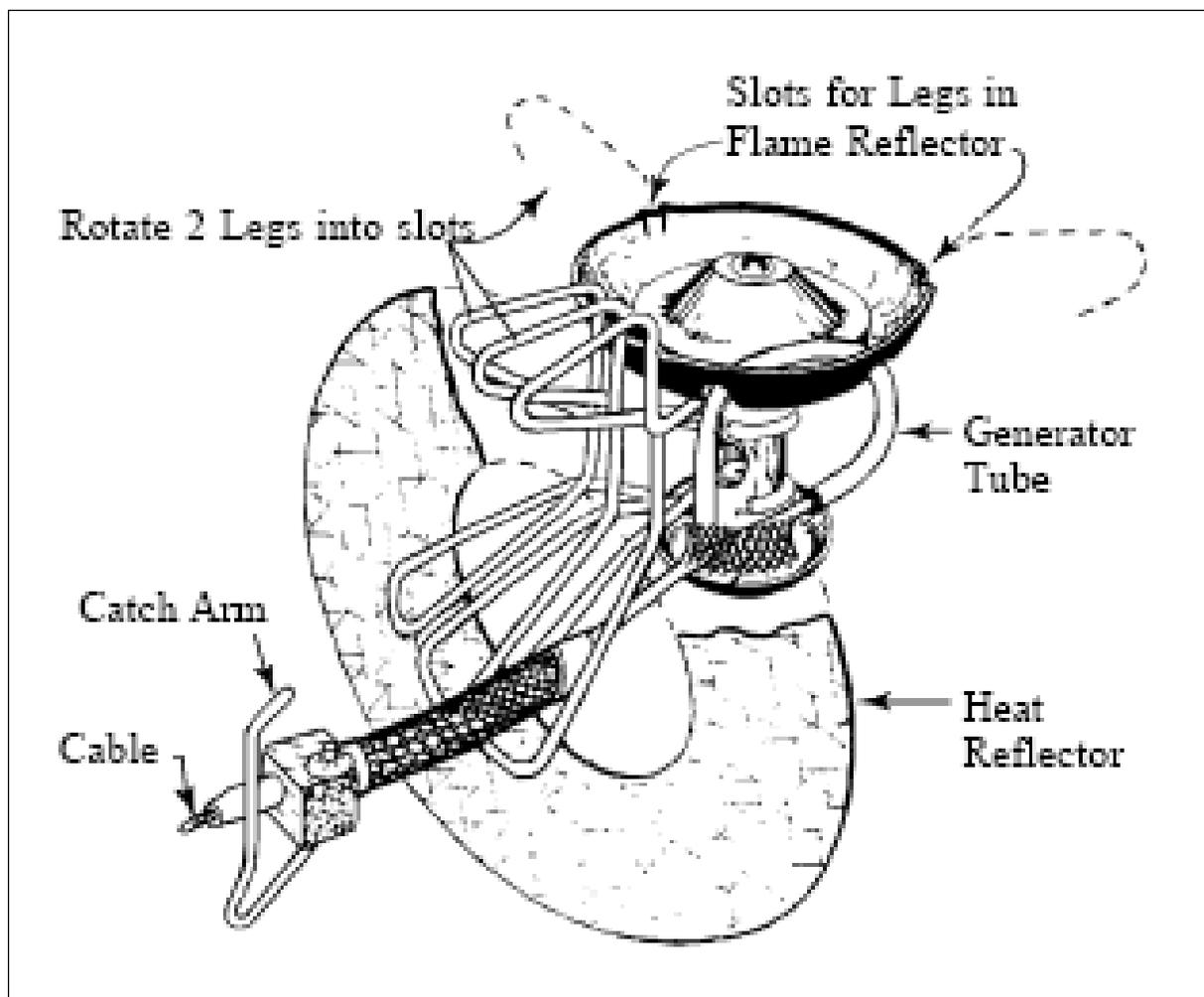


Figure 3

(6) Insert fuel line into the fuel pump until securely seated. Swing catch arm into position so the latch is centered on the fuel valve on the pump assembly. Fuel line will only seat completely to pump assembly if turned to correct position; fuel line insertion "stop" will seat completely if mounted correctly. See Figure 4

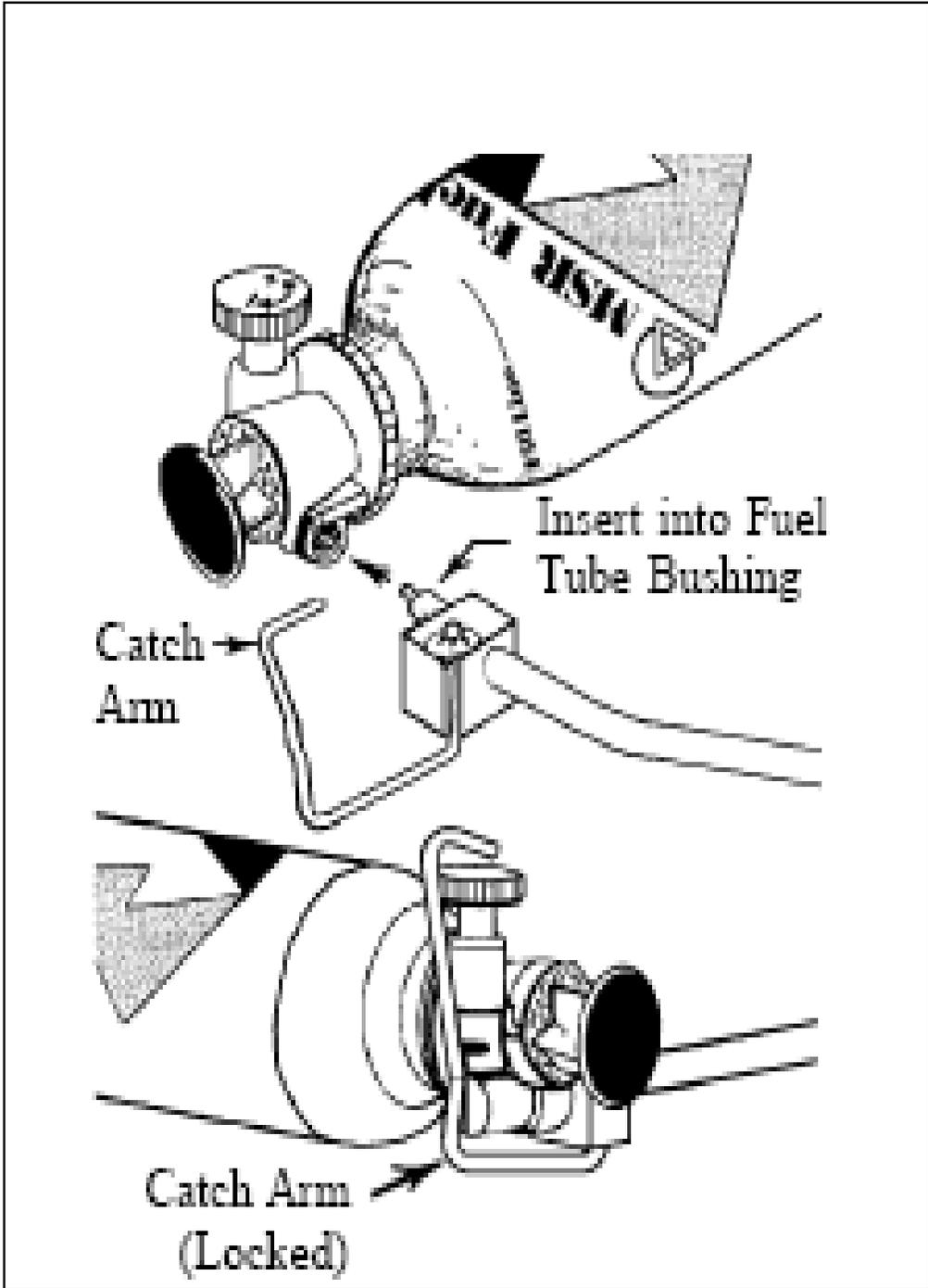


Figure 4

(7) Position stove and fuel bottle on a level, non-flammable surface.

## **Learning Step/Activity 2 – Light and Operate the MSR Whisperlite Stove.**

a. Do not burn stove inside tent. Keep flammable materials away from stove while operating. Keep head away from stove while lighting. Do not use stove if fuel leaks are found.

b. To operate the stove:

(1) Open control valve until fuel begins to flow through the jet and moistens the burner cup and priming wick. Immediately close the control valve.

(2) Light priming wick, and place windscreen around stove, (fuel valve is off).

(3) Allow priming fuel to burn until flame begins to diminish.

(4) Before the fuel in the primer pan stops burning, open the fuel valve slowly until the stove burner area produces a flame. Adjust to desired setting.

- If the flame burns yellow, allow more time to pre-heat/prime.
- If the stove goes out, allow the stove to cool before re-lighting.

(5) Once stove burns with a steady blue flame, adjust valve as required.

(6) Pump two or three additional pumps at a time to increase heat output when necessary. Do not over pressurize!

(7) Shut stove off by turning control valve clockwise until it stops. The flame may take several seconds to die out. **DO NOT OVER-TIGHTEN CONTROL VALVE.**

(8) Allow stove to cool before disassembling.

## **Learning Step/Activity 3 – Disassemble, refuel and store the Whisperlite stove.**

a. To disassemble, refuel and/or store:

(1) Close fuel valve and allow stove to cool.

(2) Invert stove and attached fuel bottle onto a Hazardous Material Absorbing Pad.

(3) Open fuel valve and allow pressure escape from bottle; a minimal amount of fuel will drain from the stove.

**CAUTION: IF STOVE HAS NOT COOLED SUFFICIENTLY, THE ESCAPING FUEL COULD IGNITE.**

(4) When all pressure has escaped, close fuel valve.

(5) Invert stove and bottle.

(6) Move catch arm from position over fuel valve.

(7) Carefully pull fuel line from pump assembly. Re-fill the fuel bottle and then repeat the steps for assembly and operating; or return all components to original configuration for storage.

#### **Learning Step/Activity 4 – Maintain the MSR Whisperlite.**

a. Burner Maintenance: For the squad stove shaker jet versions, shake the stove up and down. An audible rattle should be heard – proof that the squad stove shaker jet is functioning as designed. If the rattle is not heard or you do not have a squad stove with a shaker jet. you will need to remove the jet for cleaning with the Jet Cleaning Wire. See Figure 16.

(1) Un-screw the priming cup.

(2) Pull the generator tube out of the mixer tube.

(3) Unscrew the jet with the Jet and Cable tool. Remove the needle and clean inside the jet.

(4) Scour the fuel line. Pull the cable out of the fuel line using the Jet and Cable Tool. Wipe the cable. Push the cable in and out of the fuel line 20-30 times to scour the generator tube. Repeat scouring and wiping until clean. Reinstall cable.

(5) With the jet and needle out, flush the fuel line. Insert the fuel line into the Pump's fuel tube bushing. Open the control valve and run ½ cup of fuel through the fuel line and into a fuel container. Reassemble the stove.

b. Pump Maintenance:

(1) The silicone pump will need to be periodically checked and lubricated to ensure that it can pressurize the bottle. Turn the pump bushing of the pump plunger below the swiveling head and pull the plunger out. Chap stick or MSR Pump cup oil will lubricate the pump cup. Rotate finger inside the pump cup to expand the diameter. Reassemble.

(2) If the pump does not hold pressure in fuel bottle, clean the check valve assembly. Turn the check valve plug counterclockwise. Remove the check valve ball and spring and wipe with a cloth. Reassemble.

(3) O-rings may crack or tear. If any of the O-rings are cracked, torn, or pitted they should be replaced prior to use.

c. For additional information on this, the MSR Whisperlite Internationale or the MSR XGK-EX contact MSR at [www.msrgear.com](http://www.msrgear.com) .

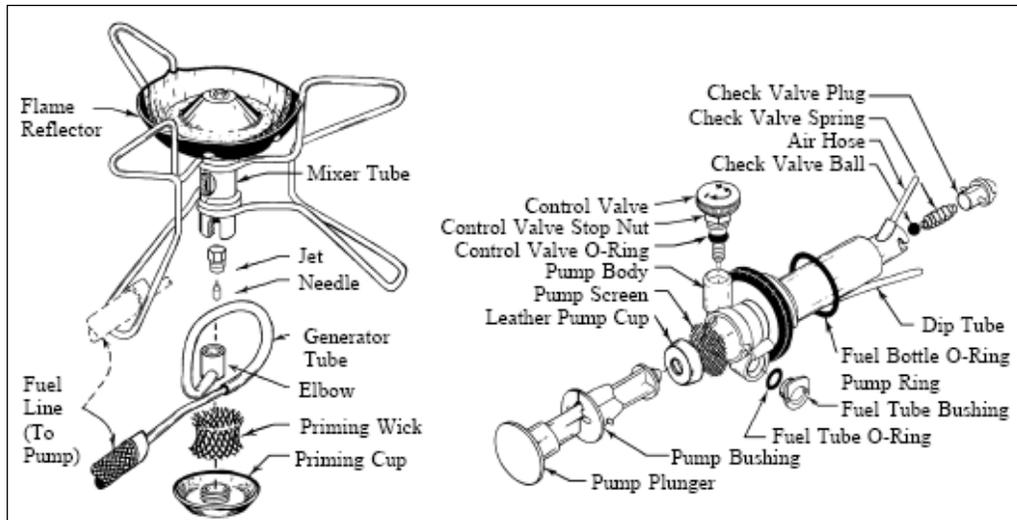


Figure 5

#### SECTION IV. SUMMARY

Heat and shelter are essential requirements for successful cold weather operations. You now understand how to provide shelter and heat for a squad sized element using the ten-man arctic tent and squad stove.

#### Check on Learning.

1. Is JP-4 or gasoline an authorized fuel in any of the stoves described above?  
No.

---

## 699-8034: Operate a Squad Lantern

---

### SECTION II. INTRODUCTION

**Motivator:** Operating in a cold weather environment puts extreme environmental stresses on you. It will take you a great deal longer to perform even routine tasks and you will fatigue far faster than you would under ordinary circumstances. Performance will improve if you can quickly prepare a heated shelter where you have the opportunity to change your clothes, prepare hot water and food and conduct personal hygiene. Central to efficient operation in a tent is light. This can be accomplished through the use of a lantern. Battery powered lanterns are available but do not perform well in extreme cold.

#### Terminal Learning Objective

|                  |   |
|------------------|---|
| <b>ACTION</b>    | <b>Operate a Squad Lantern.</b>   |
| <b>CONDITION</b> | In a field environment given a serviceable squad lantern, one liter of fuel, matches or a lighter and HAZMAT pads while wearing fuel handlers' gloves, Extended Cold Weather Clothing System (ECWCS) appropriate to weather conditions. |
| <b>STANDARD</b>  | Assembled and lit the squad lantern within 10 minutes. Disassembled and stowed the squad lantern in 5 minutes. Meet all critical performance measures IAW the Individual Student Assessment Plan (ISAP).                                |

**Safety Requirements:** Daily risk assessment conducted; adjustments made to clothing and warming shelter breaks/CWI checks based upon current conditions. Per the requirements of USARAK Regulation 420-1 a serviceable 5lb ABC fire extinguisher will be present and a serviceable smoke detector will be placed at the highest portion of the tent. HAZMAT/ fuel handlers' gloves will be worn in case of spillage of fuel. Perform in a well ventilated area. Lanterns that are hung inside a tent will have an 18 inch wire or chain attached to the carry handle. This creates stand off from the tent to reduce the risk of fire.

**Risk Assessment:** Low (Reference USARAK Pamphlet 385-4)

**Environmental Considerations:** POL products are utilized during this instruction. Ensure adequate measures are taken to prevent spills and that adequate materials are on hand to clean up any spills that do occur.

**Evaluation:** You will be tested on this lesson IAW the student/instructor evaluation guide. You will be tested on the operation of the squad lantern. You will assemble, light, disassemble and stow the squad lantern.

**Instructional Lead-In:** You will now learn how to assemble, light, disassemble and stow the squad lantern.

## SECTION III. PRESENTATION

### Learning Step Activity 1 – Light and operate a squad lantern.

a. As with any appliance that burns fossil fuels, you must be wary of the possibility of carbon monoxide poisoning, especially when such equipment is used in small relatively airtight shelters such as snow caves or thermal shelters.

b. To light and operate the lantern:

(1) Place the lantern on a HAZMAT pad and ensure the fuel valve is closed snugly.

(2) Ensure the tank has fuel in it. The tank should only be filled to the bottom of the fill tube on the tank. Use “white gas” for the best results. Some models will burn regular gasoline.

(3) Turn the pump two complete turns to the left.

(4) Place your thumb over the hole in the pump plunger, index and forefinger under the plunger and pump 30 full strokes. Turn the pump two complete turns to the right to secure it.

(5) Open the fuel valve.

(6) Light a match (long stem is preferred) or a lighter (long stem BBQ grill type is preferred) and insert into the access hole at the base of the glass globe. The flame should contact the mantles.

(7) Once the mantles are burning, adjust the fuel knob to the desired brightness.

(8) Periodically loosen the pump and give 5-10 full strokes to keep pressure in the tank. Ensure the pump is fully closed.

**CAUTION:** If the lantern is to be hung in a tent it must be suspended from a metal chain or wire at least 18 inches long attached to the carry handle. This creates stand off from the tent to reduce the risk of fire.

### Learning Step Activity 2 – Refuel a squad lantern.

a. Ensure the lantern is cool to the touch.

b. Place the lantern on a HAZMAT pad.

c. Face the fuel cap away from yourself and slowly open the fuel cap. Allow the tank to depressurize before removing the cap.

d. Using a funnel to avoid spills, fill the tank to the bottom of the fill tube.

e. Replace the fuel cap.

### Learning Step Activity 3 – Perform maintenance on a squad lantern.

a. To replace the mantles:

(1) Remove the glass globe by removing the nut at the top of the hood.

(2) Remove the hood and the globe.

(3) Remove the remnants of the old mantles.

- (4) Being careful to not touch the closed ends of the mantles, place the open end over the end of the burner tube cap.
  - (5) Tie or clip the new mantle in place. If there is extra string left clip it off close to the knot securing the mantle to the burner tube.
  - (6) Touch a flame to the bottom of each mantle and allow the flame to burn itself out at the top of the mantle. The mantles will not light without this step.
  - (7) Replace the glass globe.
  - (8) Replace the hood and nut.
- b. Perform other maintenance on the lantern.
- (1) Remove the pump plunger by removing the C clip at the top of the pump plunger tube. Pull out the assembly. Apply a light vegetable oil to the leather cup. Reinstall the plunger and the C clip. (For newer silicon plunger cups check for rot. Replace if necessary.)
  - (2) Remove the glass globe and wipe out any carbon build up.
  - (3) Replace mantles as necessary.

#### **Learning Step Activity 4 – Shut down and stow a squad lantern.**

- a. Turn the fuel knob all the way to the right to close. Allow the flame to die out.
- b. Allow the lantern to become cool to the touch.
- c. Place the lantern back into its case taking care not to damage the glass globe or the mantles.
- d. Secure the case.

#### **SECTION IV. SUMMARY**

Heat and shelter are essential requirements for successful cold weather operations. Light inside the tent makes daily chores much easier.

#### **Check on Learning.**

1. What fuel gives the best results?  
White gas.

## SECTION II. INTRODUCTION

**Motivator:** Operating in a cold weather environment puts extreme environmental stresses on you. It will take you a great deal longer to perform even routine tasks and you will fatigue far faster than you would under ordinary circumstances. Your performance will improve if you can quickly prepare a heated shelter, where you have the opportunity to change your clothes, prepare hot water and food and conduct personal hygiene.

### Terminal Learning Objective

|                  |   |
|------------------|---|
| <b>ACTION</b>    | Operate a H-45 Space Heater.  |
| <b>CONDITION</b> | In a field environment given a serviceable H-45, five gallon can of JP8, lighter, tissue paper and an area large enough to set up the stove   |
| <b>STANDARD</b>  | Assemble and light the H45 using liquid fuel within 15 minutes.<br>Disassemble and stow the H45 within 5 minutes. Meet all critical performance measures IAW the student evaluation plan. |

**Safety Requirements:** Daily risk assessment conducted; adjustments made to clothing and warming shelter breaks/CWI checks based upon current conditions. Per the requirements of USARAK Regulation 420-1 a serviceable 5lb ABC fire extinguisher will be present and a serviceable smoke detector will be placed at the highest portion of the tent.

**Risk Assessment:** Moderate (Reference USARAK Pamphlet 385-4)

**Environmental Considerations:** POL products are utilized during this instruction. Ensure adequate measures are taken to prevent spills and that adequate materials are on hand to clean up any spills that do occur.

**Evaluation:** You will be tested on this lesson IAW the student/instructor evaluation plan. You will be tested on the operation of the H-45. You will also be tested on your knowledge of the H-45 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 now learn how to assemble, operate and disassemble the H-45 stove.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Explain the general characteristics of the H-45.

General Characteristics:

a. Equipment Characteristics, Capabilities And Features.

(1) The Type I (Solid Fuel) heater is designed to operate safely with either wood or coal. The Type II (Liquid Fuel) heater is designed to operate safely with either diesel fuel (DF-A, DF-1 or DF-2), or jet fuel (JP-5 or JP-8, Jet A) and kerosene. It should be noted that there are two different H-45 stoves – the Type I which burns solid fuels only and Type II which burns liquid fuel only. At NWTC you will be exposed to the Type II Liquid Fuel H-45 only.

**WARNING: OLDER VERIONS OF THE TECHNICAL MANUAL 9-4520-257-12&P STATE GASOLINE AND JP-4 ARE APPROVED FUEL SOURCES FOR USE IN THE H-45. HOWEVER, BY THE NEW TM 9-4520-257-12&P DATED 30 SEPTEMBER 2003, JP-4 AND GASOLINE WILL NOT BE USED DUE TO THE VOLATILITY OF THESE FUELS.**

**WARNING: THE FUEL FLOW CONTROL VALVE OF THE SHA AND H-45 LOOK SIMILAR. THESE COMPONENTS ARE NOT INTERCHAGEABLE. USING THE SHA FUEL FLOW CONTROL VALVE WITH THE H-45 OR THE H-45 FUEL FLOW CONTROL VALVE WITH THE SHA WILL CAUSE THE STOVE TO MALFUNCTION.**

(2) The H-45 is used to heat all General Purpose Tents. The H-45 and component parts weigh approximately 60 pounds.

(3) The H-45 provides heat in the range of 20,000-45,000 BTU/hour. The Thermoelectric Fan (TEF) will help to circulate the heat generated by the H-45. The TEF is not issued with the H-45 and must be procured separately.

***(4) Approved liquid fuels are JP5, JP8, DF-A-1-2, Kerosene and Jet A; approved solid fuels are wood and coal. Gasoline, JP-4, used motor oil, solvents or other unauthorized fuels should NEVER be used. Using unauthorized fuels will create a fire danger and potential for explosion.***

(5) One 5-gallon-can of approved liquid fuel will burn for approximately 8 hours at the maximum firing rate.

## Learning Step/Activity 2 – Identify the components of the Type II H-45.

### a. Major Components Of The H-45 Type II (Liquid Fuel) Heater (see Figure 1)

(1) Heater assembly. The Type II (Liquid Fuel) Heater assembly consists of a heater body base (1) and atop heater shell (2). The heater body base (1) serves as a base for the assembled heater. It houses the burner shell assembly (3) during operation. Two heater body base doors (4) are cut into the heater body base (1) at opposite positions to allow air for combustion. A support (5) to hold the fuel flow control valve bracket (6) is welded adjacent to the front heater body base door. Three evenly spaced bolt and wing nut assemblies (7) are welded to the heater body base (1). Three evenly spaced brackets (8) are welded to the top heater shell (2). The three bolt and wing nut assemblies (7) secure the top heater shell (2) to the heater body base (1) when the bolts are slid into the brackets (8) and the wing nuts are tightened. During the operation of the H-45 Type II (Liquid Fuel) Heater, the top heater shell (2) is placed onto the heater body base (1) and secured. The top heater shell (2) has one internally flanged, 9-inch (22.86-centimeter(cm)) circular cutout (9) to accommodate the lid (10), and one externally flanged 4-inch (10.16-cm) cutout (11) that serves as mounting for the stack pipe sections (12).

(2) Burner shell assembly and adapter ring. The burner shell assembly (3) fits into the heater body base (1). It consists of a rolled steel pot (13) with a high fire ring (14), a burner cap assembly (15), and a super heater assembly (16). An adapter ring (17) that engages the upper rim of the heater body base (1) is welded to the burner shell assembly (3). The high fire ring (14) is held in place by three clamps (18) that attach to the adapter ring (17) with pan head screws. A cleaning tool (19) is used to clean soot and any buildup from the inside of the up-tube and down-tube.

(3) Fuel flow control valve. The fuel flow control valve (20) is mounted on the side of the heater body base (1). The fuel flow control valve (20) is designed to function with JP-8; DF-A, DF-1, or DF-2; JP-5; kerosene; Jet A-1; Jet A. It has several orifices to match the various viscosities of the fuels being used. The orifices are cut to permit a maximum and minimum flow rate consistent with the safe operation of the heater.

(4) Exhaust system. The exhaust system consists of six stack-pipe sections (12) connected end to end, leading from the 4-inch (10.16-cm) externally flanged circular cutout (11) on the top heater shell (2), through the tent roof (21), and topped by a stack cap assembly (22), to which three wire ropes and guy lines (23) are attached to provide stability.

(5) Hose assemblies. The hose assemblies conduct fuel from the fuel source to the fuel flow control valve(20), from the fuel flow control valve (20) to the burner shell assembly (3), and from the fuel flow control valve (20) to the overflow area.

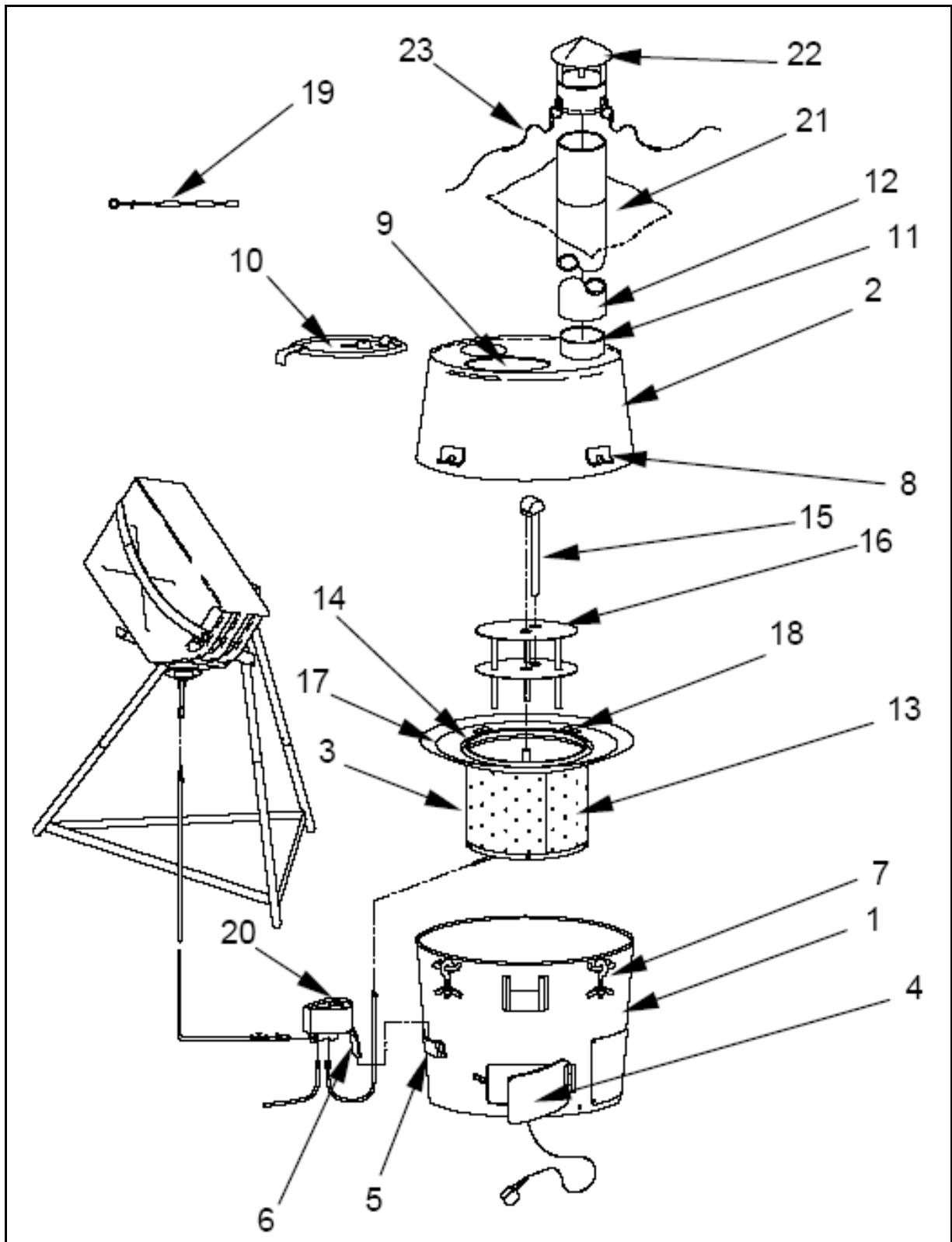


Figure 1

- Fuel Supply Hose. Figure 2 The fuel supply hose connects between the fuel can gravity feed adaptor and the fuel flow control valve. It supplies fuel to the H-45. A “T” connector with petcock permits fuel to be drained off into the measuring cup for priming.

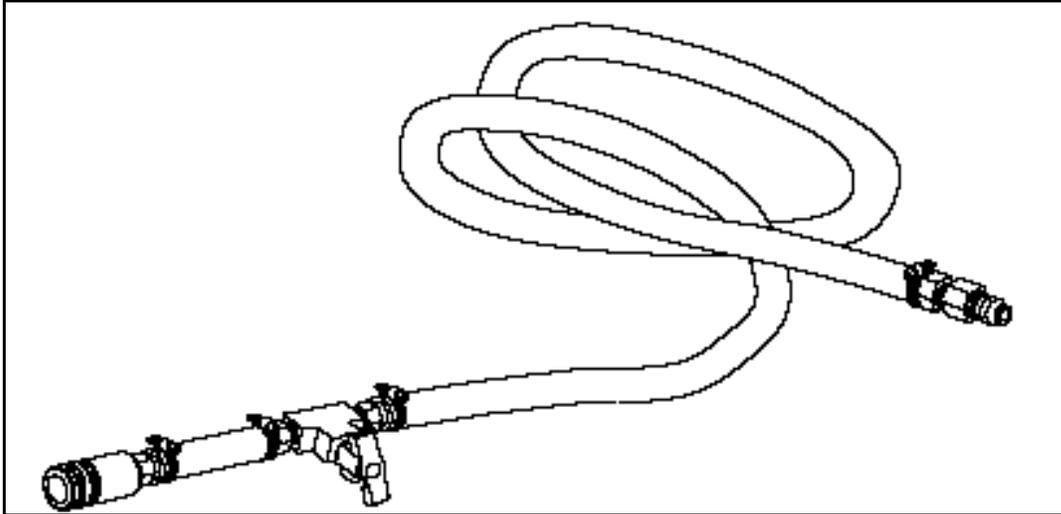


Figure 2

- Fuel Overflow Hose. Figure 3. The fuel overflow hose connects to the fuel flow control valve and allows any overflow fuel to be sent outside the shelter.

- 

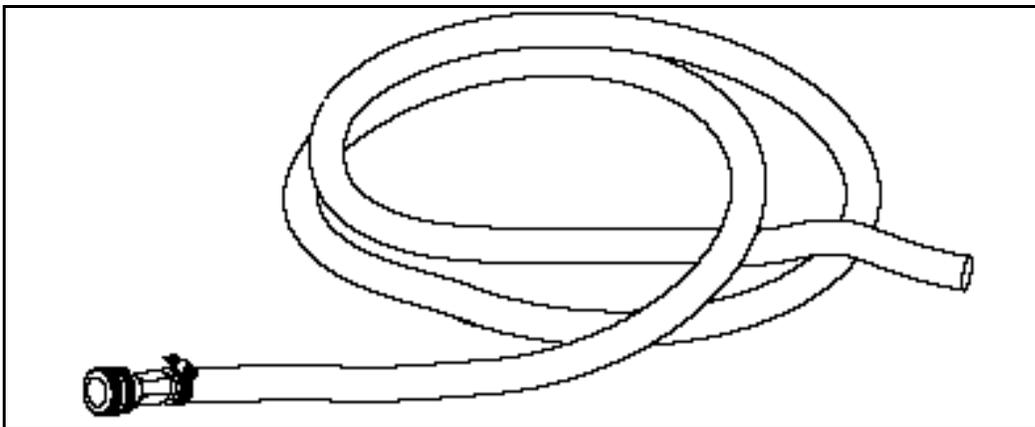


Figure 3

- Flow Control Burner Hose. Figure 4. The flow control burner hose connects to the fuel flow control valve and supplies the fuel to the burner shell assembly.

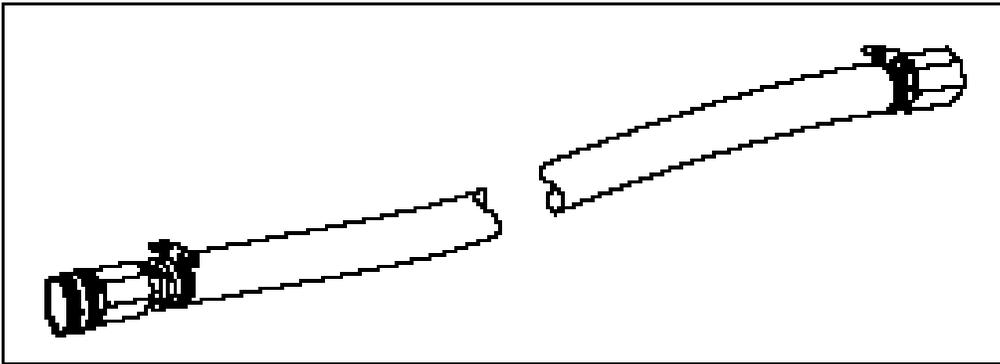


Figure 4

- (6) Fuel Can Stand. Figure 5. The fuel can stand supports a standard plastic fuel can in an inverted position in order to gravity feed fuel to the heater. The stand disassembles and folds for packing.

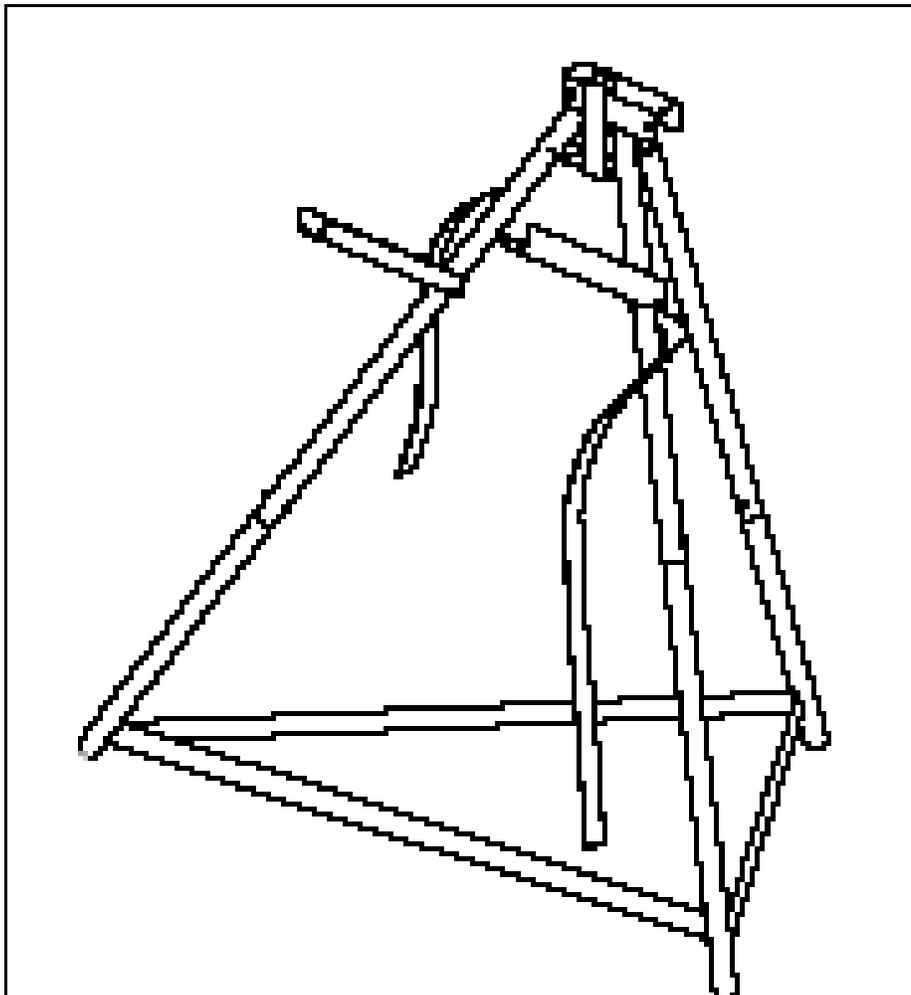


Figure 5

(7) Gravity Feed Adapter. Figure 6 This adapter installs in a standard issue plastic fuel can and permits fuel to flow by gravity from the fuel can to the H-45 Type II (Liquid Fuel) Heater.

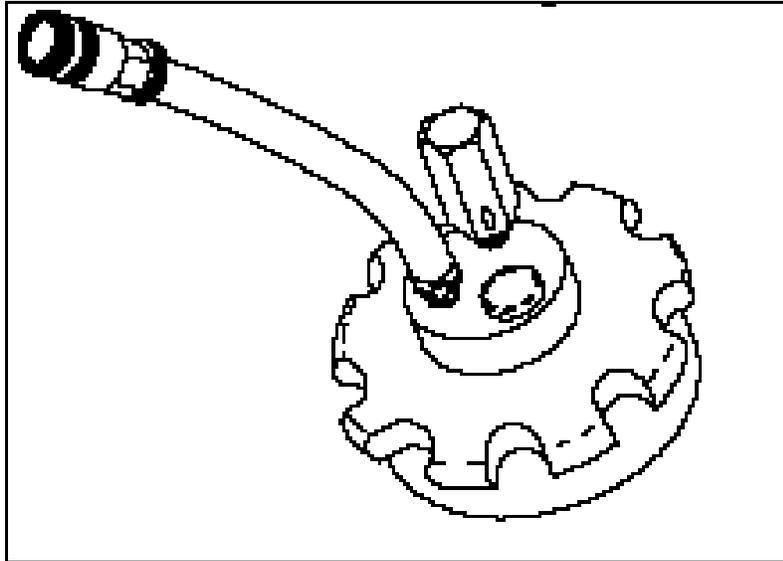


Figure 6

(8) Thermoelectric Fan (TEF), Optional. The TEF is an optional component of Type II (Liquid Fuel) Heater. The TEF generates its own power from the heat generated by the heaters and is placed on the indented area on the top heater shell of the H-45s.

### Learning Step/Activity 3 – Assemble the Type II H-45.

- a. Install and assemble the heater. Figure 13

**WARNING:** If the heater has not been used before, you will have to completely assemble the heater outside of the tent (to include the six-section stack assembly and tie down), *burn off the protective film*, allow the heater to cool, disassemble the heater, and then move the heater inside the tent. Make sure you allow enough at least 4 feet of air space between the tent walls and the heater unit. While in operation, the heater exterior will become very hot. Frequently check for heating of the tent walls while the heater unit is in use. If the tent walls become too hot, the heater needs to be shutdown, allowed to cool, and moved to a tent stack shield opening location farther away from the tent walls, if available. Failure to follow these procedures could result in the heater igniting the tent.

**NOTE:** For best operation, be sure that the heater is as level as possible.

(1) To prepare the H-45 Type II (Liquid Fuel) Heater for operation (after the protective film has been burned off), place the heater on the ground under a tent stack shield opening. If used on top of a tent floor, the heater must be set on a bed of sand or placed on three or four bricks. Level the base by eye. NWTC uses a sawed off 55 gallon drum with dry sweep as a base.

(2) Open the front base heater door (1), pull the priming cup (2) on the retainer wire (3) out of the heater body base until the wire is fully extended, and set aside.

(3) Remove the top heater shell (4) from the heater body base (8) by loosening the wing nuts on the bolt and wing nut assemblies (21) and sliding them out of the brackets (22) on the top heater shell (4). Set the top heater shell (4) aside. If not already done, remove all the components stored inside the heater.

(4) Replace the burner shell assembly (5) in the heater body base (8). If necessary, rotate the burner shell assembly (5) to ensure that the pipe nipple (6) aligns with the left side of the front base heater door opening (7) in the heater body base (8). Pull the flow control burner hose (9) through the front base heater door opening (7). The burner shell assembly (5) and adapter ring (10) welded to its top must be level and fully engaged all around the circumference of the heater body base (8).

(5) The superheater (11), burner cap assembly (12), and high fire ring (13) are all installed when shipped. Ensure that these parts are in place as illustrated.

(6) Insert the fuel flow control valve (14) into the bracket holder (15) on the heater body base (8).

(7) Attach the free end of the flow control burner hose (9) to the flow control outlet (16) on the bottom of the fuel flow control valve (14). To do this, pull back on the female Quick Disconnect (QD) fitting on the end of the flow control burner hose (9), insert it on the flow control outlet male QD fitting, and release the female QD fitting. Gently pull on the flow control burner hose to ensure the connection is secure.

(8) Attach the female QD fitting on the fuel overflow hose (17) to the fuel overflow male QD fitting (18) on the fuel flow control valve (14). To do this, pull back on the female QD fitting on the fuel overflow hose (17), insert it on the fuel overflow male QD fitting (18) on the fuel flow control valve (14), and release the female QD fitting. Gently pull on the fuel overflow hose to ensure the connection is secure. Set the free end of the fuel overflow hose aside.

(9) Connect the female QD fitting (19) on the fuel supply hose (23) to the fuel supply male QD fitting (20) on the fuel flow control valve (14). To do this, pull back on the female QD fitting (19) on the end of the fuel supply hose (23), insert it on the fuel inlet male QD fitting (20), and release the female QD fitting (19). Gently pull on the fuel supply hose (23) to ensure the connection is secure. Set the free end of the fuel supply hose (23) aside. (10) Place the top heater shell (4) on the heater body base (8). Place the bolt and wingnut assemblies (21) in the brackets (22) on the top heater shell (4) and tighten the wingnut.

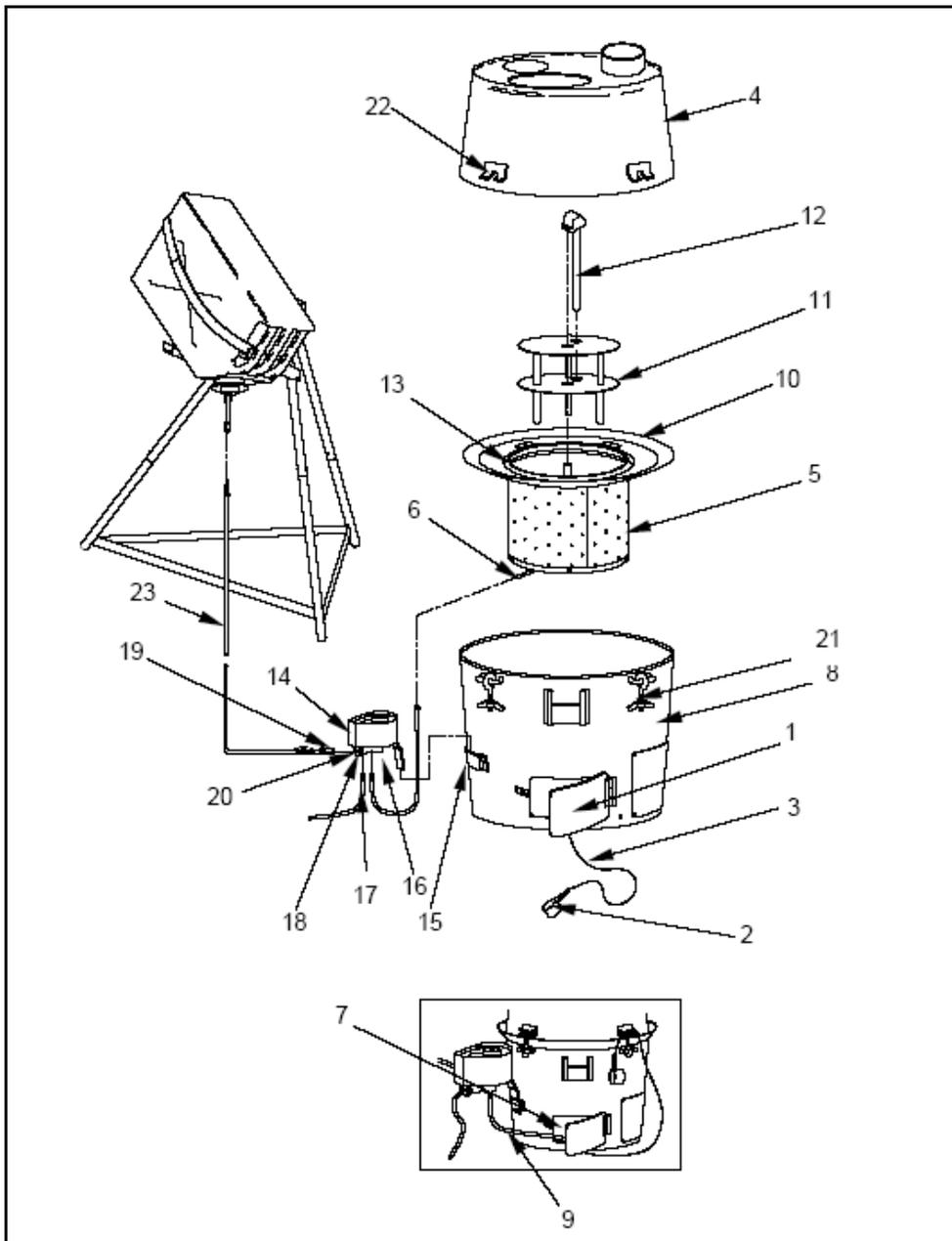


Figure 13

b. Assemble The Stack. Figure 14

**WARNING: Ensure the stack pipe sections seat together securely. Poorly fitted stack sections may allow a hot stack to fall on the tent and start a fire or allow deadly carbon monoxide to leak into the tent. It is important to stake the exhaust stack securely since this will keep the exhaust stack vertical and seated firmly within the stack adapter with a downward force. This also stabilizes the heater and helps prevent it from being knocked over if bumped by equipment or people inside the tent. The tent needs to be securely staked to prevent the tent roof and walls from flapping during snowy and windy conditions. If the tent itself is not tightly staked, the roof and sidewalls can flap, getting close to the heater and creating a fire danger. Refer to the tent-specific operator manual on**

the proper staking of the tent. During operation, the H-45 heater produces harmful carbon monoxide and other gases. Carbon monoxide is a colorless, odorless, and tasteless gas. Remember that although carbon monoxide has no telltale odor, it may mix with other odors that mask its presence; therefore, carbon monoxide can be present within a mix of seemingly harmless odors.

Mild cases of carbon monoxide poisoning can cause symptoms such as nausea, dizziness, or headaches. Severe cases of carbon monoxide poisoning can result in brain damage, heart damage, or death.

To prevent carbon monoxide poisoning, ensure that the H-45 heater exhaust stack sections fit together snugly and that the exhaust gases are properly vented through the roof of the tent. Keep the H-45 heater in good working order. Ensure that all possible sources of carbon monoxide leakage have been repaired and that the operating space is well ventilated.

**NOTE: All six stack pipe sections and stack cap assembly must be assembled, put securely in place on the top heater shell flange, and tied down during heater operation. Failure to use all six sections will adversely affect heater performance, increase soot buildup, and increase maintenance.**

**The type of tent, use of a step aid (if available), and height and strength of the persons assembling the stack may alter the following stack assembly procedures.**

(1) When the H-45 Type II (Liquid Fuel) Heater is first delivered, the stack assembly sections are provided as curved sheet metal sections. They must be formed into cylinders and their seams locked. Refer to the section entitled "Assembling the Stack Sections for the H-45 Type II (Liquid Fuel) Heater" in the Technical Manual for information on assembling the sections before initial use.

(2) Outside the tent, roll back the flap (12) on the tent stack shield opening (11), and tie it back securely. (Refer to the tent-specific operator manual for this procedure.)

(3) Inside the tent, securely install the uncrimped end of one of the stack sections onto the crimped end of another stack section (8-3). Securely install the stack cap assembly (1) with the attached guy lines (2) onto the crimped end of the stack section (3).

(4) Insert the stack cap and attached guy lines through the tent stack shield opening.

(5) Securely install the bottom of the stack assembly (8) onto the flange (9) on the top heater shell.

(6) One person should remain in the tent stabilizing the stack assembly, while two other persons go outside the tent and retrieve the three guy lines (2) from the roof of the tent.

