Civil Air Patrol
Hawk Mountain Ranger School

Winter Wilderness Search Fundamentals

Winter Wilderness Search Fundamentals

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Winter Wilderness Search Fundamentals

Introduction

This reference material was developed to be used by students attending the initial and intermediate training at Civil Air Patrol's Hawk Mountain Winter Ranger School.

The information is basic in nature and is designed to supplement prerequisite training and experience as well as formal instruction at the school.

Additional training material and performance evaluation check sheets will be provided based on the student's course of study.

Students are expected to complete the following basic