**NOTE: The use of a long stick or other such object (not supplied with the H-45) may be needed to retrieve the guy lines from the tent roof. Once the guy lines are retrieved, additional lengths of rope (not supplied with the H-45) may have to be added to the end of each guy line before the ropes can be anchored to the tent.**

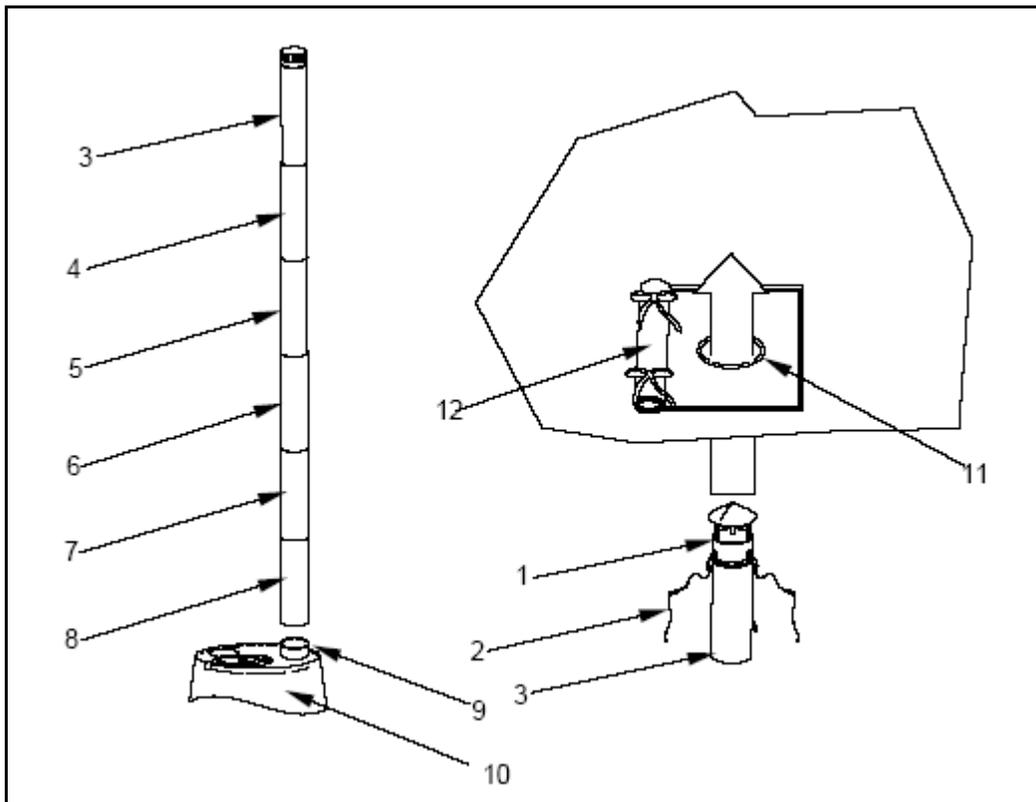


Figure 14

c. Prepare a Fuel Supply Site. Prepare the fuel site as for the SHA. All considerations that apply for the SHA also apply for the H-45.

#### Learning Step/Activity 4 – Light and operate the Type II (Liquid Fuel) H-45.

a. Starting and Operating the H-45. (See Figure 15)

(1) Open both base heater doors (1, 2).

(2) Set the fuel selector control knob (6) to the proper position for the ambient temperature and the fuel being used as described in WP 0004 00, Table 2. Once the temperature and fuel are determined, lift the fuel selector control knob (6), and turn the entire control assembly until the fuel selector control knob (6) engages in the detent. Release the fuel selector control knob (6).

(3) Turn the fuel OFF/ON control (7) on the fuel flow control valve (8) to the ON position.

**NOTE: The flow adjustment knob (9) on top of the fuel flow control valve increases the fuel flow when turned clockwise and decreases the fuel flow when turned counterclockwise.**

(4) Turn the flow adjustment knob (9) to the HI position. Wait 5 to 10 minutes for the flow control burner hose (11) and burner uptube (10) to fill with fuel. Shake and tap the hoses (11,15) to free any air that may be trapped in the hoses. Turn the flow adjustment knob (9) back to setting “3.”

(5) Using the 4-ounce cup (12) attached to the retaining wire (13), open the priming valve T-connector (14) on the fuel supply hose (15), and carefully fill the cup with fuel. Remove the lid

assembly (18), and pour one 4-ounce cup of fuel into the bottom of the burner shell assembly (16) through the lid assembly opening.

**NOTE: When operating with diesel fuel or JP8 in very cold temperatures, if problems are experienced getting the heater to light or to continue burning, it may be necessary to repeat step 5. Make sure the flame is out completely and the heater is cool before adding additional fuel.**

**NEVER add additional fuel when the burner is lit or hot.**

(6) Roll a piece of tissue paper, or similar material, into a ball approximately 2 inches in diameter. Use the paper to wipe the cup (12) to remove any remaining fuel. Do not discard the paper. It will be used when lighting the heater.

**WARNING: Keep your hands and face away from heater lid opening when lighting the burner to prevent getting burned. If the flame is accidentally extinguished, WAIT UNTIL THE BURNER COOLS BEFORE RELIGHTING. NEVER LIGHT A HOT HEATER. LIGHTING A HEATER THAT HAS NOT COOLED COULD RESULT IN AN EXPLOSION.**

**NOTE: Check all three hoses, the fuel flow control valve, and the gravity feed adapter for leaks before and after lighting the heater. Make sure that all QD fittings are securely engaged. If a leak occurs while the heater is in operation, shut down the heater immediately, and notify your supervisor if the leak cannot be corrected.**

(7) When lighting the burner with JP-8, diesel, JP-5, kerosene, Jet A-1, or Jet A fuel, place the tissue paper used to wipe the cup (12) on the top of the heater near the edge of the heater lid opening. Light the tissue paper, and push the paper into the burner shell assembly, making sure it goes to the bottom of the burner shell assembly (16). The burner reaming tool (17) can be used to force the burning paper to the bottom of the burner shell assembly (16) if necessary. Replace the heater lid immediately.

**NOTE: If fuel flow is slow, shake and/or tap the hoses to eliminate any air bubbles.**

(8) With the fuel flow adjustment knob at setting "3," wait until the burner shell assembly warms up before increasing the fuel flow with the fuel flow adjustment knob.

**NOTE: The heater is designed to operate at various firing rates, producing between 20,000 to 45,000 BTUs. A smoking, pulsing, or sooty heater indicates an overfire or underfire condition.**

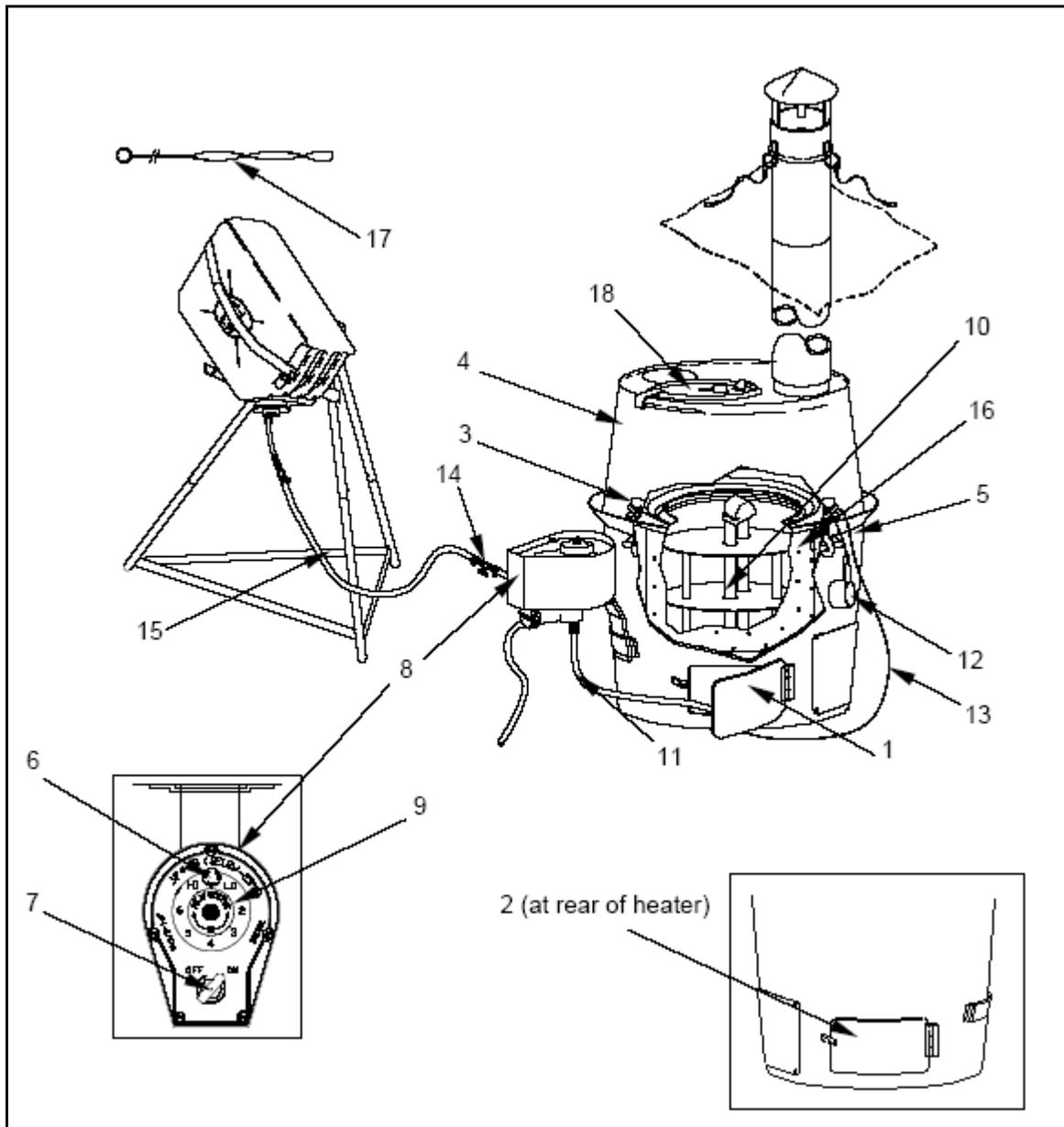


Figure 15

**NOTE:** Viscosity of liquid fuel is not consistent at all times and locations. If the heater appears to be overfiring at high settings or underfiring at low settings, adjust the fuel flow adjustment knob (4) counterclockwise or clockwise until the flame is clear, no smoke or soot is observed, and the pulsing stops. Figure 16

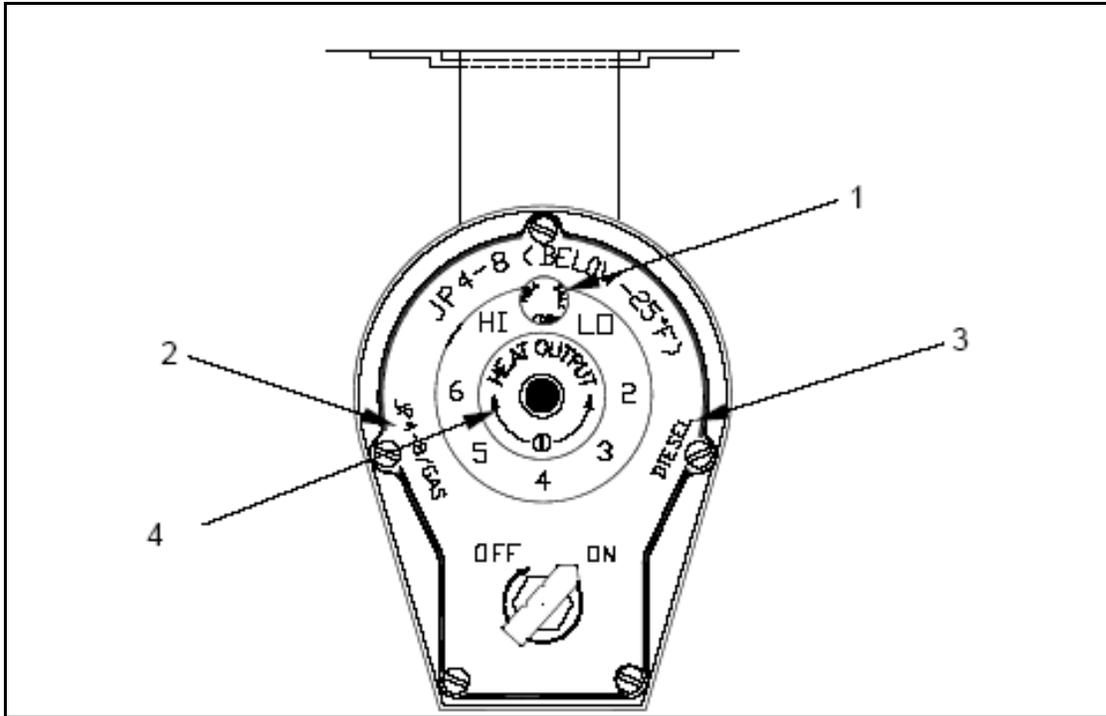


Figure 16

b. Changing Fuel Can.

**WARNING: Do not exchange heater unit fuel can unless the heater is turned off. Do not smoke, and ensure that there is no open flame in vicinity. Fire or explosion may result.**

- (1) Turn fuel ON/OFF control to the OFF position.
- (2) Remove empty fuel can from stand and set upright on ground.
- (3) Remove gravity feed adapter kit from empty fuel can.
- (4) Install adapter kit into full fuel can, insuring that the gasket on the adapter stays in place during installation. Wipe excess fuel from the washer, washer seat, and the lid of the fuel can.
- (5) Place fuel can in an inverted position on fuel can stand or other support, not less than 2 feet and no more than 3 feet above fuel flow control valve.
- (6) Wait until the stove has cooled and light the stove using proper lighting and operating procedures.

## Learning Step/Activity 5 - Shut down, recover, and store the H-45.

a. Shutdown procedures:

- (1) Turn fuel ON/OFF control to the off position.
- (2) Remove fuel can from stand and set upright on ground.
- (3) Let the stove cool.
- (4) Set fuel can on ground and disconnect adapter kit. Replace fuel can cap.
- (5) Disconnect supply flow control hose assembly from adapter kit and fuel flow control.
- (6) Disconnect flow control-burner hose assembly from fuel flow control. Remove fuel flow control and bracket and purge of any fuel. It will be very difficult to remove all fuel from this assembly, and it is therefore recommended that the fuel flow control valve be placed in a plastic bag with a HAZMAT pad. The fuel flow control valve should be stored in the "ON" position to prevent the valve from sticking to the body.
- (7) Remove and separate stack cap assembly, tent lines, and stack pipes from each other.
- (8) Loosen three wing nuts holding top heater shell to heater body base and remove top heater shell.
- (9) Remove burner shell assembly from heater body base.
- (10) Clean all components of soot, carbon buildup and fuel residue.  
return burner shell assembly to heater body base.
- (11) Return top heater shell to heater body base and secure with bolts and wing nuts.
- (12) Open lid and return all accessory components to heater body base.

## SECTION IV. SUMMARY

You can now maintain and operate a H-45 Type II Liquid fueled stove.

### Check on Learning.

1. Is JP-4 or gasoline an authorized fuel in the H-45?  
No.
2. If the stack assembly is sticks too far out of the top of the tent opening, can you remove some of the sections to make it fit better?  
No. All stack sections must be used in order for the stove to operate properly.
3. How should you store the fuel flow control valve? The fuel flow control valve should be stored in a plastic bag with a HAZMAT pad.  
The ON/OFF valve should be stored in the "ON" position to prevent it from sticking the valve body.

**SECTION II. INTRODUCTION**

**Motivator:** A patrol base and most forward operating bases, are tactical in nature, and are designed to provide living accommodations within a defended position. A patrol base should seldom be occupied for more than one night, unless it is being established in conjunction with a deliberate defense. The forward operating base will be occupied for longer periods of time and may involve considerable preparation. The patrol base is normally established at or after last light, should require the minimal amount of preparation possible, and must be organized to allow for rapid and coordinated responses to enemy action. This lesson provides you with techniques and procedures that you can use to plan for, establish and utilize a patrol base in cold regions.

**Terminal Learning Objective**

|                  |   |
|------------------|---|
| <b>ACTION</b>    | <b>Occupy a Patrol Base in Cold Regions</b>   |
| <b>CONDITION</b> | In a snow covered environment with temperatures of 10 degrees F or colder, given a standard ahkio group or tent and stove normally used by the unit in the field, field training area large enough to accommodate the unit, while wearing Extended Cold Weather Clothing System (ECWCS), fighting load carrier, ballistic helmet, weapon and rucksack with prescribed packing list. |
| <b>STANDARD</b>  | Occupy and operate from a patrol base(s) for five nights Cold Weather Leaders Course (CWLC) or one night for Cold Weather Orientation Course (CWOC) or one night for Cold Weather Indoctrination and Certification (CWIC). Do not sustain any cold weather injuries. Meet all critical performance measures IAW the Individual Student Assessment Plan (ISAP).                      |

**Safety Requirements:** Instructors are required to remain with the squad during all bivouacs to ensure that students are adhering to control measures aimed at preventing cold weather related or other environmental injuries. A minimum of two medics will be on site to conduct checks of personnel for cold weather and other illness/injuries. At a minimum, each student will be evaluated by medics the morning following any bivouac. More checks may be conducted as dictated by NCOIC/OIC or 1SG/Commandant dependent upon weather conditions. Squad instructors will also conduct periodic physical checks of students throughout the training cycle. The frequency of these checks is dependent upon the weather conditions. Daily risk assessment conducted; adjustments made to clothing and warming shelter breaks/CWI checks based upon current conditions. Per the requirements of USARAK Regulation 420-1 a serviceable 5lb ABC fire extinguisher will be present and a serviceable smoke detector will be placed at the highest portion of the tent.

**Risk Assessment:** Moderate (Reference USARAK Pamphlet 385-4)

**Environmental Considerations:** POL products are utilized during this instruction. Ensure adequate measures are taken to prevent spills and that adequate materials are on hand to clean up any spills that do occur.

**Evaluation:** You will be tested on your ability to select, establish and operate from a patrol base/assembly area for four nights (one night for CWOC) at temperatures of 10 degrees Fahrenheit or colder during the course in session. You will also be tested on your knowledge of patrol base 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:** Force protection while operating in the cold weather environment often involves considering the terrain and weather as well as the enemy. There are objective hazards that can create non-battle related injuries to soldiers and/or significant damage to equipment if these hazards are not considered. This chapter discusses various factors that leaders should take into consideration when establishing, occupying, and striking patrol bases or assembly areas, as well as information concerning construction of improvised shelters. This chapter references Chapter 5, The Principles of Patrolling in the Ranger Handbook. The information is meant to provide tactics, techniques and procedures specific to the cold weather environment and is not meant to take the place of unit SOP or dictate methods for patrolling.

The four essential requirements for survival in a cold weather environment are warmth, food, water, and shelter. Shelter is of particular importance because, without it, it is extremely difficult to provide yourself and your soldiers with the remaining three requirements, especially during inclement weather. Tents can be erected quickly with proper training and adequate practice. Soldiers must understand the importance of rehearsing this task as they would any battle drill. Soldiers that have just completed a difficult movement, or mission must be able to quickly set up shelter, get that shelter warmed and begin the process of making water and getting a warm meal. Units that are not competent at this task will suffer and quickly become casualties of the cold. There is also the tactical necessity of establishing, securing and defending a patrol base or assembly area; a unit that has not rehearsed this for cold weather operations will spend most of their time just trying to survive and the unit will become incapable of continuing with other missions.

It is also important to note that shelter can become a hindrance to training, as it provides a way to be comfortable. Soldiers may be unwilling to leave the comfort of a warm shelter and training will suffer as a result. Shelters should provide a respite from the elements, but care should be taken to ensure that field exercises do not become winter camping trips. This faulty method of 'training' will translate into soldiers that easily become casualties of the cold should they be called upon to conduct actual military operations in a cold weather environment.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Select areas for patrol bases and assembly areas in cold regions.

a. Site Selection. In the cold weather environment, some types of terrain offer better patrol base options than others; if the mission and tactical situation permit you to do so, try to choose a patrol base while keeping the following factors in mind.

(1) Forested Areas. Forests, especially those where the vegetation is spruce or pine, provide excellent patrol bases. Material for camouflage, firewood, and construction of both shelters and fighting positions is abundant. Spruce and pine forests are preferable for a variety of reasons, one being that these types of trees generally grow on well-drained soil. Another reason is that, because they retain their leaves or needles year-round, they offer better concealment as well as protection from wind and inclement weather than do deciduous trees, which lose their leaves during the winter months.

(2) Marshy Ground.

- Firmly frozen swampy areas, especially those that are covered with trees and brush, may also offer a good location to establish a patrol base. Streams and rivers which are located nearby, and which are covered with ice thick enough, may offer excellent routes for re-supply, as well as both mounted and dismounted movement. However, it is generally difficult to construct dug-in fighting positions; you may be forced to construct above-ground positions in these areas, using available materials. In addition, leaders should remember that a sudden thaw may leave them and their soldiers wallowing in a pool of mud.
- Areas lying in the bottom of deep valleys should be avoided, due to the tendency of masses of cold air settling in low ground (also known as a temperature inversion). During windless conditions, temperature inversions may result in a low-lying patrol base becoming enveloped in a cloud of ice fog, which could reveal the location of the site to enemy observers, especially if they are located on a higher vantage point than the patrol base.

(3) Open Country. Open country presents difficulties such as poor cover and concealment, exposure to high winds and drifting snow. If you must establish a patrol in open areas, tents should be pitched (or shelters constructed) in the lee of natural windbreaks such as depressions or the downwind side of ridges and hills. Where no natural windbreaks exist, tents should be dug into the snow as deeply as possible and/or loose snow or blocks of snow used to construct windbreaks.

(4) Mountainous Terrain. Above the tree line, mountainous terrain will provide little shelter from either observation or the elements. During high winds, lee slopes may offer shelter, however, for the same reason that they offer shelter to you, they can increase your exposure to avalanche hazards; wind-driven snow is deposited on lee slopes, and if the slope is steep enough, that snow will eventually slide. In snow-covered mountains, or when snowfall is imminent, you must examine a slope's potential for avalanche prior to establishing a bivouac upon it. Refer to 699-8027 in this publication for more information concerning avalanche hazard identification.

(5) Other Terrain/Weather Considerations

- Select terrain that is of little tactical value to the enemy.

- Select terrain that is off main lines of drift such as main ridges, creeks, valleys, couloirs – all likely avenues of approach.
- Provided your unit has the proper equipment, water re-supply will probably not be an issue as snow can be melted for the main water source; fuel re-supply can become an issue as it is needed to melt the snow and/or provide heat.
- Consider dominant terrain features from which an attack could develop.
- Prevailing wind direction (the wind may carry sound to you or to the enemy, depending upon its direction; try to select a site which is downwind from suspected enemy positions/avenues of approach, especially when wind speeds are low).
- Consider escape routes which facilitate rapid withdrawal.
- Consider availability of camouflage/construction material.
- Check illumination/weather conditions (in good weather or bright moonlight, try to select a shadowed area such as a north-facing slope or the middle of a wooded area), with S-2.
- Check thermal detection capabilities of enemy forces (also with S-2).

#### b. Site Reconnaissance.

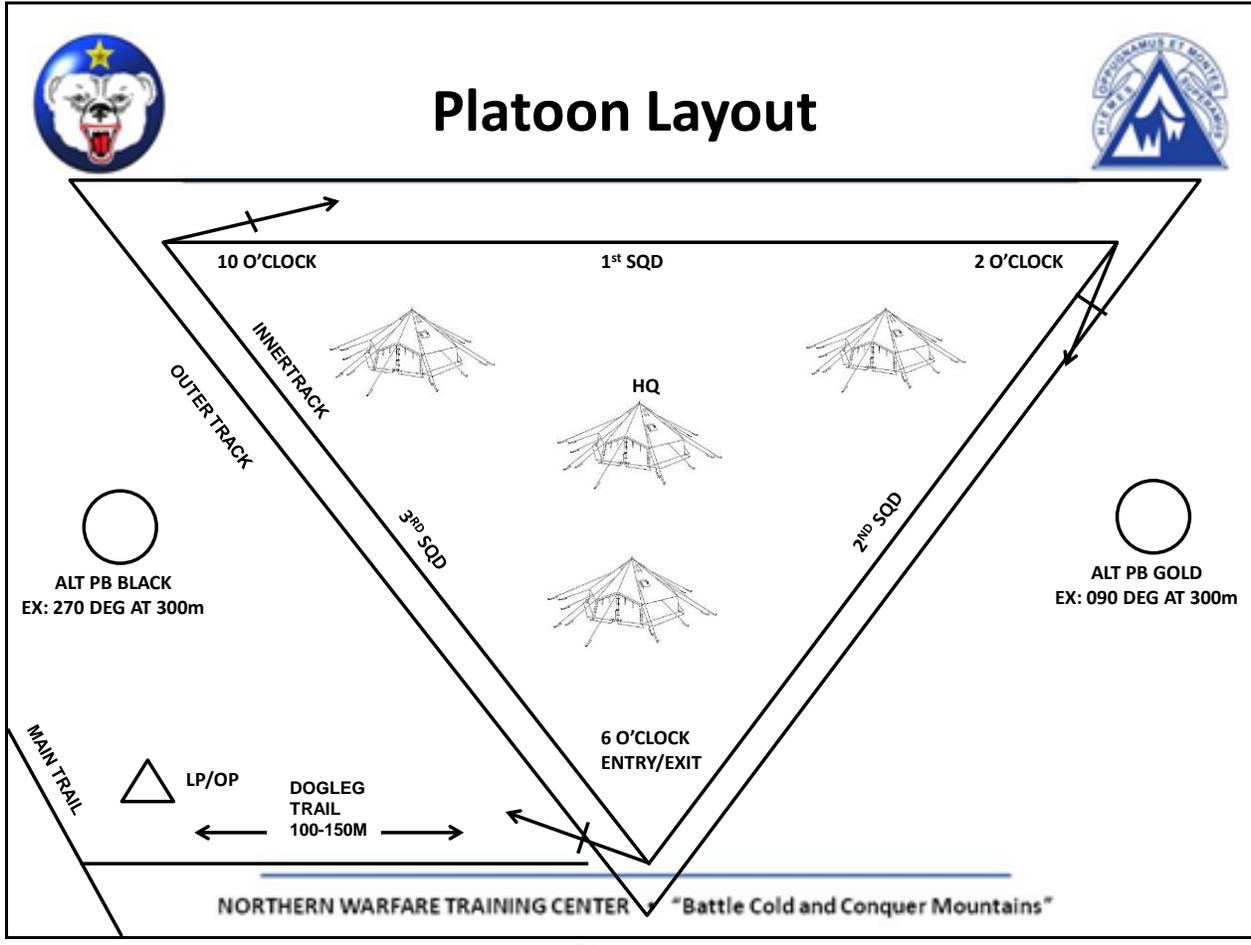
(1) Security Halt of the Unit. Before occupying a patrol base, it should be laid out by a reconnaissance or quartering party that precedes the main body. One thing that consistently gets overlooked is the posture of soldiers waiting in a security halt for the reconnaissance element to find/establish the patrol base site. Leaders that are left with the main body must ensure that soldiers remain warm while maintaining security. It may be appropriate to add layers of clothing, or have soldiers get up and move in buddy teams a few hundred meters back before returning and switching out with another buddy team. It may also be possible to send the security element forward prior to departure of the main body. In extreme cases it may be wise to move the entire element into the patrol base by force, though this should never be the norm. Leaders that are on the reconnaissance must move quickly and return as soon as possible to get the main body moving again. It is up to the unit to decide the method to use for conducting the reconnaissance. For squad size elements it may be best to occupy by force. For platoon sized elements, normally the Platoon leader, compass man, and one member of each squad should move forward to conduct a reconnaissance of the patrol base. Squad members can be positioned at the 10, 2 and 6 o'clock positions (Picture 1) and act as guides for the main body. Regardless of the method used or the size of the unit, the reconnaissance party must leave a detailed contingency plan for the main body.

(2) Tasks that must be accomplished prior to the arrival of the main body include:

- Site the Patrol Base:
  - All of the factors that were mentioned earlier in this lesson should be taken into consideration when choosing the exact location of a patrol base or assembly area. In addition, the establishment of a dummy patrol base should be considered.
  - Dummy patrol bases, when used, should be positioned between the actual patrol base and the area that you determine to be the most likely enemy avenue of approach. Ideally, the dummy bivouac position should be far enough away that your soldiers have adequate time to get into the appropriate defensive posture once the enemy is detected, and be outside of small-arms range of the actual patrol base. When establishing a

dummy site, make maximum use of mechanical ambushes and early warning devices, and, if possible, have it plotted as a target by your fire support assets.

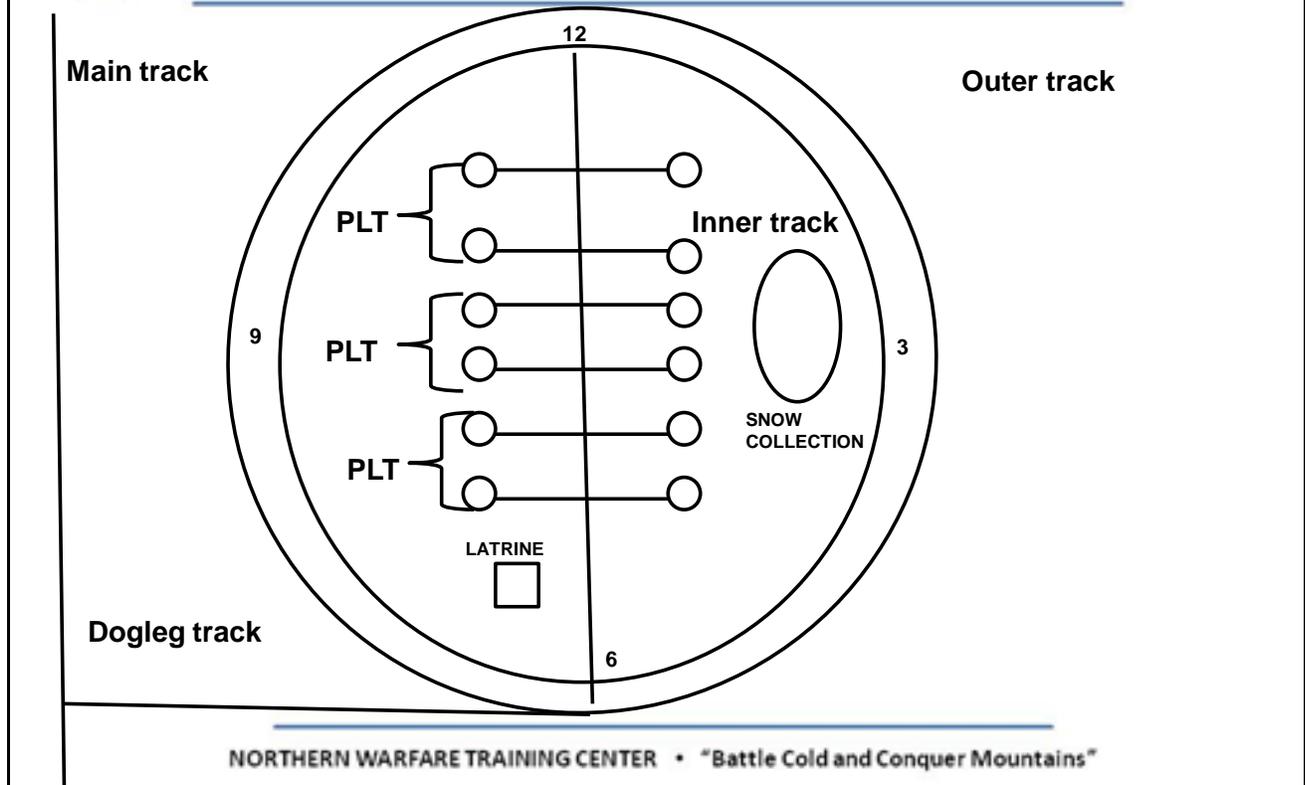
- Establish Security at the Patrol Base. Initially, security may be established, and maintained until arrival of the main body, by the use of LP/OP's along likely avenues of approach as well as by emplacement of early warning devices. The reconnaissance party is responsible for the security of the patrol base until relieved by personnel from the main body.
  
- Establish a Track Plan.
  - Track plans (Picture 1 platoon, Picture 2 company) should be established before anyone enters the site. Normally, the incoming track will be extended well beyond the point where it enters the bivouac, and may lead to a dummy patrol base (see above). Branching off from the incoming track, preferably at an acute angle to the direction of the enemy, is the patrol base track, or "main street". This is the single track that enters the actual patrol base perimeter. Minor tracks are established leading off of main street to sub-unit areas where tents are located. Both inner and outer perimeter tracks are also established.
  
  - Defensive positions are established along the outer edge of the inner perimeter track. The outer perimeter track should parallel the inner perimeter track outside of hand grenade range of the positions along the inner track. LP/OP's may be established along the outer edge of the outer track, and extensive use of early warning devices/mechanical ambushes should be made there as well.



Picture 1



# Company Layout



Picture 2

- Select Defensive Sectors.
  - The reconnaissance party should designate the defensive sectors of responsibility for each sub-unit of the main body. The boundary between each sub-unit sector should be marked. At a minimum the above should be accomplished by the reconnaissance party.
  - The tasks listed below can also be accomplished by the reconnaissance party, but remember to consider the time that the main body has been stationary.
- Mark Tent Sites. The location of each tent to be set up should be marked and a single trail established to that point. Sub-unit integrity should be maintained to the greatest extent possible, and sub-unit tent sites should be designated with regard to ease of access to that elements defensive sector.
- Select areas for cutting brushwood/gathering snow. If brush or wood will be required for construction of shelters or fighting positions, an area should be designated for personnel to obtain this material. This area should be within the inner perimeter track, and cutting should be done in a manner that minimizes the chances of detection by enemy observation from either the ground or air. Areas for gathering snow (for water production) should be designated within the inner perimeter as well, but away from latrines, wood cutting areas, and POL storage points. Care

must be taken to minimize the possibility that snow gathered from this area could be contaminated, which would render the snow unfit for producing potable water.

- Provide Guides for the Main Body
- Once the main body arrives, it is imperative that they be able to rapidly occupy the patrol base or assembly area without at the same time compromising the track plan, or noise/light discipline. Speed is essential because soldiers who have just completed a long oversnow movement are likely to be perspiring as well as tired. If they are left standing in the cold while their chain of command is trying to determine where they belong, the unit is at risk to suffer cold weather injuries.

**Learning Step/Activity 2- Occupy a Patrol Base.** Occupation. After link-up between the guides and the main body, the guides (at least one for the commander and for each sub-unit) should explain the site layout and track plan before actually leading their assigned element into the Patrol Base (PB) or Assembly Area (AA).

a. Immediately upon arrival, the leader should confirm decisions made by the reconnaissance/quartermaster party and issue orders as follows:

- Confirm/modify the track plan
- Designate temporary location(s) for weapons/equipment under his direct control to prevent loss in the snow
- Decide the type of fighting positions (built up vs. dug in) to be used, and site them
- Confirm/modify tent locations
- Confirm/modify brush cutting/snow gathering areas and latrine sites
- Designate method of, and, if necessary, location for, garbage disposal
- Decide type of improvised shelters to be constructed (if tents are not used). If there is a high probability of the enemy employing thermal detection devices/sights, improvised shelters such as thermal shelters or molded dome shelters (quingy huts) emit a much smaller thermal signature than heated tents or personnel sleeping in unheated tents.
- Give orders for preparation/consumption of hot drinks and a hot meal. *When* this order is given is determined by the amount of progress made in preparation of defenses, as well as the need for shelter (based upon weather conditions).

b. As the main body moves into the patrol base, care must be taken to ensure that track discipline (strict observance of the track plan) is enforced. In addition, noise and light discipline must be rigidly enforced. Although it is virtually impossible to occupy a site in total silence (especially when you have to pound tent pins or cut wood for positions and shelters) your soldiers should be trained well enough so that they do not need lanterns or flashlights to enable them to accomplish their tasks.

c. Once the main body has arrived, the security elements provided by the reconnaissance party should be relieved as quickly as possible. As temperatures decrease, the need for speed in conducting this relief becomes increasingly important. However, soldiers designated to relieve reconnaissance party security forces must be allowed to change out of clothing that may have become perspiration-soaked during the movement to the bivouac, and to adjust their clothing to ensure adequate protection while performing relatively sedentary duties in LP/OP's.

d. Security. In very cold conditions, sentries can only remain alert for relatively short periods of time. They cannot remain motionless or look into the wind for long, and their hearing is impaired by the additional headwear required in cold temperatures. Leaders must use their judgment on how long their soldiers can remain outside and be able to perform their duties at peak efficiency, and without increased risk of cold weather injury. The time a soldier can spend outside of a heated shelter performing relatively sedentary tasks will vary with the temperature, degree of wind chill, visibility, and the cold weather training and experience level of the soldier. The following are some techniques that may be used for maintaining security in cold weather; if you decide to use one, ensure that you select the technique which best suits the tactical situation:

(1) Combined living and fighting positions may be established on likely enemy avenues of approach. Tents or improvised shelters may be used. Ensure that warning systems are established and/or that these positions are far enough from the main patrol base to give adequate warning of an attack to the occupants of the main site.

(2) One complete sub-unit may be used to perform security duties at any given time; this will allow the remainder of the unit an extended period of time to rest in heated shelters.

(3) Double the number of personnel on guard, to allow one soldier to act as a fire guard inside the shelter/tent while another performs sentry duty. After waking up his relief the fire guard leaves the tent to relieve the sentry, who then returns to the tent to rest and warm himself.

(4) When establishing LP/OP's or emplacing mechanical ambushes/early warning devices, always approach the location you have selected from a flank; do not leave a trail in the snow that points the enemy directly toward or leads them straight into the patrol base.

(5) Keep lanterns inside tents turned as low as possible; this will minimize loss of night vision for personnel inside the tent, as well as reduce the patrol base signature created by light showing through tent openings.

(6) Balance the need to provide heated shelter against the necessity to reduce the thermal signature of the patrol base. Natural terrain features and snow constructions may be used to mask thermal signatures.

e. Duties of Tent Group Leaders. The tent group leader, usually the squad leader or senior occupant of the tent, is responsible for ensuring that the tent group is properly set up, maintained, struck, and packed, as well as for everything that occurs inside his tent. While bivouacking, the leader must ensure that:

- Sleeping space is properly allocated.
- Weapons and equipment are stored outside the tent in accordance with standard operating procedures.
- Track, camouflage, noise, and light discipline is strictly enforced.
- Guard/sentry rotations are established and disseminated, and guards/sentries know who their relief is and where that soldier sleeps.
- Blackout is maintained when personnel enter/exit the tent.
- The tent is de-iced/brushed off, and drifted snow removed regularly.
- Fire precautions are observed.

- Squad stoves and lanterns are re-fuelled outside.
- Weapons, equipment, stoves, and lanterns are regularly maintained.
- Personnel brush snow off clothing and equipment before entering the tent.
- Soldiers dry clothes at every opportunity.
- Water is made continuously and proper hydration is enforced.
- Each soldier receives adequate rations and all rations are consumed.
- Cooking utensils are clean.
- Ensure lanterns are hung by a chain a minimum of 18 inches below the apex of the tent. If the lantern is closer to the tent it is a fire hazard.

f. Organization within a tent. (Picture 3)

(1) Tents are just large enough to provide adequate sleeping space for the occupants together with a small area for cooking, washing, and performing duty as fire guard. Orderly and disciplined arrangements are a necessity in such cramped circumstances. The following procedures are established to enhance the comfort, safety, and operational effectiveness of personnel required to live in tents. Many of these procedures are readily adaptable to life in improvised shelters as well.

(2) The minimum required individual clothing, equipment, and rations are allowed inside the tent. Generally, your canteens, daily rations, insulated sleeping mat, sleeping bag, a small, sharp, knife and the clothing you will require if you leave the tent will be the only items you require. Of course, damp clothing and equipment may be brought inside where it can be hung up to dry, but once dry these items should be placed in your rucksack outside the tent. Prior to every stand-to, all items should be packed into the rucksack so that you will have the essential equipment to survive with you (except the tent group) if your unit is forced to execute a rapid withdrawal under pressure.

(3) All personnel living in a heated tent should have a knife immediately available at all times, and especially while sleeping. If, despite precautions, a tent fire occurs it may take as little as ten seconds for fire to completely engulf a tent, and less than a minute to destroy it. If personnel are asleep, with the zipper of their sleeping bag closed, they may not have enough time to unzip the bag. If they cannot do this, because of lack of time or a jammed zipper, they must attempt to roll out from under the wall of the tent while still in their sleeping bag. This may prove difficult, especially for someone just shocked into wakefulness, and still disoriented. A small, sharp, knife immediately at hand will give an individual the ability to cut his or her way out of the sleeping bag and through the wall of the tent. This single item of equipment may end up being the difference between life and death.

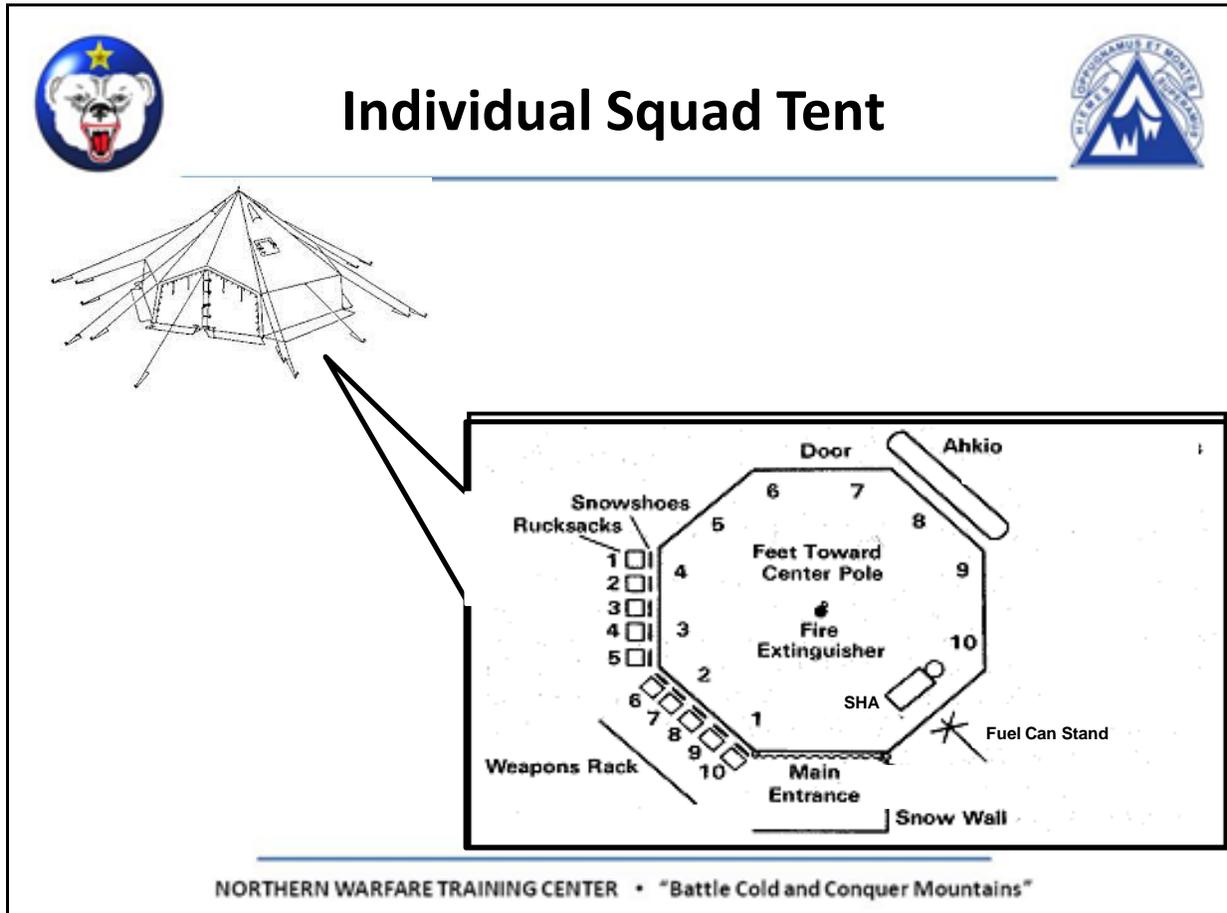
(4) As stated earlier, the tent group leader is responsible for allocating personal space within the tent. When doing so, the leader should take into consideration the duty roster, as well as the need for an orderly exit in the event of an emergency.

(5) Spare batteries for equipment such as NVG's or radios should be kept in the tent, although away from sources of direct heat such as stoves and lanterns, due to their diminished power output when allowed to become cold or frozen. Small battery-powered items such as flashlights or electric razors may be kept in the tent as well, and are ideally stored in the owners sleeping bag.

(6) Weapons racks should be constructed outside the tent as close as possible to the main entrance. A poncho should be used to keep sights, barrels, and moving parts on weapons from becoming clogged with snow. Personnel should always remember exactly where on the rack their individual weapon is

located, so that, if a situation arises which results in a mad rush to arms, they will be able to grab the correct weapon. The weapons rack is constructed in a manner identical to the cross-tree latrine, but without the wind break a latrine requires.

(7) Rucksacks should be lined up on the ground outside the main door of the tent where they will not interfere with personnel entering or exiting the tent. A specific order in which individuals in the tent must line up their rucksack in relation to the others should be established to make it easy for soldiers to identify their gear during conditions of limited visibility. Other personal equipment such as LBV/LCE's and kevlar helmets/body armor may be draped over or placed into the rucksack.



Picture 3

(8) In a cold-dry environment, it is not necessary to cover rucksacks and other gear (except weapons, ammunition, NVG's, and communications equipment) with a poncho; the temperature is too cold to allow the equipment to become wet. Simply brush off any snow before using the item. In a cold-wet environment, all weapons, ammunition, and personal equipment stored outside should be covered with a poncho or other type of waterproof cover.

(9) A plastic trash bag filled with snow taken from the snow collection area should be kept inside the tent. One of the duties of the fireguard is to melt snow for drinking water, as well as to have hot drinks ready for personnel coming in from sentry duty. The five gallon water can, which the fireguard can use as a seat, should be kept inside the tent and topped off whenever it is less than full.

(10) The amount of clothing worn by personnel while resting inside the tent will be dictated by the tactical situation, as well as whether or not the shelter is heated. For example, if there is an increased

chance of enemy contact, you may decide that your soldiers should rest on top of their sleeping mat, fully dressed, with their outer garments unzipped. When a scenario such as this occurs, tent group leaders will need to ensure that the temperature of the stove is regulated so that it is warm enough to keep the soldiers comfortable, but not so warm that they begin to perspire.

(11) When living in a close environment such as a tent or improvised shelter, the highest possible standards of sanitation and personal hygiene must be maintained. Failure to enforce or practice good sanitation and hygiene may expose you and your soldiers to sickness and disease. As discussed in chapter nine the conditions that soldiers must live in during cold weather create an exceptionally good opportunity for biological attack. In addition, a soldier is more susceptible to becoming a cold weather casualty if he does not keep both himself and his clothing clean. Remember the "**C**" in the key word **C-O-L-D!**

(12) If necessary, personnel should shave in a heated shelter just before going to sleep. This will allow natural facial oils stripped off by shaving time to replenish themselves before the face is once again exposed to the cold. These facial oils provide natural protection against cold weather injury.

(13) Soldiers should brush teeth daily. If a tooth-brush is unavailable, one may be improvised with the chewed end of a twig. If a twig is not available, salt on a fingertip may be used to gently scrub the teeth.

(14) Underwear should be changed as often as is practical, but at least twice weekly.

(15) Finally, socks should be changed as often as is necessary to keep the feet dry.

#### g. Heating at night.

(1) The tactical situation, weather, and your soldiers' level of hydration must all be taken into account when determining whether or not to operate heaters throughout the night. The major disadvantages of heating your shelters all night long, other than increased fuel requirements, are the obvious thermal signature of a heated shelter in the middle of a cold environment and the necessity of an additional soldier losing sleep to perform duty as a fire guard.

(2) Some advantages of keeping the stove burning are that soldiers will lose less body heat and conserve more energy while sleeping (with improved performance the following day). Also, troops can be more ready to react to a threat by sleeping fully clothed on top of their sleeping bag (or just their insulating pad).

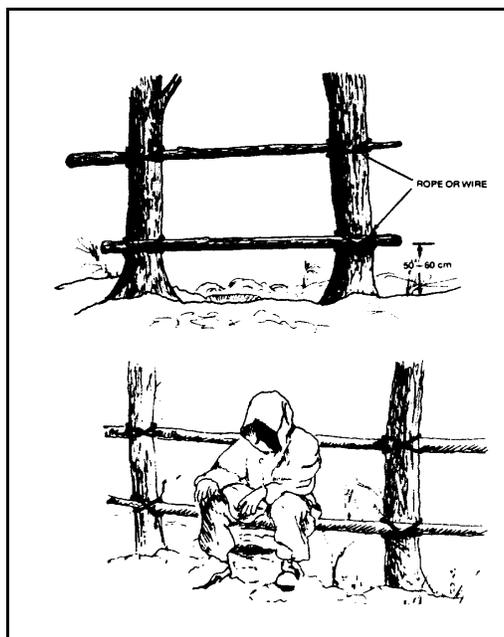
(3) Soldiers sleeping in heated shelters will have the opportunity to dry wet clothing by allowing it to hang in the tent while they sleep; they should not try to dry wet clothes in their sleeping bags while they rest.

(4) Fire guards can use their guard shift to melt snow to provide potable water and hot drinks for sentries, as well as perform weapons maintenance, monitor communications, or conduct personal hygiene.

h. Latrines. Normally, a central latrine should be established if dispersion within the patrol base is not too great. One latrine will normally serve the needs of up to a platoon-sized unit. The following should be taken into consideration when establishing latrines:

(1) The preferred type of latrine for field use is a straddle trench. However due to environmental restrictions during training, or to solidly frozen soil, it may not be permissible or possible to construct a

latrine of this type. Another type of latrine that is recommended for use is the cross tree type latrine, (Picture 4) especially when used in conjunction with a ration case lined with trash bags. Once filled, the bags can be sealed, closed into the case, and burned or hauled to the rear to be properly disposed of



Picture 4

(2) Latrines must be sited downwind from patrol bases, but not so far from the shelters that soldiers are encouraged to violate sanitation discipline. They should also be downwind and well away from snow gathering areas within the patrol base. They should be wind-proofed with branches, ponchos, snow blocks, or other available materials, and must be camouflaged. The site should be in between the inner and out track to maintain security for Soldiers using the facility. Chem lites can be used to mark for dark hours. Make it “directional” by placing it on the friendly side of a tree.

(3) Soldiers should urinate in a designated spot on the ground, and fresh snow should be used to cover this spot daily. The spot should not be covered after each use, because the color of the snow at this location will give leaders valuable feedback on whether or not their soldiers are properly hydrated. If the spot is bright yellow or a darker color, it's time to start melting more snow and forcing hydration.

i. Water Procurement. Water from central sources is often hard to transport due to freezing. Every effort should be made to ensure Soldiers have clean water.

(1) If water is to be transported, consider filling the five gallon cans with hot water. This will help cut down on freezing enroute to the field. Water should be transported in a heated cargo compartment as well.

(2) Water can be taken from lakes and streams but it must be purified before drinking. This can be done by:

- Boiling. Utilize the mess kits in the Ahkio to boil water. The first pot full of water will be used to sanitize the mess kit pots to preclude contamination.
- Mechanical Purifier can be used to treat water. These devices do not operate well in freezing temps and can not be rough handled while frozen.

- Iodine tablets can be used. Two iodine tablets per qt of water. Allow to stand for five minutes, shake the water so some spills onto the cap/threads then seal and allow to stand for 25 minutes before drinking.
- Melting snow is the least preferred method as it is very time intensive. Snow must be gathered and transported to the tent area and melted over the SHA/ Whisperlite. Sometimes "floaties"- leaf debris- are in the water and must be removed. Snow gathering areas should not be marked with chemlites. This cuts down on confusing this area with the latrine area.

j. Food storage. MCW can be stored frozen. MRE can be frozen but must be consumed. Multiple freeze thaw cycles will damage them. Mess kits should be cleaned and sanitized prior to use. Store food away from POL and latrine sites.

k. Waste Disposal. Poor waste disposal practices, in addition to being violations of both environmental regulations and proper field sanitation procedures, can provide the enemy with a great deal of information which should be denied them. Follow these guidelines for proper waste disposal:

- (1) Back haul all trash to the fullest extent possible. This denies the enemy a valuable intelligence resource.
- (2) If temporary storage is needed, store away from living areas, food and water storage and snow gathering areas. Guard against animal scavenging. Burial and burning are the last options.

### **Learning Step/Activity 3. Breaking Camp**

(1) When a unit departs a patrol base the commander determines what time the unit will begin movement. Using the backwards planning process, he or she will also determine "pull-pole" time as well. The time interval commanders allow their soldiers between "pull-pole" and departure must be kept as short as possible, and pulling poles should be done in the same order in which movement will be conducted. The bottom line is that you must prevent your soldiers from standing around in the cold unnecessarily.

(2) In order to do this, every leader must know how long their troops require between the time the order to break down tents is given and the time they are ready to move. This length of time will be in inverse relation to the amount (and quality) of both the individual and collective training that you conduct to prepare for cold weather operations. A well trained squad should require 15 minutes, provided they have been given at least 30 minutes of advance warning to prepare all of their personal gear and all of the tent group equipment, except the tent itself, packed and ready to move. It is the tent group leader's responsibility to ensure that their tent is ready to strike at the designated time.

(3) Before departing a patrol base, all latrines and garbage pits should be covered with at least two feet of earth or packed snow. Finally, leaders must ensure that security precautions are not relaxed, nor track, camouflage, noise, or light discipline forgotten.

(4). Striking Tents. If a tent is slowly or improperly set up, only the occupants of that tent will suffer; however, if a squad is slow in striking their tent, more efficient squads will have to stand in the cold and wait for them. Therefore, ensuring that breaking camp and striking tents becomes a battle drill for your soldiers is extremely important.

## **SECTION IV. SUMMARY**

You now have a basis for conducting patrol base operations, assembly area operations and bivouacs in cold regions. It is your job to take this information back to your unit and develop standard operating procedures for your unit while conducting training and/or operations in the cold weather environment.

### **Check on Learning.**

1. What are three open ground patrol base techniques?

Answer - Linear, Crow's Foot and Circular.

2. What is a problem that typically occurs while the recon party looks for and establishes a PB/AA?

Answer - The main body is inactive and soldiers become susceptible to cold weather injuries. The recon party must establish the site quickly and the main body must take steps to keep soldiers warm. Another option is to occupy by force in extreme cold conditions.

## SECTION II. INTRODUCTION

**Motivator:** Soldiers have successfully lived, worked and fought in cold weather environments. The Army provides the proper clothing and equipment to clothe, sleep and warm soldiers. In most situations the supply system provides the resources to sustain soldiers throughout field exercises.

In certain situations, however, you may find yourself separated from traditional sustainment equipment. Do you have what it takes to survive through a night or longer in temperatures of -20 degrees without a support base? The improvised shelters that you will learn about in this lesson are designed to keep you fully mission capable in the absence of traditional support methods.

### Terminal Learning Objective

| ACTION    | Construct Improvised Shelters in Snow Covered Terrain   |
|-----------|---|
| CONDITION | In a snow covered environment with temperatures of 10 degrees F or colder, given a bow saw, parachute, 100 feet of 550-cord (thermal shelter only), shovel(s), Extended Cold Weather Clothing System appropriate to temperature, issued cold weather sleep system with insulating pad and other equipment prescribed by unit. |
| STANDARD  | Construct an improvised shelter. Sleep in the shelter for approximately 8 hours without the aid of an external heat source. Do not receive a cold weather injury during the bivouac. Meet all critical performance measures IAW the Individual Student Assessment Plan (ISAP).  |

**Safety Requirements:** Instructors are required to remain with the squad during all bivouacs to ensure that students are adhering to control measures aimed at preventing cold weather related or other environmental injuries. A minimum of two medics will be on site to conduct checks of personnel for cold weather and other illness/injuries. At a minimum, each student will be evaluated by medics the morning following any bivouac. More checks may be conducted as dictated by NCOIC/OIC or 1SG/Commandant dependent upon weather conditions. Squad instructors will also conduct periodic physical checks of students throughout the training cycle. The frequency of these checks is dependent upon the weather conditions. Students will place boots in sleeping bag for duration of bivouac. A heated shelter will be available to students; students should be aware of how to get to this shelter from their improvised shelter. Candles and/or squad stoves will not be used to heat shelters.

**Risk Assessment:** Moderate (Reference USARAK Pamphlet 385-4)

**Environmental Considerations:** In USARAK, trees greater than 4 inches in diameter in military training areas will not be cut down without prior approval from Range Control.

**Evaluation:** You will be tested on your ability to construct and live in a thermal shelter during the course in session. You will also be tested on your knowledge of improvised shelters 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 provides you with techniques to construct and use improvised shelters that will protect you from cold weather.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Construct a thermal shelter.

#### a. The Thermal Shelter.

(1) The thermal shelter is primarily designed as a one to two person shelter; a larger shelter can be constructed to accommodate a small team or squad. In forested areas, a wooden framework is normally built and covered with a parachute, ponchos, evergreen boughs, etc. This structure is then covered with about 8 to 10 inches of snow for insulation.

(2) Aside from the obvious benefits gained during survival situations, the shelter can also be built to enhance forward fighting positions, LP/OPs, and other static positions away from the patrol base. The shelter will increase Soldier comfort and lengthen the time a team can remain at these perimeter positions. Because the conditions within the shelter are reasonably comfortable without the use of additional heat sources, use of thermal shelters in static positions may provide an excellent alternative to using heated shelters when detection by infrared and other thermal devices must be avoided.

(3) The shelter actually becomes more efficient as the outside temperature decreases. Inside one of these shelters, temperatures of +5°F have been measured with an outside air temperature of -40°F. This was achieved solely by the shelters capacity to retain emitted thermal radiation; there was no additional heat provided by personnel, stoves, or candles. If a candle or stove is used in the shelter, the door must be cracked open or a ventilation hole must be added during construction.

(4) The key to construction is to remove the snow from the ground surface, exposing the frozen soil which will then radiate thermal energy into the shelter. The doorway is best sealed by filling a trash bag or other large sack with loose snow and form-fitting it into the door opening. A rucksack or other bulky item can also be used.

#### b. Thermal Shelter Construction. (Picture 1)

- (1) Remove snow and ice exposing ground surface.
- (2) Construct framework from available materials. Spine log is 6-8", A-frame logs are 4-6" and the ribs should be 2-4".
- (3) Ensure front and sides of framework have enough slope to retain snow
- (4) Frame door opening large enough so a heavily clothed soldier will fit
- (5) Door opening should be 1 or 2 ft. above ground to ease entry and exit.



Picture 1

(6) Cover framework with poncho, parachute, evergreen boughs, or other suitable material, ensure material extends 1 or 2 ft. beyond skirt of framework. (Picture 2)



Picture 2

(7) Secure material at skirt with logs, rocks, snow, etc.

(8) Cut a hole in material over door opening so material overlaps door frame.

(9) Lash material to door frame for a secure fit.

(10) Tie a 10- 12 in. diameter log or bundle of sticks above door frame to support snow load.

(11) Cover entire framework with 8- 10 inches of snow.

(12) Fill a trash bag or waterproof bag with snow and form-fit to plug door opening; a rucksack filled with extra clothing, etc., will also work fine. (Picture 3)



Picture 3

### **Learning Step/Activity 2 – Bivouac in a thermal shelter.**

a. Set up the thermal shelter for bivouac prior to entering the shelter as the shelter is small and difficult to maneuver in:

(1) Lay a poncho on the ground (optional).

(2) Place insulated sleeping mat followed by sleeping bag.

(3) Place most equipment outside of the thermal shelter; items that will be needed at first call, for a guard shift or that need to remain warm (equipment batteries, clothing etc.), should be brought into the shelter and placed in the sleeping bag.

(4) Undress in the sleeping bag and keep the clothing in the bag with you.

(5) Place boots in the sleeping bag with you.

b. Do not burn candles or squad stoves in the shelter as CO may build up and not be ventilated.

### **Learning Step/Activity 3 – Construct a snow cave.**

a. Snow caves are relatively easy to build provided there is enough snow of the proper quality available. Snow caves have many advantages:

(1) More easily concealed than tents

(2) Display almost no thermal signature

(3) Easy to conceal

(4) Because of the white reflective walls, are easily illuminated

(5) Simple to build

(6) Comfortable

(7) Are very warm

b. Snow caves require a large snow bank or drift, and it is important to choose this carefully and estimate the depth of the snow before starting work: examination of the ground behind the snow bank, protruding saplings, wind blown ridges, and exposed moss surfaces and rock are often a useful guide. For a 2 or 4 man cave a drift 10 feet wide and 7 feet deep is needed. Larger caves require proportionally larger drifts. A snow cave can be built either by tunneling or by building it up with blocks. Here are a few principles to observe:

(1) The top of the entrance should be lower than the sleeping bench. This will ensure that warm air is trapped around the occupants.

(2) The ceiling should be arched and smooth to prevent dripping. Ceilings will melt back with age and the internal dimensions of the shelter will increase.

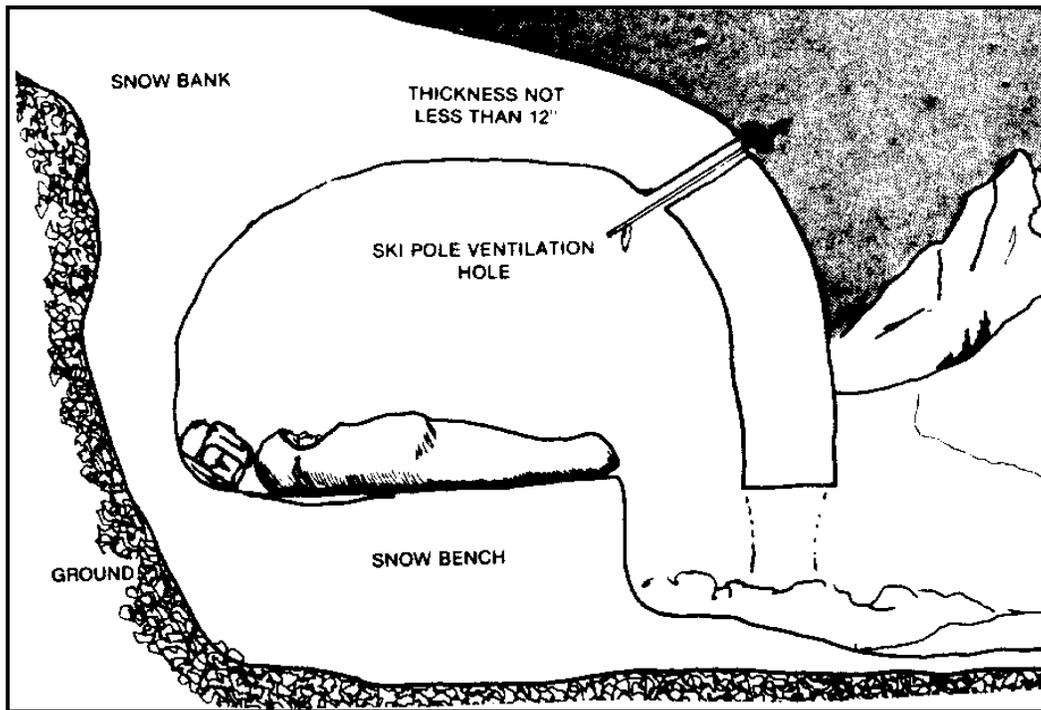
(3) At least one snow shovel should be kept inside each snow shelter so you can dig out if the cave or entrance collapses. Another shovel should be kept outside the entrance.

(4) Every snow shelter must have a permanently open ventilation hole in the roof or walls. A hole made with a ski pole is suitable for this.

(5) Building snow caves follows no firm rules as the depth and condition of the snow will vary and the tactical needs may dictate the type and degree of comfort which can be achieved.

c. The Tunnel Method. (Picture 4)

(1) A tunnel is made into the snow bank. Initially only one man can work but later two can be employed. The front man tunnels while the second clears the excavated snow away from the entrance. Having dug in approximately two meters, the location of the sleeping bench must be decided. If there appears to be plenty of snow, it is best to have a sleeping bench on either side of the tunnel lying along the axis. If the snow bank is narrow, it may be necessary to have the sleeping bench at right angles to the tunnel. A snow block can be used to seal the entrance but care must be taken to ensure that a ventilation hole is kept open. (See Figure 4)

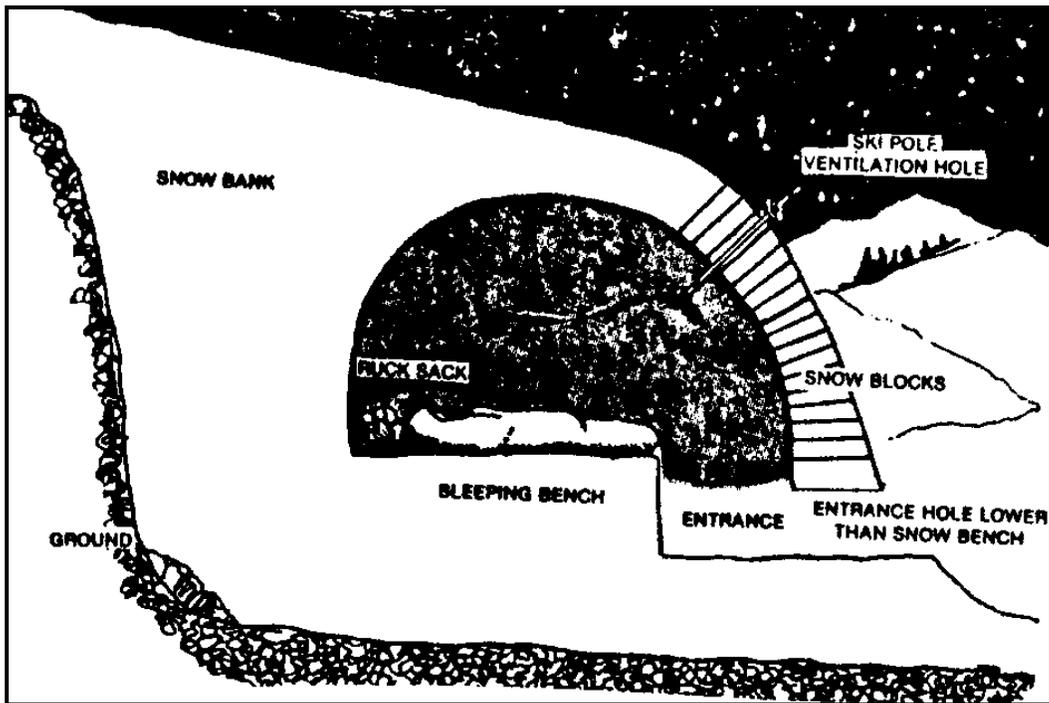


Picture 4

d. The Block and Cave Method. (Picture 5)

(1) If the snow is easy to cut into blocks, the block and cave method should be used. The principles for deciding the internal layout are the same as for tunneling. Having decided on the total internal width of the snow hole, digging can proceed straight into the snowdrift all along the width. There is plenty of room to work and several men can work together while one man digs the entrance tunnel to the side of the main excavation.

(2) Once the snow hole is completed and the sleeping benches and stove position determined, the cave can be sealed with snow blocks. These are best cut during the last stages of excavation as the snow is usually more densely packed inside a drift. Using snow blocks from this area reduces the amount of snow moving. (See Figure 5)



Picture 5

#### Learning Step/Activity 4 – Bivouac in a snow cave.

- a. Snow caves generally have more room than a thermal shelter. Equipment can be brought into the cave if there is enough room; ideally most equipment should remain packed and ready and stored outside the shelter. A poncho can be placed on the bench; the bivouac cover for the MSS is recommended. Place insulated sleeping mat followed by sleeping bag.
- b. The soldier should undress in the sleeping bag and keep the clothing in the bag with him. This is especially true of boots; these must be kept in the sleeping bag with the soldier.
- c. Do not burn candles or squad stoves in the shelter as CO may build up and not be ventilated.

**CAUTION: DO NOT BUILD A SNOW CAVE IF THE SNOW WILL NOT SUPPORT ITSELF WHILE TRYING TO CONSTRUCT THE CAVE ENTRANCE (I.E. THE SNOW COLLAPSES WHILE DIGGING THE ENTRANCE TUNNEL). IF THE SNOW COLLAPSES SELECT A DIFFERENT SITE OR CONSTRUCT A QUNIZHEE SHELTER.**

### **Learning Step/Activity 5 – Construct a Quinzhee Shelter.**

a. In alpine regions and other barren conditions, shelter can be constructed by piling up a large mound of snow and then digging into it. Even light powder snow will solidify enough once it is disturbed and shoveled into a mound. This variation to the Thermal Shelter, similar in appearance to a snow cave, is referred to as a molded-dome shelter or "Quinzhee Shelter".

b. Although the quinzhee shelter may look like a snow cave, this molded dome should not have a sleeping bench. Dig the entire living area down to ground level (or as close to it as possible) and seal the entrance as you would the thermal shelter.

c. To construct the Quinzhee Shelter (for two personnel):

(1) Clear an area down to the ground (or close to it). The area should be at least 2 feet wider and 2 feet longer than a pair of sleeping mats placed side by side. Place a ski pole upright, in the center. Place a second pole along the ground towards one of the long ends.

(2) Begin to pile snow back into the area.

(3) After piling 2-3 feet of snow up, walk on the area to pack the snow down.

(4) Continue to pile snow, periodically stopping to pack the snow down. Pile and pack snow into a dome at least five feet in height.

(5) Let the snow set for about 3-4 hours. After this time, check to see that the snow has sufficiently hardened. If it has not you will need to wait until it does, possibly repacking the area.

(6) If the snow has hardened, begin to tunnel in from one of the long ends of the dome along the ski pole, at or just above ground level. Remove snow until you reach the center pole and then begin to widen the sleeping area until two personnel can fit. The ceiling should be arched and smooth to prevent dripping. Ceilings will melt back with age and the internal dimensions of the shelter will increase. Make the walls at least 8-10 inches thick.

### **Learning Step/Activity 6 – Bivouac in a quinzhee shelter.**

a. A quinzhee shelter generally has more room than a thermal shelter. Equipment can be brought into the cave if there is enough room; ideally most equipment should remain packed and ready and stored outside the shelter. A poncho can be placed on the ground; the bivouac cover for the MSS is recommended. Place insulated sleeping mat followed by sleeping bag on the ground.

b. The soldier should undress in the sleeping bag and keep the clothing in the bag with him. This is especially true of boots; these must be kept in the sleeping bag with the soldier.

c. Do not burn candles or squad stoves in the shelter as CO may build up and not be ventilated.

## **SECTION IV. SUMMARY**

You now have experience constructing and utilizing improvised shelters.

### **Check on Learning.**

1. Can heat sources be used by personnel in an improvised shelter?

Answer - NO, because of the danger of carbon monoxide poisoning. A candle may be used to warm shelter prior to the rest cycle, but must be extinguished as personnel enter.

2. Why do we dig to the ground for the thermal shelter?

Answer - To gain the benefits of thermal radiation from the ground.

3. In areas with a low snow pack and few trees, what is the best choice of thermal shelter?

Answer -The Quinzhee Shelter.

**SECTION II. INTRODUCTION**

**Motivator:** Avalanches surprise more people in the winter than any other hazard. Many of these surprises end in casualties. In addition to casualties, the military significance of an avalanche can be lost/damaged equipment or blocked mobility corridors that require the commitment of resources to clear. Avalanches have had a significant effect on military operations in snow covered terrain. The Salang pass in Afghanistan is a main link between Kabul and the northern provinces. In winter it is the only link with the north as other routes are closed by heavy snows. Located at an altitude of over 11,000 feet, the Salang pass has been closed in winter as the result of avalanches, creating significant logistical difficulties for ongoing military operations. On the Austria-Italian front in World War I, over 60,000 soldiers were killed by avalanches.

**Terminal Learning Objective**

|  |  |
|--|--|
| <b>ACTION</b>                              | Move Safely in Avalanche Terrain   |
| <b>CONDITION</b>                           | Under field conditions in avalanche terrain, given transceiver, probe, shovel, inclinometer, military snowshoes, ski poles, survival rucksack (packed IAW training schedule), while wearing cold weather clothing items appropriate to weather conditions, ballistic helmet, fighting load carrier and weapon. |
| <b>STANDARD</b>                            | Squad-<br>Evaluate the avalanche potential in different areas.<br>Choose safe routes in terrain with avalanche potential.<br>Use special equipment to recover personnel and equipment from a mock avalanche scenario. Casualty(s) are found within 15 minutes and recovered within 30 minutes.                 |
| <b>REFERENCES<br/>MORE<br/>INFORMATION</b> | <a href="http://www.alaskasnow.org/eastern-alaska-regional-avalanche-center/">http://www.alaskasnow.org/eastern-alaska-regional-avalanche-center/</a><br>Avalanche Essentials by Bruce Tremper.<br>Snow Sense by Jill Fredston and Doug Fessler  |

**Safety Requirements:** Instructors that teach and lead this lesson will have attended a Level 1 avalanche course. These same instructors will evaluate the terrain for the practical exercise to ensure that avalanche danger is low and take steps to mitigate any existing avalanche danger by a thorough terrain, weather, and snow pack analysis.

**Risk Assessment:** Low for classroom training. For field training, risk level will be determined by the squad instructor based upon the current conditions.

**Environmental Considerations:** None

**Evaluation:** You will be tested on your knowledge of avalanche hazards 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. In addition you will participate in two practical exercises. You are expected to evaluate the potential for avalanche in a particular area using knowledge presented in classroom and field instruction. You are also expected to use special equipment to locate personnel and equipment buried in a mock avalanche accident.

**Instructional Lead-In:** (Slide 3) You may be expected to plan and or conduct a movement in terrain with avalanche potential. Or you may decide to venture into the backcountry of Alaska on snow machine, skis or snowshoes to hunt, trap or just enjoy one of the most beautiful places in the country. But do you know the risks? Which route would you take to get through the saddle in this photo? Avalanches can and have killed people in areas that you probably would never think twice about going into. With the knowledge gained in this lesson and some common sense, you should be able to mitigate the risk to reduce or eliminate the chances that you or your unit becomes caught in an avalanche.



### SECTION III. PRESENTATION

#### Learning step/ Activity 1- Define avalanches.

a. An avalanche is a mass of snow sliding down a mountainside. Avalanches are also called snow slides.

#### Learning Step/Activity 2 – Describe the two type of avalanches.

a. There are two main types of avalanches – loose snow or point release avalanches and slab avalanches.

b. The **loose snow slide or point release** ( Picture 1) usually occurs on steeper slopes from 35° and up. Loose snow slides start small, at a point, and grow in width as descent occurs, picking up more snow as it goes; typically this involves only the very top layer of fresh snowfall. These types of avalanches typically do not carry much snow but can trigger slab avalanches. In late spring, however, these types of slides can carry become very significant as they become wet snow slides carrying large amounts of heavy wet snow that can be quite destructive. They can also be the trigger for a large slab to break.



## Point Release Avalanche





ALTHOUGH USUALLY SMALL, THEY CAN TRIGGER A SLAB TO RELEASE

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 1

c. **Slab avalanches** (Picture 2) contain a more cohesive mass of snow. The formation of a slab can occur at any depth in the snow pack. A typical winter snow pack could contain many separate slabs varying from an inch to ten feet or more in thickness. Each new snowfall eventually forms a definable layer in the snow pack. The bonding of these adjacent layers determines the overall strength of the snow pack. Not all layers in a snow pack evolve into slabs. Many detailed events occur over time that affects the bonding process of the snow crystals within the snowpack. The lack of a strong bond between layers increases the probability of avalanche. In addition to the strength of the various layers, other factors affect avalanche probability.

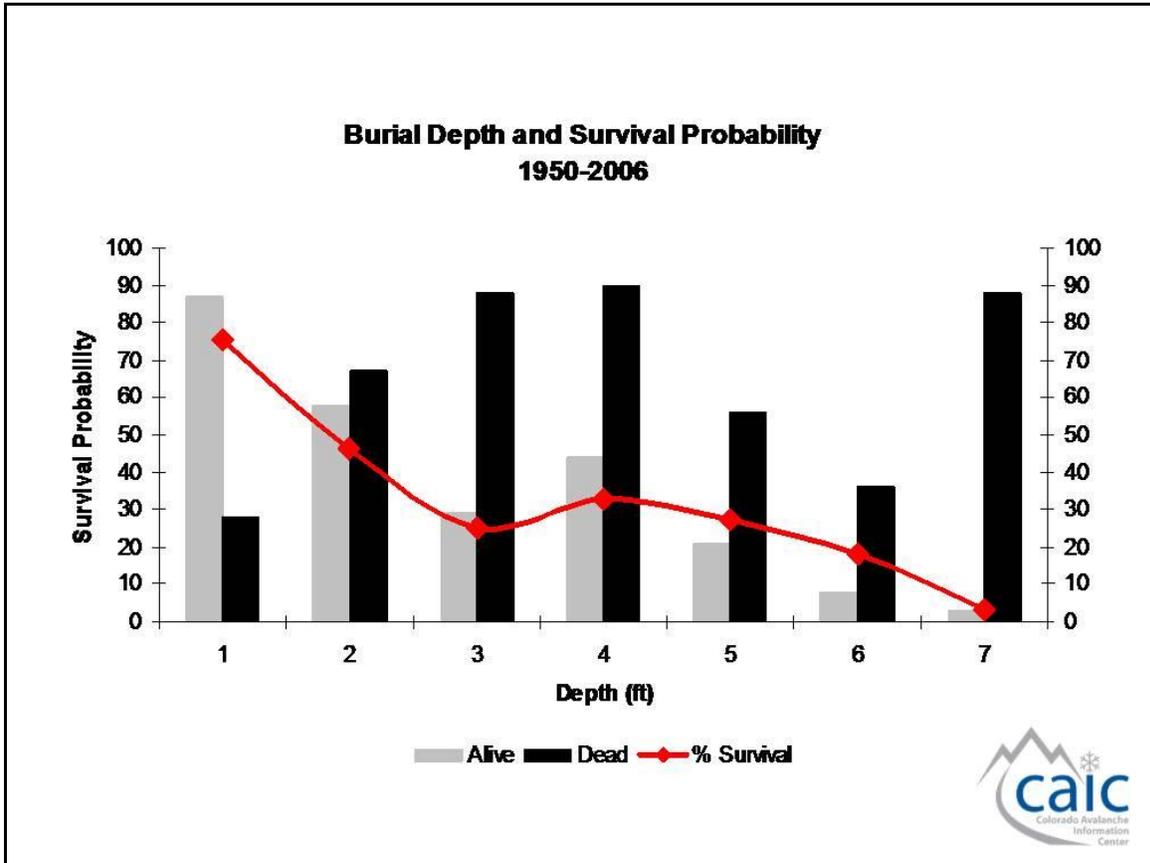
d. The crown is the “starting zone”. This is where the fracture occurred. The track is the path the slide took. The run out is where the slide stopped.



Picture 2

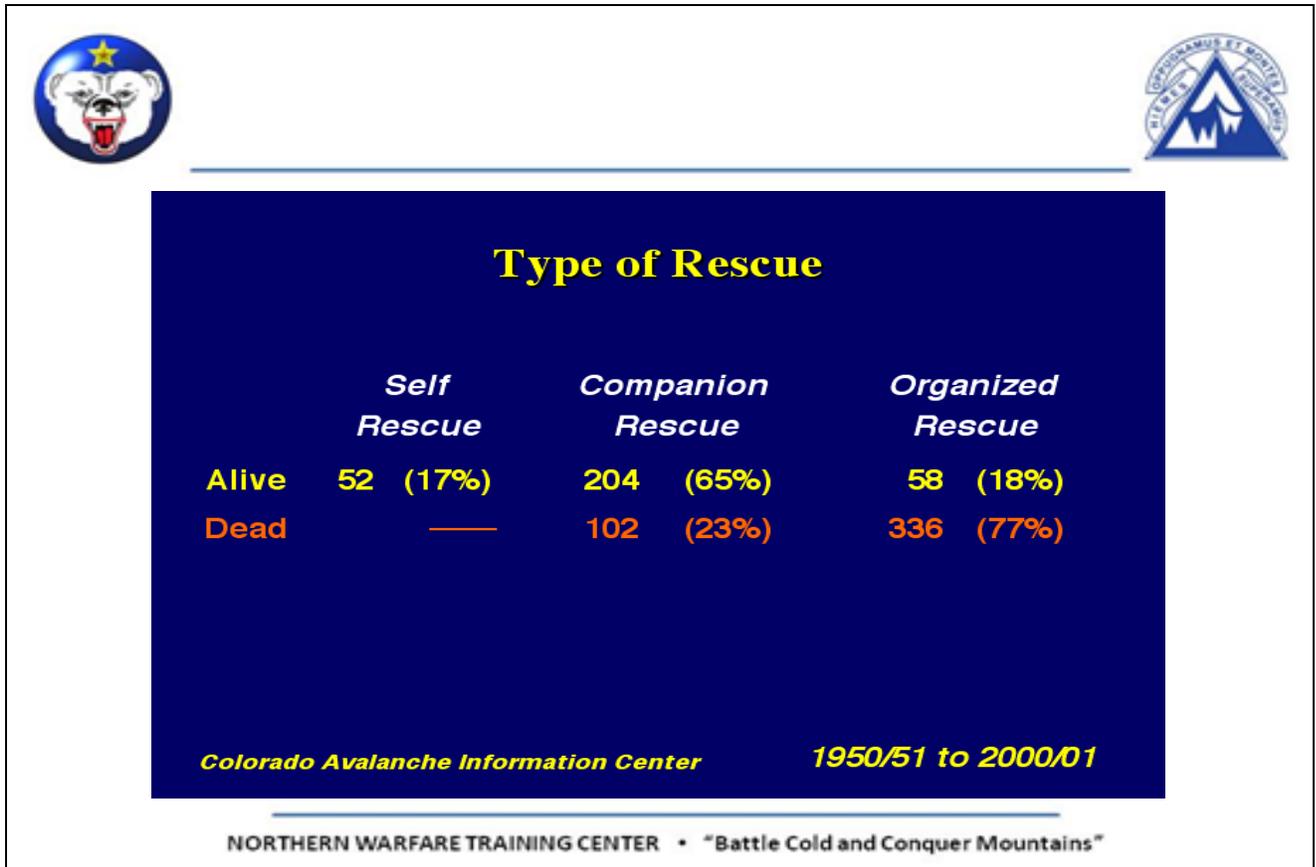
**Learning Step/Activity 3 – Describe the effects of avalanches.**

a. One of the most obvious results of an avalanche is the burial of people. As this chart ( Picture 3) shows, as burial depth increases, the probability of survival decreases. Being buried is not necessarily the cause of death. Trauma from impact with objects and asphyxiation are the leading causes of fatalities. Asphyxiation happens as a result of the victims warm exhalations melting a fine layer of snow around the nose and mouth. This creates an ice mask which prohibits fresh air from reaching the victim.



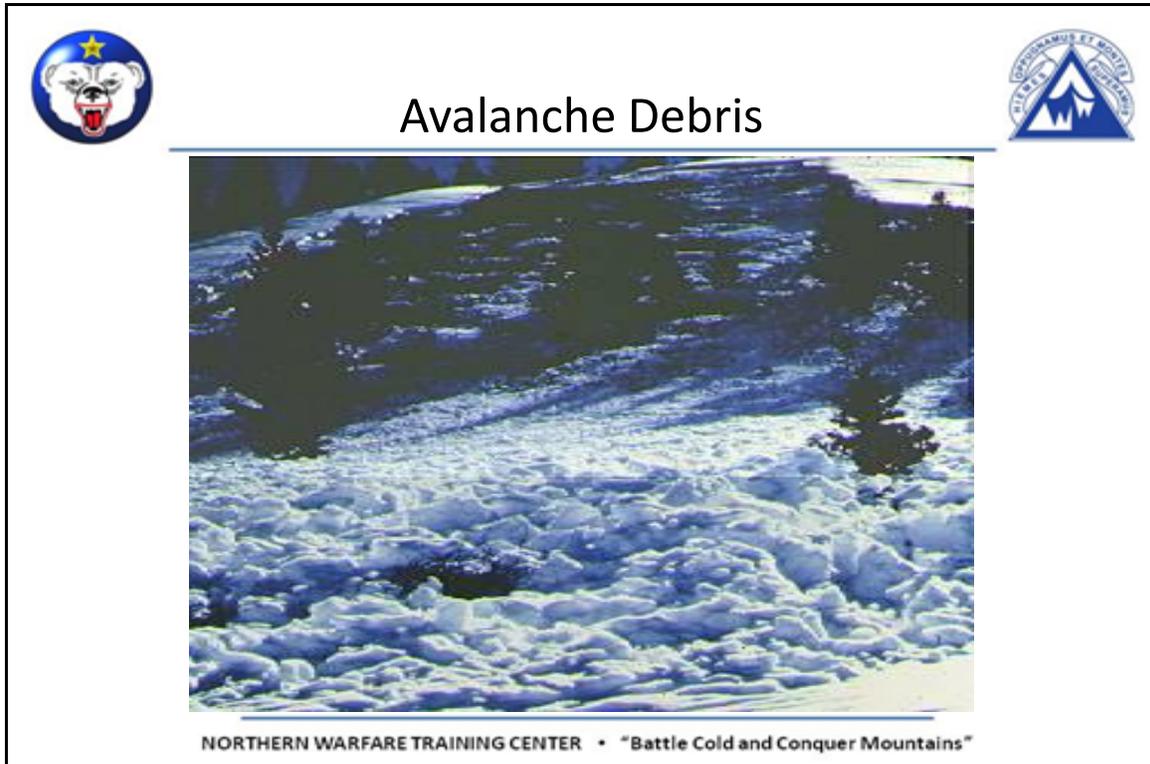
Picture 3

b. The probability of surviving a burial diminishes with each passing moment. (Picture 4) The chance of survival drops to half after 15 minutes. As you can see from this chart, companion rescue is most effective. If you witness an avalanche that buries people, **you** are the best chance of getting those persons out alive. If you go for the help of an organized rescue, the chances are that you are going to get help for a body recovery.



Picture 4

c. Many tons of debris moved down this slope (Picture 5,6). As a slide moves downhill, it may reach speeds of 80 miles an hour given the right conditions. In addition to the snow blocks, the surrounding terrain features also become hazards. The victim may impact trees and rocks as well as debris being carried within the snow. When the snow comes to a halt it sets up very hard, almost like concrete. As the snow moves downhill friction and heat are generated. This action causes the snow to become a semi liquid. After stopping the cold temperature of the air and snow causes it to refreeze immediately.



Picture 5

d. Even though this slope had adequate anchors, the snow-pack above the tree-line slid and the weight and force of the moving snow removed all vegetation from the slope.



## Avalanche Debris

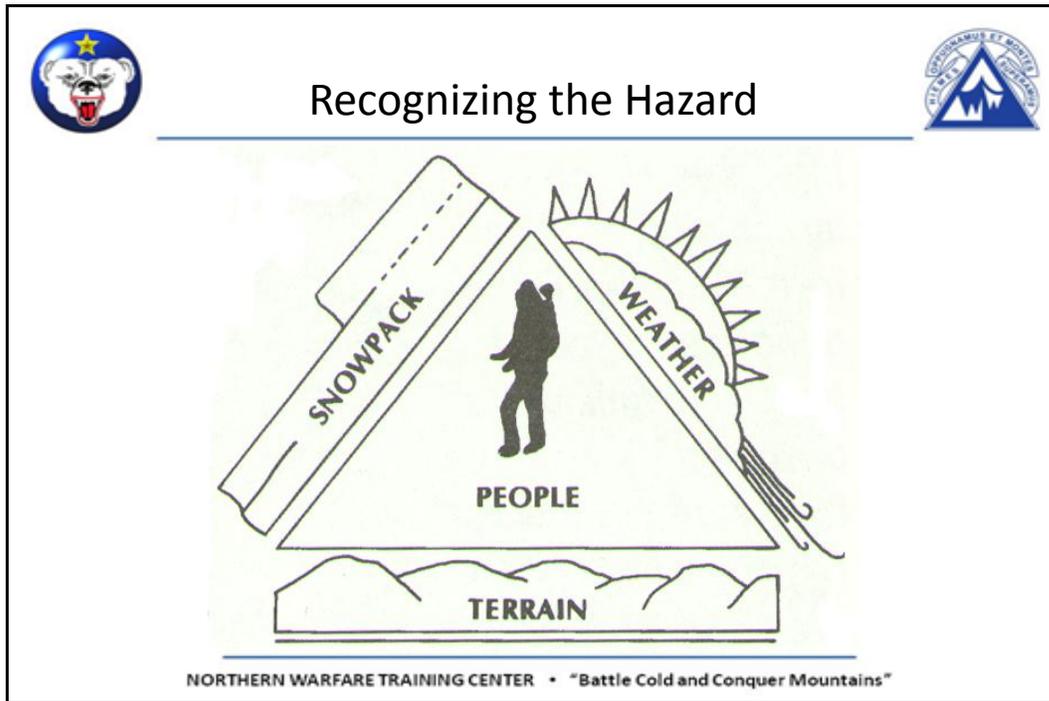


NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 6

#### Learning Step/Activity 4 – Recognize the four elements that contribute to avalanches.

a. There are four elements to consider – **Terrain, Snow pack, Weather and People**. Without people there is no hazard. This is the famous data triangle created by Doug Fesler and Jill Fredston two avalanche specialists who reside in Alaska. (Picture 7)



Picture 7

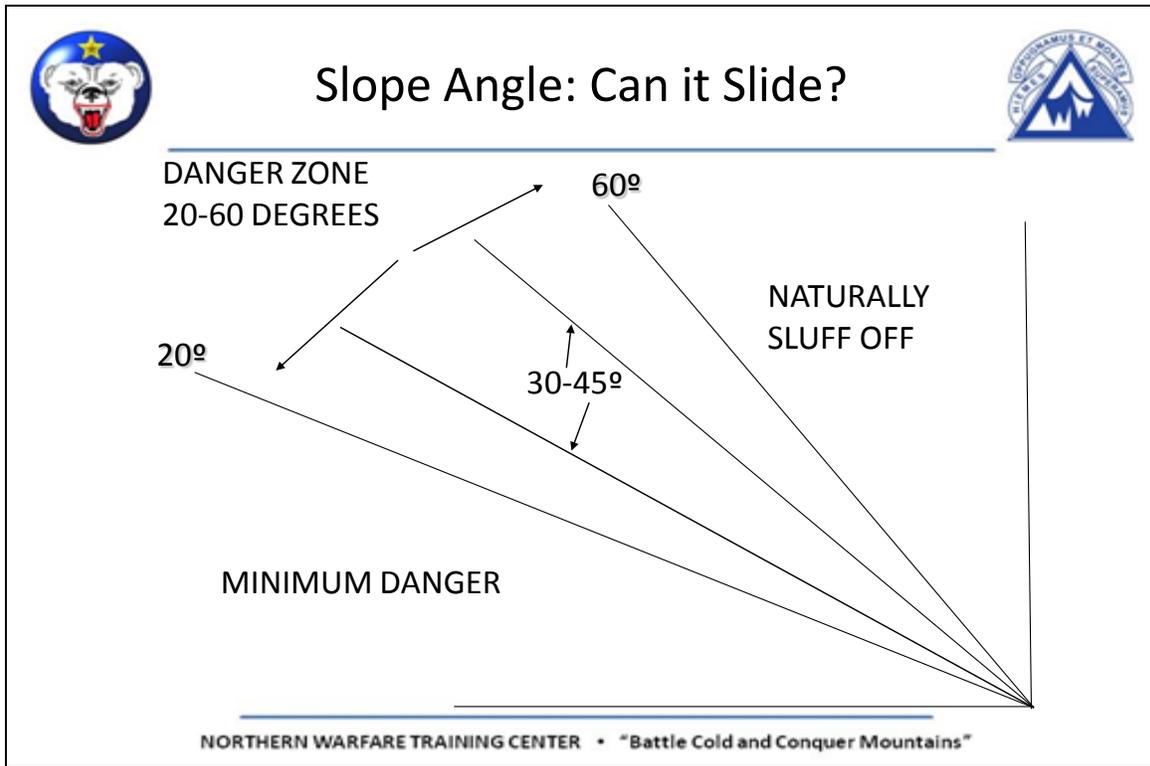
#### Learning Step/Activity 5 – Evaluate how terrain relates to the avalanche hazard.

a. The first thing we will consider is the terrain itself. Is it capable of producing a slide? What angle slopes will slide? How do I determine what this slope angle is? What other terrain characteristics contribute to slope instability? These are the first questions you need to ask.

b. When we look at terrain we look at the slope angle, slope shape, the terrain characteristics and feature(s) you are dealing with, and anchors (trees, boulders, scree etc.). If you become competent at evaluating terrain you can manage it to your advantage as you move over it and keep yourself out of harms way in most cases.

c. Slope Angle: (Picture 8) Typically, as the slope angle increases, the probability of an avalanche increases. Based on statistics, without an angle greater than  $20^\circ$ , the gravitational force on the snow pack is typically not great enough to produce a slide. While avalanches usually occur on slope angles between  $20^\circ$  and  $60^\circ$ , a majority of avalanches occur between  $30^\circ$  and  $45^\circ$  and a disproportionately large number occur between  $35^\circ$  and  $40^\circ$ . The "sweet spot" seems to be 38 degrees. Although slope angles above  $55^\circ$  predominately produce loose snow slides, slab avalanches can occur. Snow falling on the steeper slopes tends to "sluff" off upon falling.

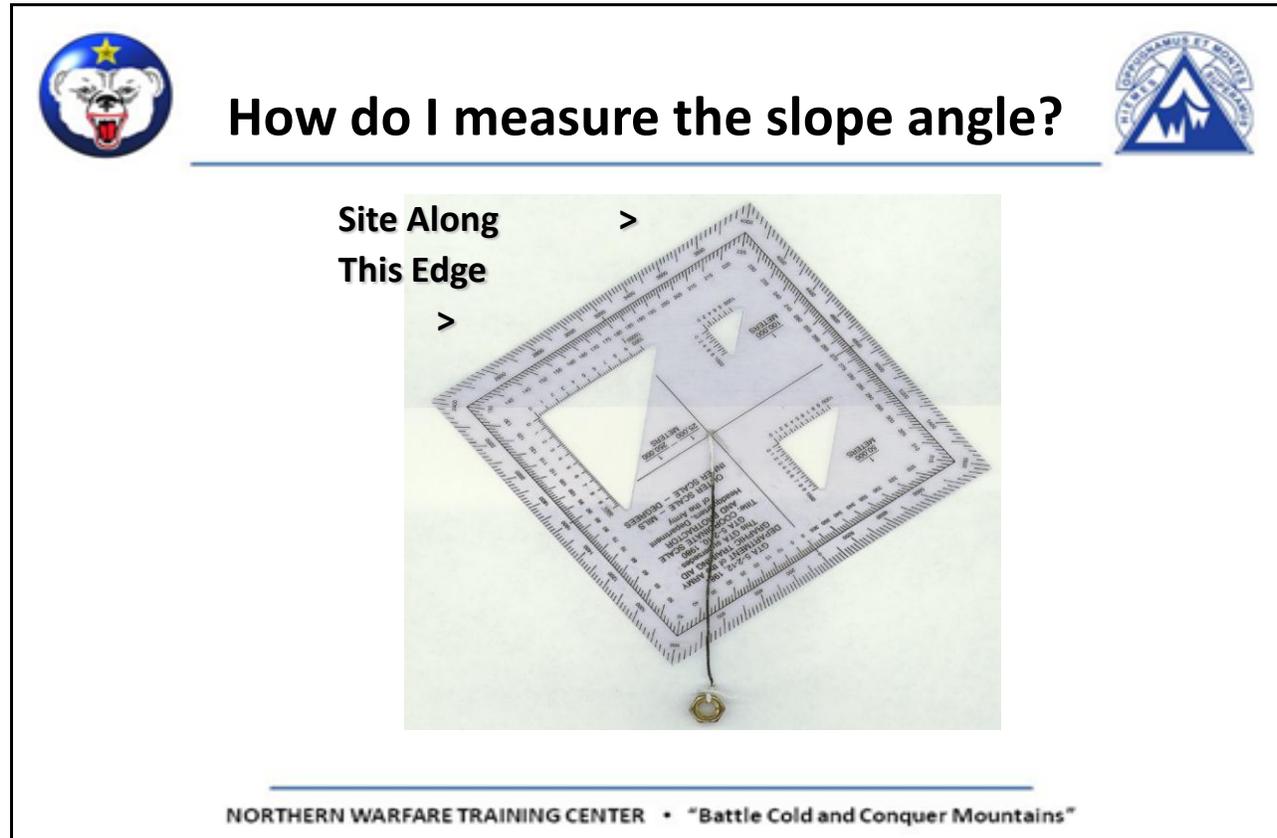
d. The reason we measure slope angle is to determine if the snow can move. A lot of terrain can be eliminated as a hazard area just by measuring the angle. Bear in mind that just because the angle is prime to move does not mean it will slide. There are other parts of the triangle to consider.



Picture 8

e. Inclinometers (Picture 9) There are several methods used to measure slope angle. Some compasses have an inclinometer built in, and there are several stand alone inclinometers manufactured. These devices all cost money and this prohibits their mass issue. The issued Army Protractor, GTA 5-2-12, 1981, can be modified to read slope angle easily.

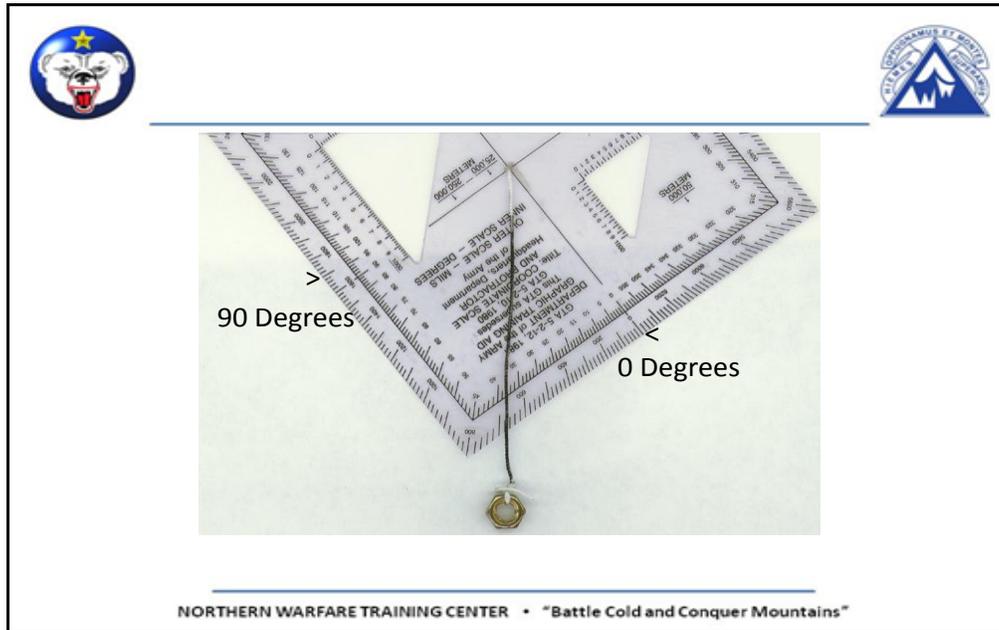
- (1) Hold the card so the text can be read.
- (2) Punch a hole in the exact center of the device and thread a tiny string through and tie a securing knot on the backside of the card.
- (3) Extend the string far beyond the farthest corner of the card; add 2 - 3 inches and cut the string.
- (4) Tie a weight, such as a small washer or nut, to the fresh cut end.



Picture 9

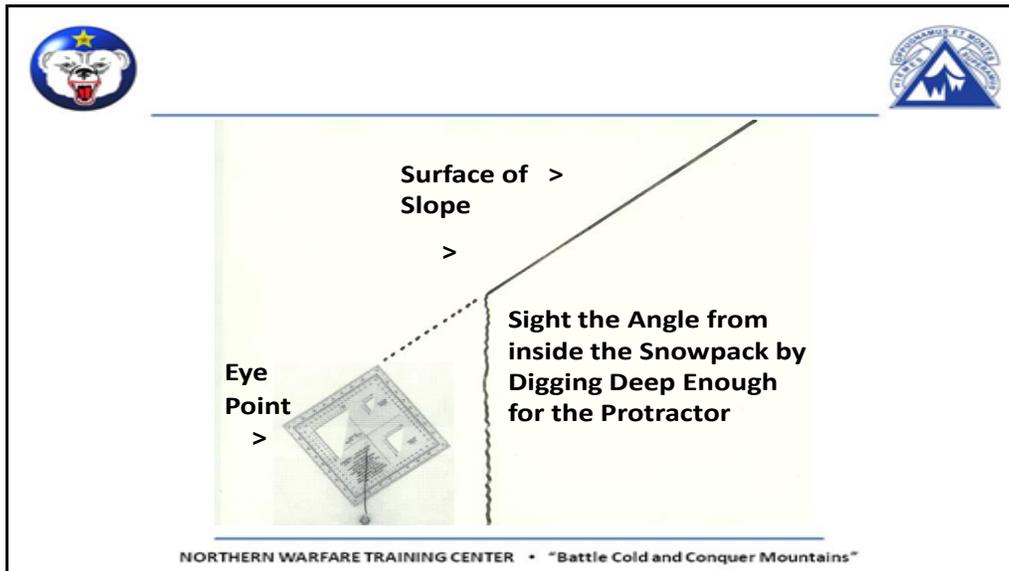
**f. Measuring Slope Angle (Picture 10):**

(1) Hold the card vertically so the data is legible and rotate until the weighted string hangs on the zero mark. The corners containing the 2400 and 4000 mil marks define the sighting edge of the device, with the eye point being the 2400 mil corner. Hold the card vertically, aligning the sighting edge with a slope and allowing the string to hang freely against the card. When the string is stable, pinch it on the outside edge of and against the card between the thumb and a finger. Move the card from the sighting position and read the indicated angle.



Picture 10

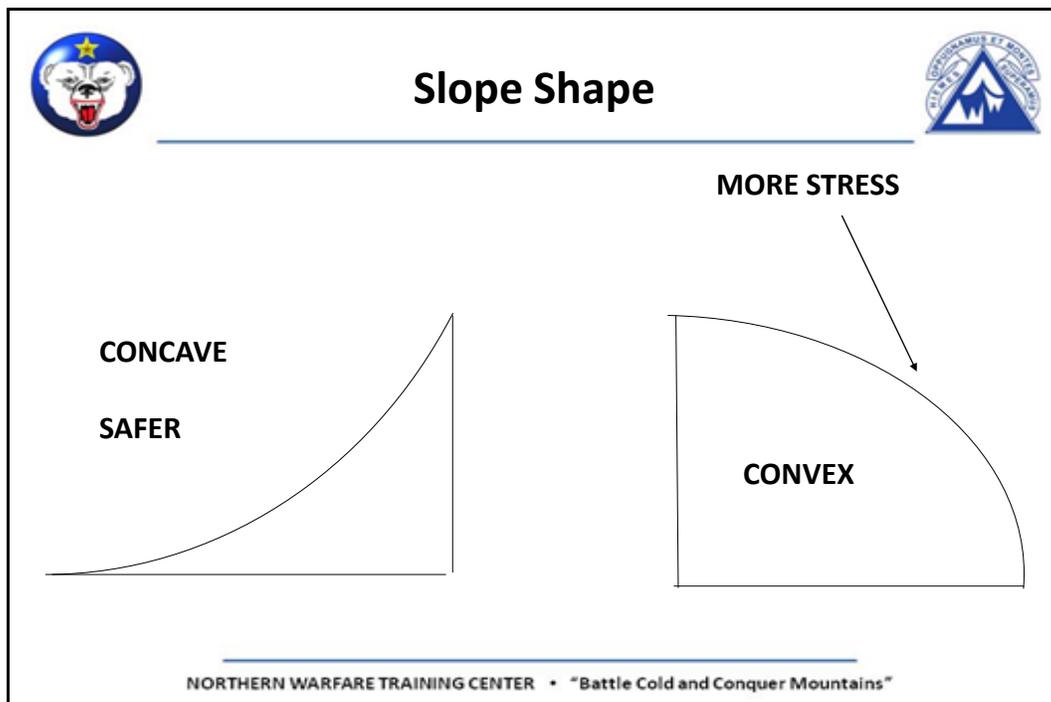
(2) (Picture 11) Dig into the snowpack deep enough to align the site edge with the slope. Orient the card to the slope as in the photo and ensure the card faces are vertical as in the photo. As the string is hanging steady, pinch the string and the outer edge of the card between the thumb and a finger. Turn card so you can read the indicated angle. If slope angle varies, use the steepest angle for your assessment.



**g. Slope Shape:**

(1) In broad general terms, a concave slope is safer than a convex slope. (Picture 12) This generality is true on smaller slopes as compression forces at the bottom of the concave slope help prevent the snow from sliding. The reason is that a concave slope is under compression, meaning it is being pushed together. On larger slopes this advantage disappears.

(2) The majority of avalanche accidents occur on convex slopes. The convex slope is under tension, meaning it is being pulled apart. This is quite evident on “rollers” or small hills. The military crest is the most likely point of fracture.



Picture 12

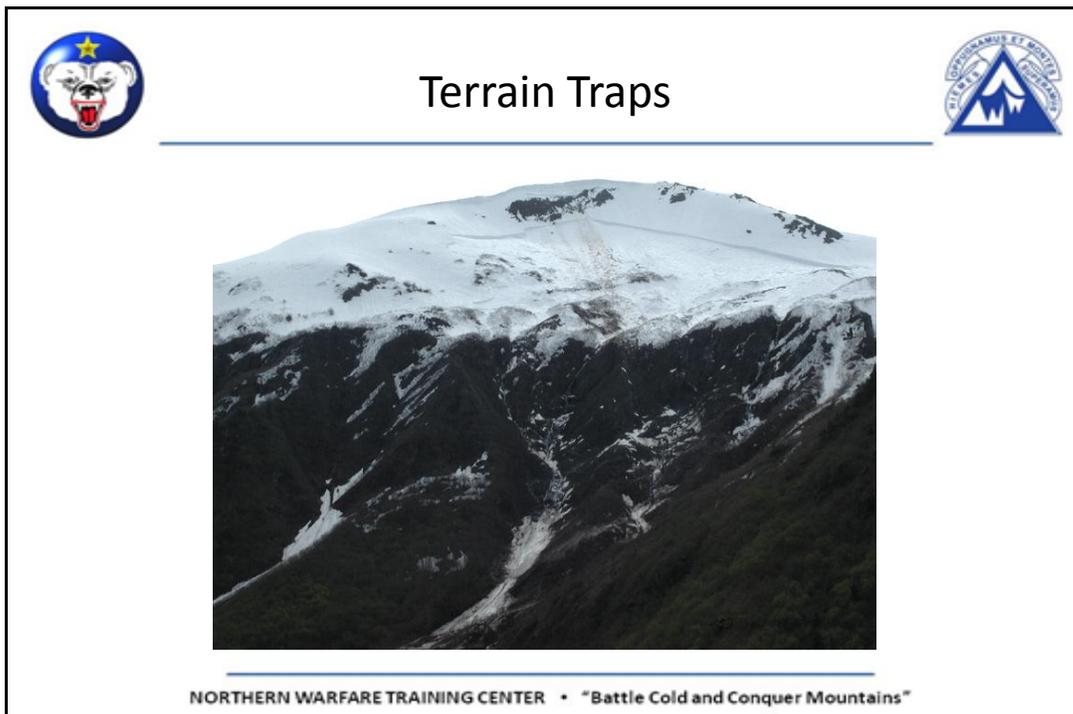
h. **Anchors** will hold snow under most conditions. Grass and smooth rock will not hold snow for very long. Talus, and downed trees will hold the very bottom layers until the snow depth covers the top of the rocks or trees. Standing trees will hold surrounding snow, but a slide can still occur especially if the trees are widely spaced.

i. **Terrain traps** (Picture 13,14) are areas that offer no escape should an avalanche occur; snow is naturally funneled into these areas. Gullies, couloirs, creek beds and canyons are places that people tend to go because the traveling is easier but an avalanche from above can fill these areas. A cliff below a line of travel also presents the problem of going over the edge if swept away.



Picture 13

j. The avalanche above this canyon filled in the low ground. Be aware of the hazard above.



Picture 14

## Learning Step/Activity 6 – Evaluate how the snow pack relates to the avalanche hazard.

a. Once we have determined that the terrain can produce an avalanche (i.e. the slope angle is sufficient, there are few if any anchors, the slope is convex or too large to matter, etc.), we must look at the snow pack to determine if it is stable or unstable. An evaluation of snow pack can become very scientific and for avalanche forecasters it does. For us a basic knowledge of the snow pack ingredients required for a slide to occur are necessary. But before we look at these ingredients lets look at why a slab slides.

b. The failure of the elastic energy in a slab of snow is the basis of an avalanche. Elastic strength is defined as the strength within a slab cross section. An example of elastic strength is the strength necessary to tear a pan cake apart with two hands. With enough force, the slab will separate from itself, with one side remaining on the slope while the other slides downward. In the example with the pancake, the outside force was the strength of the hands. In the snow pack, the outside force could be a skier, other travelers, cornice breaks, or other natural occurrences putting stress on the snow pack. In simple terms, the proverbial “straw that broke the camels back” is all that’s needed to start an avalanche. An outside force is anything that comes in contact with the snow pack. An avalanche could be triggered from the valley floor away from the slope. The slab structure will sometimes encompass all of a valley floor and a surrounding slope.

c. (Picture 15) There are three ingredients that combine to form an unstable snow pack and the potential for a slab avalanche. Of course they must be in a particular configuration and this slide depicts an unstable snow pack that could slide. The ingredients are:

- (1) Slab: One or more layers of generally cohesive strongly bonded snow.
- (2) Weak Layer: This is a layer of poorly bonded snow. It will often be loose and granular and it is often called sugar snow, because it has the same consistency of loose, dry sugar.
- (3) Bed Surface: This is another layer of consolidated snow, ice or the surface of the ground.

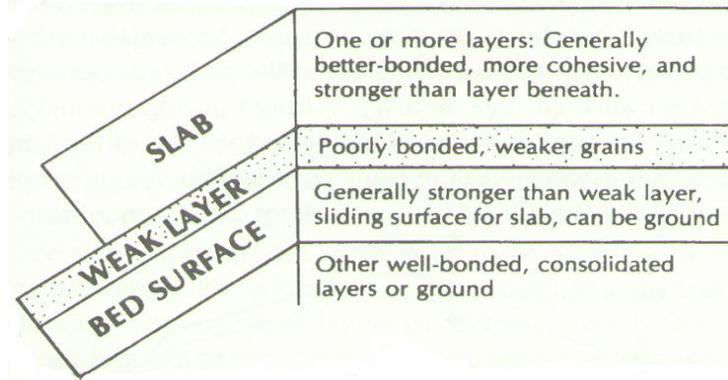
d. There are many layering combinations; the three layers mentioned are only one possibility. These various combinations are dependent upon a number of weather factors which create layers within the snow pack. There are some simple tests to determine snow pack stability that we will discuss and practice later.



## Snowpack: Ingredients for an Avalanche



### UNSTABLE SNOW STRUCTURE



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 15

### Learning Step/Activity 7 – Evaluate how weather relates to the avalanche hazard.

a. The weather creates the conditions that can lead to a stable or unstable snow pack. Wind action, precipitation, slope aspect and temperature are some of the important factors that need to be considered. Avalanche forecasters record weather data to help determine the stability of the snow pack. Again, this can become very scientific, but for our purposes some simple observations can help us determine how weather has effected and is effecting stability and ultimately where safe and unsafe routes exist.

b. **Wind** (Picture 16, 17, 18) will transport snow from one area to another. This action can more than double the snow on the lee side of a given slope. When this snow is deposited it forms a hard slab of compacted snow. Because there is so much more snow, the weight alone can trigger a very destructive slab avalanche. Snow can be top loaded, meaning it comes over the top of a feature, or side loaded meaning it comes around. Either way the result is the same. If travel is necessary, the windward side will often offer the safest route.



## Wind Loading

Wind moves snow from one area to another forming a wind slab



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 16

c. The bare area is the windward side. The lee side was top loaded.



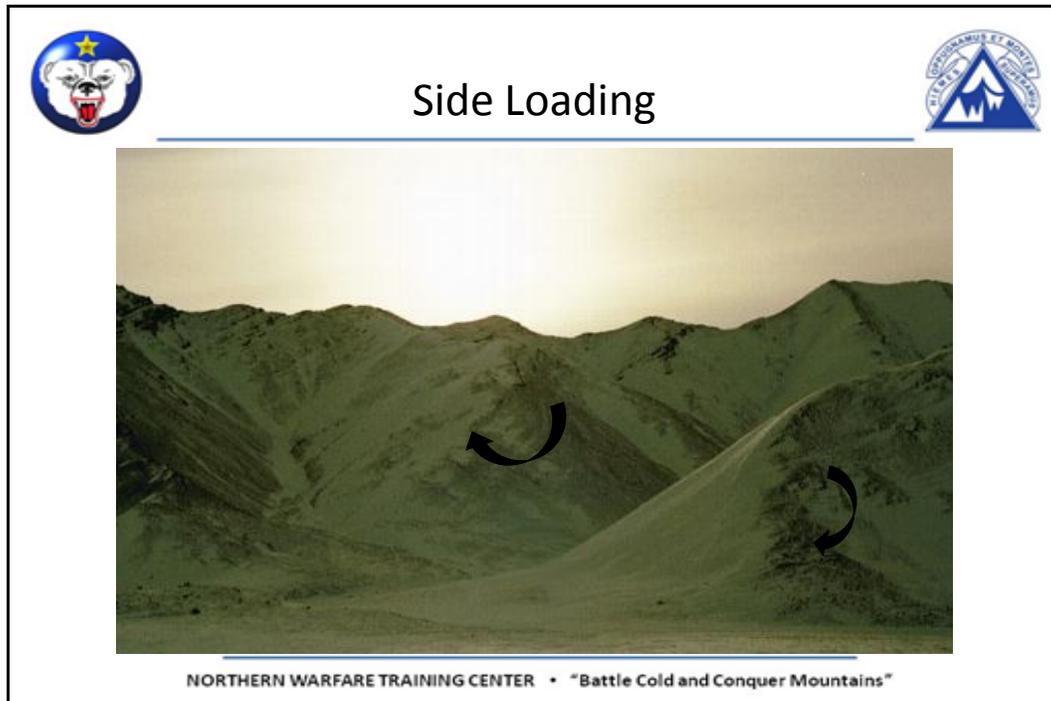
## Wind Loading



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

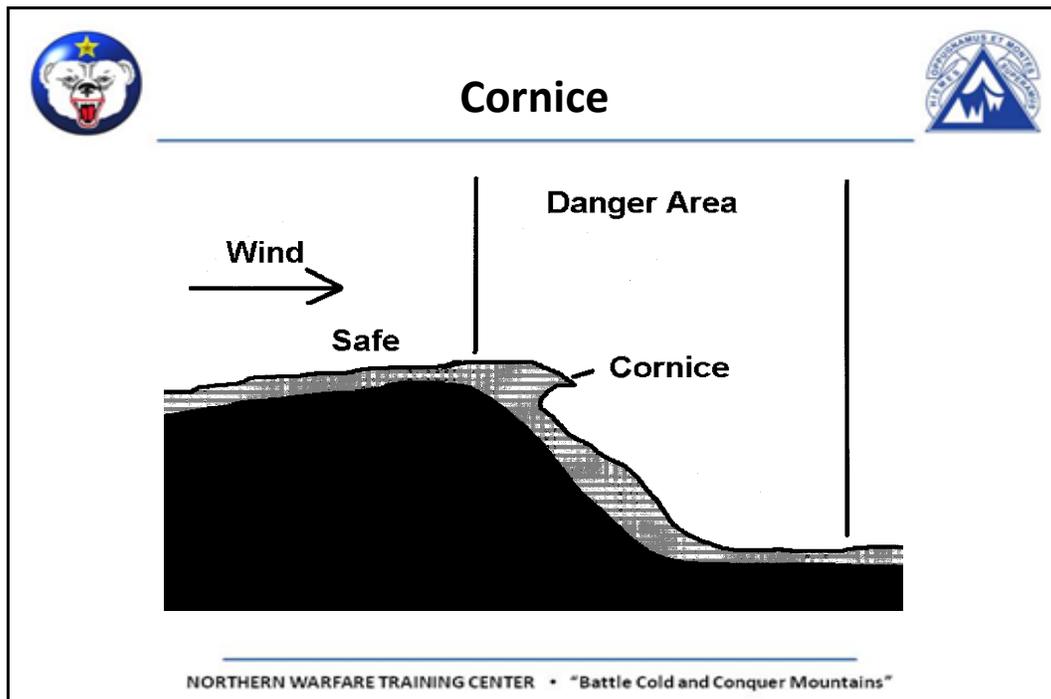
Picture 17

d. Evidence of side loading. This picture also shows how much snow collects in the couloirs in the background.



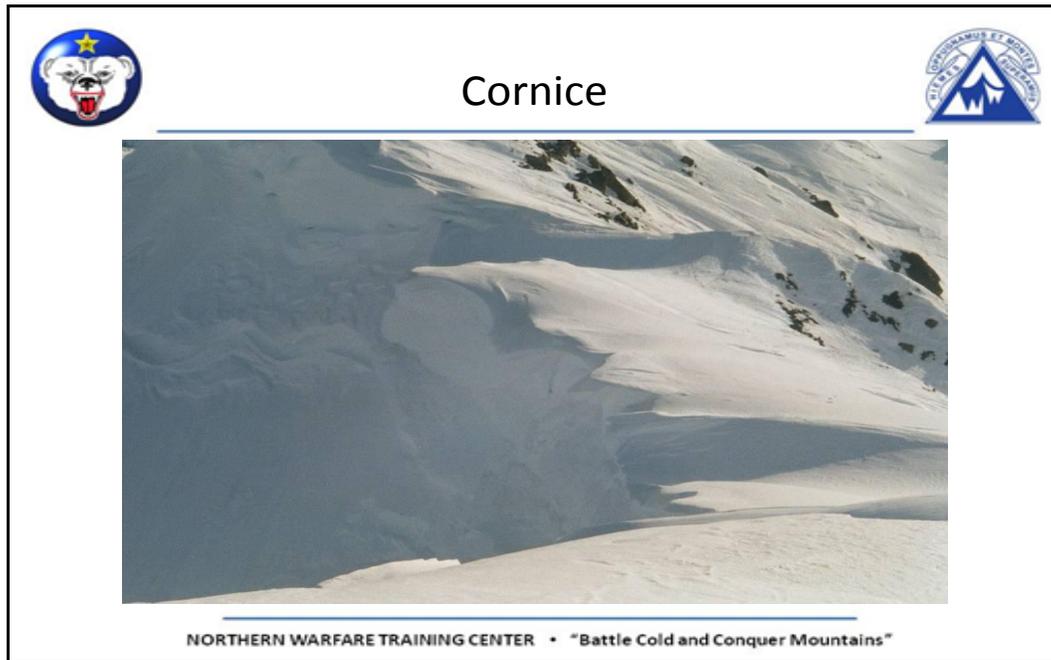
Picture 18

e. A **cornice** (Picture 19, 20) is formed by wind action – wind moves snow and a “bridge” builds up that gets bigger with time. These may reach out away from the slope 20-30 feet. In some areas with turbulent winds they may be doubled on both sides of the ridge. On glaciated peaks there may be a crevasse present along the long axis of the ridge. The safe area of travel is well down hill on the windward side. A cornice can break off and start an avalanche.



Picture 19

f. The whole top of this peak is corniced, extending approximately 15 feet from the ridge. A person would not know they are standing over the void until they were right on top of it. Stay well back from the leeward edge of any ridge or peak.



Picture 20

g. **Precipitation:** Recent heavy snow or rain is a contributing factor to avalanche danger. Both forms of precipitation add weight to the snowpack stressing the elastic strength.

i. Snow falling at a rate of one inch or more per hour for 6 hours or more and/or 12 inches within 24 hours is cause for immediate concern. Most natural releases will occur within 24 to 48 hours following a storm.

j. The aspect of a slope, or the direction it faces, greatly affects the occurrence of avalanches. North-facing slopes are usually more prone to avalanche in mid-winter while south-facing slopes are more dangerous in spring and on sunny days. As the sun moves to shine on a particular slope during the day, that slope usually becomes more avalanche prone.

k. In a perfect world snow forms a six sided crystal called a stellar crystal. This is the same shape as what would be seen on a Christmas card. As these crystals fall through the atmosphere, the sharp edges lock onto each other. Upon reaching the ground, they continue to lock into each other forming a layer. Snow that forms as other crystals such as dendrites, plates and columns will bond differently or not at all. Graupel is similar to little beads that will generally not bond together at all.

l. As time passes the crystalline structure deteriorates and the snow will look like barbells joined together. This is the perfect snow pack.

m. Changes in temperature affect the bonding process of the crystal structure of the snowpack. This bonding is the cause of slab formation. Extreme drops in temperature will make the snowpack more brittle and likely to fracture. As temperatures in the snowpack increase, the bonding time of recent snow to old snow is decreased. In other words, a warmer temperature increases the stability of the snowpack. However, when temperatures rise above freezing, rain and meltwater can rapidly destabilize an otherwise

safe snowpack. Increases in temperature can cause wet snow slides. If a cold snap occurs after a warm spell, the snowpack can freeze solid and bond very well. But this may form a layer of ice, resulting in a smooth surface layer that may become a bed surface for a new slab later on.

n. As temperatures increase, the bonding of the crystals happens more rapidly. This process is called the freeze/thaw cycle. Temperature usually drops after a storm. Snow covered terrain is usually most unsafe immediately after a storm due to the lower temperatures delaying the freeze/thaw process and the added weight (stress) on the old snow pack.

#### **Learning Step/Activity 8 - Evaluate how people relate to the avalanche hazard.**

- a. If the terrain, weather and snow pack conditions add up to unsafe conditions, adding people will often trigger an avalanche. Recreationally, people often have limited time to play and will often ignore blatant avalanche warning signs. Ignorance of the hazard can also contribute to accidents. Slabs as shallow as a few inches thick have slid and killed people. For the military, focus on the mission can cause leaders to ignore the warning signs. This was evident on a large scale in World War I on the Austro-Italian front where over 60,000 soldiers focused on the mission lost their lives to avalanches (most of them triggered by themselves). Overconfidence can also play a role. If you have traveled to an area repeatedly with no consequences you may be conditioned to expect that the area is always safe. You may also feel that you and your travel partners have the necessary training and equipment so that even if there is an avalanche, you can help yourselves. Look at the whole picture of what is happening and make an informed decision about whether or not to travel.

#### **Learning Step/Activity 9 – Describe some of the common avalanche triggers.**

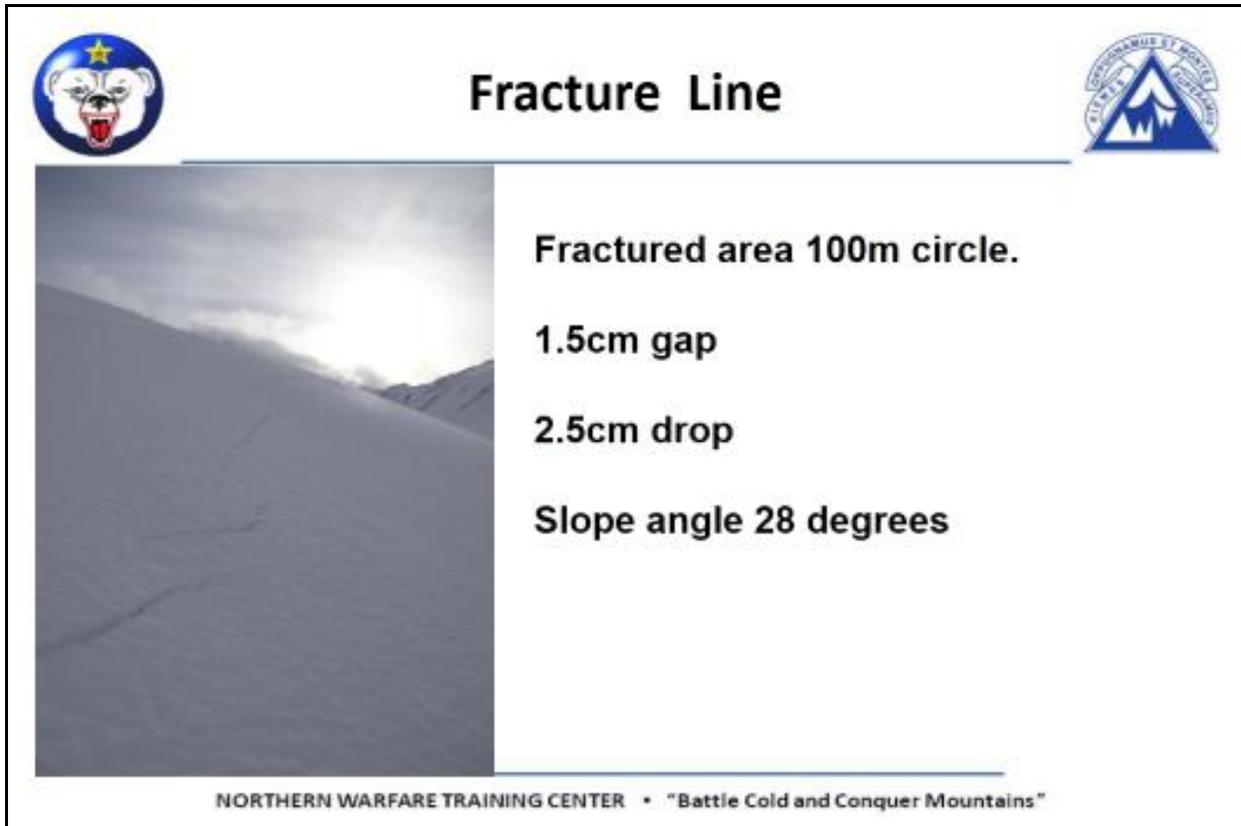
- a. When terrain, weather and snow pack all combine to create prime conditions, all we need is a trigger to set off an avalanche. When more than one inch of snow falls per hour, a rapid load is being placed on the existing snow. This is also the case during a wind event. A cornice break can impact the snow with significant force and people moving on snow can also cause it to move. In all of these instances natural slides can be triggered. Of course personnel and vehicles moving on unstable slopes can also tip the balance and trigger a slide.

- b. Demolitions can be used to set off unstable snow. The use of decommissioned artillery pieces, air cannons and demolitions at ski resorts and roads is widely practiced. It must be noted though, the charge must hit the “sweet spot”, and some instability must be present in order to be effective. Weapons such as Anti Tank rockets/missiles (AT4, TOW etc.), hand grenades and M203 will most likely be ineffective.

#### **Learning Step/Activity 10 - Describe general indicators of avalanche prone terrain.**

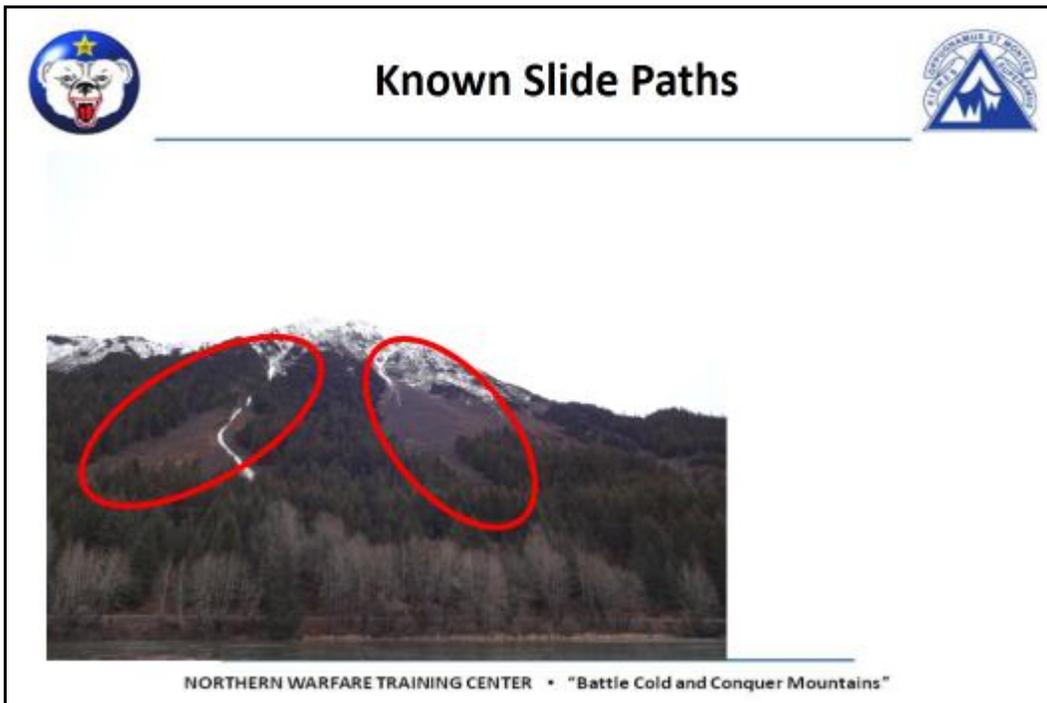
- a. Evidence of previous avalanches- debris piles at the base of a slope, flagged trees, trees all pointed away from the slope, known slide paths
- b. Steep slopes between 30° and 45°
- b. Heavy snowfall- added weight to the existing snowpack

- c. Visible fracture lines in the snow- even on low angle terrain indicates possible weaknesses on surrounding steeper terrain (Picture 21)

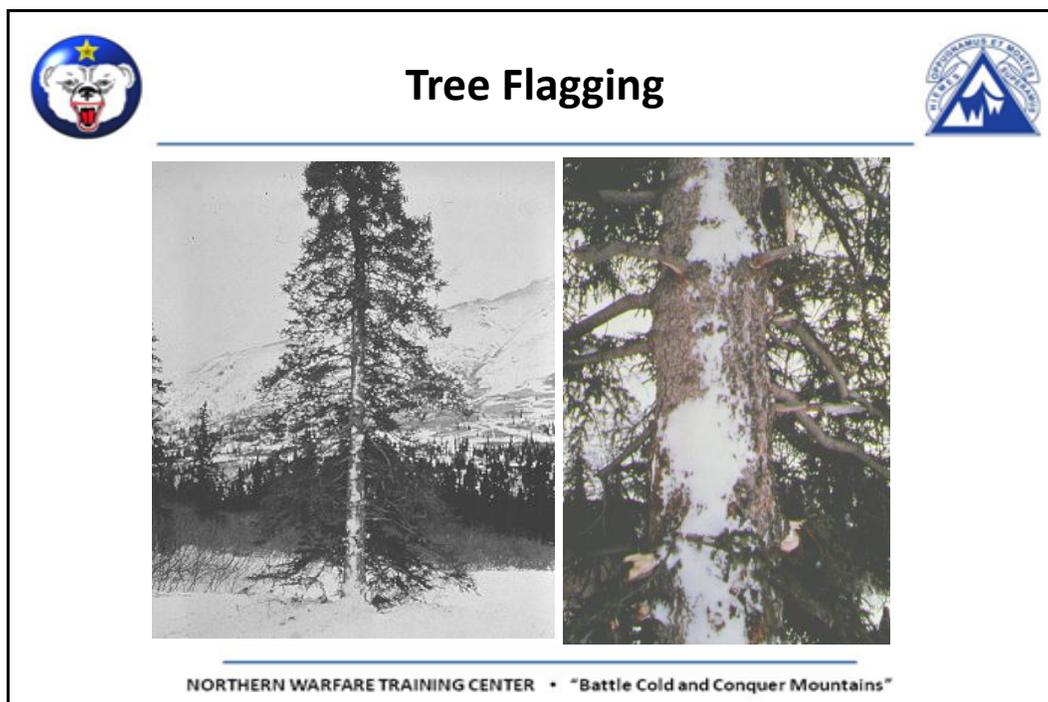


Picture 21

- e. Audible settling of the snowpack- a "whumpf" sound comes from collapse of an underlying weaker layer of snow or hoar frost
- f. Severe changes in temperature- increasing temperature increases weight of surface layer(s) through melting
- g. Lee slopes- usually are topped by a cornice; as the cornice is built the excess snow is deposited downslope by the same wind and adds weight to the existing snowpack
- h. Snow plumes and high winds- build cornices and leeward deposits
- i. Slushy "spring" snow- very heavy and apt to slide at high angles
- j. An outside force to give the force to break the stability
- k. Flagging (Picture 22-23) – vegetation shows signs of destruction from up slope; clear swaths surrounded by vegetation are previous avalanche paths; trees bent, broken trees, trees with branches missing up to a certain height are indicators that an area is prone to slides. Closer inspection reveals the size of the limbs and the force of the avalanche.



Picture 22



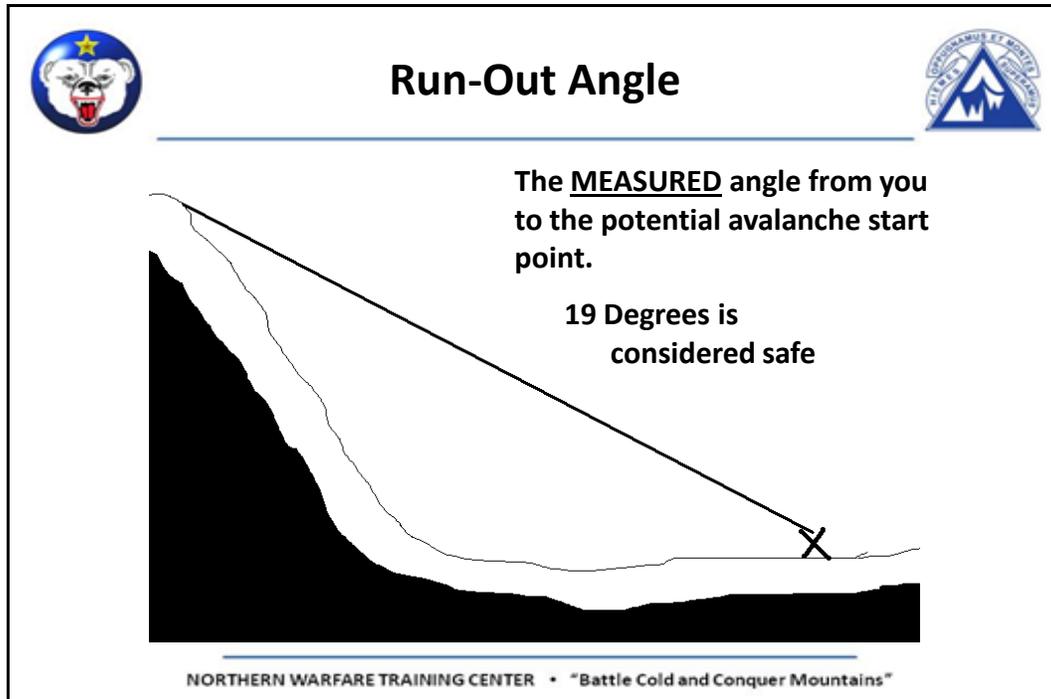
Picture 23

**Learning Step/Activity 11 – Select the safest routes for travel in avalanche prone terrain.**

a. The most important part of military mountaineering is the ability to evaluate mountain hazards and select a way to avoid them or mitigate the risk if it is impossible to avoid the hazard. While traveling in snow covered, and potentially avalanche prone terrain there are a number of considerations for proper route selection. The answer to the question on the slide is almost always YES! Some of the considerations have already been discussed such as traveling on windward slopes as opposed to leeward slopes and avoiding terrain traps such as creek beds and travel below cliffs.

b. Travel in Valleys. Sometimes travel below snow covered slopes is unavoidable. A consideration of the past weather and current snow pack conditions combined with common sense route selection (as far away from the potential slide path as possible) can make for safe travel. Consider the run-out area of any potential slides.

c. Run-out (Alpha) Angle-(Picture 24) The measured angle from your location to the potential avalanche start point. This is based on elevation difference and potential runout distance. 19° or less is considered safe. Once a safe alpha angle has been achieved, insure you did not back into another hazardous area. Consider all surrounding slopes. The higher the start point upslope, the further you need to be from the base of the slope for safety. Slides on concave slopes tend to run further than slides on convex slopes.



Picture 24

### Learning Step/Activity 12 – Describe simple tests to evaluate the snow pack.

a. Snow Pack Stability Tests - There are many tests that you can perform on the snowpack to determine stability. Many of the tests will tell you nothing unless you study snowpack science and study snowpack frequently enough to remain proficient and use the knowledge. For the average snow terrain traveler, there are a few tests that produce practical results and are simple to perform. These tests will be demonstrated in the field during the course of instruction.

### Learning Step/Activity 13 – Assess the hazard level of a potential avalanche area.

a. Chart 1 is a hazard evaluation checklist designed by the Alaska Mountain Safety Center (Doug Fesler and Jill Fredston). It lists all four elements required for an avalanche and asks questions designed to determine the hazard level associated with the current conditions and circumstances. It uses a Green (Safest), Yellow (Caution Advised) and Red (No Go) system to make the evaluation. We will take this out to the field and use this checklist to conduct a thorough risk assessment. USARAK PAM 385-4 APPENDIX F also has this checklist. This checklist is used to supplement the Risk Management process.

# AVALANCHE HAZARD EVALUATION CHECKLIST

|                      |                        |
|----------------------|------------------------|
| <b>Critical Data</b> | <b>Hazard Rating</b>   |
| <b>PARAMETERS:</b>   | <b>KEY INFORMATION</b> |
|                      | <b>G Y R</b>           |

**TERRAIN:** *Is the terrain capable of producing an avalanche?*

- Slope angle (steep enough to slide? prime time?) □ □ □
- Slope aspect (leeward, shadowed, or extremely sunny?) □ □ □
- Slope configuration (anchoring? shape?) □ □ □

**Overall Terrain Rating:** □ □ □

**SNOWPACK:** *Could the snow fail?*

- Slab Configuration (slab? depth and distribution?) □ □ □
- Bonding Ability (weak layer? tender spots?) □ □ □
- Sensitivity (how much force to fail? shear tests? clues?) □ □ □

**Overall Snowpack Rating:** □ □ □

**Weather:** *Is the weather contributing to instability?*

- Precipitation (type, amount, intensity? added weight?) □ □ □
- Wind (snow transport? amount and rate of deposition?) □ □ □
- Temperature (storm trends? effects on snowpack?) □ □ □

**Overall Weather Rating:** □ □ □

**Human:** *What are your alternatives and their possible consequences?*

- Attitude (toward life? risk? goals? assumptions?) □ □ □
- Technical Skill Level (traveling? evaluating aval. hazard?) □ □ □
- Strength/Equipment (strength? prepared for the worst?) □ □ □

**Overall Human Rating:** □ □ □

**Decision/Action:**  
 Overall Hazard Rating/GO or NO Go? GO □ or NOGO □

**\*HAZARD LEVEL SYMBOLS:**  
 R = Red light (stop/dangerous)  
 G = Green light (go/OK)  
 Y = Yellow light (caution/potentially dangerous).

©Alaska Mountain Safety Center, Inc.

Chart 1

### **Learning Step/Activity 14 – List the equipment required for back country travel in avalanche terrain.**

- a. Avalanche Probe- at least eight feet long, ten is better; typical construction is many shorter sections connected by a cable, similar to tent poles.
- b. Shovel- heavy duty, wide blade, short handle, packable. Plastic shovels are dubious.
- c. Transceiver- quickest device used to locate a victim; they are quite expensive, about \$200.00 each. **THEY WILL NOT KEEP YOU FROM GETTING IN TROUBLE AND SHOULD NOT BE A REASON TO TAKE CHANCES!** Must have at least two- one transmitting from the victim and the other switched to receive and worn by the searcher. A significant amount of time must be dedicated to gain proficiency.
- d. Slope angle device.

### **Learning Step/Activity 15 – Cross a questionable slope.**

- a. If a questionable slope must be crossed the following actions must take place:
  - (1) Route must be the shortest possible. If possible use “islands of safety” such as trees, exposed rocks etc.
  - (2) A watch is posted to note the person’s direction of travel and note where they go should a slide occur.
  - (3) Disconnect ski pole and ski binding leashes so they can be discarded rapidly. A heavy rucksack can drag you under, a light puffy rucksack can aid in flotation.
  - (4) Cross one at a time.

### **Learning Step/Activity 16 – React to an avalanche.**

- a. Discard ski poles and skis if able. Also discard a heavy pack.
- b. A swimming motion can help to maintain a surface position. Fight hard to maintain this surface position.
- c. Try to form an air space as soon as you stop.
- d. Watch the victim. Note where they went on the slide path and terrain traps that may hold them.
- e. After the area has been ascertained to be safe, begin looking for the victim.
- f. Go to the last point seen and mark it.
- g. Look downslope for surface clues, but do not remove them. Use them as you would the sights on a rifle. They will usually point downhill to the area of burial.
- h. Begin a beacon search if your group has them. Ensure EVERYBODY is in receive mode. Some of the party can begin in the deposition zone, others in terrain traps. There is one person in charge and the

effort must be organized. Utilization of beacons will be covered in a practical exercise in the next block of instruction.

i. If the party was not using beacons then probing will be necessary. Avalanche probes are preferred, but ski poles with the baskets removed, long sticks, or any other long rigid object will work.

j. Don't go for help. You are the help.

**NOTE: At this point the instructor will review and summarize the computer based instruction. The next Learning Steps/Activities will be performed in the field IAW the published training schedule for the course in session.**

**NOTE: The remainder of the Learning Steps/Activities are performed in a field environment.**

### **Learning Step/Activity 17 – Conduct hasty snow stability tests and terrain evaluation during travel.**

a. As you travel on the snow occasionally push your ski pole into the snow and “feel” the layer construction with the basket as you pull the pole from the hole. Not scientific, but this test gives you clues as to the strength of the snow pack.

b. If you are making switch backs while ascending a hill, you can jump on the uphill track where you changed direction. You are looking to see if you can make the snow slide. Snow that slides easily is an indicator of instability. This test will show the bonding of the top layers only. Of course this test must be done on a slope with little or no consequence; that is you want to conduct the test where if you do create a snow slide, it does not have the potential to bury you or others.

c. Find and ski little “rollers” or small hills along your route. These should be of the same aspect and steepness of the larger hill you intend to climb. Again, this test should be performed in an area with little to no consequence to you or others.

d. Begin to form an opinion about the terrain you are traveling over (is it red, yellow or green terrain). Note the angle of the slopes you are moving on. Get your protractor out and do some measuring. Look at the terrain above you as you travel. Think about the potential for avalanche coming from above. Think about the run out angle if an avalanche were to occur above you (again use your protractor to determine the run out angle). Watch out for terrain traps and think about the consequences of moving through a particular area.

e. You should continue to do this as you travel over and over again. Results in one area can differ dramatically after a few hundred meters or even a few feet. You are trying to develop an overall picture of what is going on around you, not just a localized one.

### **Learning Step/Activity 18 – Dig a snow pit.**

a. Snow pit test- This test gets your eyes and hands into the snow pack. Choose a safe slope with a similar aspect, direction and angle (must be at least 30 degrees), as the suspect slope or the slope you want to travel.

b. Carefully dig into the bank above you with a shovel or similar device. The width should be 1m. You should go down approximately 1.5m or ground level in shallower snow. When finished you will have three walls of the snow pack exposed. The walls should be straight and smooth. In this pit, you can further analyze the strengths and weakness of the layers of snow, the bonding between old and new snow layers.

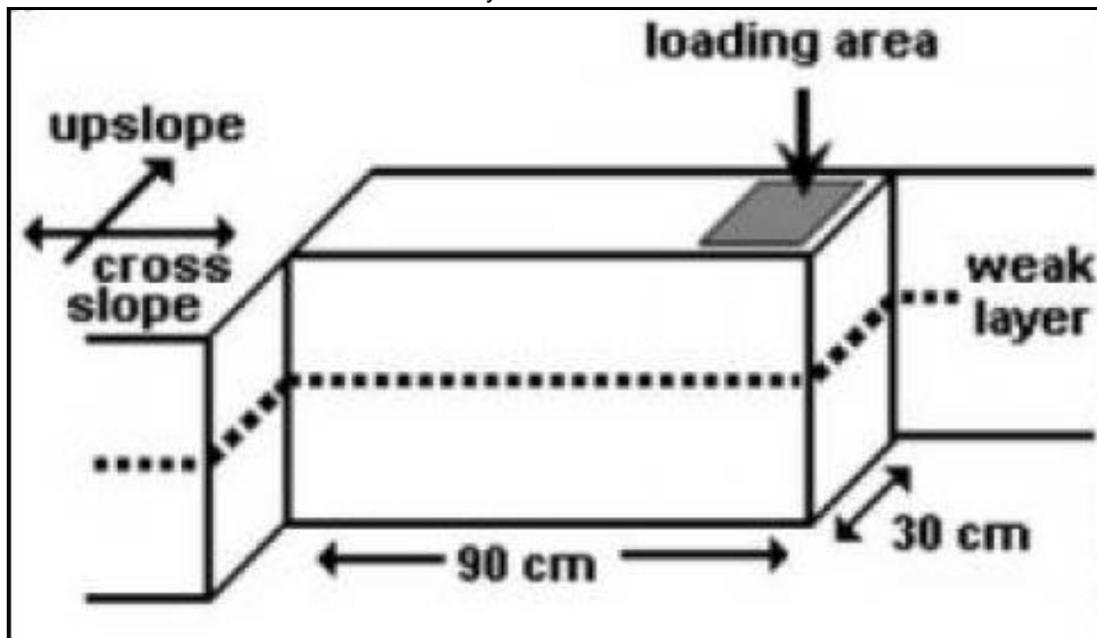
c. At this point you can see the different layers of snow. They can be exposed by lightly brushing with a paint brush or the back of your hand. On one of the side walls begin to feel the layers for varying hardness. Start with your fist and try to push it into the snow and note the resistance. If you meet a lot then try four fingers, if too much then one finger, then a pencil and finally a pocket knife. The idea is that you are figuring the difference in density between the layers. If there is a change of more than one step there can be a stability issue. For example a layer of knife hard snow with a layer of four finger snow on top and a layer of knife hard on top of that. The layer of four finger snow is a weak layer.

d. You are looking for the three ingredients in the right combination that could create a slab avalanche. That would be a slab (well consolidated snow) on top of a weak layer (poorly bonded snow) on top of a bed surface (e.g. smooth ground surface, an ice lens that formed early in the season, a hard slab). You can use this information to begin to determine the stability of the snow pack. Along with some of the hasty steps you performed earlier and some of the other stability tests we will demonstrate next you can give the snow pack a red, yellow or green evaluation.

### Learning Step/Activity 19 – Conduct an Extended Column Test (ECT). Picture 25

a. Start with the snow pit as in LSA 18.

b. Measure a block 90cm long by 30cm wide. With a snow saw cut a wedge to isolate a column of snow. Then cut the back a side with the saw. You may have to excavate more snow to access the back.



Picture 25

c. Once the column is isolated place the blade of the shovel flat on top of the column on the open end of the column. Rest your hand on the blade and forearm on the handle and articulating from the wrist tap the shovel blade 10 times. If the column does not fail execute 10 additional taps by articulating from the elbow. If the column still has not failed, execute 10 more taps from your shoulder using the full weight of

the arm. With this last step, allow your arm to fall onto the shovel; do not accelerate the arm. During this procedure watch the front of the column for any propagation on a weak layer.

d. Evaluate the snow pack as follows:

(1) Column fails when cutting or on 1-10 taps. Red light for the snow pack or unstable snow.

(2) Column fails after 11-20 taps. Yellow light for snow pack. Caution should be used on prime slope angles. This is a good day to manage the danger by managing (reducing) the angle of the slopes you travel on.

(3) Column fails after 21-30 taps or not at all. Green light or stable snow pack.

c. This test measures the amount of compression the snow will tolerate and whether a crack is capable of running across a slope. Several pits will need to be dug in a wide area to gain a better picture of what is happening within the snow.

### **Learning Step/Activity 20 – Practice safe travel techniques.**

a. Safe travel through avalanche terrain is an art. One of the most important things you can do in avalanche terrain is to continually assess the hazard and make efforts to mitigate any risk that you find. This is probably the most important action you can take to keep yourself and or your unit out of danger. During movement, there are a number of ways to minimize your exposure to any dangers that may be present. You may (and probably should) conduct a thorough risk assessment utilizing the chart on page 256 or APPENDIX F of USARAK 385-4. The evaluation can then be used to make decisions about how you will move. Here are some techniques (from **Staying Alive in Avalanche Terrain**) to try for the different conditions you may encounter:

(1) Red Light conditions. You have observed any or all of the following:

- Recent avalanche activity
- Collapsing and cracking of the snow pack
- Most or all of your snow pit tests show unstable snow conditions
- Recent heavy loading of new and/or windblown snow
- Rain on new snow
- Rapid melting of new snow
- Sinking in past your knees while walking on wet snow

(2) During red light conditions you must:

- Manage your slope angles. Travel on terrain with slope angles of less than 30 degrees.
- Watch your run out angle.
- If you must travel on steeper terrain, do so in areas that are heavily wooded or wind scoured only.
- Travel one at a time through suspect areas and be sure to keep watch as an individual moves through the danger areas
- Be prepared to deal with the consequences of an avalanche.

(3) Yellow light conditions. You have observed any or all of the following:

- Localized recent avalanche activity
- Areas of collapsing or cracking
- Mixed results from snow pit tests

- More than two days since a heavy loading or rapid warming event
- Sinking in past your ankles when walking on wet snow
- Rain on old snow
- Rapid warming of old snow

(4) During yellow light conditions:

- This is where most avalanche accidents happen. You often get mixed results and may convince yourself that it is safe to take greater risks.
- You should stay on gentle terrain (less than 30 degrees) unless you have extensive experience.
- Travel one at a time through suspect areas and be sure to keep watch as an individual moves through the danger areas.
- Watch the run out angles and again be prepared to deal with a slide.

(5) Green light conditions. You have observed any or all of the following:

- No recent avalanche activity
- No collapsing or cracking
- Snow pit tests show stable conditions
- More than several days without heavy loading or rapid warming
- Thick refrozen snow
- Not sinking in past ankles when walking

(6) During green light conditions:

- Most routes are safe
- Continue to practice safe travel techniques

### **Learning Step/Activity 21 – Rescue avalanche victim(s) (initial steps).**

a. Immediate action- Ascertain that the area is safe; hang fires, adjacent slopes feeding into the slide path. Survivors at the avalanche site are organized into the first rescue team and immediately start rescue operations. If any indication of the location of the victim is found, random probing starts in that vicinity. The tip and edges of the deposition zone are also likely areas to search. A human body is bulky and is apt to be thrown toward the surface or the sides.

b. General Procedures- Establish from witnesses where the victim was just prior to the avalanche, then determine the point where the victim disappeared - the "last seen" point. Making use of this and any other information, establish a probable victim trajectory line leading to high priority search areas. Make a rapid but systematic check of the slide area and the deposition area and mark all clues. Look for and physically check skis, poles, ice axes, packs, gloves, hats, goggles, boots, or any other article the person may have been carrying, it might still be attached to the victim.

c. In many respects, a moving avalanche resembles a liquid. A human body, with a higher density than the flowing snow, would be expected to sink deeper and deeper into the avalanche; however, several factors influence this. Turbulence, influence of terrain, and the victim's own efforts to surface himself, all interact to determine the final burial position. Study of a large number of case histories leads to the following conclusions:

d. The majority of buried victims are carried to the place of greatest deposition, usually the toe of the slide.

e. If two points of the victim's trajectory can be established, a high probability exists that the victim will be near the downhill flow line passing through these two points.

f. Any terrain features which catch and hold avalanche debris are also apt to catch a victim.

g. If an avalanche follows a wandering gully, all debris deposit areas are likely burial spots. The likelihood of a victim being buried in a particular bend is proportional to the amount of debris deposited there.

h. Vegetation, rocks, and other obstacles act as snares. The victim tends to be retained above the obstacle. An obstacle may simply delay the victim's motion, leading to final burial down flow from the obstacle.

i. Maximum speed of the flowing snow occurs at the avalanche center. Friction reduces flow velocity along the edges. The closer the victim's trajectory is to the center of the slide, the greater his burial depth.

j. Efforts of the victim to extricate himself by vigorous motion and "swimming" definitely minimize burial depth. Conversely, the limp body of an unconscious victim is likely to be buried deeply.

k. An occasional exception to the above is emphasized. The victim may not be buried but may have been hurled away from the avalanche by wind blast. In the case of large and violent avalanches, a search of the surrounding terrain is advisable. Victims have been located in tree tops outside the slide area.

#### **Learning Step/Activity 22 – Rescue avalanche victim(s) using a probe line.**

a. Organize initial searchers and probers. Everyone should have a shovel or other tool for digging or if there are sufficient people, a shoveler can be standing by to assist when needed. If the initial search reveals items from the victim, make an initial probe search in that area. This probing should take only a few seconds. If no other search method exists, make a coarse probe of all likely areas of burial, and repeat it as long as a live rescue remains possible. Resort to the fine probe only when the possibility of a live rescue is highly improbable, within the first thirty minutes. Unless otherwise indicated, start the coarse probe at the deposition area.

b. Probing for Avalanche Victims- Probing offers the advantage of requiring very simple equipment that can be operated by personnel without previous training. Although the probers do not need previous training the search leader must be familiar with the technique to insure proper execution of the probe line.

c. For the probing operation to be effective, lines must be orderly and properly spaced. To insure systematic and orderly probing, the number of personnel per line should be limited. Twenty per line is satisfactory, while thirty is normally the upper limit. The number of probers in the line will be dictated by not only the width of the area to be probed but the amount of people available. A string may be used to keep the probe lines aligned, but will require added time to maintain.

d. The probe line maintains a steady advance upslope. Advancing uphill automatically helps set the pace and permits easy probing to the full length of the probe. Probing does not come to a halt when a possible contact is made. The probe is left in contact and the line continues. A shovel crew follows up on the strike by digging down along the pole. Extra probes are carried by the shovel crew to replace those left in contact. Such a plan of operation is especially important when more than one victim is buried. Striking a body gives a distinct feel to the probe. This feel is easily recognizable in soft snow but is less

easy in hard compacted snow. A common problem is encountering debris within the snow that can be mistaken for the victim. The only sure check is by digging.

e. Two distinct probing methods are recognized: Coarse Probe and Fine Probe. As evidenced by their names, coarse probing implies a wider spacing of probe pole insertions with emphasis on speed. Fine probing involves close-spaced probing with emphasis on thoroughness. Coarse probing is used during initial phases of the search when live recovery is anticipated. Fine probing is the concluding measure which almost guarantees finding the body. The coarse probe technique has a 80 percent chance of locating the victim on a given pass, while the fine probe has essentially a 100 percent chance of locating the body. The Coarse Probe functions as follows:

(1) Probers are spaced along a line at double arm interval so their wrists are touching.

(2) The leader commands "LEFT, PROBE". Everyone pushes their probe into the snow until it stops then pulls it up. The leader commands "CENTER, PROBE". Everyone pushes their probe into the snow until it stops then pulls it up. The leader commands "RIGHT, PROBE". Everyone pushes their probe into the snow until it stops then pulls it up. Maintain about half a meter in between each probe hole.

(3) On signal of the probe line commander, the group advances one half step and repeats the process.

(4) By adhering to these commands, the leader can keep closer control of the advancing line of probers. It is important that the signals be adjusted to a rhythm which enforces the maximum reasonable pace. Further, a string could be used along the probe line to keep the probers dressed, although this would require the use of two people to control the string. Strict discipline and firm, clear commands are essential for efficient probing. The probers themselves work silently. If someone thinks they have found something, leave the probe in place, get a new probe from a shoveler if available, step around and continue the line. The shovel crew will then move in.

f. The Fine Probe- This method is much slower, deliberate and controlled than the coarse probe. This method is used when there is a high likelihood of recovery on the first pass such as a very small deposition zone or when multiple passes of a coarse line fail to produce a result. The fine probe functions as follows:

(1) Probers are spaced shoulder to shoulder. Each man probes in front of his left foot, then in the center of his straddled position, and finally in front of his right foot.

(2) On signal, the line advances one half step and repeats the probing sequence.

(3) The commands for the fine probe are:

"LEFT PROBE"  
"UP PROBE"  
"CENTER PROBE"  
"UP PROBE"  
"RIGHT PROBE"  
"UP PROBE"  
"STEP FORWARD"

g. Good discipline and coordinated probing is even more necessary than with the coarse probe. Careless or irregular probing can negate the advantages of fine probing. Use of a string to align the

probers is especially important with the fine probe. The three insertions are made along the line established by the string line which is then moved ahead 1 foot.

### Learning Step/Activity 23 – Rescue avalanche victim(s) using a beacon.

**NOTE: There are many beacons available and each has features and options that must be familiar to the user. You must be familiar with the particular beacon you are using, adhere to the manufacturers instructions and practice with it frequently to maintain proficiency. This block of instruction will provide instruction on the use of the BCA Tracker (Picture 26) in the Snow and Ice Mobility Kit.**

- a. The same procedures for establishing the victims general location are followed.
- b. Ensure everybody in the group turns their beacons to receive or off to eliminate the possibility of false signals.
- c. If the group is large enough, some members can begin searching in likely terrain traps while the bulk searches in the deposition zone.
- d. To search:



Picture 26

(1) Press the red button in the center. This switches the unit to receive.

(2) Orient the unit in the direction of the strongest signal. The lights in the center of the display should be illuminated. Begin moving while taking care to keep the center three lights illuminated. The display window will show a range in meters to the signal. If you come to a point where the signal fades, mark that spot, turn around and retrace till you find the strongest signal.

(3) Upon returning the strongest signal position, turn 90 degrees left or right and repeat the process. This should narrow your search area.

(4) After you have come to within 1 meter on the display, you are ready to begin a fine search. This is the same as above; only instead of walking you pass the beacon from hand to hand close to the snow surface.

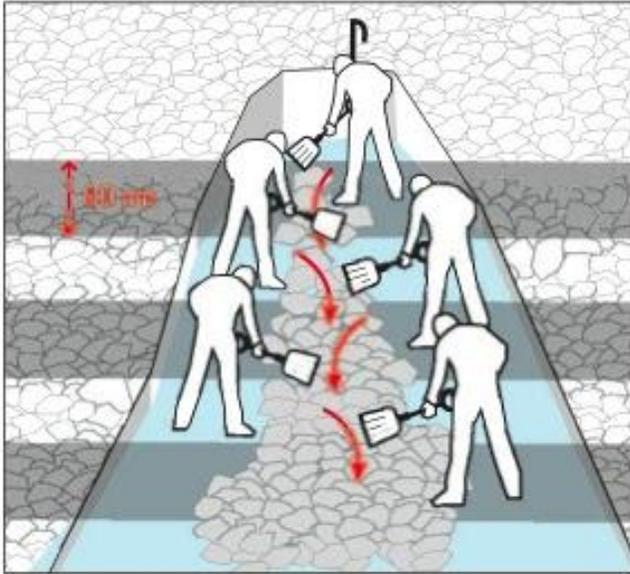
(5) After you have found the strongest signal, DO NOT LAY THE BEACON ON THE SNOW. It will invariably get buried. Get probes and probe for the victim in a quick efficient manner. Probe using a spiral pattern from the point of strongest signal keeping your holes 25 cm apart.

(6) Because of the way beacons transmit their signal you may find it helpful to turn and walk several feet off your present course when a very strong signal is gained and lost quickly. During a fine search point the beacon downward and rotate its orientation periodically.

(7) Speed is of the essence. Narrow down the search area as quickly as possible. In the case of multiple burials, expose the victims face, make sure they are breathing, and turn off their beacon and MOVE ON. If you are part of a larger group you can assign someone to dig this person out.

**Learning Step/Activity 24 – Perform strategic shoveling. (Picture 27)**

- a. Moving several feet of snow in an efficient manner is the hardest part of a recovery. This is accomplished through strategic shoveling. This is the art of shoveling to avoid lifting snow uphill while creating a horizontal exit path for your victim.



Picture 27

1. Check the depth of the victim but do not remove the probe.
2. Move downhill of the probe at least 1.5 times the burial depth. Line up shovelers in an upside down V. Everyone should touch the blades of their shovels to get the spacing right. This keeps you from getting hit.
3. The person at the point of the V begins to dig into the snow using a paddling motion such as you would in a canoe. He is just moving snow down hill. Everyone behind him continues the conveyor belt of snow.

4. When the point of the V is close to the victim, the shoveling should slow to avoid cutting the victim.
  5. If the lead shoveller is fatigued, everyone rotates one position to the right.
- b. Once the victim is located, begin careful excavation toward the head to clear an airway.

## SECTION IV. SUMMARY

You now have a general understanding of the avalanche hazard and some of the steps you can take to mitigate risk when moving in avalanche prone terrain.

### Check on Learning.

1. What are the four elements required for an avalanche?

**Terrain** between 20 and 60 degrees slope angle, an unstable **snow pack** that contains a slab, weak layer and bed surface, the **weather** conditions to create the unstable snow pack and a **trigger** such as a skier.

2. Does having a slab on a slope of 30 degrees mean that the slope will slide?

Not necessarily. If there is a weak layer and bed surface below the slab and there is a trigger there is a high probability of a slide. But the presence of a slab itself on a 30 degree slope does not mean that the snow will avalanche.

## SECTION II. INTRODUCTION

**Motivator:** Weapons, the lubricants used to maintain weapons and ammunition are all adversely affected by cold weather. You must understand these effects and you must be able to take steps to reduce these effects in order to keep your weapon working.

### Terminal Learning Objective

|                  |   |
|------------------|---|
| <b>ACTION</b>    | Perform Weapons Maintenance in Extreme Cold Weather   |
| <b>CONDITION</b> | In temperatures of 32° F to -60 °F, given assigned weapon with technical manual.  |
| <b>STANDARD</b>  | Identify common problems with weapon systems that are caused by the cold weather. Take steps to reduce or eliminate problems caused by the cold before, during, and after operations. |

**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 weapons use in cold 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:** This lesson will give you some common effects of cold on weapons and ammunition as well as some tips and procedures to reduce or eliminate problems associated with maintaining and firing weapons in the cold.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Describe the effects of extreme cold weather on weapons.

a. Sluggishness. Weapons will function under extreme cold conditions, if given proper care. Lubricants that are normally used under temperate conditions, such as CLP, thicken in cold weather and stoppages or sluggish weapon action will result from their use. CLP will freeze at  $-35^{\circ}\text{F}$ . To eliminate this problem, the weapon must be completely stripped, thoroughly cleaned, and lubricated with LAW (Lubricating oil, Weapons). As a minimum, the camming surfaces of the bolt should be lightly oiled with LAW. The rest of the weapon can be left dry. LAW is not available in the refillable half ounce bottles normally found in weapons cleaning kits, but is available in larger sized one quart containers (NSN 9150-00-292-9689). If LAW is not available, use a dry graphite lubricant or fire weapon dry.

#### b. Condensation on Weapons.

(1) Condensation forms on weapons when they are taken from the cold into a warmer environment. This is called "sweating". If weapons are taken back into the cold without removing the condensation this "sweat" can turn to ice, which will result in stoppages. For this reason, it is best to leave weapons outside when temperatures are below freezing. When left outside, weapons should be readily accessible, but sheltered, so that ice and snow will not get into the working parts of the weapon (sights, barrel).

(2) If necessary, weapons may be taken inside for cleaning. The condensation or "sweating" will continue for approximately one hour after introduction of the weapon into a warm shelter. Wait until the "sweating" process has concluded, then, begin to thoroughly clean the weapon. If weapons are to be kept in heated shelters, they should be kept near, but not on, the floor to minimize condensation.

#### c. Fouling from Snow and Ice.

(1) To keep snow and ice out of a weapon, some type of cover is needed. Request muzzle caps from the unit armorer, they are expendable and will do the job. If none are available, you may have to improvise. Some ways of doing this are: using plastic bags, tape, or condoms. Keep ejection port covers closed.

(2) Another recommendation is to carry something to de-ice a weapon should part of the weapon become frozen. Windshield wiper fluid carried in a small bottle has been used successfully; aircraft deicer and antifreeze are other options. Periodic cycling of the weapon will also keep parts from freezing.

(3) Operate the action on weapons periodically. This can help identify icing issues.

d. Visibility Issues. A visibility problem can be encountered when weapons are fired in still air conditions where temperatures are below  $-30^{\circ}\text{F}$ . As the round leaves the weapon, the hot propellant gases cause the water vapor in the air to condense. These droplets of condensed water vapor then freeze, creating ice particles which produce a cloud of ice fog. This fog will hang over the weapon and follow the path of the projectile, obstructing the gunner's vision along his line of fire, as well as revealing his location to the enemy. When faced with this problem, fire at a slower rate and/or relocate to an alternate firing position.

Tests have shown that even in warmer temperatures, a fog will develop around the gun from hot gases and the breath of the gunner, making it difficult to observe the strike of rounds. For crew served

weapons, the assistant gunner may need to take up a position further left or right to help with adjustments. For individual weapons frequent changes in position may be required. When using optics in the cold, care must be exercised to keep the users breath from condensing on the sight. Even the warmth put out by the close proximity to the face can cloud the sight. Allow a stand off between the eye and the sight. When taken from a cold to a warm environment the optics must be allowed to adjust to the new temperature slowly to avoid cracking the lens.

e. Breakage and Malfunctions.

(1) Extreme cold causes metal and plastic to become more brittle than it is at warmer temperatures. Breakage generally occurs early when a cold weapon is fired; the metal is heating and rapid, unequal expansion of parts is occurring. Unit armorers will need to carry extra parts. Begin firing small arms at a slow rate of fire in extreme cold weather, if the tactical situation permits. This will greatly reduce the likelihood of the weapon malfunctioning.

(2) Freezing of moisture produced by sweating or the accumulation of snow or ice in the weapon will also cause malfunctions and stoppages. After a weapon has been fired, the heat it has generated can cause any snow or ice it comes into contact with to melt. This water will then re-freeze and may cause the weapon to malfunction. Again a deicer can be used to thaw the weapon and keep it working properly. Cycle the weapon periodically.

f. Emplacement Issues. Crew-served weapons requiring some type of base or platform for firing need special consideration. Emplacement of a weapon on snow, ice, or frozen ground, may result in breakage, or inaccuracy because of sinking, or the inability to absorb shock. Emplacements relating to particular weapons will be discussed in the section pertaining to that weapon.

g. Reduced Velocity and Range of Projectiles. As temperature drops, so does the muzzle velocity, and thus the range of projectiles. This is because of a change in both internal and external ballistics.

(1) Internal Ballistics. This occurs inside the weapon; the burning rate of propellant decreases, thus the rate of gas expansion decreases and in turn the rate at which the projectile moves down the barrel decreases.

(2) External Ballistics. This occurs after the projectile leaves the muzzle. Decreased muzzle velocity reduces the stability of the projectile as it leaves the muzzle, possibly causing the projectile to tumble. At longer ranges this further reduces velocity and accuracy. Colder air is denser than warmer air which may create increased drag on the projectile thus further decreasing range.

h. Automatic Weapons have a high rate of breakage and malfunction due to cold weather. Especially affected are the sear and bolt parts. Gun crews must carry extra parts of this type. One common malfunction is short recoil where the bolt does not recoil fully to the rear. A second malfunction is caused by the freezing and hardening of buffers. This causes great shock and rapid recoil, increasing cyclic rate and can cause parts to break. All internal components and friction surfaces of machine-guns should be coated with LAW. These small arms should be fired cold and dry if LAW or CLP is not available. Firing should begin slowly at first to allow the weapon to warm; short two or three round bursts at short intervals are sufficient until the weapon components warm. Machine-guns should be test fired in cold weather prior to combat deployment to a cold weather area of operations. Ammunition must be transported in enclosed drums or cans to prevent snow fouling. It should be kept at the same temperature as the weapon. All weapons should be re-zeroed in extreme cold.

## **Learning Step/Activity 2 –Describe techniques for ensuring weapons function in the cold weather environment.**

Some specific weapons considerations:

### a. 9mm Pistol

1. Breakage of moving parts is rare, but some breakage of the extractor and the firing pin can occur.
2. This weapon is affected by condensation more than other weapons, due to the fact it is most often carried by personnel whose duties require them to frequently enter and exit heated shelters and vehicles. Freezing generally occurs around slide and magazine well.

### b. M16A2/M4

1. Little breakage will occur if the weapon is fired at slow rate of fire until warm.
2. Breakage usually occurs around the extractor, ejector, and firing pin.
3. Condensation in the buffer tube will decrease the shock absorbing ability, which may result in breakage or reduced recoil, which can result in the omission of the cocking step in the cycle of operation. Wipe the buffer tube out frequently to remove condensation and reduce the chance of having the weapon malfunction.
4. Re-zero the weapon when deploying from a temperate to a cold environment. Cold temperatures may cause a decrease in the burning rate of propellants, which can significantly change projectile trajectories. In effect, this will nullify the zero of the weapon. Remember that altitude will also have an effect on a weapon system, and when a significant change in altitude occurs the weapon should also be re-zeroed.
5. When wearing mittens or bulky handwear open the trigger guard for firing. Keep the trigger guard closed but unlatched for safety when not in use.

### c. M249

1. High rate of breakage due to the large number of moving parts. Armorers should carry plenty of spare parts, especially those most prone to failure. (firing pins, extractors, feed pawls, etc).
2. The M249 safety selector switch is extremely difficult to operate when the weapon is cold soaked.
3. Buffer group assemblies are affected in the same manner as the M16/M4. A common malfunction is short recoil (bolt does not recoil fully to the rear) which occurs early in firing. Apply immediate action procedures until metal warms.
4. When changing barrels, avoid placing a hot barrel in the snow – the rapid cooling of the barrel may warp it and will cause condensation to freeze in the barrel.
5. The ammunition must be protected. Un-protected belts are a sure way to introduce ice into the weapon when firing.
6. Semi- permanent platforms may be constructed by attaching ski pole baskets or snowshoes to the bipod. Ski pole baskets only work well in hard or compacted snow; issuing an extra snowshoe without bindings to weapons crews is preferable.

### d. M240

1. The same considerations as the M16/M249 apply to this system.
2. Emplacement considerations may be more involved.
3. For the bipod, apply the same techniques mentioned for the M249 (ski baskets or snowshoes. Testing has shown that resting the weapon on a ruck does not provide a stable platform and makes it difficult to operate from the kneeling (to low) or the prone (to high) position.

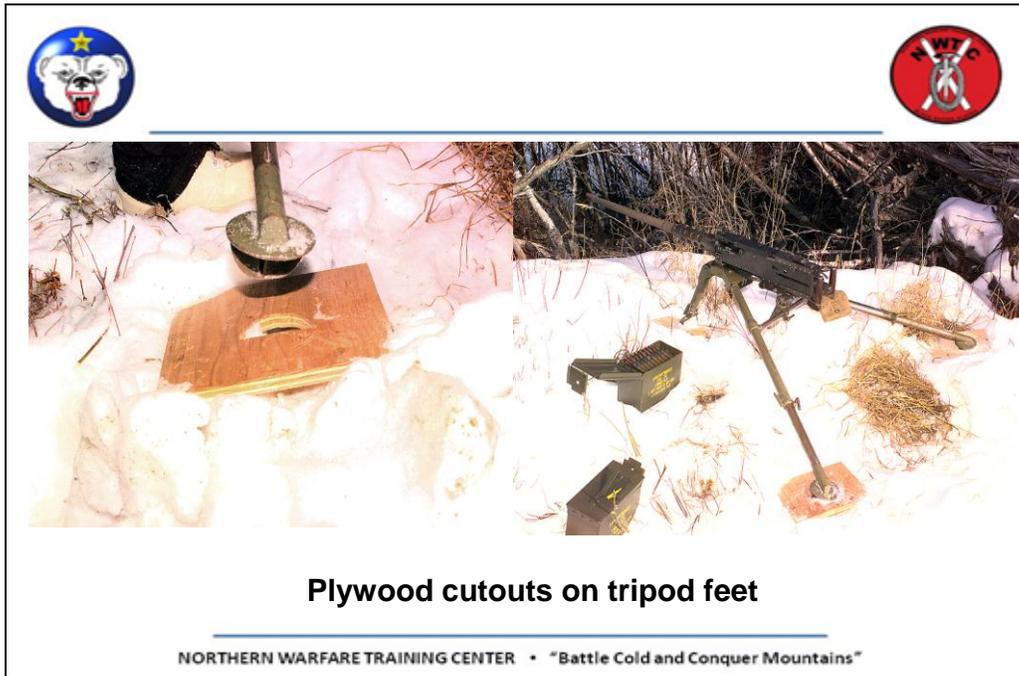
4. For the tripod, the Ahkio or other sled (Picture 1) may be used as a platform. On hard ground or ice each leg will need to be seated in a slot that is chipped out to fit the base of each leg. Ice screws or pitons driven into frozen ground or ice and attached to the tripod legs with 550 cord may increase the stability of the position.



Picture 1

e. M2

1. The same considerations as the M16/M249 apply to this system.
2. For the tripod, see the techniques noted for the M240. Plywood cutouts can be easily made. (Picture 2) Sandbags have also been used to provide a stable platform for the tripod on hard ground, but tests have shown the bags to rip after 300-400 rounds.



Picture 2

f. MK 19 Automatic Grenade Launcher

1. Use Lubricant, Weapon, Semi-Fluid (LSAT) OR Grease, Molybdenum Disulfide lubricant down to -25F. Below that use LAW.
2. Use cloth covers rather than plastics to protect the weapon from the elements. In addition, plastic or rubberized covers can become stiff or brittle in the cold. This may result in difficulty removing them (especially when you must do so in a hurry) or in damage to the cover.
3. Use the same techniques for the tripod as the M2/M240.

g. Mortars

1. Hand protection must always be worn (contact gloves). The gloves must not be loose, because when the ammo is being dropped into the tube, a vacuum occurs which can suck the glove into the tube creating a hazardous situation.
2. Breathing on sites, or on the mortar ballistic computer will cause fogging and freezing of equipment.
3. Muzzle and sight covers should be used when not firing the weapon to prevent snow and ice from entering the tube.
4. The Mortar Ballistic Computer is programmed to accept temperatures down to -50°F. This automatically compensates for cold-induced slow burning of charges when computing firing data. The MBC is not programmed for temperature inputs colder than -50°F.
5. Aiming stakes will become loose when placed in snow. Utilize sandbags or an anchoring device to keep them in place once set.
6. (Picture 3) Base plates become brittle when exposed to the extreme cold, this, coupled with the decreased ability of frozen ground to absorb shock, results in base plates being more prone to breakage than normal. Base plates must be dug in if possible, to prevent the base plate from skipping. Shock absorbing materials such as spruce branches, sandbags, even ice chips or soil should be used for absorbing recoil during firing, but not to an extent which will allow the base plate to bounce out of the hole that has been dug for it. Demolitions may be used to prepare a firing position quickly (1.25 lb block of C-4 works well). After emplacement base plates may be hard to remove.



Picture 3

7. Swab bores thoroughly after each mission to remove any excess propellants.
8. VT fuses are not preferred due to the severe dampening effects of snow. Airbursts are preferred. Malfunctions will occur in direct proportion to the severity of the weather.
9. The rubber tube cover may harden and become extremely difficult to remove as temperatures fall.
10. When firing in drop mode, expect greater number of misfires. Using the trigger will correct this.

h. M136 (AT-4) Antitank Weapon

1. Plastic and rubber components become brittle and can crack in extreme cold.
2. Ice fog and vapor trails will occur when weapon is fired.
3. Gunner must wear a facemask or scarf when temperatures reach  $-15^{\circ}\text{F}$  to prevent icing of sight.
4. Sights are more difficult to release from their covers.

i. M220 Series TOW Weapons System

1. Can be effectively used in temperatures down to  $-25^{\circ}\text{F}$ ; can be stored down to  $-65^{\circ}\text{F}$ .
2. Double the backblast danger/caution area size if the temperature is below  $0^{\circ}\text{F}$ .
3. In extreme cold the heat from the engine can distort the image in the sight. Fire the weapon over the back or side.

j. MANPADS (Stinger)

1. Additional interrogation/tracking time will be required due to temperature-related diminished battery performance.
2. The Nickel-Cadmium battery must be fully charged.
3. Double the backblast danger/caution area size if the temperature is below  $0^{\circ}\text{F}$ .

k. Javelin.

1. The javelin has a slight drop when fired in the cold; be cognizant of this when using from defilade or reverse slope positions.
2. Can be effectively used in temperatures down to  $-25^{\circ}\text{F}$ ; can be stored down to  $-65^{\circ}\text{F}$ .

l. Hand Grenades.

1. Fragmentation grenades suffer a reduced causality-producing radius due to energy dissipation in the snow.
2. Smoke grenades are useless unless placed on a platform to prevent them from sinking into the snow. Taping or wiring a grenade to a stake which can be driven into the snow works well.

**CAUTION: SOLDIERS USING GRENADES MUST ENSURE THAT THEIR GLOVES OR MITTENS ARE DRY. FAILURE TO DO SO MAY RESULT IN AN ARMED GRENADE FROZEN TO THE THROWER'S HAND.**

m. Demolitions.

1. C-4 hardens making it difficult to insert blasting caps. In extreme cold conditions, C-4 has shattered from the blasting cap rather than detonating.
2. Detonation cord, time fuze and shock tube become brittle and may break and will be more difficult to tie in cold weather.
3. Time fuze tends to retain its curl and will break when unrolled.
4. Condensation contributes to the incidence of misfires. Hangfire and misfire waiting times should be doubled.

**SECTION IV. SUMMARY**

This lesson presented you with some basic considerations for firing and maintaining weapons in the cold weather. During the remainder of the course you will have an opportunity to put these techniques and procedures into action as you fire and maintain your weapon.

**Check on Learning.**

1. What should be used to lubricate weapons in the cold weather environment?

LAW is preferred because CLP thickens and eventually freezes at  $-35^{\circ}\text{F}$ .

**SECTION II. INTRODUCTION**

**Motivator:** You are all familiar with camouflage techniques in temperate climates. In a cold, snow covered environment there is some additional equipment that you must use and some additional techniques and precautions that you must take in order to camouflage yourself and your equipment.

**Terminal Learning Objective**

| <b>ACTION</b>    | <b>Employ Individual Camouflage in a Snow Covered Environment</b>  |
|------------------|--|
| <b>CONDITION</b> | In any snow covered field environment above or below treeline while wearing Extended Cold Weather Clothing System appropriate to conditions, fighting load carrier, ballistic helmet, weapon, and rucksack. Given a set of overwhites ( trousers, parka, mitten covers, helmet cover and rucksack cover), tape if available. |
| <b>STANDARD</b>  | Select the camouflage outerwear appropriate for the terrain. Camouflage equipment and weapon without affecting the function. Change camouflage scheme as the conditions change.  |

**Safety Requirements:** Daily risk assessment conducted; adjustments made to clothing and warming shelter breaks/CWI checks based upon current conditions.

**Risk Assessment:** Low

**Environmental Considerations:** None

**Evaluation:** You will be tested on your knowledge of camouflage, 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 provides you with some techniques and procedures for camouflage in the snow covered environment.

### SECTION III. PRESENTATION

#### **Learning Step/Activity 1 –Camouflage yourself and your individual equipment using techniques appropriate for different snow-covered terrain.**

a. You are issued the over-white uniform. Simply putting these items on as the weather turns cold does not constitute good camouflage technique. Some thought needs to be put into blending into the surroundings and changes may be frequent to match the changing terrain.

**WARNING: Camouflage paint will not be worn when temperatures are below 32° F IAW USARAK PAM 600-2. The main reason for this is that it will become impossible to monitor soldiers for cold weather injuries (frostbite) when skin camouflage is worn.**

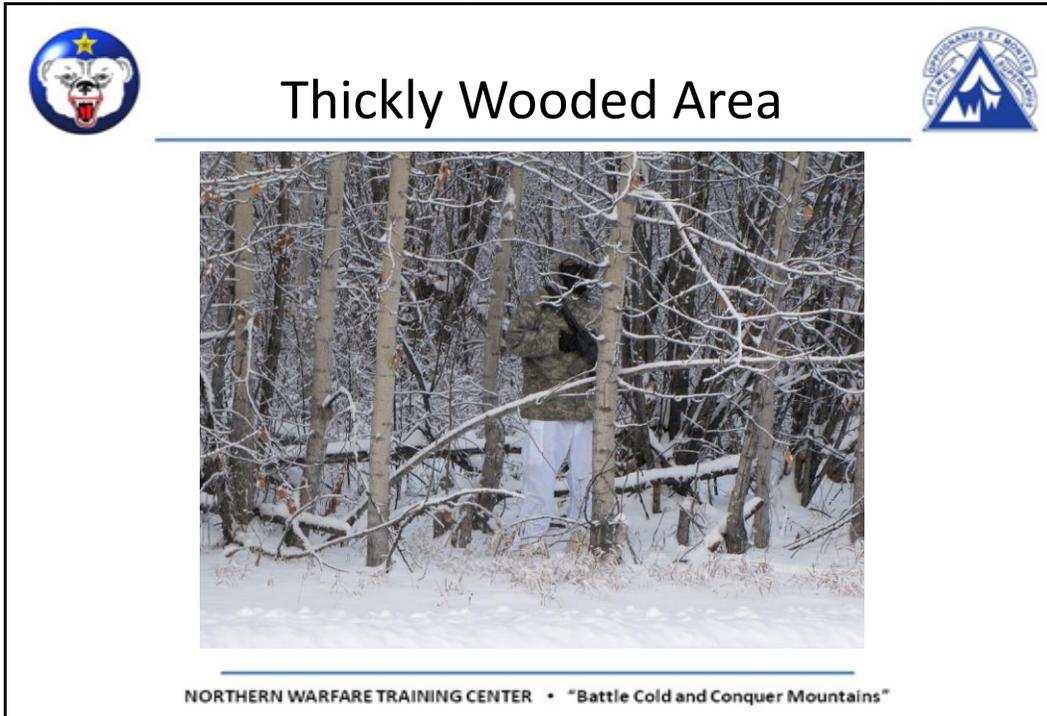
b. Camouflage in a cold weather environment. These are some of the combinations that are typically used in snow covered terrain:

- (1) Thickly wooded areas- wear ACU pattern uniform or ACU pattern with white trousers.
- (2) Low brush or light scrub area- wear over white parka top with ACU pattern trousers.
- (3) Forested areas- wear ACU pattern top with over white bottoms.
- (4) Above tree line, open areas- wear full over white camouflage.

c. Additional considerations:

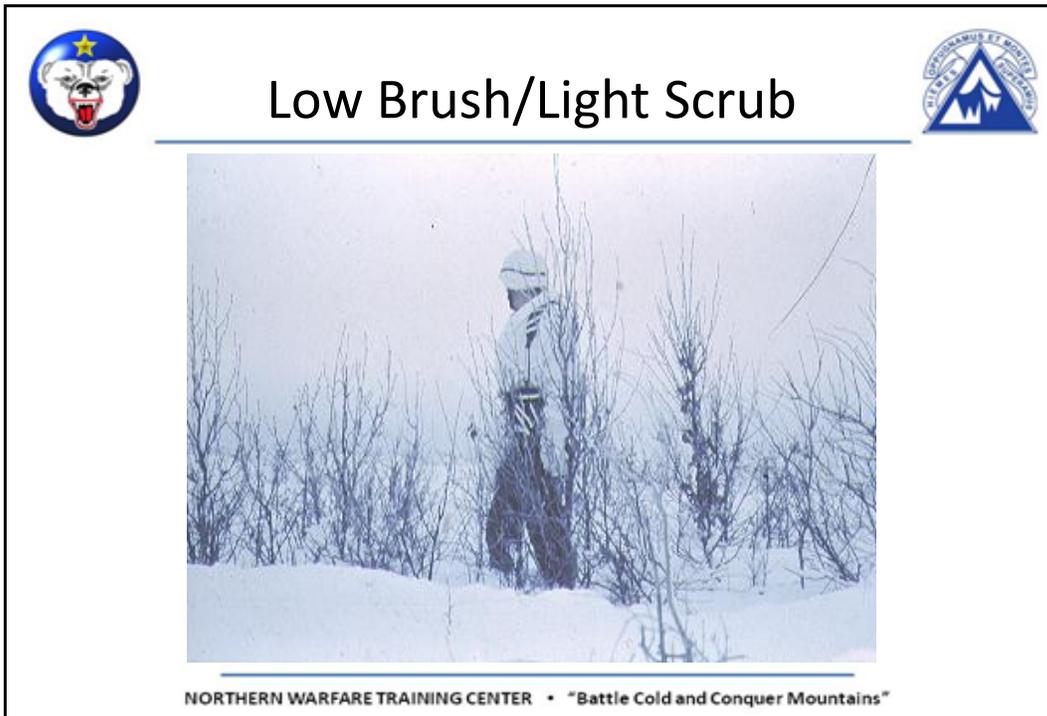
- (1) Avoid routes requiring numerous changes in camouflage pattern.
- (2) Have camouflage garments handy so changes in pattern can be made fast, on the move.
- (3) Like anything else there are exceptions – for example, after a heavy snowfall, complete over whites may be appropriate for any of the terrain listed.

d. Thickly wooded areas use ACU ECWCS parka and over white trousers. (Picture 1)



Picture 1

e. Approximately waist high vegetation. Use over white helmet cover, parka and mitten covers., fighting load carrier is broken up with white engineer tape. (Picture 2)



Picture 2

f. On trails or road systems, Soldier wears over white trousers, ECWCS parka and standard helmet cover.(Picture 3)



Picture 3

g. The entire over white system is used in open areas or when operating above tree line. (Picture 4)



Picture 4

h. Material that can be used for camouflage in the cold weather environment.

(1) Tape is good but can become brittle in cold and fall off (use cloth tape).

(2) Old over whites/cloth.

(3) Spray Paint (check with unit armorer).

(4) Engineer tape.

(5) Use as much white as necessary to break pattern and blend with surrounding snow cover. Snow covered terrain is rarely solid white. Leaving some black exposed on the M16, for example, blends better than completely covering the weapon in white.

(6) Care must be taken not to interfere with moving parts and normal equipment/weapons operation.

### **Learning Step/Activity 2 – Demonstrate camouflage techniques for different terrain situations.**

Give students the opportunity to establish a hasty ambush on a trail. After 15 minutes walk through and try to identify positions.

### **SECTION IV. SUMMARY**

You now have experience selecting camouflage patterns in a snow covered environment.

#### **Check on Learning.**

1. What pattern should you wear in open terrain or above tree line?

The entire over white set should be worn.

2. What pattern should you wear on roads and trails?

Over white trousers with ECWCS Parka top.

## SECTION II. INTRODUCTION

**Motivator:** It is relatively easy to hit targets on a range once you have received some basic instruction. In fact most have you have probably shot expert or close to it. When you are on the move, it is more difficult to come to a stop control your breathing and make good shots. Add in movement on skis or snowshoes and it becomes even more difficult to put rounds on target.

### Terminal Learning Objective

|                  |  |
|------------------|--|
| <b>ACTION</b>    | <b>Engage Targets in a Snow Covered Environment</b>  |
| <b>CONDITION</b> | In a field environment on a range given a M4 or M16, 30 rds M855 Ball, while wearing Extended Cold Weather Clothing System (ECWCS) appropriate to the temperature, fighting load carrier, ballistic helmet, over white set as needed, skis or snowshoes and ski poles. |
| <b>STANDARD</b>  | Engage targets from a standing, kneeling and prone position on skis or snowshoes. Hit 25 of 30 targets.  |

**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 to watch for cold weather injuries. Squad leader is responsible for taking breaks in warming shelters as required. Range procedures IAW Ft. Greely range Control and NWTC Range SOP are in effect.

**Risk Assessment:** Low

**Environmental Considerations:** None

**Evaluation:** You will engage targets from a standing, kneeling and prone position on skis and snowshoes. This practical exercise will prepare you to move over a 10K cross country course; on the course you will engage targets from a standing, kneeling and prone position.

**Instructional Lead-In:** This lesson gives you firing techniques while moving on skis and snowshoes.

### SECTION III. PRESENTATION

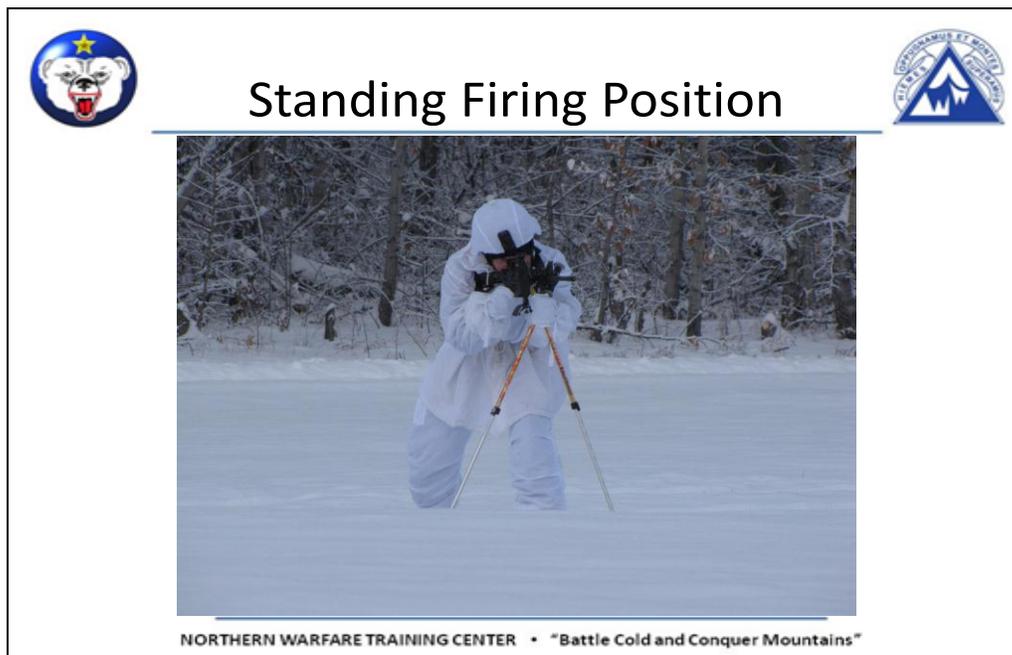
#### Learning Step/Activity 1 – Carry a weapon while using skis or snowshoes.

- a. Attach the sling to the rear sling swivel and the slip ring (where the hand guards attach to the receiver).
- b. 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
- c. Attach the sling at the slip ring and the small of the butt stock and hang in the same manner.
- OR
- d. Another method is by use of a “three point sling” available commercially.

#### Learning Step/Activity 2 – Select individual firing techniques on skis or snowshoes. (Picture 1)

a. Standing on Skis and Snowshoes - This firing position is best applied when fire must be returned quickly such as during an assault. When cover is available it should be sought. Make use of the depression around a tree trunk as it will lower the shooters profile. Do not allow snow to foul the weapon especially while it is hot. It is a good technique for long distance and rolling terrain and it is easy to get into. A major disadvantage is that it presents a high silhouette for the enemy. To get into position:

- (1) Assume a suitable standing firing position. Based on your situation, assume the position that will allow you to observe and engage targets, yet minimize your exposure to enemy fire.
- (2) Place the ski poles in the non firing hand in an X pattern.
- (3) Place the fore stock of the weapon in the crotch of the X for support. This will require the Soldier to squat slightly.
- (4) Place the ski or snow shoe of the firing side leg in a half herring bone position.
- (5) Maneuver by running on the snowshoes or kick and glide on skis. Carry the ski poles in the non-firing hand and the weapon in the firing hand.



Picture 1

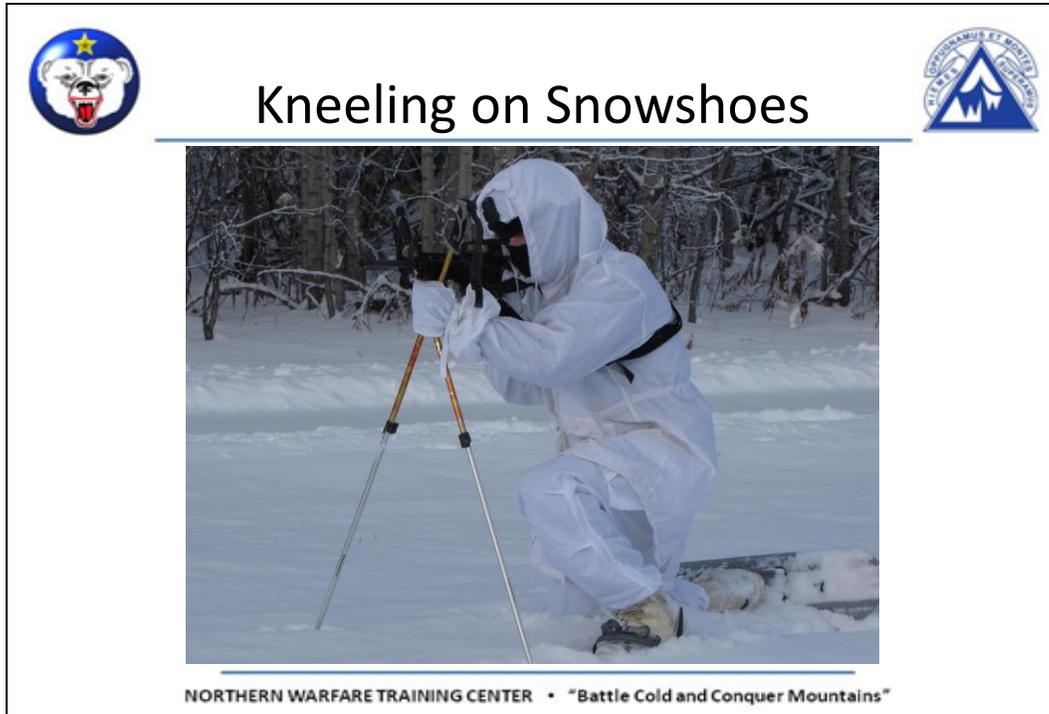
**b. Kneeling firing position skis (Picture 2)**

- (1) Assume a suitable kneeling firing position. Based on your situation, assume the position that will allow you to observe and engage targets, yet minimize your exposure to enemy fire.
- (2) Place the ski poles in the non firing hand in an X pattern.
- (3) Place the fore stock of the weapon in the crotch of the X for support.
- (4) Place the ski or snow shoe of the firing side leg in a half herring bone position. Take care that the snowshoe shovel does not injure the shin. If using skis, the firing side knee may be placed directly on top of the ski.
- (5) Point the ski or snow shoe of the non firing side leg in the direction of the target.
- (6) Maneuver by running on the snowshoes or kick and glide on skis. Carry the ski poles in the non firing hand and the weapon in the firing hand.
- (7) Place the knee on the firing hand side on the ski to maintain stability when the snow pack is deep and unconsolidated.



Picture 2

c. **Kneeling on Snowshoes. (Picture 3)** The technique is similar to kneeling on skis. However care must be taken to prevent the knee/shin on the firing hand side from being injured by the shovel of the snowshoe.



Picture 3

d. **Prone firing on skis and snowshoes. (Picture 4,5)** Similar to the standard prone position except that the soldier uses poles under elbows for flotation in deep snow and each ski or snowshoe is placed at ½ herringbone position. The snowshoes do not have to be placed in the ½ herringbone position. It provides a stable firing platform and a low silhouette, but it can be difficult to get out of, especially in deep snow.



Picture 4



Picture 5

### Learning Step/Activity 3 – Select firing techniques for crew served weapons. (Picture 6)

a. Crew served weapons cause problems because the additional weight will cause them to sink into snow. It may also be difficult to establish a stable firing platform on frozen ground or on ice. Effectively seating base plates for mortars into frozen ground may also cause problems. Some of the remedies for these problems were discussed in the Effects of Cold on Military Equipment; more detail is provided here on emplacement issues and firing platforms.

b. Using an ahkio as a support. The ahkio can also be used as a platform with the added advantage of keeping ammunition out of the snow. As noted in Effects of Cold on Military Equipment, it is useful for the AG to carry a small bottle of methanol (windshield wiper fluid) to defrost the weapon should it become iced over.



Picture 6

c. M-240 machinegun in tripod mode.

(1) Mount the machinegun on the tripod and secure it to the ahkio sled and the whole system can be moved at once if maneuver becomes necessary.

(2) Chip away ice or frozen ground for the tripod feet if the snow cover is shallow or non-existent.

(3) Fill sandbags with snow and use as a support for tripods in deeper snow in more static positions.

(4) Skis or snow shoes of the gun crew are placed in a herringbone position.

### Learning Step/Activity 4 – Demonstrate individual firing techniques on snowshoes.

**Note:** Have students demonstrate each firing position (standing, kneeling and prone) on snow shoes.

After a dry fire run, students will get 30 rounds to demonstrate each firing position.

### Learning Step/Activity 5 – Demonstrate individual firing techniques on skis.

**Note: Have students demonstrate each firing position (standing, kneeling and prone) on skis.**

**Learning Step/Activity 6 – Demonstrate individual movement techniques on snowshoes.**

**Note: Have students negotiate the IMT lane using each firing position (standing, kneeling and prone) on snow shoes.**

#### **SECTION IV. SUMMARY**

You now have the skills to move and shoot on skis or snowshoes.

#### **Check on Learning.**

1. What can be used to provide a stable platform for a crew served weapon?

A snowshoe or and Ahkio sled can be used.

2. What are the advantages and disadvantages of the kneeling position?

The kneeling position offers greater stability than the standing position and is easier to get into than the prone, but is not as stable as the prone position.

## SECTION II. INTRODUCTION

**Motivator:** Try to dig down in frozen ground and chances are you will either not get very far or will break your shovel. But you may still have the requirement to construct a fighting position. By using the materials at hand, you can build effective above ground fighting positions.

### Terminal Learning Objective

|                  |  |
|------------------|--|
| <b>ACTION</b>    | <b>Construct a Fighting Position in a Snow Covered Environment</b>   |
| <b>CONDITION</b> | In a snow covered field environment given a specific location with trees able to support a wall, a sector of fire, snow, logs, binding materials, and pioneer tools. While wearing Extended Cold Weather Clothing System appropriate to conditions, fighting load carrier, ballistic helmet and weapon. Fighting load carrier and weapon may be grounded but remain within easy reach. A location for ice crete will be furnished if it is necessary to produce ice crete blocks. This location will have a water source, gravel source, forms of uniform size and snow. |
| <b>STANDARD</b>  | Construct a fighting position wide enough for yourself, battle buddy and all equipment. Clear assigned sector of fire. Provide side, rear and overhead cover.  |

**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 to watch for cold weather injuries. Squad leader is responsible for taking breaks in warming shelters as required.

**Risk Assessment:** Low

**Environmental Considerations:** In USARAK, trees greater than 4 inches in diameter, in military training areas, will not be cut down without prior approval from Range Control.

**Evaluation:** You will be tested on your knowledge of fighting positions, 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 provides you with some techniques for constructing fighting positions when the ground is frozen.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Select building techniques for fighting positions in the cold weather environment.

Cold weather operations present some unique problems when constructing fighting positions. Ideally, positions should be dug into the ground, but in very cold climates the ground may be frozen to depths which make digging almost impossible with hand tools. Earth defenses of the conventional type are difficult to build without engineer assistance or demolitions. Consider the following when determining what type fighting positions to build, but always remember that, ultimately, there is no substitute for traditional defensive positions. Defenses constructed of snow and ice will eventually disintegrate under sustained fire, and are subject to the variability of the weather.

a. Construction materials. These are some of the construction materials that can be used to put together fortifications when the temperatures fall below zero: snow, frozen soil, ice, stone, timber.

b. Snow is an excellent construction material, but must be moved and packed in order for it to be truly effective at stopping projectiles. Moving and packing snow (i.e. shoveling it into piles), causes it to consolidate and increases the strength of this material. Wind will often do some of the work for you by packing snow into drifts that can be used as a start for shelters and fortifications.

- Wet snow packs well and is easier to shape. It becomes stronger as it sets and further strengthens if temperature drops after construction.
- Dry snow is less suitable for construction as it does not pack as well as wet snow. Takes longer to set after being moved.
- Hard Packed snow (wind slab) can be very hard. Makes very good shelters

c. Ice Crete is created using a form (such as an MRE box), and a combination of snow, soil, water rock, sand, gravel or silt. When it sets it will have all of the properties of Portland cement and is an excellent means of building above ground fighting positions when the ground is frozen solid. The primary disadvantage of this method is that it takes water to construct, which may not be readily available in large quantities. It is easiest to make a factory of sorts then transport the completed blocks to the area needed. Mix as follows:

(1) Mix equal parts snow, sand and 1" gravel in a large container.

(2) Add dry mix to a form- MRE box sleeve, ammo crate etc. strive for consistency in size and at least 12" thickness.

(3) Pour in water and continuously stir until mixture is the consistency of a wet snow cone. Too much water will cause the sand/gravel to settle out, too little will not bond the mix. Ensure the mixture is packed into the form or it will not set consistently.

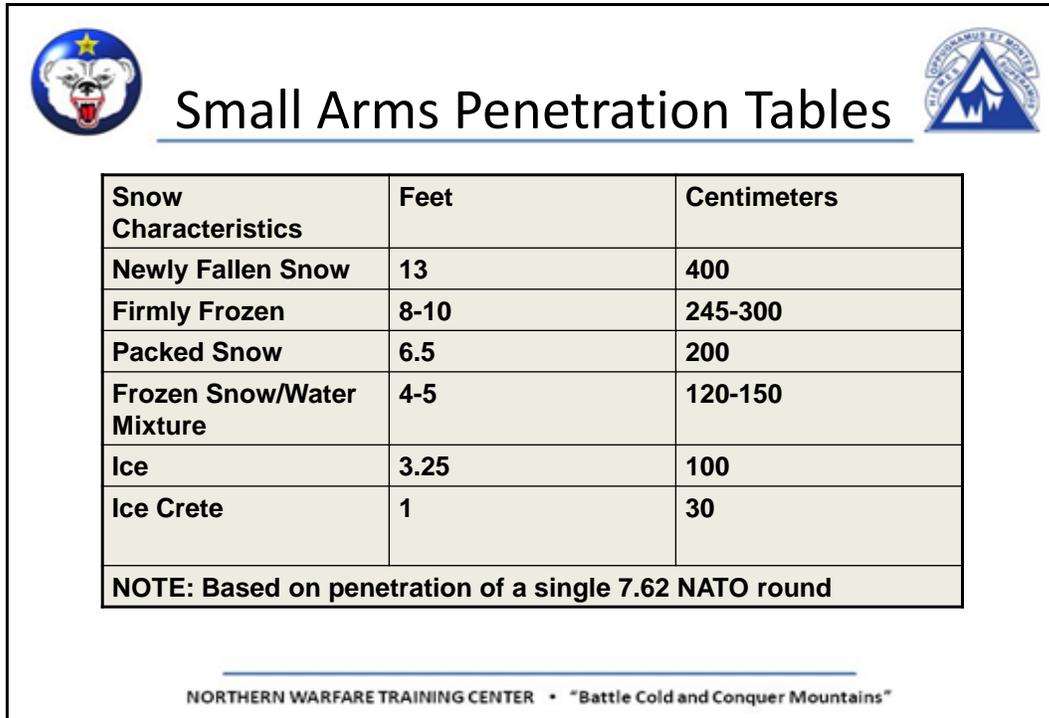
(4) Allow blocks to freeze. Time will depend on temperature.

(5) At building site stack the blocks in the same manner as concrete blocks overlapping the joints. Water and snow slush can be applied as a mortar to better bond the joints.

(6) The form will help the ice-crete block stay together under sustained fires. If there are not enough

forms to allow them to stay on the block and they have to be removed and re-used, be sure to reinforce the position with packed snow.

d. Small Arms penetration tables. (Table 1) The construction materials already noted provide variable protection. This table shows the type and amount of material needed to stop a single 7.62 NATO round.



The graphic contains two logos: a circular logo with a star and a stylized figure on the left, and a triangular logo with a mountain and a figure on the right. The title "Small Arms Penetration Tables" is centered between them.

| Snow Characteristics      | Feet | Centimeters |
|---------------------------|------|-------------|
| Newly Fallen Snow         | 13   | 400         |
| Firmly Frozen             | 8-10 | 245-300     |
| Packed Snow               | 6.5  | 200         |
| Frozen Snow/Water Mixture | 4-5  | 120-150     |
| Ice                       | 3.25 | 100         |
| Ice Crete                 | 1    | 30          |

**NOTE: Based on penetration of a single 7.62 NATO round**

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Table 1

e. Snow wall construction for protection from grenades, small-caliber fire and HEAT projectiles. Table 2 provides additional information for construction of snow fortifications.

| <i>Snow Density<br/>(lb per ft<sup>3</sup>)</i> | <i>Projectiles</i> | <i>Muzzle Velocity<br/>(ft. per sec)</i> | <i>Penetration<br/>(ft)</i> | <i>Required<br/>minimum<br/>thickness (ft)</i> |
|---|--------------------|--|-----------------------------|--|
| 18.0-25.0                                       | Grenade fragments  | -  | 2.0                         | 3.0  |
| 11.2-13.0                                       | 5.56mm             | 3250                                     | 3.8                         | 4.4  |
| 17.4-23.7                                       | 5.56mm             | 3250                                     | 2.3                         | 2.6  |
| 11.2-13.1                                       | 7.62mm             | 2750                                     | 13.0                        | 15.0   |
| 17.4-23.7                                       | 7.62mm             | 2750                                     | 5.2                         | 6.0  |
| 25.5-28.7                                       | 7.62mm             | 2750                                     | 5.0                         | 5.8  |
| 19.9-24.9                                       | 12.7mm             | 2910                                     | 6.4                         | 7.4  |
|   | 14.5mm             |  | 6.0                         | 8.0  |
| 28.1-31.2                                       | 70mm HEAT          | 900                                      | 14.0                        | 17.5   |
| 31.2-34.9                                       | 70mm HEAT          | 900                                      | 8.7-13.0                    | 10.0   |
| 27.5-34.9                                       | 90mm HEAT          | 700                                      | 9.5-11.2                    | 14.0   |

Table 2

**NOTE: Snow walls degrade under sustained fire. Penetrations given for 12.7mm or smaller are for sustained fire (30 continuous firings into a 1x1 foot area).**

**NOTE: Penetration characteristics of Warsaw Pact ammunitions do not differ significantly from US counterparts.**

**NOTE: Figure given for HEAT weapons are for Soviet RPG-7 (70mm) and US M67 (90mm) fired into machine packed snow**

**NOTE: High explosive grenades produce small, high velocity fragments that stop in 2 feet of packed snow. Effective protection from direct fire is independent of delivery method, including newer machine guns like the Soviet AGS-17 (30mm) or US MK-19 (40mm). Only armor penetrating round are effective.**

f. Follow these guidelines in constructing positions:

(1) Ground not frozen/light snow cover – construct conventional earth defense.

(2) Ground not frozen/deep snow cover – use combination of conventional positions and above ground positions.

(3) Ground frozen/light snow cover – if engineer support/demolitions are available, construct conventional defenses; when engineer support/demolitions are unavailable, positions must be built above ground.

(4) Ground frozen/deep snow cover – if engineer support/demolitions are unavailable, construct snow defenses. Otherwise, use a combination of conventional positions and above ground positions.

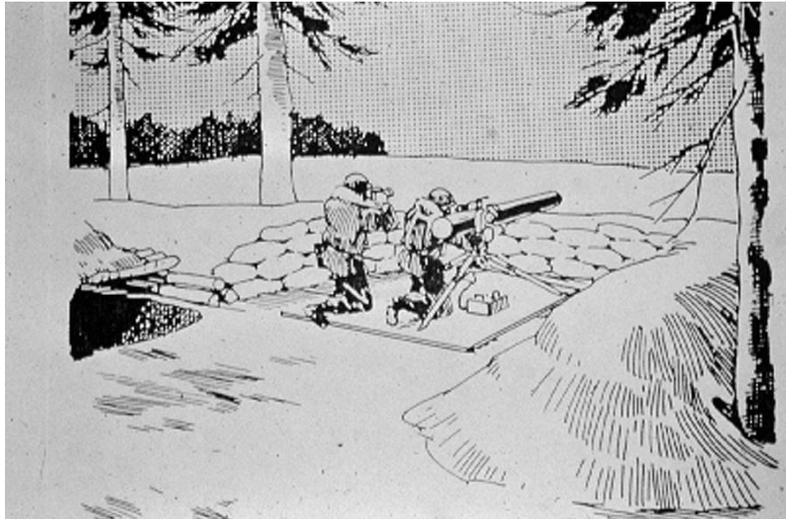
g. Standard rules apply for constructing overhead cover. Snow may be used in place of or with soil for overhead cover. Use snow for camouflage.

h. For any crew served weapon, a stable firing platform will need to be constructed. Plywood or timber will serve this purpose when there is time to prepare defenses. In the case of the TOW/ Javelin, overhead cover should be offset and to the rear to prevent back-blast from injuring personnel.

(Picture 1)



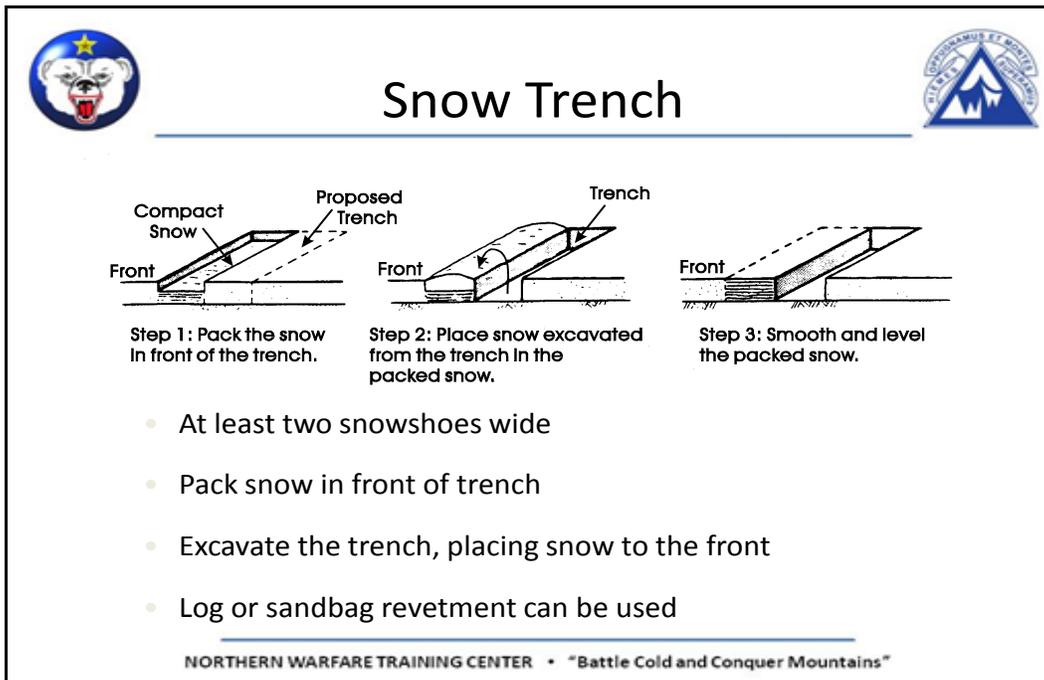
## TOW / Machine Gun Position



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

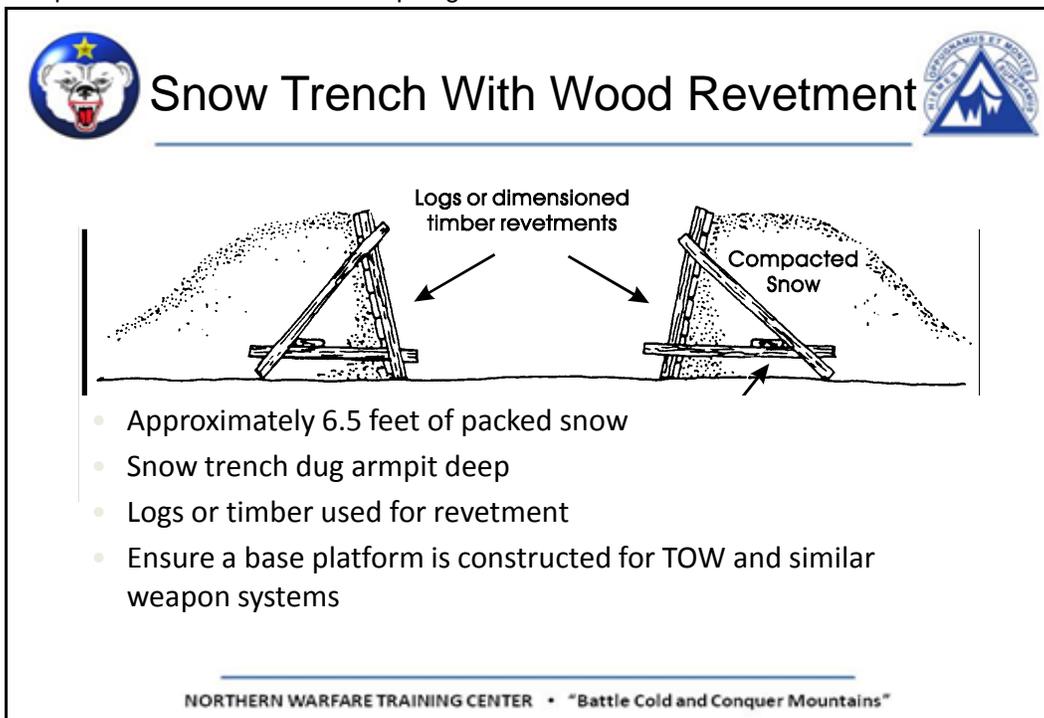
### Learning Step/Activity 2 – Select techniques for above ground positions.

- a. Above Ground Positions. Used when digging is not possible because of frozen ground or when little time is available. Parapets should be 8-9 feet in front and 2-3 feet thick on sides. Measure at the **top** of the packed snow. Flattening the top of parapets will help to deflect rounds.
- b. Snow bags, logs, and/or ice-crete should be used in the construction of more permanent defensive positions.
- c. One type of above ground position is the snow trench. (Picture 2) It should be dug to approximately arm pit depth.



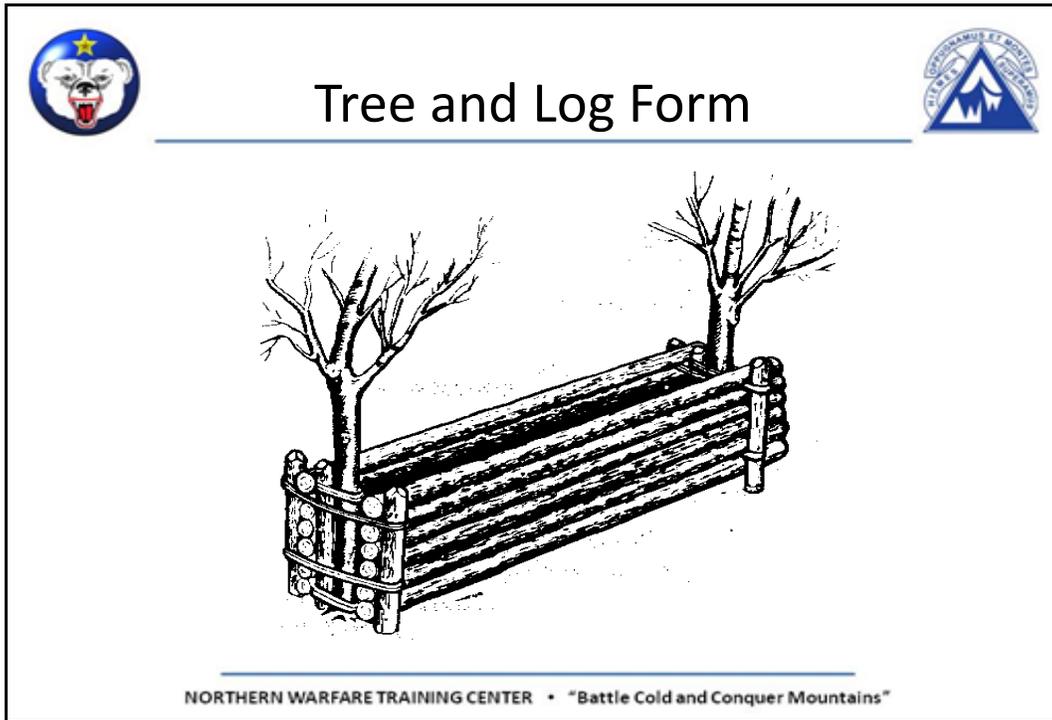
Picture 2

- d. Picture 3 is a variation constructed with timber revetments for increased protection from small arms and to prevent the shelter from collapsing under indirect fire.



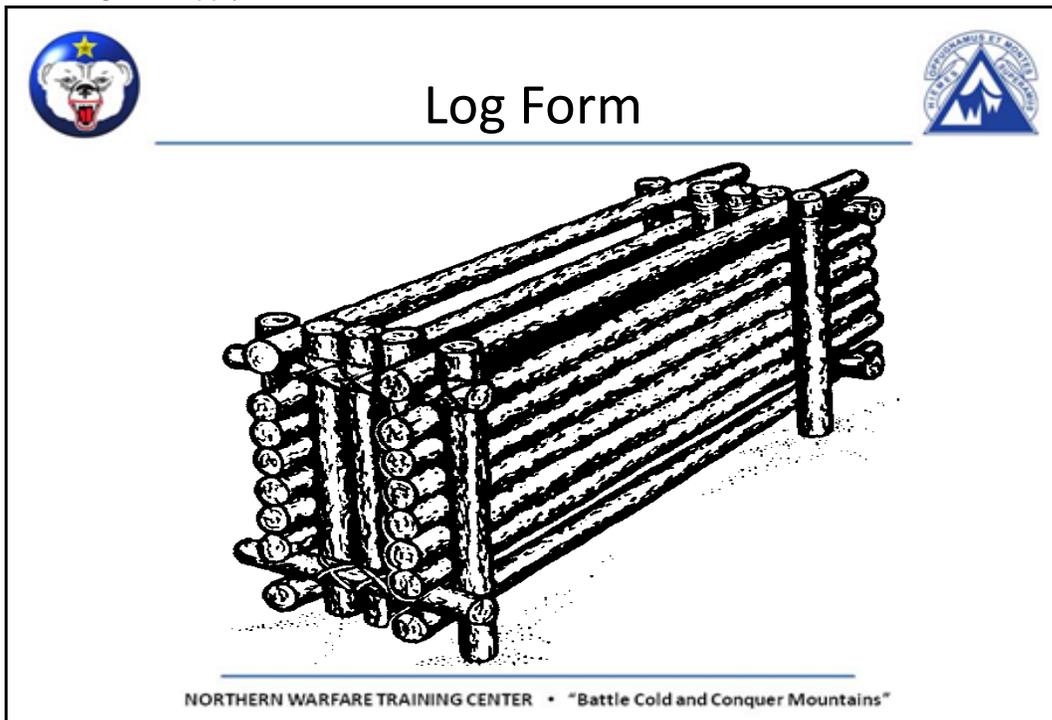
Picture 3

- e. Tree and Log Forms (Picture 4) provide increased protection from small arms and indirect fires when below ground positions cannot be constructed. Timber should be at least 6 inches in diameter. Minimize gaps between logs. They can be filled with rocks, snow, sand gravel etc. and water can be used to make ice-crete inside the form, further strengthening the position. Snow should be used to camouflage the position.



Picture 4

- f. The log form (Picture 5) free standing version of the tree and log form. The same considerations as tree and log form apply.

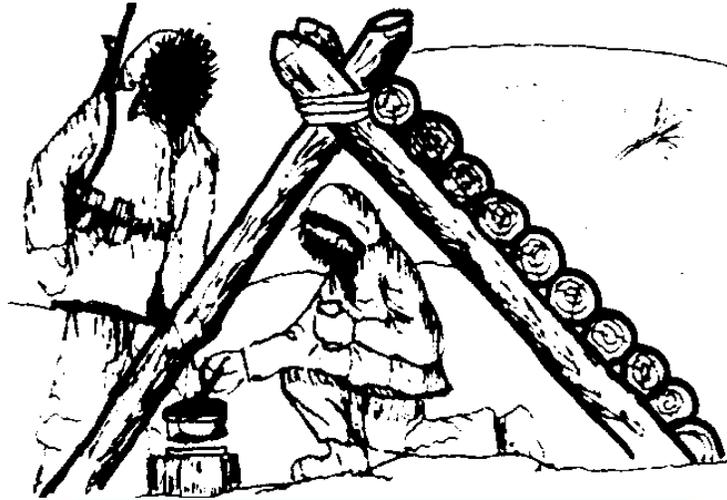


Picture 5

- g. The tripod supported (Picture 6,7) wall can also be constructed out of timber at least 6 inches in diameter and used as an effective above ground position. At least 8-9 feet of snow should be packed to the front of the position.



## Tripod Supported Wall: Side View



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 6



## Tripod Supported Wall: Rear View



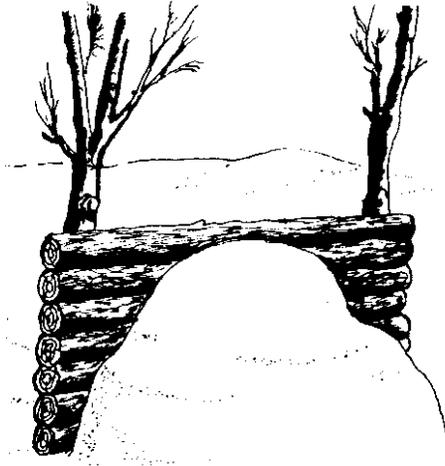
NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 7

- h. The tree supported wall (Picture 8,9) is similar to the tripod supported wall, but is easier to construct. Again pack at least 8-9 feet of snow to the front and ensure that the logs are completely covered for concealment of the position.



## Tree Supported Wall: Oblique View

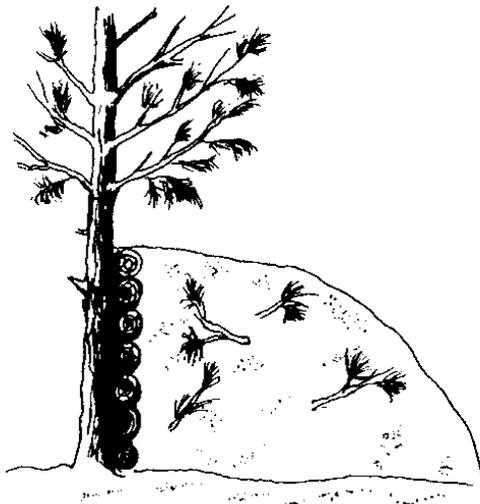


NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 8



## Tree Supported Wall: Side View



NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 9

**Learning Step/Activity 3 – Select building techniques for fighting positions in the cold weather environment.**

Give students load bearing equipment, helmet, personal weapon, appropriate clothing, a specific location with trees able to support a wall, a sector of fire, snow, logs, binding materials, and pioneer tools. A

location for ice crete will be furnished if it is necessary to produce ice crete blocks. This location will have a water source, gravel source, forms of uniform size and snow.

Each squad will construct a fighting position designated by the squad instructor. These positions will be constructed in the tactical bivouac area.

#### **SECTION IV. SUMMARY**

##### **Check on Learning.**

1. What are some of the materials that can be used to construct an above ground fighting position?

Snow, ice, soil, gravel, rock, trees.

2. How much packed snow does it take to stop a 7.62mm round?

6.5 feet of packed snow.

## SECTION II. INTRODUCTION

**Motivator:** “The cold has been identified as an enemy of military forces and equipment since the beginning of recorded history. When employed in a cold region, a force actually faces two enemies-- the tactical enemy and the environment that also aggressively attacks and can destroy equipment and men. The impact of cold weather on combat forces can readily be seen during decisive campaigns in history. Napoleon’s disastrous march into Russia, Germany’s failed conquest of Russia during World War II, and the operations of United Nations forces in Korea are modern examples. With United States (US) reliance on global force projection, Army forces must prepare to operate in a variety of climates, including extreme cold.”

### Terminal Learning Objective

|   |  |
|---|--|
| <b>ACTION</b>   | <b>Operate a Military Vehicle in Extreme Cold Weather</b>  |
| <b>CONDITION</b>  | In temperatures of 32° F to -60 °F, given the requirement to maintain and operate a military vehicle, and the correct technical manual and lubrication orders for the vehicle. |
| <b>STANDARD</b>   | Identify the common problems with cold weather vehicle operation. Take steps to reduce or eliminate problems caused by the cold before, during, and after operations.          |
| <b>Reference</b>  | TM 9-2320-387-10, TM 9-2350-285-10, TM 4-33.31 Operations and Maintenance of Ordnance Material in Cold Weather, USARAK 750-1,  |
| NOTE: This lesson plan has two Practical Exercises. Install tire chains and perform vehicle recovery with a winch (SUSV). |  |

**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 vehicle maintenance in cold 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:** This lesson will give you some common effects of cold on materials and vehicles as well as some tips and procedures to reduce or eliminate problems associated with operating vehicles in the cold.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Describe cold conditions and the effects that cold conditions have on materials.

a. Operating equipment in temperatures down to 10° F presents few problems. Conditions are similar to those experienced during winter in the northern part of the continental United States (CONUS).

b. From 10° F to -25° F, operations become more difficult. At the warmer end of this range, lack of winterization results in only a slight loss of operating efficiency. Proper training and preventive maintenance prevents many failures of materiel and injuries to you.

c. When temperatures drop below -25° F, operations become increasingly difficult. At temperatures nearing -50° F and lower, it will require maximum effort on your part to perform even the simplest tasks with completely winterized materiel. Even if heated facilities are available, the frozen parts will need to be thawed. This lag time will need to be planned for.

d. Other than extreme cold, conditions that affect equipment most often encountered in a cold weather environment include condensation, snow and frozen surfaces. Most equipment will operate normally down to about 10°F. Below this temperature the physical properties of materials change and can affect operations. Temperatures of 10°F to -65°F are encountered often in the winter season in the interior of Alaska and other regions of the world. Equipment must be winterized to function effectively in this range. Humidity and warm air combine with a piece of cold equipment to cause condensation. This can freeze the internal parts of vehicles and equipment and has greater detrimental effect in extreme low temperatures as it turns to ice. Snow creates similar moisture problems in addition to mobility issues. Cold temperatures hinder any penetration of the ground. Cold can also cause equipment to be cold soaked which may prevent operation, cause contact frostbite, fusing of components, and traction problems.

e. Effect on Materials. Severe cold changes the properties of materials that we use everyday. You must take special care to reduce the shock load that is placed on items affected by severe cold. Some metals can withstand only half of the shock load at -20°F that they can in temperate climates. This is the reason that ski lifts are shut down at -20° F. Rubber remains flexible to -20°F, then will gradually stiffen. At -60°F it loses all elasticity and becomes very brittle. Special care must be taken when handling rubber covered cables. They must be protected from bending and flexing. They should be warmed before bending to prevent insulation from cracking and causing a short. Plastics tend to expand and contract much more than metal or glass. Any materials made of plastic must be handled carefully. Glass and other ceramics can be expected to perform normally at low temperatures. However, cracking may result if heat is applied directly to a cold windshield or vehicle glass. Canvas and cotton duck fabrics retain their flexibility even at extremely low temperatures provided that they are kept dry. Some newer tent materials become brittle and difficult to fold at low temperatures. Flexible tent windows are extremely difficult to smooth out at subzero temperatures.

f. Maintenance Plans. Maintenance becomes increasingly difficult as temperatures drop. Prioritizing what vehicle gets repaired first must balance the tactical and life support needs of the units. The unit as a whole must understand that there will be lag times as vehicles are thawed first before work can be performed. Recovery vehicles can become taxed quickly. Maintenance plans must address:

- Shelter sized to accommodate the vehicle
- Heaters capable of thawing the equipment
- PPE for personnel who may have to work outside

- Repair parts availability
- Storage areas for fluids
- Snow and ice removal and dump sites

**Learning Step/Activity 2 – Describe the effects of extreme cold on antifreeze, fuels, lubricants and batteries.**

a. An anti-freeze mixture of anti-freeze compound and water must be used to protect cooling systems from freezing. It is imperative that the correct mixture of antifreeze to water is used for maximum protection.

The optimal mixture for extremely low temperature protection is 68% antifreeze and 32% water (7 parts antifreeze to 3 parts water to make it easy). Above or below this mixture will result in reduced cooling/antifreeze protection.

Arctic type antifreeze offers the maximum low temperature protection to -90°F, but is not efficient at higher temperatures. It is only compatible with selected types of equipment.

Ensure vehicles have correct thermostats and winter fronts or radiator shutters installed.

b. Fuels.

(1) Mogas is not affected by low temperatures, although there are additives available which will increase the performance.

(2) Diesel fuel contains waxes that congeal at temperatures below 0°F. If this occurs, the fuel filter will clog and the fuel will not flow. Diesel fuel, Arctic (DFA), does not contain as much wax and performs well at low temperatures.

(3) Condensation and water can accumulate in fuel containers, pumps, carburetors and fuel injectors. At low temperatures, this water will form ice crystals that will clog fuel lines, filters, jets, and injector nozzles. To prevent this, add fuel system icing inhibitor to diesel fuels. Add methanol, technical, to gasoline.

(4) Some fuels come premixed and adding too much ice inhibitor can cause reduced engine performance and possible engine damage.

c. Hydraulic Fluids. There are specific recommendations in TM's and LO's concerning the proper hydraulic fluid for cold temperatures.

d. Lubricants. Lubricants represent the single most critical problem encountered by vehicles in cold regions. A vehicle lubricated for use in temperate regions will simply not operate in extremely cold temperatures. A chunk of heavy gear oil can be used to pound nails at -40°F.

(1) USARAK 750-4 (Picture 1,2 ) governs lubricants used on vehicles and weapon systems. Other units should check applicable TM's and FM 9-207 for recommended lubricants. Lubricant orders are based upon three temperature ranges:

- above 32° F
- +40° to -10° F
- from 0° to -65° F

(2) Store lubricants in warm place.

(3) OEA (oil, engine, arctic) is generally best for cold weather operations, and can be used for short periods of time in temperate conditions. This will allow you to winterize vehicles prior to load-out when deploying from a temperate to a cold region.

(4) Lubricants must have a sufficiently low viscosity for low temperatures.

(5) Use of unsuitable lubricants will result in difficult starting, shifting, and equipment failure.

(6) GAA has a very wide heat tolerance of -50°F to +225°F and can be used year round.



## LUBRICANTS

---

**Engines will use Oil, Engine, Synthetic, OEA, 0W30 year round unless specified otherwise by manufacturer.**

**Transmissions, gear cases and hydraulic and power steering systems use OEA 0W30.**

- OEA is compatible with all transmission fluids including Dexron III.
- Can be mixed with other types of fluids.

**Caterpillar transmissions use 15W40**

**Allison (FMTV) transmissions use OEA only**

---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 1



## LUBRICANTS

---

**Manual transmissions, transfers, differentials and final drives use Oil, Gear 75/90 Synthetic**

- HEMTT and HMMWV transfer cases use OEA

**Chassis and wheel bearing lubricant is Grease Automotive and Artillery (GAA)**

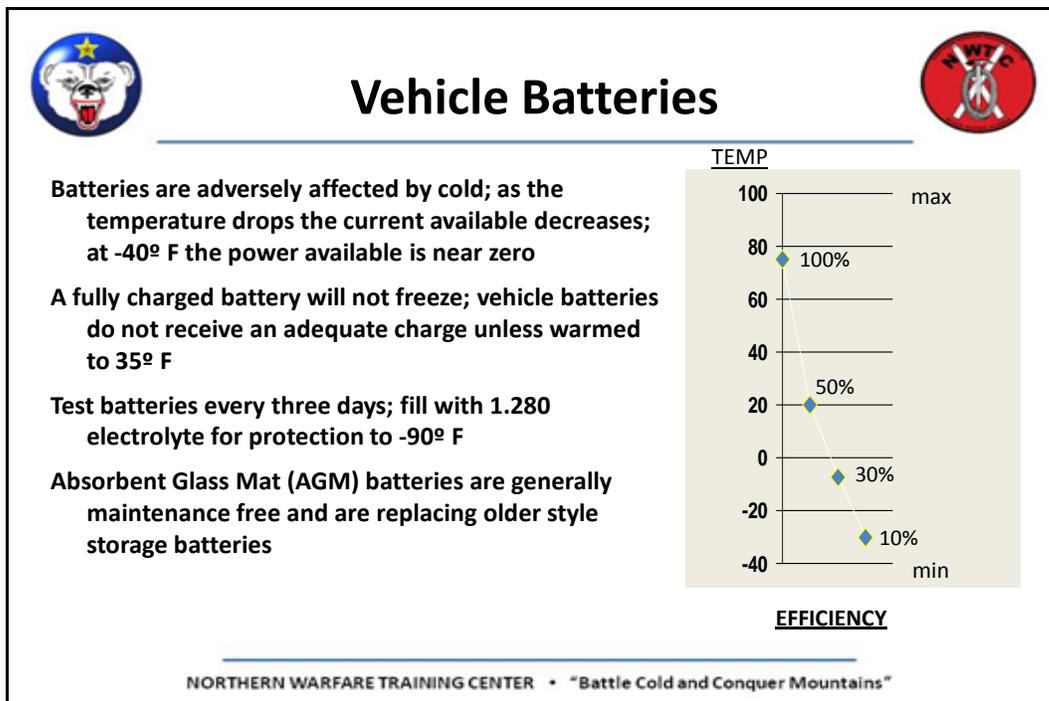
---

NORTHERN WARFARE TRAINING CENTER • "Battle Cold and Conquer Mountains"

Picture 2

e. Vehicle Batteries.(Picture 3) Batteries are adversely affected by the cold; available power decreases as battery temperature decreases.

- (1) As temperatures fall, the battery's available energy will also fall. Power requirements for starting a vehicle increase when the battery is least capable of delivering power. For example at 15° F, a fully charged battery will only deliver 50% of the current normally produced. At -40 and below the available current is just about zero.
- (2) A fully charged battery will not freeze. Frozen batteries rupture and break internally and externally.
- (3) Vehicle batteries do not receive an adequate charge unless the battery is warmed to about 35 F.
- (4) At temperatures below -25° F, batteries should be tested every three days. If the specific gravity is less than 1.1250, the battery should be recharged.
- (5) Batteries should be filled with 1.280 specific gravity electrolyte (different from the standard 1.250 electrolyte), as this will protect the battery to -90 F.
- (6) Ensure that the battery has not frozen prior to jump-starting a vehicle. A frozen battery can explode due to the combination of hydrogen gas and the blockage of battery vents by ice.
- (7) Absorbent Glass Mat (AGM) batteries are due to replace the standard vehicle batteries. They are generally maintenance free, will not freeze and have a longer life span than conventional vehicle batteries. Another advantage is that they may be submersed in water with no adverse effects.



Picture 3

f. Small equipment batteries. Small equipment batteries for flashlights, Night Vision Devices, and field telephones should use alkaline batteries. Two sets of batteries should be available for each item of equipment. One set can be carried under the Soldiers insulating garments. When cold degrades the performance of equipment, batteries can be rotated. To get maximum effectiveness out of Nickel-Cadmium, or NiCad, batteries, the charging memory must be destroyed. The battery must be completely discharged before it can be recharged. Ni-Cad batteries are a very effective low temperature power source. Lithium based batteries are the preferred cold weather battery. The lithium sulfur dioxide battery is recommended for use with the SINCGARS. Mercury batteries should not be used below 0°F. The Additional Items Authorized table in a TM has items that can be used to externally heat small equipment batteries.

### **Learning Step/Activity 3 - Describe preparation and operation of military vehicles in extreme cold weather.**

a. Movement in cold weather environments can be one of the most difficult tasks that a unit may encounter. Vehicles are the preferred method of movement, but, with cold weather comes a higher maintenance requirement and incidence of problems. Some of the most commonly encountered problems are listed below, along with some useful problem-solving tips, which may assist you in accomplishing your mission:

- (1) Wheel Bearings. Wheel bearings are serviced for all year round operations as GAA is rated from 225° F down to -50° F. A simple check for proper adjustment is all that is required.
- (2) Hydraulic Brakes. A simple check for a full reservoir is all that is required – no change of fluids.
- (3) Air Brakes. Drain reservoirs immediately after operation and close drain cocks immediately after draining to prevent from freezing in the open position. Failure to do this can cause condensation between the brake shoes and pads to freeze making the vehicle impossible to move. Portable heating equipment will be needed to correct this. Condensation in brake lines, chambers etc. can freeze and create failures in the braking system.
- (4) Central Tire Inflation Systems (CTIS) and other vehicle air compressors can experience frozen condensation problems similar to air brakes. At a minimum, drain air tanks after operation. Check for frozen valves and report these immediately. Alcohol evaporators are part of winterization kits and are designed to draw water out of the air going into the compressors. These should be checked before, during and after operations.
- (5) Steering Gear. Improper lubricants congeal making steering difficult or impossible. OHT or OEA is the proper lubricant for hydraulic power steering reservoirs. DEXRON II should not be used.
- (6) Shock absorber fluid may congeal at low temperatures resulting in a hard riding shock or broken shock absorbers. Check that they are still mounted securely to the frame and under extreme cold conditions move the vehicle slowly for the first 3-5 miles of operation to allow the lubricant in the shocks to warm up.
- (7) Springs can become brittle and break at low temperatures. Check clips, leaves, bolts, hangars, and shackles for proper mounting and tighten loose components.

- (8) Tires become more rigid and develop flat spots when parked in extreme cold temperatures. Inflate tires in a warm environment such as motor pool, to 10PSI above normal. This allows for contraction and pressure loss once vehicle is out in the cold. Place barrier materials, (spruce branches, cardboard) under tires to prevent freezing to ground when parked for long periods of time.
- (9) Winterize fire extinguishers IAW the appropriate fire extinguisher technical bulletin.
- (10) Oil engine Arctic (OEA) should be used for cold weather operations. Drain the engine lubrication system when the engine is warm.
- (11) Antifreeze. Ensure that proper antifreeze/water mixture is utilized. Generally a 68% antifreeze, 32% distilled water mixture offers the best protection against extreme cold temperatures.
- (12) Inspect all belts and hoses for cracks, dry-rot, or breaks, and replace as necessary.
- (13) Ensure vehicles have correct thermostats installed. To get the vehicle to an operating temperature that will allow the engine to operate properly, a thermostat in the temperature range of 190 to 195 degrees F should be installed in a vehicle that normally uses a 150° F thermostat.
- (14) Install winter fronts or radiator shutters (radiator covers).
- (15) Ensure that the vehicle personnel heater is mounted and operational.
- (16) Ensure that tire chains, ice scrapers, and other equipment required for operation in cold/icy/deep snow conditions is present, and that vehicle crews are thoroughly trained in their use. Tire chains should be pre-fitted to vehicles, and their mounting/dismounting should be a crew drill.

b. Vehicle operation. Vehicles must be tuned and serviced prior to the onset of the winter. Cold will cause an improperly tuned motor to run even less efficiently. Always PMCS vehicle before, during, and after vehicle operation. Follow the TM when doing so. Some additional considerations for operations are:

- (1) Heat retention devices such as winter-fronts and higher temp thermostats must be installed to allow efficient operation.
- (2) Start engine and allow vehicle to idle for approximately 5 minutes before moving. Drive slowly at first, allow time for moving parts to reach operating temperatures before increasing engine speed.
- (3) It may be necessary to start and idle vehicles periodically to prevent the vehicle engine from becoming cold soaked and to warm lubricants. The rate at which this is done is based upon the ambient temperature. As temperatures dip below -25 F, it may be necessary to idle vehicles for longer periods or at times continuously. One rule of thumb is to run the vehicle for 20 minutes every 2.5 hours. It should be remembered that this will shorten the life span of engine components, increases fuel consumption and discharges batteries. It can compromise positions due to exhaust output and heat signatures. It may also increase the chance of carbon monoxide poisoning.

- (4) Downgrade all hoist and winch capabilities. Certain metals will lose up to 50% of their shock load tensile strength at temperatures of  $-20^{\circ}\text{F}$  or colder.
- (5) Ensure that correct engine idle is set for proper battery charge (usually 1100-1200 rpms). This may have to be increased or set higher for vehicles that operate as a command or communications vehicle and run for longer periods.
- (6) Remove ice and snow from windows.
- (7) If CTIS equipped, select mode for this type of terrain; watch for indicator showing correct mode selection on CTIS panel and adhere to speed restrictions. CTIS may have to be off until tires warm.
- (8) Place vehicle into motion by following general operating procedures in the applicable vehicle TM under "operation under unusual conditions."
- (9) Begin movement in second or third gear (manual transmission) rather than first or low. Engage clutch gradually to prevent wheel spin. Drive slowly at first; allow time for moving parts to reach operating temperatures before increasing engine speed.
- (10) For automatic-transmission-vehicles use D2 range and gradually apply throttle.
- (11) Avoid quick acceleration.
- (12) Drive at reduced speed for better control and safer stops.
- (13) Display turn signals earlier than usual (if tactical situation permits).
- (14) Maintain at least double the normal following distance from the vehicle ahead.
- (15) Pump brakes to give early warning to those following of your intention to stop (Non ABS).
- (16) Apply steady brake pressure earlier when stopping for warn others of your intentions (ABS only).
- (17) Descend moderate grades in the gear normally used to climb the same grade.
- (18) Install tire chains prior to vehicle operation.

**NOTE: The rest of this Lesson Plan is Practical Exercises.**

#### **Learning Step/Activity 4 – Install tire chains on a wheeled vehicle. (HMMWV)**

- a. See APPENDIX E and F.

#### **Learning Step/Activity 5 – Perform vehicle recovery using a winch. (SUSV)**

- a. See APPENDIX G or TM 9-2350-285-10.

### **SECTION IV. SUMMARY**

You now have a general understanding of some of the challenges associated with operating vehicles in the cold weather and some techniques to overcome these problems. Refer to equipment specific manuals for more detailed information on cold weather operation.

#### **Check on Learning.**

1. At what temperature does the cold start to significantly effect most military equipment?

At temperatures below 10 degrees F, the cold will start to have a significant effect on most military equipment.

2. What type of batteries are preferred in the cold weather environment?

Lithium based batteries are preferred in the cold weather environment. NiCad will also work well provided the “memory” is erased prior to recharging these batteries.

## SECTION II. INTRODUCTION

**Motivator:** Since the very early days of human activity Soldiers of all armies have had to carry the means to fight and sustain themselves. Technology has made the load smaller and somewhat lighter but the need to move it still exists and this usually means it goes on the Soldiers body. Failure to load yourself correctly will make for a miserable experience at the least and may lead to injury.

### Terminal Learning Objective

|                  |   |
|------------------|---|
| <b>ACTION</b>    | Pack a Rucksack   |
| <b>CONDITION</b> | In a field or classroom environment, given a mission rucksack, seasonal packing list, fighting load carrier, weapon and ballistic helmet. |
| <b>STANDARD</b>  | Pack your rucksack to assure the load is accessible, balanced, compressed and streamlined.  |

**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

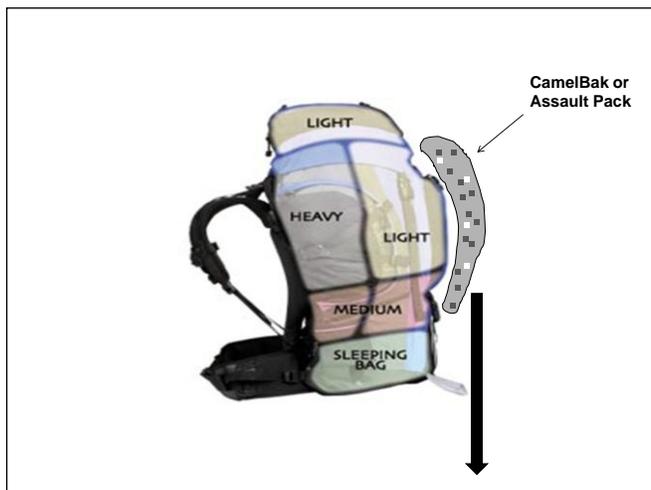
**Evaluation:** You must score a 70% on the written exam. If you fail the written exam, you will be given a second exam after re-training has been conducted. If you fail this second examination, you will be dismissed from the course.

**Instructional Lead-In:** Your ability to move through the environment whether in training or actual combat is directly affected by what and how you pack.

## SECTION III. PRESENTATION

### Learning Step/Activity 1 – Pack a rucksack.

- a. There are a few tricks to packing and carrying a heavy pack that will make life a bit easier during movement.
- Accessible-** mission critical items should be readily retrievable at any given time in a mission. The location of these items must be standard across the unit. Keep like items together.
  - Balanced-** A pack that is lop-sided is a miserable experience. Ounces make pounds. Police your Soldiers to reduce the non-essential and redundant equipment. Strive to use multifunction equipment as much as possible. MRE's can be field stripped and packaging removed from items. It must be noted though, waterproofing is absolutely necessary. A drenching rain can more than double the weight of your equipment very quickly.
  - Compressed-** Utilize the compression straps to keep the internal load from shifting around. This also keeps the load closer to the body. 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.
  - Streamlined-** Hanging equipment on the outside of the pack is a very poor practice. Heavier items can be felt swinging with each step. Heavy items such as hydration bladders and assault packs (see illustration below) will act like a lever actually increasing the felt weight. Place these things directly on top or inside, close to the body. 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 axe 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.

Pack heavy items close to the body. Heavy items act like levers the further away they get.

## **Learning Step/Activity 2 – Manage loads.**

- 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. 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.

## **SECTION IV. SUMMARY**

You now have the fundamental skills required to pack your equipment efficiently.

### **Check on Learning.**

1. What are the three fundamentals of packing a rucksack?

A-accessible. B balanced C- compression S- streamlined

2. What is the relevance of standardization?

Everyone knows where to find a particular item eg; ammunition without unloading everything.

## Appendix A: Ahkio components and Army Approved Heaters

Tent group equipment is designed for use by a rifle squad; however, it can readily be structured to accommodate any task-organized unit, regardless of that unit's size or mission. This section will discuss equipment you will need to be intimately familiar with before undertaking field training in a cold weather environment. The tent group equipment is also commonly referred to as the ahkio group, as the tent and the ahkio are the two key items among all the equipment that constitutes the group.

a. The following is a list of typical tent group equipment recommended for a light infantry squad operating in cold regions:

Table 1: Tent (Ahkio) Group Contents

| ITEM  | # | NSN or ordering information  |
|---|---|--|
| Scow-sled, 200 lbs. capacity (ahkio)                              | 1 | 8920-00-273-8211   |
| Tent 10-man Arctic, complete with pole board                      | 1 | 8340-00-262-3684<br>Steel stakes 8340-00-823-7451  |
| Pole Board  | 1 | Cut a 1'x1' piece of plywood. Cut a second 5"x5" piece of plywood. Bore a hole that is slightly larger than the tent pole diameter into the center of the 5"x5" piece and glue it to the center of the 1'x1' piece.              |
| Door Poles  | 2 | Cut two 6 foot poles that are 2-3 inches in diameter   |
| Space Heater Arctic (SHA)   | 1 | 4520-01-444-2375   |
| Stove board   | 1 | Cut a piece of plywood 3' x 2', rip it lengthwise in half, cover top side with galvanized sheet steel and re-join the two pieces with hinges. This allows you to fold it in half for storage.                                    |
| Fuel Can Stand  | 1 | 4520-01-465-4430   |
| Five gallon fuel can  | 1 | 7240-01-337-5268   |
| Five gallon water can   | 1 | 7240-00-089-3827   |
| D-handle coal shovels   | 2 | 5120-00-188-8446   |
| Machetes (with sheath)  | 2 | 5110-00-813-1286   |
| Squad cook sets   | 2 | 7630-00-272-2485   |
| Squad stoves  | 2 | NWTC uses the MSR Whisperlite Internationale OR the MSR XGK-EX (this stove can be fitted with a jet that burns JP-8) Contact MSR <a href="http://www.msrgear.com">www.msrgear.com</a><br><br>7310-01-578-6413 XGK<br>Whisperlite |
| Fuel bottles  | 2 | 7240-01-351-2133   |
| Bow saw   | 1 | 5110-00-340-3276   |
| Ax  | 1 | 5110-01-416-7827   |
| Hammers 2 lb.   | 2 | 5120-00-203-4656   |
| 50 or 60m static rope OR Army 120' Greenline                      | 1 | 4020-01-526-6234 (NWTC uses Blue Water Ropes/<br>contact APEXX 404-551-4913 or <a href="http://www.apexsales.com">www.apexsales.com</a> )<br><br>4020-01-577-8714  |
| Trace, ahkio pulling, 9 ft  | 3 | Cut from static rope (you can buy in spools and cut)   |
| Tow Rope 27 feet  | 1 | Cut from static rope   |
| Harnesses, Man's, Sled (ahkio towing)                             | 4 | 8465-00-255-8413   |
| Aluminum oval carabiners (used for towing and rescue systems)     | 8 | 8465-01-578-8906   |
| Aluminum Locking Pear Shaped Carabiners (used for rescue systems) | 2 | 8465-01-578-8898   |
| 25' 1 inch tubular nylon webbing (used for rescue systems)        | 1 | 8305-00-268-2455   |
| 6' 7mm cordelette   | 2 | 4020-01-577-8686   |
| Fire extinguisher   | 1 | 4210-00-165-4703   |
| Lantern, gasoline*, with case                                     | 1 | NWTC utilizes a Coleman Brand White Gas Lantern  |

**\*CAUTION:** THE USE OF PROPANE-FUELED LANTERNS DURING COLD WEATHER OPERATIONS IS NOT RECOMMENDED. PROPANE TURNS TO LIQUID AT APPROXIMATELY -40°F. IN THIS LIQUID STATE IT MAY SPRAY FROM ITS' CONTAINER WHEN THE VALVE IS OPENED, CREATING AN EXTREMELY HAZARDOUS CONDITION.



Figure 1: Tent (Ahkio) Group Contents

b. The scow sled, 200 lb. capacity, commonly known as the ahkio, is the infantry squad's primary means of transporting tents and other sustainment equipment in a cold weather environment. It is a 38 pound fiberglass sled with an attached canvas cover, and has a carrying capacity of 200 pounds. In addition to its' primary function of transporting the tent group equipment, the ahkio is excellent for transporting weapons, rations, and ammunition, providing a stable firing platform for crew-served weapons in deep snow, and for casualty evacuation.

## Heater Models and Applications

| Item  | Description   | Item   | Description   |
|---|---|--|---|
|    | <b>Space Heater Small</b><br><b>4520-01-478-9207</b><br>16"L x 9" W x 14" H<br>32 Lbs.<br>12,000 BTU/Hr                                 |    | <b>UH680DH</b><br><b>PN 168325</b><br>30"L x 11" W x 24" H<br>125 Lbs.<br>60,000 BTU/Hr<br>110 VAC, 450 Watts                                     |
|    | <b>Space Heater Arctic</b><br><b>4520-01-444-2375</b><br>17"L x 9" W x 17" H<br>41 Lbs.<br>25,000 BTU/Hr                                |    | <b>Large Capacity Field Heater</b><br><b>4520-01-500-1534</b><br>62"L x 40"H x 44.5W<br>622 Lbs.<br>400,000 BTU/Hr<br>Self-Powered, Diesel Engine |
|   | <b>H45 Space Heater</b><br><b>4520-01-329-3451</b><br>18" Dia x 24" H<br>65 Lbs.<br>45,000 BTU/Hr                                       |   | <b>MTH150</b><br><b>PN 15000</b><br>56"Lx26"Wx31"H<br>200Lbs<br>120,000 BTU/Hr<br>110 VAC, 12 Amps  |
|  | <b>Space Heater Convective (SHC35)</b><br><b>4520-01-431-8927</b><br>40"L x 14" W x 18" H<br>74 Lbs.<br>35,000 BTU/Hr<br>Self-Powered   |  | <b>MTH150CP</b><br><b>PN 15000-1</b><br>56"Lx26"Wx31"H<br>200Lbs<br>120,000 BTU/Hr<br>110 VAC, 12 Amps<br>CBRN Ready                              |
|  | <b>Space Heater Convective (SHC60)</b><br><b>4520-01-520-6477</b><br>44 3/4 "x 17"x19"<br>98Lbs.<br>60,000 BTU/Hr<br>Self-Powered       |  | <b>MV60S-1</b><br><b>PN 53457-1</b><br>51"Lx16.5"Wx25"H<br>115Lbs<br>60,000 BTU/Hr<br>110VAC, 4.75Amps  |
|  | <b>UH68G1</b><br><b>Space Heater</b><br><b>4520-01-203-4410</b><br>26"L x 22"H x 10W.<br>110 Lbs<br>60,000 BTU/Hr<br>110 VAC, 450 Watts |  | <b>A20, Space Heater</b><br><b>4250-01-396-2826</b><br>27"L x 8" Dia.<br>38 Lbs.<br>60,000 BTU/Hr<br>24 VDC, 20 amps                              |

| <b>Application</b>                 | SCT | 5 and<br>10 man<br>Arctic | GP<br>Small | GP<br>Medium | 305 | MCPS | SSS | TEMPER<br>Tent | MGPTS<br>Small | MGPTS<br>Medium |
|------------------------------------|-----|---------------------------|-------------|--------------|-----|------|-----|----------------|----------------|-----------------|
| <b>Space<br/>Heater<br/>Small</b>  | X   |                           |             |              |     |      |     |                |                |                 |
| <b>Space<br/>Heater<br/>Arctic</b> |     | X                         |             |              |     |      |     |                |                |                 |
| <b>H45</b>                         |     |                           |             | X2           | X   | X2   | X2  | X2             | X              |                 |
| <b>SHC 35</b>                      |     |                           | X           | X2           | X   | X    | X2  | X2             | X              |                 |
| <b>SHC 60</b>                      |     |                           | X           | X            | X   | X    | X   | X              | X              |                 |
| <b>UH68ODH</b>                     |     |                           | X           | X            | X   | X    | X   | X              | X              |                 |
| <b>MV60S-1</b>                     |     |                           | X           | X            | X   | X    | X   | X              | X              |                 |
| <b>MTH150</b>                      |     |                           |             |              |     |      | X   | X              |                | X               |
| <b>MTH150CP</b>                    |     |                           |             |              |     |      | X   | X              |                | X               |

Hunter Manufacturing Company

800-684-6111

[www.huntermfgco.com](http://www.huntermfgco.com)

**Appendix B:  
NSN's of Cold Weather Equipment**

**Ahkiio Group**

| NSN              | ITEM DESCRIPTION     | UNIT OF ISSUE | NUMBER                                 |
|------------------|----------------------|---------------|--|
| 5110-00-340-3276 | BOW SAW              | EA            | 1                                      |
| 7240-00-089-3827 | CAN, WATER           | EA            | 1                                      |
| 8340-00-242-7872 | CLIP, LINER          | EA            | 1                                      |
| 8305-00-926-6171 | CLOTH, DUCK, 5 YARDS | EA            | 1                                      |
| 7630-00-272-2485 | COOK SET, FIVE MAN   | EA            | 2                                      |
| 4210-00-165-4703 | FIRE EXTINGUISHER    | EA            | 1                                      |
| 5120-00-203-4656 | HAMMER, 2 ½ POUND    | EA            | 2                                      |
| 8465-00-255-8413 | HARNESS, MAN'S, SLED | EA            | 4                                      |
| 5120-00-Z27-0001 | LANTERN WITH CASE    | EA            | 1                                      |
| 8340-00-262-3698 | LINER, TENT          | EA            | 1                                      |
| 5110-00-813-1286 | MACHETE, WITH CASE   | EA            | 2                                      |
| 8340-00-965-4432 | PEAK PLATE           | EA            | 1                                      |
| 8340-00-823-7451 | PIN, TENT, STEEL     | EA            | 13                                     |
| 8340-00-188-8413 | POLE, TENT           | EA            | 1                                      |
| 5120-00-188-8446 | SHOVEL, COAL         | EA            | 2                                      |
| 8920-00-273-8211 | SLED, SCOW           | EA            | 1                                      |
| 8340-00-205-2759 | SLIP, TENT LINE      | EA            | 1 PER LINE                             |
| 7130-00-Z27-1824 | STOVE, WHISPERLITE   | EA            | 2                                      |
| 8110-01-415-3957 | FUEL BOTTLE 1QT      | EA            | 2                                      |
| 8340-00-262-3684 | TEN MAN TENT, ARCTIC | EA            | 1                                      |
| 8340-00-262-3658 | TENT LINE, 12' 6"    | EA            | 1 PER CORNER<br>EAVE, EAVE AND<br>DOOR |
| 8340-00-262-6911 | TENT LINE, 19'       | EA            | 1 PER CORNER                           |

**Coleman Lantern**

| MFR PART NUMBER | ITEM DESCRIPTION   | UNIT OF ISSUE |
|-----------------|--------------------|---------------|
| 288-4411        | BALL NUT           | EA            |
| 290-5341        | BURNER ASSEMBLY    | EA            |
| 290-763         | CARRYING CASE      | EA            |
| 200-6381        | CHECK VALVE SYSTEM | EA            |
| 290-5291        | COLLAR             | EA            |
| 290-5231        | FEED TUBE ASSEMBLY | EA            |
| 290-6151        | FOUNT              | EA            |
| 290-5301        | FRAME ASSEMBLY     | EA            |
| 220C1401        | FUEL CAP           | EA            |
| 290-5891        | GENERATOR          | EA            |
| 690A048         | GLOBE              | EA            |
| 288-5491        | KNOB               | EA            |
| 290-700         | LANTERN            | EA            |
| 288-1641        | NUT                | EA            |
| 242D5201        | PLUNGER ASSEMBLY   | EA            |
| 530A5071        | PUMP CLIP          | EA            |
| 216-1091        | PUMP CUP           | EA            |
| 220-C175        | SCREW              | EA            |
| 290-1251        | U-CLIP             | EA            |
| 290A6571        | VALVE ASSEMBLY     | EA            |
| 290-4851        | VENTILATOR         | EA            |

**Oversnow Mobility Equipment**

|                  |   |
|------------------|---|
| 8465-01-558-7367 | Tails, Snowshoe                               |
| 8465-01-558-6896 | Binding, Assembly, Snowshoe, Right            |
| 8465-01-558-6807 | Strap, Heel, Snowshoe, Modular Steel Traction |
| 8465-01-558-6863 | Binding, Assembly, Snowshoe, Left             |
| 8465-01-558-6823 | Kit, Repair, Snowshoe                         |
| 8465-01-558-7678 | Binding Strap, 12" GRAY                       |
|                  |   |

| <b>Nomenclature</b>                  | <b>NSN</b>              | <b>Number</b> | <b>Cost</b>        |
|--------------------------------------|-------------------------|---------------|--------------------|
| <b>Snow and Ice Mobility Kit</b>     | <b>8465-01-604-6077</b> | <b>1 Kt</b>   | <b>\$3,6015.82</b> |
| Anchor, Ice Screw (size I)           | 8465-01-578-6433        | 10 ea         | 37.23              |
| Anchor, Ice Screw (size II)          | 8465-01-578-6447        | 10 ea         | 37.23              |
| Anchor, Snow                         | 8465-01-578-8717        | 8 ea          | 14.47              |
| Axe, Ice                             | 8465-01-578-7741        | 43 ea         | 57.19              |
| Container, Storage                   | 8145-01-584-0796        | 1 ea          | 269.95             |
| Crampon (with center strap extender) | 8465-01-578-8908        | 43 pr         | 86.91              |
| Shovel, avalanche w/probe            | 4240-01-582-8261        | 20 ea         | 77.15              |
| Snowshoe, Assault, Military          | 8465-01-558-9958        | 43 pr         | 181.59             |
| Transceiver, Avalanche               | 8465-01-572-3962        | 43 ea         | 178.25             |
| Visual User's Guide, SIM Kit         | N/A                     | 43 ea         | 10.98              |

| <b>Nomenclature</b>                      | <b>NSN</b>              | <b>Number</b> | <b>Cost</b>       |
|--|-------------------------|---------------|-------------------|
| <b>High Angle Mountaineering Kit</b>     | <b>8465-01-604-6325</b> | <b>1 Kt</b>   | <b>\$8,276.10</b> |
| Belay Device, Mountaineering             | 8465-01-578-7850        | 40 ea         | 20.92             |
| Carabiner, Locking                       | 8465-01-578-8898        | 80 ea         | 8.70              |
| Carabiner, Non Locking                   | 8465-01-578-8906        | 80 ea         | 8.12              |
| Container, Storage                       | 8145-01-584-0796        | 1 ea          | 269.95            |
| FM 3-97.61 Military Mountaineering       | N/A                     | 1 ea          | 0                 |
| Harness, Mountaineering                  | 8465-01-578-8910        | 40 ea         | 54.85             |
| Rope, Cutter, Electric                   | 4940-01-582-8347        | 1 ea          | 82.78             |
| Rope, Kernmantle, accessory cord         | 4080-01-577-8686        | 1 roll        | 170.00            |
| Rope, Kernmantle, Static                 | 4020-01-577-8714        | 1 roll        | 295.00            |
| Visual User's Guide HAMK                 | N/A                     | 40 ea         | 10.98             |
| Visual User's Guide, Mountain Operations | N/A                     | 40 ea         | 20.33             |
| Washer, Rope                             | 4940-01-582-5658        | 1 ea          | 24.53             |
| Webbing, Mountaineering                  | 8305-01-578-8909        | 80 ea         | 2.65              |

| <b>Nomenclature</b>                                     | <b>NSN</b>              | <b>Number</b> | <b>Cost</b>       |
|---|-------------------------|---------------|-------------------|
| <b>Assault Climber Team Kit</b>                         | <b>8465-01-604-6235</b> | <b>1 Kt</b>   | <b>\$3,503.96</b> |
| Anchor, Rock, Camming Device type I (00-6), Type II (7) | 8465-01-578-7534        | 1 set         | 465.30            |
| Anchor, Rock, Chock Type I ( 1-11)                      | 8465-01-578-6458        | 1 set         | 76.23             |
| Ascender, Mechanical, Type I                            | 8465-01-579-3239        | 3 ea          | 87.24             |
| Ascender, Mechanical, Type II                           | 8465-01-579-3245        | 3 ea          | 87.24             |
| Bag , Assault Climber                                   | 8465-01-578-8828        | 3 ea          | 34.72             |
| Belay Device, Mountaineering                            | 8465-01-578-7850        | 3 ea          | 20.92             |
| Carabiner, locking                                      | 8465-01-578-8898        | 9 ea          | 8.70              |
| Carabiner, non locking                                  | 8465-01-578-8906        | 30 ea         | 8.12              |
| Container, Storage                                      | 6760-01-491-2810        | 1 ea          | 199.99            |
| Harness, Mountaineering                                 | 8465-01-578-8910        | 3 ea          | 54.85             |
| Pick, Chock   | 4240-01-582-5611        | 3 ea          | 6.18              |
| Rope, Kernmantle, accessory Cord                        | 4020-01-577-8686        | 1 roll        | 170.00            |
| Rope, Kernmantle, static                                | 4020-01-577-8748        | 2 coils       | 295.00            |
| Visual User's Guide ACTK                                | N/A                     | 40 ea         | 14.46             |
| Webbing, Mountaineering                                 | 8305-01-578-8909        | 20 ea         | 2.65              |

## APPENDIX C USARAK 750-1

DEPARTMENT OF THE ARMY  
HEADQUARTERS, UNITED STATES ARMY ALASKA  
Joint Base Elmendorf-Richardson, Alaska 99505-5000

United States Army Alaska Regulation 750-1

JAN 15 2014

### Maintenance of Supplies and Equipment

#### Ground Equipment Cold Weather Operation and Maintenance

**Summary.** This United States Army Alaska (USARAK) Regulation supplements Army and United States Army Pacific (USARPAC) maintenance policies, and provides maintenance requirements and technical guidance for operating and maintaining ground equipment in cold weather. This regulation supersedes USARAK PAM 750-1, dated 14 February 2006.

**Applicability.** This regulation applies to all units assigned or attached to USARAK.

**Supplementation.** Supplementation of this regulation is prohibited without prior approval from the Deputy Chief of Staff for Logistics, G4, Maintenance Management Division, Attention: APVR-RLG-M.

**Suggested improvements.** The proponent agency of this regulation is the Deputy Chief of Staff for Logistics, G4, Maintenance Management Division. Users are invited to send comments and suggested improvements on Department of the Army Form 2028 (Recommended Changes to Publications and Blank Forms) directly to APVR-RLG-M.

**Distribution.** This regulation is distributed solely through USARAK homepage at: <http://www.usarak.army.mil/publications/>.

| Contents  | Paragraph | Page |
|---|-----------|------|
| <b>Chapter 1</b>  |           |      |
| Introduction  |           |      |
| Purpose   | 1-1       | 3    |
| Responsibilities  | 1-2       | 3    |
| <b>Chapter 2</b>  |           |      |
| Cold Weather Effects and Operational Considerations General | 2-1       | 4    |
| Personnel   | 2-2       | 4    |
| Cold Weather Materiel Utility                               | 2-3       | 4    |
| Cold Effects on Material                                    | 2-4       | 4    |
| Maintenance Planning  | 2-5       | 7    |

**Chapter 3**

Equipment Winterization General  
Winterization Items

3-1        9  
3-2        9

**Chapter 4**

Equipment Operation and Maintenance General  
Lubricants  
Chassis and Body Components  
Power Train  
Electrical System

4-1        11  
4-2        11  
4-3        11  
4-4        15  
4-5        19

# USARAK Regulation 750-1

## Chapter 1 Introduction

### 1-1. Purpose

a. This publication provides general directives for operating and maintaining ground equipment in cold weather. Primarily designed for use by equipment maintainers, operators, and first line supervisors, this regulation places special emphasis on procedures and techniques used when working in extreme cold (-25° to -60° Fahrenheit) temperatures. Additionally, cold weather operation planners can use this regulation as a quick reference publication.

b. In addition to limiting training event scope and Arctic mission accomplishment, failure to follow this guidance may cause personnel injury and equipment damage. In addition to AR 750-1 and USARPAC 750-1, USARAK units shall incorporate requirements from this regulation into their maintenance Standing Operating Procedures (SOP).

c. Information in this regulation does not replace applicable Technical Manuals (TMs), Regulations, or Field Manuals (FMs). It is intended as a supplement requiring USARAK units to address the special and unique challenges encountered in cold weather equipment operations and maintenance. ✓

### 1-2. Responsibilities

a. The Deputy Chief of Staff for Logistics, G4, Maintenance Management Division shall monitor USARAK operations and maintenance in cold weather. Revisions to this regulation will include lessons learned.

b. USARAK units shall review this regulation and incorporate applicable requirements and procedures in their unit maintenance SOP, and use this regulation to prepare and conduct annual training.

# USARAK Regulation 750-1

## Chapter 2

### Cold Weather Effects and Operational Considerations

#### 2-1. General

Cold weather operations are a necessary part of doing business in Alaska. With the proper equipment preparation and training, Soldiers can fight and win on the Arctic battlefield by following guidelines set forth in this regulation.

#### 2-2. Personnel

Self-preservation consumes a large portion of every Soldier's time and energy while operating in cold weather. This reduces personnel efficiency in equipment operation and maintenance. In addition to operating and maintaining equipment, Soldiers and leaders must learn what is appropriate and how to adjust when operating in an Arctic environment. As the temperature decreases, all routine tasks will increase from simple to maximum effort required. It cannot be overstated that at temperatures below -50° F, simple tasks require maximum effort of well-trained personnel on completely winterized equipment.

#### 2-3. Cold Weather Materiel Utility

Before acquisition, much of the Army's equipment is developed and tested for proper cold weather operation at temperatures down to -25° F. Almost all equipment procured by the Army functions correctly at the -25° F threshold. At temperatures below -25° F, equipment begins to malfunction exponentially corresponding directly with decrease in temperature. Current efforts at Army level are addressing acquisition processes to ensure that equipment fielded for operation in extreme cold temperatures meets requirements of -25° to -60° F. Most TMs currently outline special operating procedures for cold temperature operations, but many do not address specific operating procedures and maintenance requirements for the extreme cold temperatures. Failure to follow the "Operations Under Unusual Conditions (Cold)" procedures in the operator and field maintenance TMs and guidance in this regulation will result in unit financial and readiness impacts from equipment failures in cold and extreme cold temperatures.

#### 2-4. Cold Effects on Materiel

a. Metals. Metals become brittle in severe cold temperatures and parts cannot withstand the same shock loads that they sustain at higher temperatures. At -20° F certain steels can only withstand 50 percent of the shock load that they can withstand at room temperature. For a given change in temperature, various metals will expand or

## USARAK Regulation 750-1

contract different amounts. These characteristics will especially affect bearings in which the bearing and shaft are of different metals, parts of different type metals bolted together, and meshing gears of different metals. Take special care in adjusting these types of parts for cold weather operations, especially when adjusting bearing clearances.

b. Rubber. In addition to natural and synthetic rubber, there are many rubber substitutes. These synthetic rubbers look and usually react like natural rubber, and mostly retain flexibility at high temperatures. As it cools, natural rubber will gradually stiffen and begin to exhibit peculiarities below  $-20^{\circ}$  F. When cooled gradually but continuously over a short time, the rubber will remain flexible until reaching approximate  $-60^{\circ}$  F. At this point, the rubber suddenly loses elasticity and becomes brittle. Furthermore, if the rubber is consistently kept at a temperature below  $-20^{\circ}$  F for a long time, an effect similar to crystallization occurs, causing it to become brittle.

c. Rubber covered cables. Take extreme care in handling electrical cables at low temperatures. If the rubber jackets become hard, protect the cables from shock loads and bending to prevent short circuits caused by any covering breaks. Neoprene jackets on cables become very brittle and break easily at low temperatures.

d. Tires. Tires become rigid in the cold, causing flat spots on the portions that touch the ground during shutdown periods. Sidewalls become brittle and crack in severe cold temperatures. Tread surface properties will vary depending on the rubber used in the manufacturing process, but will lose "gripping" properties on ice as temperatures decrease and the rubber stiffens. Inflate tires to appropriate pressure in cold temperatures. A tire inflated to 40 pounds Per Square Inch (PSI) indoors will change to 25 pounds PSI when moved outside at  $-50^{\circ}$  F. Generally, inflate room temperature tires to 10 pounds PSI over the normal pressure during cold weather, and recheck tire pressure before operations.

e. Plastics. Generally, plastics expand and contract much more than metal or glass. Handle any plastic parts or materials carefully. Many vehicular canvas covers have plastic windows that become very brittle and, in many cases, break due to a combination of cold and vibration.

f. Glass. If handled carefully, expect glass, porcelain, and other ceramics to perform normally at low temperatures. If applying heat directly to cold windshields or vehicle glass, cracking may result.

g. Fabrics. Kept dry, fabrics generally retain their flexibility even at extremely low temperatures. However, tarpaulins present difficulties in conforming to their intended.

## USARAK Regulation 750-1

dimensions due to shrinkage. This is usually the result of wrinkles that are extremely difficult to smooth out at subzero temperatures. Whenever possible, unfold tarpaulins in heated enclosures

h. Liquids. Place special training and emphasis on keeping water and other liquids in a liquid state. Proper attention must be paid to freeze protection properties and additives for engine coolant, windshield washer fluid, etc. Items containing liquids susceptible to freezing in extreme cold temperatures, such as batteries and Petroleum, Oils, and Lubricants (POL), must have warm storage or thawing equipment available before use.

### i. Batteries.

(1) Vehicle batteries. Vehicle batteries lose their effectiveness during extreme cold weather operations and will freeze if not maintained at a full state of charge. Most USARAK vehicles have been outfitted with Valve Regulated Lead Acid - Absorbed Glass Mat (VRLA-AGM) batteries, which provide better potential to recover/recharge if properly thawed before servicing. Cold chamber testing has revealed that a fully charged battery can withstand temperatures of -70° F without freezing. Conversely, a fully discharged battery can freeze at 10° F. If a standard flooded-cell vehicle battery is not maintained at full charge, the internal cells may sustain permanent damage from expansion of the frozen electrolyte. Never jump (slave start) a vehicle with frozen batteries, or they could explode. Specific cold chamber testing is being conducted for VRLA-AGM batteries as of the release of this Regulation, Table 2-1 shows how much of a flooded-cell lead acid battery's power is lost as the temperature drops.

**Table 2-1 Flooded-Cell Vehicle Battery Efficiency**

| Efficiency Percent | Temperature                              |
|--------------------|--|
| 100%               | Room Temperature (77 Degrees Fahrenheit) |
| 50%                | 15 Degrees Fahrenheit                    |
| 30%                | -20 Degrees Fahrenheit                   |
| 10%                | -30 Degrees Fahrenheit                   |

(2) Small equipment batteries. For small equipment, alkaline batteries are far superior to carbon batteries. For example, a flashlight using "D" batteries should use the BA3030/U rather than the BA-30. Also use these batteries in artillery and mortar night aiming post lights and tactical telephones such as the TA 312/PT. While dismantled, Soldiers should keep spare small equipment batteries in interior pockets to help keep them warm.

## **USARAK Regulation 750-1**

(3) Lithium sulfur dioxide batteries. The lithium sulfur dioxide battery is recommended for use in extreme cold conditions. Lithium sulfur dioxide batteries have unique characteristics that provide improved operational capabilities and extended battery life. Handle lithium sulfur dioxide batteries as hazardous material when new and during use, and dispose of them as hazardous waste when depleted. Refer to TB 43-0134 for disposition procedures.

### **2-5. Maintenance Planning**

The importance of Preventive Maintenance Checks and Services (PMCS) and equipment repair planning become paramount in Arctic conditions. Man-hour requirements for operators and maintainers to complete all tasks must be considered when planning and executing maintenance operations in extreme cold temperatures, periods of heavy snowfall, and extended hours of darkness. At temperatures below -20° F, maintenance tasks could require up to five times the normal amount of time to complete. The additional time resourced to increase the frequency of equipment PMCS tasks must be considered while planning operations during winter months in the Arctic. Complete equipment winterization, diligent maintenance programs, and well-trained crews are the keys to effective cold weather operations. Several factors that affect maintenance directly and require detailed planning are:

a. Appropriate facilities or maintenance shelters are necessary to provide a protected workspace for personnel to operate in reasonably comfortable temperatures. Whether the structure is a permanent building in garrison or a maintenance tent in field environments, appropriate heaters must be available to warm the workspace and equipment requiring maintenance. All planning should include accommodations to bring equipment inside which require extensive or precise inspection/work, well in advance to melt snow and/or ice and warm components before conducting maintenance. Lighting should be sufficient to provide visibility necessary to conduct maintenance, to include undercarriage work. Lighting becomes a critical planning factor in Arctic regions during winter months when natural daylight hours are significantly reduced. If operating in a field environment, ensure planning includes appropriate measures to clear ground snow and/or provide insulating material to place on the ground to prevent operators/mechanics from lying directly on the ground while working under vehicles. Rapid body cooling caused by heat transfer to the ground may result in cold weather injury. Additional considerations should include canvas or cardboard under vehicles to catch dropped parts. This prevents parts and fasteners from becoming lost in the snow. Leader involvement with maintenance operations in extreme cold weather is required to ensure that Soldiers do not operate equipment inside a building/tent without appropriate ventilation to prevent carbon monoxide poisoning.

## USARAK Regulation 750-1

b. Appropriate and sufficient Class IX repair parts and Class III POL should be managed to sustain equipment through the winter months. Many of the repair parts and POL products used throughout USARAK for winterized equipment are peculiar in nature, and often difficult to obtain on short notice. Proper planning for requisition, storage, and issue of these supplies before winter months will alleviate difficult sustainment challenges during extreme cold temperatures.

c. Proper planning for maintenance Soldiers' clothing and work performance is critical to timely repairs and service procedures. Extreme Cold Weather System (ECWS) gear issued to Soldiers in USARAK is often bulky and loose fitting by design, and not conducive or safe for performance of certain maintenance tasks. Leaders must ensure that Soldiers are appropriately dressed for extreme cold temperatures to prevent cold weather injuries, yet not working around moving shafts, pulleys, belts, fans, etc. with large gloves or loose fitting parkas that may get caught and cause injury. Gloves may become saturated with fluids when performing maintenance on fuel or cooling systems, which reduces the insulating value and may result in cold weather injury. Extreme cold weather fuel handler gloves will prevent fluids from contacting the skin, and if necessary the wear of rubber gloves under insulated gloves will prevent coolant and other liquids from contacting the skin. Never allow unprotected hands/skin to come in contact with cold metal.

## **USARAK Regulation 750-1**

### **Chapter 3 Equipment Winterization**

#### **3-1. General**

Equipment fielded to USARAK units should arrive in Alaska fully winterized. As of the release of this regulation, significant requirements are being addressed at DA level to incorporate equipment winterization in AR 750-1 and Program Manager equipment fielding plans. Winterized equipment will include the application/installation of approved auxiliary arctic kits or equipment necessary to pre-heat and start equipment within one hour, maintain a temperature of 41° F in troop compartments, and ensure water remains in a liquid state (water buffalo) when in extreme cold temperature range of -25° to -60° F. The use of arctic grade lubricants and fluids for engines, transmissions, gear cases, hydraulic systems, and other assemblies as necessary should meet requirements outlined in USARAK Regulation 750-4 until such time that Army Lubrication Orders (Los) and TM are updated to reflect extreme cold climate operational requirements. All USARAK equipment winterization will be standardized as much as specific model design permits, regardless of the units' garrison location. Initial winterization of equipment currently owned by USARAK units that do not have approved auxiliary arctic kits in the equipment TM, will be coordinated by the USARAK G4, Maintenance Management Division until policies are finalized at DA level to require winterization prior to equipment fielding in Alaska.

#### **3-2. Winterization Items**

a. Liquid cooled, engine driven equipment will have the following devices installed:

(1) Engine block heater. This device is a permanently installed 120 volt Alternating Current (AC) electrical heating element that draws no more than 15 amps. It will be capable of maintaining engine coolant temperature at 80° F above ambient air temperature. Tactical generators with fuel-fired coolant preheaters do not require block heaters.

(2) Fuel-fired engine preheater. This device is a permanently installed engine coolant heater capable of heating and circulating coolant throughout the engine. It is electrically powered by the vehicle 24 volt Direct Current (DC) batteries, and draws fuel supply from the vehicle fuel system. At temperatures down to -60° F, the preheater will be capable of sufficiently heating an engine to start up temperatures in one hour or less.

(3) Battery maintainer. This device is a permanently installed 120 volt AC electrical maintainer that remains connected to the vehicle batteries at all times. This device will

## USARAK Regulation 750-1

draw no more than 5 amps, and provide sufficient trickle charge to maintain serviceable vehicle batteries (AGM or flooded-cell) in a full state of charge to temperatures of -60° F.

(4) Each electrical device will have an electrical cord with a polarity protected, grounded male connector. Multiple electrical devices will be connected through a "pig-tail" arctic-grade (remains flexible in extreme cold) cord with at least 14 gauge wiring, so that only one connector (120 volt AC, polarity protected, grounded, male) will extend from the vehicle.

b. Tactical vehicles designated to transport Soldiers shall be fitted with arctic hardtop kits that provide improved cabin area shelter and insulation. The hardtops are capable of withstanding heavy snow load and prevent rain and snow melt from entering the vehicle. The hardtop kits for troop carrier vehicles are designed to permanently install personnel heaters necessary to maintain troop cabin areas at 41° F (MIL-STD-1472G) in extreme cold conditions. Deliberate decisions must be made by commanders to determine operational requirements for troop transport with tactical vehicles. Although removable, the hardtops should remain on the vehicle once installed. Cargo areas for vehicles with hardtops are limited to access by the rear doors, and the equipment cannot be air-dropped during airborne operations with the hardtop installed.

c. Personnel heaters. Generally, tactical and combat vehicles provide adequate heat through standard engine coolant heaters during cold weather operations. However, tactical equipment design often proves to be insufficient when operating in extreme cold temperatures below -25° F. Auxiliary fuel burning and electrical (PTC) heaters are permanently installed in USARAK vehicles as necessary to augment standard vehicle design enough to reach appropriate troop cabin temperatures. This is especially important when transporting Soldiers on troop seats in the cargo areas of FMTV and HMMWV family of vehicles.

d. Water trailers (buffalo) are fitted with a permanently mounted fuel-fired water heater kit. The heater is electrically powered by 24 volt DC battery and draws fuel from an on-board fuel tank to heat and circulate special antifreeze through a closed circuit pipe that is mounted inside the water tank.

## **USARAK Regulation 750-1**

### **Chapter 4 Equipment Operation and Maintenance**

#### **4-1. General**

TMs provide complete PMCS procedures and must be on hand (hard copy or maintenance support device) for operator and field level maintenance activities. This chapter addresses items and procedures that require special attention during extreme cold weather. While in garrison, when temperatures are below -25° F and during periods of heavy snowfall, USARAK units will increase PMCS frequency to include additional operator PMCS (before, during, after) as required to clear snow from vehicles, circulate fluids, recharge batteries, and exercise tires/seals/belts and other rubber components. Commanders must not allow batteries to completely discharge between weekly PMCS periods on equipment without battery maintainers plugged into Headbolt Outlets (HBO). While in tactical or field training environments during winter months, commanders and maintenance personnel should develop a schedule that requires equipment to be operated on a routine basis to prevent vehicles from becoming cold-soaked. Noise discipline and concealment may have to be sacrificed to maintain equipment operational readiness. A well-planned PMCS program will help minimize time-consuming slave starting and equipment repairs that detract from other training and mission events at critical moments, and the expense associated with replacing components and parts permanently damaged by extreme cold weather. Appropriate time should be factored as a resource requirement during cold temperatures to allow for engine preheats procedures, snow removal, and window defrost before equipment operation is required.

#### **4-2. Lubricants**

The LOs and TMs for ground equipment are supplemented by USARAK Regulation 750-4 for all lubricants, fuels, fuel additives, and fluids, and are applicable to all USARAK units and activities while operating ground equipment in Alaska. It is critical for operators and maintainers to utilize the appropriate fluids, as expensive and permanent damage to vehicle components will occur when improper fluids fail to retain proper viscous properties and perform immediately in extreme cold temperatures.

#### **4-3. Chassis and Body Components**

a. Ice, mud, and snow can build up on operating vehicles to such an extent that it overloads vehicle components, reduces ground clearance, and prevents or interferes with normal moving component operation. Slush and water buildup and freezing around an operating vehicle's wheels can cause a steering ability loss.

## USARAK Regulation 750-1

### b. Brakes.

(1) Frozen moisture in the air brake system seriously affects operation. Brake lines, air brake filters, brake chambers, push rods, valves, and seals are subject to defects and failure in the cold. Condensation between brake shoes and drums may freeze, making it impossible for the vehicle to move. When this happens, use portable heating equipment to thaw the brake shoes from the drums.

(2) Ensure the alcohol evaporator kit is functioning if it is part of the system. Check the air compressor, the unloader valve, and the governor for good condition and satisfactory operation. With air pressure at the governed maximum and brakes applied, stop the engine. There should not be a noticeable drop in pressure within one minute. Drain reservoirs immediately after operation and close drain cocks immediately after draining to prevent freezing in the open position. Build up brake pressure before the moving the vehicle again.

(3) It is imperative to inspect and maintain hydraulic brake systems during extreme cold temperatures to ensure brake fluid is not contaminated or exposed to moisture/condensation. Contaminated brake fluid is susceptible to freeze within the braking components, rendering the braking system inoperable. Any indication of brake fluid contamination renders the vehicle Non Mission Capable, and requires complete field level maintenance inspection, component repair, and fluid flush.

(4) Do not set the parking brake for extended periods during cold temperatures, since they may freeze and not release. Use chock blocks to hold wheels or tracks in place. If the brake components do freeze in the set position, use an external heat source (portable heater) for thawing, to prevent damage to the vehicle power train. For the Small Unit Support Vehicle (SUSV), apply the parking brakes when stopped since there is not neutral-park gear.

c. Shock absorbers. The light-weight hydraulic oil in shock absorbers is susceptible to extreme cold weather. Check shocks for leaks and breakage at every rest period. After long inactivity periods, move the vehicle out slowly to allow the hydraulic oil to warm up. This helps prevent leakage and provides a smoother ride.

### d. Steering system.

(1) Warm up steering systems before movement (especially power steering systems). While the vehicle engine is warming up, move the steering wheel SLOWLY lock to lock. Repeat this a few times to warm the steering system oil. The heat created by the pump's high pressure side will quickly warm the oil to an acceptable operating

## USARAK Regulation 750-1

temperature. In manual steering systems, this exercise will achieve the same results except it will take more time due to lower friction inherent in unpressurized manual systems.

(2) Examine the arms, tie rods, drag links, seals and boots, pitman arm, gear column, and wheels for good condition and secure mounting. Ensure that the gear case is not leaking and the gears are properly adjusted.

### e. SUSV track.

(1) Remove all dirt, snow, and ice and inspect for good condition and proper lubrication. Check the track adjustment. Do not adjust tracks too tightly in a warm shelter since they will contract and break easily in temperatures below  $-40^{\circ}$  F.

(2) SUSV track will warm-up while in use and melt snow on and under itself. After parking in extreme cold temperatures, the water on the SUSV track will freeze and result in the track being frozen to the ground. If track freezes to the ground, use a portable hot air heater to melt away ice from the track. If time is critical, slowly move the vehicle back and forth in an attempt to break away from the frozen ground. If the SUSV has been operated enough to warm the track, park on insulating material to prevent the track from freezing to the ground.

### f. Tires.

(1) During extreme cold temperatures, tires become very brittle and sidewalls may contract and separate from wheels. Though they appear to be all right, the tire can slip away from the wheel and tear the tubes and valve stems. With tubeless tires, this slippage can break the seal between the tire and wheel, deflating the tire. Tires may also have a flat spot where they contacted the ground. Move very SLOWLY for the first mile or so, allowing the tires to warm up and become pliable, giving a good seal against the wheel.

(2) Wheel assemblies with two-piece rims must be inspected intensely at temperatures below  $-25^{\circ}$  F during PMCS. The rubber o-ring that seals the mating surface internally between the two rim halves is susceptible to contract and harden, and must be replaced by maintenance personnel if a slow leak is discovered.

(3) During periods of freezing rain, do not park vehicles in areas with pooling water. If operating in areas with pooling water, move vehicles frequently and place insulating material (small branches work in tactical situations) under tires before parking to prevent

## USARAK Regulation 750-1

tires from freezing to the ground surface. If tires do freeze in place, use a portable hot air heater to melt the tires loose.

g. Springs. Metal, like most other material, becomes brittle in extreme cold weather. Cold-soaked metal can easily snap, causing damage to vehicle and trailer suspension systems. By initially moving SLOWLY, the springs will warm up and regain their elasticity, avoiding damage. Avoid driving into depressions or over obstacles that may cause excessive flexing and possible spring breakage in extreme cold temperatures.

h. Wheel bearings.

(1) No lubricant changes are required since all wheel bearings are serviced for year-round operations with grease (automotive and artillery) that has a temperature range of -65° to +225° F.

(2) Inspect SUSV oil-lubricated road wheel bearings to ensure that water has not collected during operation. If a significant amount of water has collected, seals may rupture as it freezes and expands.

i. Universal and slip joints. Thoroughly lubricate joints with molybdenum disulfide grease.

j. Cab enclosures and Arctic hardtops provide insulation necessary to maintain adequate temperatures for troop comfort and safety. When crossing frozen streams or other bodies of water, open the doors to permit quick personnel escape in the event the vehicle should break through the ice and submerge.

k. Tire chains will be available in every USARAK vehicle on dispatch from 1 Oct through 15 April, and should be inspected to ensure they are serviceable before operation. Require operators/crews to practice mounting and removing them, to ensure they are capable of properly employing them on the correct tires (always across the axle, i.e. do not stagger one left front/one right rear) IAW unit SOP and risk management decisions. Ensure operators and vehicle commanders check the chains frequently at vehicle halts to ensure they retain the appropriate tension, as loose chains will damage the vehicle. Remove chains when not needed to prevent unnecessary damage to the vehicle, wear on the chains, and destruction to ground/road surface. Tire chains are not intended for extended use on asphalt surface, and will wear out prematurely if not employed appropriately.

l. Stryker vehicle hulls must be free of water before parking in freezing temperatures. Fuel, air, hydraulic lines and cylinders are all located in the hull, and

## **USARAK Regulation 750-1**

susceptible to damage caused by freezing fluid. Install environmental covers over the air intake and exhaust grills to prevent entry of snowfall, which will melt during vehicle operation and freeze in the hull after operation.

### **4-4. Power Train**

#### **a. Engines.**

(1) Appropriate engine oil as prescribed in USARAK 750-4 will prevent fluid friction on cylinder walls and bearings. Fluid friction from using higher weight engine oil will place additional strain on the vehicle batteries and starter while starting a cold-soaked engine, in addition to damage sustained initially to internal engine components due to the oil pump inability to circulate thicker fluid. Check the engine oil level before starting and fill to the prescribed level if necessary. As soon as the engine starts check the oil pressure gauge readings, and shut down the engine if oil pressure is not correct within 30 seconds. The low oil pressure warning lights may blink on and off initially when idling at 500 to 650 RPM using appropriate fluids outlined in USARAK 750-4, but should not remain on at higher RPMs.

(2) Extreme cold weather often prevents engines from reaching normal operating temperatures, increases engine carbon development, and increases oil dilution and condensation. These factors all combine to create internal engine sludge. To correct a sludge condition, maintenance personnel must drain the oil while the engine is hot, change the oil filter, and refill with clean oil. If the particular vehicle is enrolled in Army Oil Analysis Program, a special sample will then be submitted. While performing After Operations PMCS, particular attention should be paid to the oil pan, valve cover, timing chain cover, and external oil lines for evidence of oil leaks.

(3) Most fan/serpentine belts used on tactical vehicles are made to retain flexibility in extreme cold temperatures, but particular attention should be paid during Before Operation PMCS to inspection of the belts. Cracks in the rubber will make the belts susceptible to break at a much higher rate in subzero temperatures.

(4) Starting vehicles/equipment in cold and extreme cold temperatures should be performed by carefully following procedures in the appropriate -10 operator TM for Operation Under Unusual Conditions (Cold). Many of the current manuals will direct operators to TM 4-33.31 (formerly FM 9-207) for additional procedures in extreme cold temperatures, as most of the current TMs do not contain procedures for use and operation of USARAK winterization items and procedures. When attempting to start, do not hold the key/switch in the "start" position longer than 15 seconds, and allow 60 seconds for the starter to cool between starting attempts.

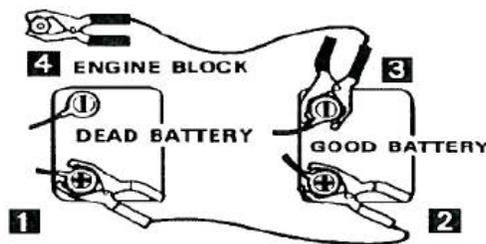
## USARAK Regulation 750-1

(a) Never start a cold-soaked engine without performing preheat procedures. While in a garrison locations (mostly Fort Wainwright) with Headbolt Outlets (HBO) in the tactical motor pools, ensure the vehicle's 120 volt AC block heater remains plugged in. In garrison locations or while in tactical environments, the block heaters are still a simple preheat capability for short duration requirements using tactical power generators. The vehicle fuel-fired engine preheater will be used in all other instances, ensuring a minimum of one hour preheat time is allowed before attempting to start the engine. Stryker vehicle systems have a very specific sequence outlined in the -10 TM to operate the Personnel and Engine Coolant circulating Heater (PECCH), which must be followed to prevent damage to the PECCH components. Pay particular attention to the fuel level in vehicles/equipment with frequent fuel-fired preheater use, as the preheater will consume small amounts of fuel and battery power each time it is operated.

(b) Starting fluid (Ether) will not be used to start cold-soaked engines, as severe internal damage is sustained while metal tolerances and lubrication properties are affected by cold temperatures in an engine that is not properly preheated. Using starting fluid is strictly prohibited at all times if not incorporated in the equipment's original manufacturer's configuration as a system, and employed in accordance with the TM.

(c) Slave/jump starting procedures should never be performed in extreme cold temperatures if the vehicle battery electrolyte condition is unknown. The VLRA-AGM batteries are sealed, making it difficult to determine the state of electrolyte. Dead batteries in USARAK vehicles with frozen electrolyte have exploded while slave starting from another vehicle. If in doubt, move batteries to a location to warm/thaw before attempting to slave start. The vehicle TM provides specific procedures for slave starting. Jump starting equipment without North Atlantic Treaty Organization slave capability using standard "jumper cables" should be connected as illustrated in Table 4-1. Always ensure that the batteries are the same voltage, amperage, and negative posts are properly grounded. Vehicles should not touch each other, and all power, electronics, and communications equipment are off prior to connecting slave or jumper cables.

Table 4-1



## USARAK Regulation 750-1

(d) Engine idle should be raised to 1000-1200 RPM to circulate coolant and provide proper alternator charge to vehicle batteries. Do not allow engines to idle to operate personnel heaters, and ensure licensed Soldiers are physically present to monitor temperature and pressure gauges while equipment is running. Be sure there is adequate troop compartment ventilation to prevent carbon monoxide poisoning.

### b. Transmissions.

(1) Automatic, semi-automatic, and manual transmissions will use oils prescribed in USARAK Pam 750-4 while operating in Alaska. When operating vehicles in extreme cold temperatures, it is imperative to allow appropriate time for a cold-soaked transmission to warm up before moving to prevent damage to internal components from the lack of lubrication.

(2) Operators must be extremely careful when moving a vehicle with congealed gear case lubricants, wheel bearing greases, or tires frozen to the ground. An attempt to operate with these conditions can damage the transmission and other drive train components. Before moving the vehicle, put the transmission in low gear and the transfer unit, where applicable, in low range. Drive the vehicle approximately 100 meters, being careful not to stall the engine, and then up shift. Continue slowly into the higher gears until the vehicle moves freely and/or tire thump ceases.

(3) When preparing a vehicle for shut down, place the transmission and transfer unit shift levers in the neutral position. This prepares the units for the next start by preventing them from freezing in an engaged position.

### c. Cooling systems in all USARAK vehicles/equipment should meet extreme cold temperature requirements year-round.

(1) An approximate mix of three parts antifreeze (ethylene glycol, inhibited (MIL-A-46153)) to two parts water (3:2 ratio) will provide protection down to approximately -60° F. Test all antifreeze protection levels during scheduled field maintenance services (minimum annually if enrolled in Low Usage) with a hydrometer or view type tester. Record the cooling system protection level on the SAMS-1E equipment records (minimum annually if enrolled in Low Usage) with a hydrometer or view type tester. Record the cooling system protection level on the SAMS-1E equipment records (DA 5988-E) filed in the vehicle service packet. Refer to Table 4-2 for antifreeze requirements to provide protection levels.

(2) If engine coolant is determined to be frozen during Before Operations PMCS, employ engine preheat devices (block heater or fuel-fired preheater) to warm the

## USARAK Regulation 750-1

engine. Inspect for any possible leaks or cooling system damage caused by expansion of the coolant. Operating an engine with frozen coolant without proper preheat procedures during extreme cold temperatures could result in burst hoses or water pump damage.

**Table 4-2**  
**Antifreeze Protection Table**

| Cooling System<br>Quart Capacity | Quarts of Antifreeze Coolant Required<br>For Protection to Temperature Points Fahrenheit Shown Below |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------|--|------|------|------|------|------|------|------|------|------|------|------|
|                                  | 2  | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   |
| 5                                | -12°   | -62° |      |      |      |      |      |      |      |      |      |      |
| 6                                | 0°   | -34° |      |      |      |      |      |      |      |      |      |      |
| 7                                | 6°   | -17° | -54° |      |      |      |      |      |      |      |      |      |
| 8                                | 10°  | -7°  | -34° | -69° |      |      |      |      |      |      |      |      |
| 9                                |  | 0°   | -21° | -50° |      |      |      |      |      |      |      |      |
| 10                               |  | 4°   | -12° | -34° | -62° |      |      |      |      |      |      |      |
| 11                               |  | 8°   | -6°  | -23° | -47° |      |      |      |      |      |      |      |
| 12                               |  | 10°  | 0°   | -15° | -34° | -57° |      |      |      |      |      |      |
| 13                               |  |      |      | -9°  | -25° | -45° | -66° |      |      |      |      |      |
| 14                               |  |      |      | -5°  | -17° | -34° | -54° |      |      |      |      |      |
| 15                               |  |      |      | 0°   | -12° | -26° | -43° | -62° |      |      |      |      |
| 16                               |  |      |      | 2°   | -7°  | -19° | -34° | -52° |      |      |      |      |
| 17                               |  |      |      | 5°   | -4°  | -14° | -27° | -42° | -58° |      |      |      |
| 18                               |  |      |      | 7°   | 0°   | -10° | -21° | -34° | -50° | -65° |      |      |
| 19                               |  |      |      | 9°   | 2°   | -7°  | -16° | -28° | -42° | -56° |      |      |
| 20                               |  |      |      | 10°  | 4°   | -3°  | -12° | -22° | -34° | -48° | -62° |      |
| 21                               |  |      |      |      | 6°   | 0°   | -9°  | -17° | -28° | -41° | -54° | -68° |
| 22                               |  |      |      |      | 8°   | 2°   | -6°  | -14° | -23° | -34° | -47° | -59° |
| 23                               |  |      |      |      | 9°   | 4°   | -3°  | -10° | -19° | -29° | -40° | -52° |
| 24                               |  |      |      |      | 10°  | 5°   | 0°   | -7°  | -15° | -24° | -34° | -46° |

**Guide for Preparation of Ethylene-Glycol Antifreeze Solutions**

|   |  |
|---|--|
| Do Not use without some water; 68% concentration gives maximum protection | Use at least 25% concentration for protection against rust and corrosion |
|---|--|

### d. Fuel System.

(1) During cold temperatures, condensation can easily build up in tanks, drums, containers, fuel pumps, fuel lines, injectors, and carburetors. At low temperatures, this condensation will form ice crystals that will clog injector nozzles, carburetor jets, fuel lines, filters, and pumps. Anti-icing additive usage will eliminate the condensation. Keep fuel tanks filled to the appropriate expansion level which will reduce space in the tank for condensation to form, and ensure to wipe snow from dispensing equipment and around the fuel tank before refueling. Fuel tanks should not be completely filled in cold temperatures if determined the vehicle will be moved to a warm location/indoors, as expansion of the fuel in the tank may cause spillage.

(2) Drain fuel filters in accordance with the equipment TMs at the end of each day of operations. Do not assume that the filter is dry if nothing flows from the drain cock. If water is present, it may be frozen in the filter housing.

## **USARAK Regulation 750-1**

### **e. Hydraulic System.**

(1) Hydraulic systems will use fluids prescribed in USARAK Regulation 750-4 while operating in Alaska or any Arctic location where extreme cold temperatures are suspected.

(2) Hydraulic systems should not be allowed to cold soak if immediate use is required. Most material handling equipment, cranes, wreckers, and construction equipment have large-volume hydraulic tanks, pumps, lines, valves, and cylinders which hold a substantial volume of hydraulic fluid, which must be gradually warmed prior to using the equipment. If cold-soaked in extreme cold temperatures, the hydraulic system must be operated (under no load) for one hour to prevent equipment damage and prevent environmental spills which result from ruptured hydraulic lines, blown seals, or cracked component housings.

## **4-5. Electrical System**

a. One of the greatest hindrances to successful military operations in Arctic conditions is the extreme cold temperature effects on batteries. Temperature effects, combined with the lack of preventive maintenance result in a significant reduction in battery life expectancy. Most vehicles in USARAK utilize VRLA-AGM batteries, which provide benefits associated with a maintenance-free battery and the increased ability to recover/recharge multiple times after a complete loss of charge. Never mix VRLA-AGM batteries with conventional flooded-cell lead acid batteries in multi-battery electrical systems.

(1) At temperatures below 32° F, the battery electrochemical reaction time prolongs the time required to recharge. Vehicle batteries should be maintained at a full state of charge to ensure proper electrolyte condition, and reduction in time required to recover the loss of battery charge from cranking and use of electronic and communications equipment. Battery maintainers should remain plugged in during periods of extreme cold temperatures to ensure batteries do not deplete and freeze between PMCS periods. Extended engine run time above idle RPM is necessary to provide proper recharge of batteries during sub-zero temperatures, and the VRLA-AGM batteries have proven to take longer than standard flooded-cell batteries to return to a full state of charge.

(a) VRLA-AGM vehicle batteries are sealed and do not require the addition of water or electrolyte. VRLA-AGM batteries will freeze in extreme cold temperatures if not maintained at a full state of charge, but are usually recoverable and recharge once thawed.

## USARAK Regulation 750-1

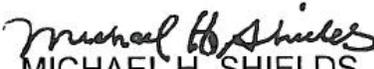
(b) Flooded-cell vehicle batteries require electrolyte maintenance. Consider 1.280 specific gravity the optimum level for a charged battery. Do not add distilled water to a battery during extreme cold temperatures, as the water will not mix with the electrolyte and will freeze in the battery. A frozen flooded-cell battery should be considered damaged and disposed of without attempting to thaw or recharge.

(2) A battery will more readily accept a charge at warmer temperatures (above 35° F). If it is necessary to recharge a battery at low temperatures, the charging voltage should be low enough to prevent excessive electrolyte boiling. Never attempt to recover/recharge a frozen battery. Specific guidance on field level maintenance, testing, and recharging of vehicle batteries is provided in the USARAK Battery Maintenance Program memorandum and TM 9-6140-200-13 (Maintenance for Automotive Lead Acid Storage Batteries).

b. Vehicle-mounted electronic components and C4ISR equipment are extremely sensitive, and will malfunction if circuits are exposed to moisture or improperly operated in extreme cold temperatures.

(1) Snow, ice, and condensation should be removed from electrical/electronic components. Ensure vehicle cupolas, gunner hatches, etc.; remain closed when not occupied, to shield sensitive components from snowfall. If internal moisture is suspected to have occurred on sensitive electronic components, do not operate or apply electrical power as costly damage may occur. Remove the components from the vehicle, or move the entire vehicle to an area to thoroughly warm and dry the affected items prior to applying electrical power.

(2) C4ISR components should not be allowed to cold soak if immediate use is anticipated. Most display panels (LCD) have internal heating elements which enable normal operation, but for normal planning purposes electronic equipment exposed to extreme cold temperatures should be preheated or warmed with vehicle heat for one hour prior to use to prevent electrical power being applied to frozen circuitry.

  
MICHAEL H. SHIELDS  
Major General, USA  
Commanding

## APPENDIX D USARAK 750-4

\*United States Army Alaska Regulation 750-4

DEPARTMENT OF THE ARMY  
HEADQUARTERS, UNITED STATES ARMY ALASKA  
Fort Richardson, Alaska 99505-7100

United States Army Alaska Regulation 750-4

16 February 2006

### Maintenance of Supplies and Equipment

#### Lubricants, Fuels, Fuel Additives, and Fluids for Ground Equipment

**Summary.** This regulation about lubricants, fuels, fuel additives, and fluids used in United States Army Alaska (USARAK) ground vehicles has been revised. This regulation sets forth USARAK policies for using lubricants, fuels, fuel additives, hydraulic fluids, brake fluids, alcohol evaporator systems, and windshield washer fluids.

**Applicability.** This regulation is applicable to all organizations assigned or attached to USARAK.

**Supplementation.** Supplementation of this regulation is prohibited without prior approval from the USARAK G-4, APVR-RDL-M.

**Interim changes.** Interim changes to this regulation are not official unless they are authenticated by the Director of Information Management. Users will destroy interim changes on their expiration dates unless superseded or rescinded.

**Suggested improvements.** The proponent agency for this regulation is USARAK G-4 Maintenance Branch. Users are invited to send comments and suggested improvements on Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) directly to APVR-RDL-M.

#### 1. Purpose.

This regulation's purpose is to provide USARAK command policy on lubricant, fuel, fuel additive, hydraulic fluid, brake fluid, alcohol evaporator system, and windshield washer fluid usage. This regulation pertains to both commercial and military designed equipment, except aircraft. Aircraft technical manuals and pertinent technical publications contain like-type information for aircraft.

#### 2. References.

a. Related publication. A related reference is merely a source of additional information. The user does not have to read it to understand this regulation. Field Manual (FM) 9-207 (Operation and Maintenance of Ordnance Materiel in Cold Weather (0 Degrees to Minus 65 Degrees Fahrenheit)) is a related publication.

b. Referenced form. DA Form 2028 (Recommended Changes to Publications and Blank Forms) is a referenced form. It is cited in the suggested improvements statement.

#### 3. Explanation of abbreviations.

The abbreviations used in this publication are listed in the glossary.

#### 4. Responsibilities.

---

\*This regulation supersedes USARAK Regulation 750-4, dated 30 November 1996

**USARAK Regulation 750-4**

a. The Chief of USARAK G-4 Maintenance is responsible for coordinating policies with higher headquarters and technical activities and publishing needed policies for the command.

b. Commanders at all levels are responsible for assuring that materials and procedures specified herein are used.

**5. General.**

a. Alaska's extreme weather and the inability of technical publications to stay abreast of changes in technology dictate the need for a local policy that can be readily updated.

b. During the equipment manufacturer's warranty period, use manufacturer-specified products and procedures. After the warranty expires, use materials and procedures specified in this regulation.

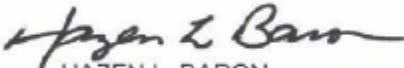
c. This regulation addresses only the usual Alaskan climatic conditions. Units that must deploy to climate conditions not common to Alaska must follow the appropriate equipment lubrication order .

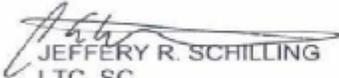
**6. Policy.**

Appendixes A through D contain the current USARAK policy that supersedes all previous instructions.

FOR THE COMMANDER:

OFFICIAL:

  
HAZEN L. BARON  
COL, GS  
Chief of Staff

  
JEFFERY R. SCHILLING  
LTC, SC  
Director of Information Management

DISTRIBUTION:

Copy posted at <http://www.usarak.army.mil/publications>

**Appendix A.  
Lubricants.**

**A-1. Gasoline, diesel, and multifuel engines.** USARAK commanders will utilize only Oil, Engine, Synthetic, OEA, 0W30 on a year round basis unless otherwise specified by the component manufacturer. Table A-1 shows the lubricant's temperature limitations for gasoline, diesel, and multifuel engine usage.

| Table A-1.<br>Gasoline, diesel, and multifuel engine lubricant temperature limitations |                         |                        |
|--|-------------------------|------------------------|
| Lubricant  | Lower Limitation        | Upper Limitation       |
| OEA 0W30   | -67 degrees Fahrenheit* | +90 degrees Fahrenheit |

\*This temperature is without external heaters. With heat, oil is satisfactory at much lower temperatures.

**A-2. Transmissions, gear cases, and hydraulic and power steering systems.** Table A-2 shows the temperature limitations for the lubricants used in this equipment.

a. Automatic transmissions and hydraulic and power steering systems. Use OEA 0W30 in automatic transmissions and hydraulic and power steering systems on a year-round basis. OEA 0W30 is compatible with all types of automatic transmission fluids (including Dexron III). OEA 0W30 can be mixed with other transmission fluids or other transmission fluids can be added to it.

b. Semiautomatic transmissions (including all Caterpillar series transmissions). When temperatures permit, 15W40 is the preferred oil for these transmissions.

c. Allison transmissions utilized in the FMTV will use OEA 0W30 only.

| Table A-2.<br>Transmission, gear case, and hydraulic and power steering system lubricant temperature limitations |                        |                         |
|--|------------------------|-------------------------|
| Lubricant  | Lower Limitation       | Upper Limitation        |
| 15W40  | -10 degrees Fahrenheit | +212 degrees Fahrenheit |
| OEA 0W30   | -67 degrees Fahrenheit | +90 degrees Fahrenheit  |

**A-3. Gear cases.** Manual transmissions, transfers, differentials, and final drives that normally utilize GO90/140; use oil, gear, 75/90 Synthetic. Some manufacturers may require different lubricants in specific applications; for example, the HEMTT and the HMMWV transfer cases use OEA 0W30.

**A-4. Chassis.** Use grease, automotive and artillery (GAA) for chassis lubrication, including wheel bearings.

**A-5. Weapons.** Table A-3 shows the temperature limitations for the lubricants used in weapons.

a. Small arms and machine guns.

(1). Use lubricating oil, weapon (LAW), lubricating oil, small arms (LSA), cleaner lubricant and preservative (CLP), and rifle bore cleaner (RBC) on your weapons.

(2). Do not mix lubricants on the same weapon. Thoroughly clean the weapon when changing from one lubricant to another. PRF-680 is recommended for cleaning when changing from one lubricant to another.

**Appendix B.  
Fuels and Fuel Additives.**

**B-1. Gasoline, Automotive, Unleaded or Low-lead, VV-G-1690B.** Unleaded gasoline is the only fuel authorized for gasoline-powered equipment.

**B-2. Diesel Fuel.** Use JP-8 for all multifuel- and diesel-powered equipment.

**B-3. Additives. Ether.** Using ether or a similar-type fluid as a starting aid is strictly prohibited, except when the equipment's original configuration includes such a system as a starting aid. The factory-installed systems meter a mixture into the engine that will not cause damage. Using a spray can or other means to inject a mixture into the engine is likely to cause internal engine damage and is extremely dangerous to personnel.

**Appendix C.  
Miscellaneous Fluids.**

**C-1. Brake fluid.** The only brake fluid authorized for use is as specified in the vehicle lubrication order (LO).

**C-2. Alcohol evaporator systems.** Vehicles equipped with air braking systems must have an operable alcohol evaporator system which draws vaporized alcohol into the compressed air system or an air dryer system installed during cold weather (0 degrees to -65 degrees Fahrenheit). These systems are designed to prevent the forming and freezing of condensation in the air systems. An inoperable alcohol evaporative system or air dryer system from 1 October through 31 April renders the vehicle not mission capable (NMC)

- a. A bolt-on type evaporator kit is available under national stock number 2530-00-859-7335.
- b. Use only methanol technical, type OM 232 in this system.

Appendix D.  
Lubricants and Miscellaneous Fluids

Table D-1 lists antifreeze, fuels, hydraulic fluids, and cold weather lubricants used in cold weather (0 to -65 degrees Fahrenheit)

| Table D-1.<br>Lubricants and miscellaneous fluids used in cold weather (0 to -65 degrees Fahrenheit). |  |   |
|---|--|---|
| Item  | NSN  | Container Size  |
| Lubricating Oil Aircraft (Instrument) (OAI) (MIL-L-60)  | 9150-00-223-4129   | 1-quart   |
| Antifreeze: Ethylene Glycol (MIL-A-46153)   | 6650-00-181-7933<br>6850-01-464-9152   | 5-gallon can<br>55-gallon drum  |
| Brake Fluid, Silicone (BFS) (MIL-B-46176)   | 9150-01-102-9455<br>9150-01-072-8379   | 1-gallon plastic container<br>55-gallon drum  |
| Cleaner, Lubricant Preservative (CLP) (MIL-PRF-63460)   | 9150-01-053-6688<br>9150-01-054-6453<br>9150-01-102-1473<br>9150-01-079-6124<br>9150-01-054-6453 | 1-gallon drum<br>1-pint container<br>4-ounce liquid<br>4-ounce liquid<br>16-ounce aerosol |
| Grease, Molybdenum Disulfide (GMD)  | 9150-00-935-4018<br>9150-00-754-2595<br>9150-00-223-4004<br>9150-00-965-2003                     | 14-ounce cartridge<br>1.5-pound can<br>5-pound can<br>35-pound can                        |
| GPL, Lubricating Oil, General Purpose   | 9150-00-271-8427   | 4-ounce bottle  |
|   | 9150-00-231-2361   | 1-quart can   |
|   | 9150-00-231-2356   | 5-gallon can  |
|   | 9150-00-231-2357   | 55-gallon drum  |
| Grease, Wide Temperature Range (WTR) (MIL-G-81332)  | 9150-00-181-7724   | 8-ounce tube  |
|   | 9150-00-944-8953   | 1.75-pound can  |
|   | 9150-00-145-0268   | 6.5-pound can   |
|   | 9150-00-935-5851   | 35-pound can  |
| Cleaning, Compound, Windshield  | 6850-00-926-2275   | 16-ounce bottle   |

| Table D-1 (cont'd).<br>Lubricants and miscellaneous fluids used in cold weather (0 to -65 degrees Fahrenheit).  |  |   |
|---|--|---|
| Item  | NSN  | Container Size  |
| Gasoline, Automotive Unleaded<br>Volatility Class E:<br>Limited, Unleaded (VV-G-1690)<br>Regular, Unleaded (VV-G-1690)<br>Premium, Unleaded (VV-G-1690) | 9120-00-148-7102<br>9130-00-148-7102<br>9130-00-148-7102   | All bulk  |
| Grease, Aircraft Instrument (GIA)<br>(MIL-G-23827)  | 9150-00-985-7245<br>9150-00-985-7246<br>9150-00-985-7247<br>9150-00-935-4017   | 8-ounce tube<br>1.75-pound can<br>6.5-pound can<br>14-ounce cartridge                                       |
| Grease, Automotive and Artillery (GAA)  | 9150-01-197-7688<br>9150-01-197-7693<br>9150-01-197-7690<br>9150-01-197-7689<br>9150-01-197-7692<br>9150-01-197-7691 | 2.25-ounce tube<br>14-ounce cartridge<br>1.75-pound can<br>6.5-pound can<br>35-pound pail<br>120-pound drum |
| Hydraulic Fluid, Petroleum Base<br>(OHT) (MIL-H-6083C)  | 9150-00-935-9807<br>9150-00-935-9808<br>9150-00-935-9809<br>9150-00-935-9810   | 1-quart can<br>1-gallon can<br>5-gallon can<br>55-gallon drum   |
| Inhibitor, Corrosion (Antifreeze<br>Extender) (MIL-A-53009)   | 6850-01-160-3868   | 1 quart   |
| Methanol Technical (Air Brake Evaporative<br>System Additive)<br>(OM-232)   | 6810-00-597-3608<br>6810-00-275-6010<br>6850-00-224-8353   | 1-gallon can<br>5-gallon can<br>55-gallon drum  |
| Fuel Oil, Diesel,(JP-8)<br>MIL-DTL-83133E   | 9130-01-031-5816   | Bulk  |
| Oil, Engine Arctic (OEA)<br>(MIL-L-46167)   | 9150-00-402-4478<br>9150-00-402-2372<br>9150-00-491-7197   | 1-quart can<br>5-gallon can<br>55-gallon drum   |
| Oil, Engine, 15W40 (MIL-L-2104D)  | 9150-01-178-4725<br>9150-01-152-4117<br>9150-01-152-4118<br>9150-01-152-4119   | 1-quart plastic bottle<br>1-quart can<br>5-gallon can<br>55-gallon drum                                     |
| Lubricating Oil Gear (GO 75W)<br>(MIL-L-2105C)  | 9150-01-035-5390<br>9150-01-048-4593<br>9150-01-035-5391   | 1-quart can<br>1-gallon can<br>5-gallon can   |
| Lubricating Oil Gear (Synthetic),<br>75W90 (MIL-L-2105D)  | 9150-01-363-1192   | 1-quart can   |

| Table D-1 (cont'd).<br>Lubricants and miscellaneous fluids used in cold weather (0 to -65 degrees Fahrenheit). |                  |                |
|--|------------------|----------------|
| Item   | NSN              | Container Size |
| Lubricating Oil Gear Oil Go 80-90<br>(MIL-L-2105C)   | 9150-01-035-5392 | 1-quart can    |
|  | 9150-01-035-5393 | 5-gallon can   |
|  | 9150-01-035-5394 | 55-gallon drum |
| Lubricating Oil Aircraft Turbine,<br>Synthetic (MIL-L-7808) (*Note 1)  | 9150-00-782-2627 | 1-quart can    |
|  | 9150-00-270-4057 | 1-gallon can   |
|  | 9150-00-782-2679 | 55-gallon drum |
| Oil, Lubricating Small Arms (LSA)<br>(MIL-L-46000)   | 9150-00-935-6597 | 2-ounce bottle |
|  | 9150-00-889-3522 | 4-ounce bottle |
|  | 9150-00-687-4241 | 1-quart can    |
| Lubricating Oil, Semi Fluid  | 9150-00-753-4686 | 1-gallon can   |
| Lubricating, Oil Weapon (LAW)<br>(MIL-L-14107A)  | 9150-00-292-9689 | 1-quart can    |
|  | 9150-00-292-9687 | 5-gallon can   |
| Rifle Bore Cleaner (RBC) (MIL-C-372)   | 6850-00-224-6656 | 2-ounce bottle |
|  | 6850-00-224-6657 | 8-ounce can    |
|  | 6850-00-224-6658 | 1-quart can    |
|  | 6850-00-224-6663 | 1-gallon can   |
| Lubricant, Weapon, Semi-Fluid (LSAT-T)<br>(MIL-L-46150)  | 9150-00-949-0323 | 8-ounce tube   |
|  | 6850-00-274-5421 | 1-gallon can   |
|  |                  |                |

Note 1. For use in Quiet Reliable Generators (QRG).

## APPENDIX E Tire Chain Placement

Tire Chains . . .

# Exceptional Data

**B**etween your vehicle's -10 TM and FM 21-305, *Manual for the Wheeled Vehicle Driver*, you can find most everything you need to know about the use of tire chains on your vehicle.

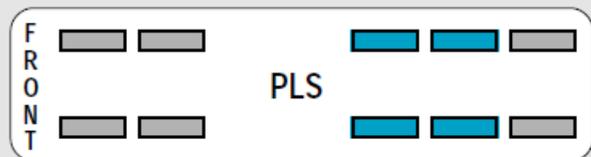
The -10 TM is boss in the matter—unless there's no info in it on tire chain use. Then the FM takes over.

There are, however, exceptions to the rules found in those pubs. Take note:

 **M939A1-series and M939A2-series 5-ton trucks:** Use chains on the intermediate axle only. CTIS doesn't prohibit the use of chains on the intermediate axle.



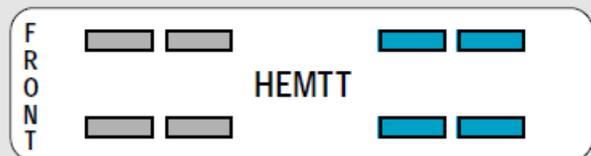
 **Palletized loading system (PLS):** Use chains only on axles No. 3 and No. 4. Don't use chains when driving on hard surfaces where there is no wheel slippage.



Chains can cause severe component damage under “no-slip” conditions.

Also, set the CTIS to CROSS COUNTRY and proceed no faster than 10 mph on-highway or 15 mph off-highway.

 **HEMTT:** Use chains only on both rear axles. On M978 fuel tankers, never use chains when driving on paved surfaces.



They could cause sparks.

 **HMMWV:** Although Page 3-28 of TM9-2320-280-10 says to use chains on all four wheels, **you can use chains on just the frontwheels as a set, or just on the rear wheels as a set.**

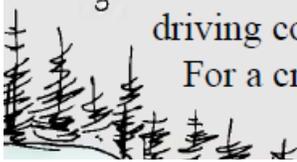


It's OK to use chains on runflat tires, too.

Remember, also, that it's still important to select the right transfer range for driving conditions, as prescribed in your -10 TM.

For a cross-reference list of chains and tire sizes, visit Team Tire's web site:

<http://www.tacom.army.mil/immc/Support/Teamtire/chain.htm>



## APPENDIX F INSTALL TIRECHAINS ON HMMWV

TM 9-2320-280-10

### 3-22. TIRE CHAIN INSTALLATION AND REMOVAL

#### CAUTION

Tire chains are only used when extra traction is required and must be used as an axle set. Any other combination may cause damage to the drivetrain.

#### a. Radial Tire Chain Installation.

(1) Spread out tire chain assembly (1) and line up with tire.

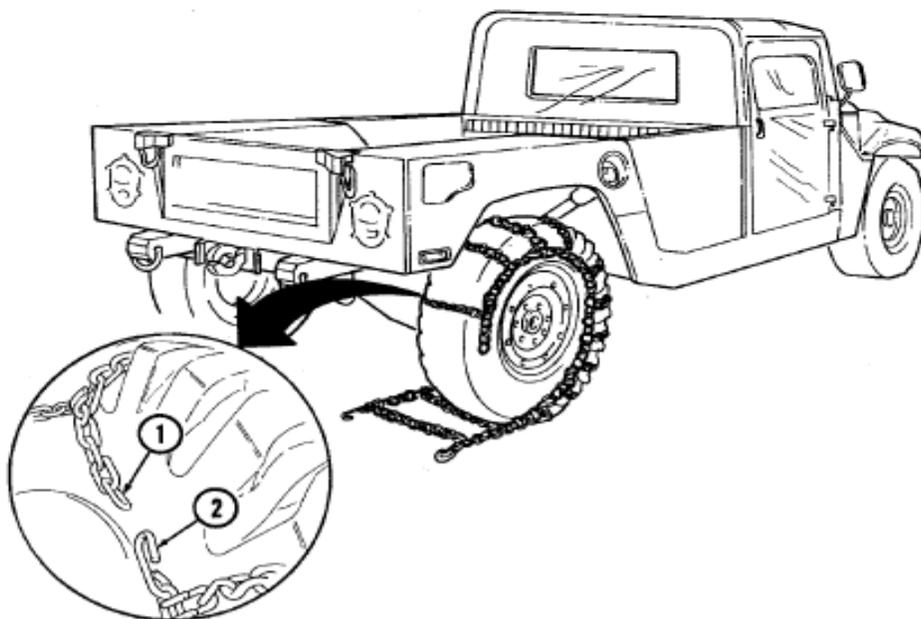
(2) Cautiously move or drive vehicle over tire chain assembly (1) until wheel is positioned at either end of chain assembly (1), allowing tire chain assembly (1) to be draped up and over tire.

(3) Maneuver tire chain assembly (1) until cross-link sections are evenly spaced around tire. Secure one side of tire chain assembly (1) to tire by hooking inside fastener (2) to chain assembly (1). Tighten chain assembly (1) as much as possible.

(4) Repeat steps 1 through 3 above until all tire chain assemblies have been properly installed.

(5) Hook end fastener (3) to chain assembly (1) and secure with locking retainer (4) to tighten chain assembly (1). Ensure as many chain links as possible lay between the sidewall head lugs (5) on both sides of tires.

(6) Move vehicle forward a few feet and retighten chain assembly (1) to remove any slack from where tire was resting on chain assembly (1). Secure loose chain linkage to chain assembly (1) with wire or other field expedient method.



3-28 Change 1

(7) After vehicle is driven one or two miles, stop and retighten tire chains. Ensure as many chain links as possible lie between the sidewall head lugs (5) on both sides of the tires.

(8) After final tightening, secure loose chain linkage to chain assembly (1) with wire or other field expedient method.

(9) Occasionally check tire chains (1) during operations to ensure tire chains (1) have not slipped.

**b. Radial Tire Chain Removal.**

**CAUTION**

Remove tire chains from tires as soon as possible after leaving area requiring their use. Prolonged use of tire chains may damage drivetrain.

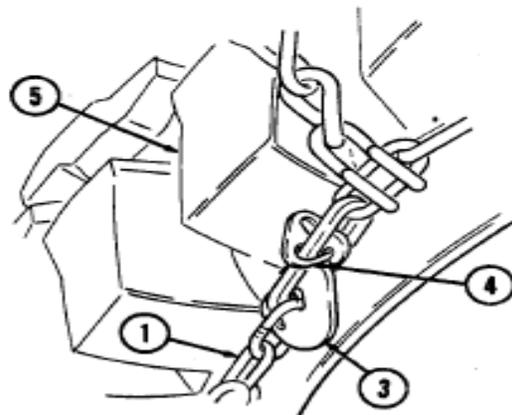
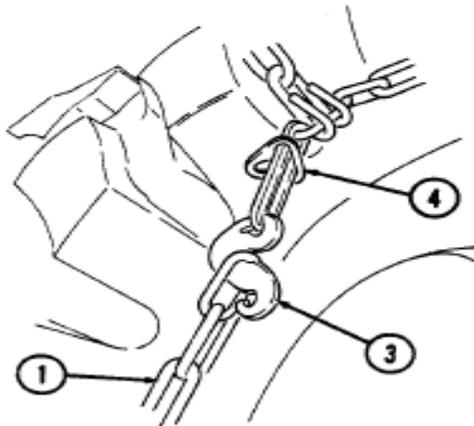
(1) Detach locking retainer (4) from end fastener (3) and unhook end fastener (3) from chain assembly (1).

(2) Unhook inside fastener (2) from chain assembly (1) and remove chain assembly (1) from tire.

(3) Drive vehicle off chain assembly (1).

(4) Repeat operations listed in steps 1 through 3 above until all tire chain assemblies (1) have been removed from tires.

(5) Stow tire chain assemblies (1) under driver's seat.



Change 1 3-28.1

### c. Bias Ply Tire Chain Installation.

#### **CAUTION**

Tire chains are only used when extra traction is required and must be used as an axle set. Any other combination may cause damage to the drivetrain.

(1) Install quick link (1) through cross-link connector (4) located on each side of tire chain assembly (5) between the third and fourth cross chains (3). Tighten nut (2).

(2) Spread out tire chain assembly (5) and line up with tire.

(3) Cautiously move or drive vehicle over tire chain assembly (5) until wheel is positioned at either end of chain assembly (5), allowing tire chain assembly (5) to be draped up and over tire.

(4) Maneuver tire chain assembly (5) until cross-link sections are evenly spaced around tire. Secure one side of tire chain assembly (5) to tire by hooking inside fastener (6) to chain assembly (5). Tighten chain assembly (5) as much as possible.

(5) Repeat steps 2 through 4 above until all tire chain assemblies have been properly installed.

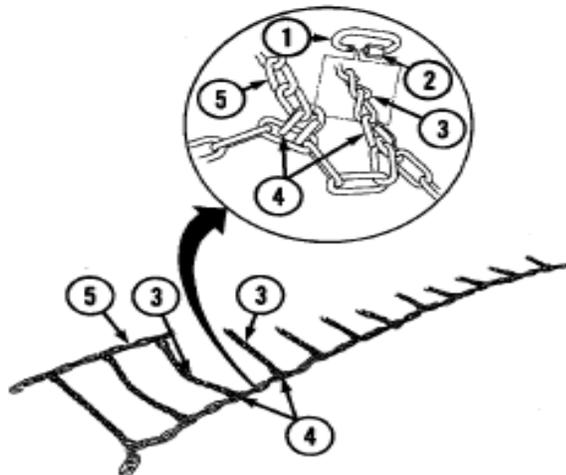
(6) Hook end fastener (7) to chain assembly (5) and secure with locking retainer (8) to tighten chain assembly (5). Ensure as many chain links as possible lay between the sidewall head lugs (9) on both sides of tires.

(7) Move vehicle forward a few feet and retighten chain assembly (5) to remove any slack from where tire was resting on chain assembly (5). Secure loose chain linkage to chain assembly (5) with wire or other field-expedient method.

(8) After vehicle is driven one or two miles, stop and retighten tire chains. Ensure as many chain links as possible lay between the sidewall head lugs (9) on both sides of the tires.

(9) After final tightening, secure loose chain linkage to chain assembly (5) with wire or other field-expedient method.

(10) Occasionally check tire chains (5) during operations to ensure tire chains (5) have not slipped.



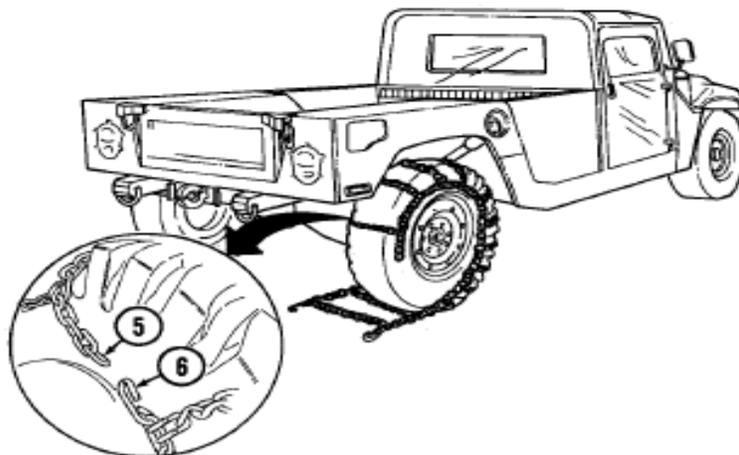
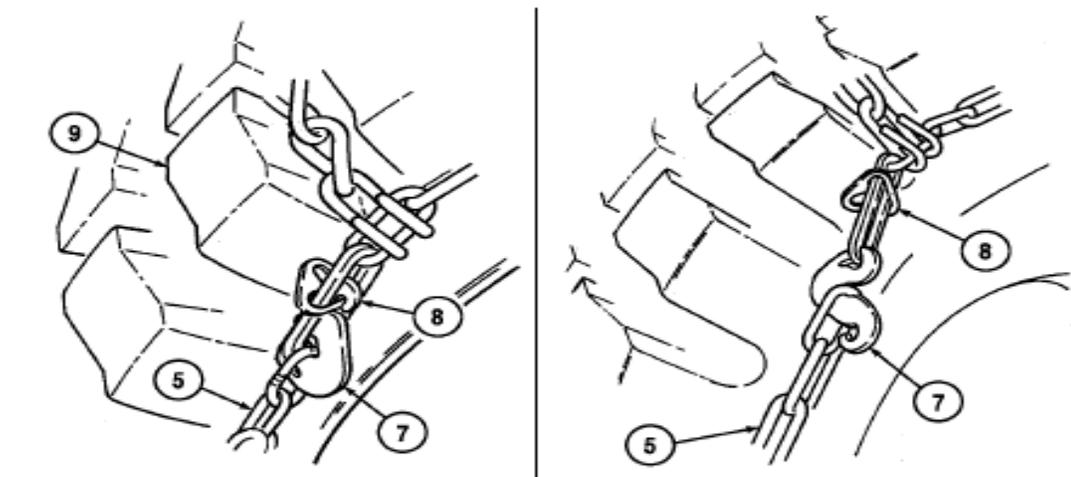
3-28.2 Change 1

**d. Bias Ply Tire Chain Removal.**

**CAUTION**

Remove tire chains from tires as soon as possible after leaving area requiring their use. Prolonged use of tire chains may damage drivetrain.

- (1) Detach locking retainer (8) from end fastener (7) and unhook end fastener (7) from chain assembly (5).
- (2) Unhook inside fastener (6) from chain assembly (5) and remove chain assembly (5) from tire.
- (3) Drive vehicle off chain assembly (5).
- (4) Repeat steps 1 through 3 until all tire chain assemblies (5) have been removed from tires.
- (5) Stow tire chain assemblies (5) under driver's seat.



Change 1 3-29

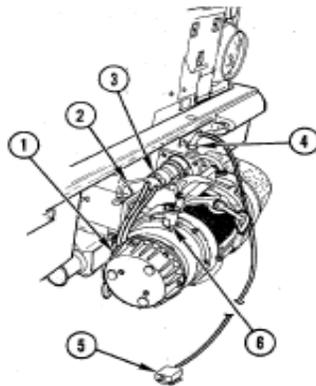
## APPENDIX G SUSV WINCH OPERATION

TM 9-2350-285-10

### 2-14. OPERATE WINCH.

#### a. Prepare Winch for Operation.

- (1) Release latch, pull out pin, and remove winch (1) from stowage bracket. Install on front of vehicle.
- (2) Install winch mounting pin (2).
- (3) Plug one end of power cable (3) into vehicle slave receptacle at rear of driver's seat and one end in power receptacle on winch.
- (4) Connect remote control cable (4) to winch control receptacle.



#### b. Operating Winch.

- (1) Start engine (see paragraph 2-8).

#### **WARNING**

- Cables can become frayed or contain broken wires. Wear heavy leather-palmed work gloves when handling cables. Frayed or broken wires can injure your hands.
- Never let moving cable slide through your hand even when wearing gloves; broken wire could cut through glove and cut your hand.

#### **CAUTION**

DO NOT use winch motor to pay out winch cable. DO NOT pull out winch cable with another vehicle. Damage to winch motor may result.

- (2) Move remote control toggle switch (5) to wind OUT position. Release remote control toggle switch as soon as winch cable has some slack.
- (3) Pull up drum lock (6) and turn it 1/2 turn to unlock winch drum.

## 2-14. OPERATE WINCH (Con't).

- (4) Pull out needed length of winch cable by hand.

**NOTE**

To avoid overloading the winch, use tackle block when rigging for winching.

- (5) Remove tackle block from stowage location (see Appendix E).

**CAUTION**

Rig cable to ensure that straight pull is maintained on winch. Winching with cable at an angle to winch drum can damage cable.

- (6) Attach tackle block with winch cable to vehicle or permanent fixture.

**WARNING**

Clear all personnel from vehicle and from path of cable at distance equal to length of cable. Cable could break causing injury to personnel.

- (7) Turn drum lock (6) until it falls into lock position.

**CAUTION**

Winch has mechanical and thermal overload protection. Winch must be allowed to cool down for approximately 5 minutes when thermal overload protection is initiated. If winch locks up a special tool is needed. Notify your supervisor.

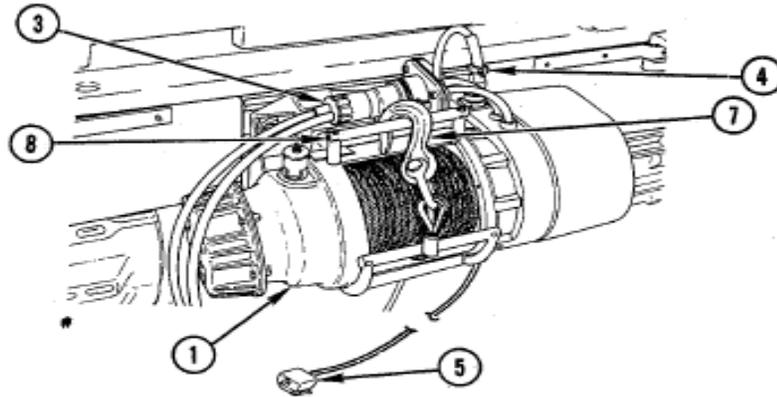
- (8) Move remote control toggle switch (5) to wind IN position. Release remote control toggle switch to stop winching movement.
- (9) Move remote control toggle switch (5) to wind OUT position until cable is slack. Disconnect winch cable.

## c. Prepare Winch for Travel.

- (1) Disconnect tackle block with winch cable from vehicle or permanent fixture.
- (2) Maintain tension on winch cable to ensure that it winds evenly on drum.
- (3) Move remote control toggle switch (5) to wind IN position.

2-14. OPERATE WINCH (Con't).

- (4) Remove tackle block from winch cable and stow in stowage location.
- (5) Wind IN cable until cable hook (7) is near winch and release remote control toggle switch (5).
- (6) Attach cable hook (7) to winch pipe bracket (8).



**CAUTION**

DO NOT wind winch cable too tightly on drum. Damage to winch can result.

- (7) Move remote control toggle switch (5) to wind IN position until cable has slight tension and release remote control toggle switch.
- (8) Shut off engine.
- (9) Disconnect and stow remote control cable (4) and power cable (3).
- (10) Remove and stow winch (1).

# APPENDIX H Commanding General's Policy Letter 14



DEPARTMENT OF THE ARMY  
HEADQUARTERS, U.S. ARMY ALASKA  
724 POSTAL SERVICE LOOP #5000  
JOINT BASE ELMENDORF-RICHARDSON AK 99505-5000

AUG 29 2013

APVR-ROP

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Cold Weather Physical Readiness Training Policy (CG Policy #0-14)

1. References:

- a. Army Regulation 385-10, 4 Oct 11, subject: The Army Safety Program.
- b. United States Army Alaska (USARAK) Regulation 350-1, 5 Jun 09, subject: Training.
- c. USARAK Pamphlet 600-2, 1 Oct 10, subject: Arctic Warrior Standards.
- d. USARAK Pamphlet 385-4, 30 Sep 09, subject: Risk Management Guide for Cold Weather Operations.

2. Purpose To establish procedures for conducting cold weather physical readiness training. This policy applies to all USARAK units.

3. General. Leaders are our first line of defense against cold weather injuries (CWIs). I expect every leader to thoroughly analyze the associated risks and exercise sound judgment, during the conduct of cold weather physical readiness training (PRT). You are expected to maintain an aggressive PRT program, but not at the expense of CWIs for your Soldiers. It is imperative that leaders train and educate Soldiers to train and operate in the cold without injury. To that end, I expect each of you to directly supervise your Soldiers to ensure they possess and properly utilize the right clothing/equipment for all training activities.

4. Policy/Procedures. During the winter months (Oct –Apr), all major subordinate commands (brigades, tenant units and separate commands) will check USARAK portal to determine the temperature (including wind chill) prior to the start of PRT. Care must be exercised as temperature variations of between 10 and 20 degrees are possible, depending on the time of day and training location. Leaders must ensure each Soldier is prepared to train under the coldest temperature for the given time period. Individuals may wear additional clothing such as long underwear, or upgrade to a warmer glove/mitten, as necessary, to avoid CWIs. Commanders may always determine that additional protective clothing must be worn, based on local conditions.

5. Use the following guidance as the minimum standard for the conduct of PRT during extreme conditions:

**PRT UNIFORM**

| Temperature (Fahrenheit)                 | Army IPFU shirt & shorts with running shoes and reflective belt/vest | IPFU Jacket/pants | Issued gloves, Fleece Cap or Balaclava | Trigger finger mittens and balaclava | Polypropylene top and bottom, trigger finger mittens, balaclava (with arctic mittens carried) | Arctic field uniform, polypropylene, balaclava, VB boots, cortex, trigger finger mittens, arctic mittens |
|--|--|-------------------|--|--------------------------------------|---|--|
| 44 to 33 degrees                         | X  | X                 |  |                                      |   |  |
| 32 to 10 degrees                         | X  | X                 | X                                      |                                      |   |  |
| 10 to -10 degrees                        | X  | X                 |  | X                                    |   |  |
| -10 to -25 degrees                       | X  | X                 |  |                                      | X   |  |
| Below -25 degrees (including wind chill) |  |                   |  |                                      | X   | X  |

a. At temperatures (including wind chill) of -10 to -25 degrees Fahrenheit, units will continue to conduct normal PRT. Units should conduct warm-up/stretching, conditioning and cool-down indoors. In this temperature range, the PRT uniform consists of Army PFU sweats, polypropylene tops and bottoms, running shoes, trigger finger mittens, balaclava, and arctic mittens (arctic mittens carried). If the balaclava is worn down during the run, it must stay down and over the nose until the unit moves indoors. If the temperature is below -20 degrees Fahrenheit, units will not spend more than four minutes outdoors before or after the run, and commanders should reduce the distance/duration of the run (recommend four miles maximum). At this temperature and

APVR-ROP

SUBJECT: Cold Weather Physical Readiness Training Policy (CG Policy #0-14)

lower, unit commanders will allow Soldiers to move to a warm facility during PRT if they feel there is potential for injury.

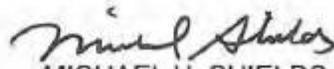
b. At temperatures (including wind chill) below -25 degrees Fahrenheit, Soldiers will wear the arctic winter field uniform ECWCS GEN II or GEN III, VB boots, Gortex, trigger finger mittens, arctic mittens, and balaclava. Commanders should conduct an alternate form of aerobic PRT, such as snowshoeing or skiing. Indoor hallway/stair runs are authorized.

c. At temperatures below freezing (32 degrees Fahrenheit), unit commanders will ensure all Soldiers participating in outdoor PRT have the appropriate non-slip running devices or spikes for running shoes in order to mitigate the risks from slipping when running during winter conditions.

d. Any deviations of the prescribed uniform guidance above will be done by the unit commander or first sergeant IAW the unit's risk assessment.

e. Prevention of CWIs is a leader and individual Soldier responsibility. Consult USARAK Pamphlet 385-4, Risk Management Guide for Cold Weather Operations, prior to execution of PRT in extreme temperatures. By adhering to these guidelines and accepting the philosophy that no cold weather injury is acceptable, leaders can conduct safe and demanding PRT.

6. Point of contact for this policy is Sergeant Major Seegrist, USARAK G-3/5/7, (907) 384-2285.

  
MICHAEL H. SHIELDS  
Major General, USA  
Commanding

DISTRIBUTION: A

## USARAK 9-Line Medevac Request

### 9-Line MEDEVAC Request

|   |  |
|---|--|
| <ol style="list-style-type: none"> <li>1. Location of Pickup Site</li> <li>2. Radio Frequency / Call Sign</li> <li>3. Number of Patients by precedence:                             <ol style="list-style-type: none"> <li>A. Urgent</li> <li>B. Urgent Surgery</li> <li>C. Priority</li> <li>D. Routine</li> <li>E. Convenience</li> </ol> </li> <li>4. Special Equipment                             <ol style="list-style-type: none"> <li>A. None</li> <li>B. Hoist</li> <li>C. Extraction Equipment</li> <li>D. Ventilator</li> </ol> </li> <li>5. # Patients by type                             <ol style="list-style-type: none"> <li>L. Litter</li> <li>A. Ambulatory</li> </ol> </li> <li>6. Number and type of wounds</li> </ol> | <ol style="list-style-type: none"> <li>7. Method of Marking Pickup Site                             <ol style="list-style-type: none"> <li>A. VS-17 Panel</li> <li>B. Pyro</li> <li>C. Smoke</li> <li>D. IR Light</li> <li>E. None</li> </ol> </li> <li>8. Patient Nationality &amp; Status                             <ol style="list-style-type: none"> <li>A. US Military</li> <li>B. US Civilian</li> <li>C. Foreign Military</li> <li>D. Foreign Civilian</li> </ol> </li> <li>9. Terrain Description                             <ul style="list-style-type: none"> <li>Hills</li> <li>Power Lines</li> <li>Buildings</li> <li>Landing Surface</li> </ul> </li> </ol> |
|---|--|



**ON FEDERAL TRAINING LANDS**  
*(FWA, YTA, DTA, JBER, TFTA, etc)*

1. Contact Range Control:
 

|                          |          |
|--------------------------|----------|
| Primary                  | FM 38.30 |
| Secondary                | FM 40.50 |
| Contingency 907-353-7535 |          |
2. Relay 9-Line MEDEVAC Request on the back of this card.
3. Contact Your Unit with SITREP.
4. Continue to provide medical care until MEDEVAC arrives or ground EVAC completed.

**OFF FEDERAL TRAINING LANDS**  
*(Parks HWY, Richardson HWY, Glenn HWY, etc)*

1. Dial 911
2. Inform 911 Operator of the location and injuries.  
(Refer to 9-Line)
3. Contact Your Unit with SITREP.
4. Continue to provide medical care until EMS or MEDEVAC arrives.



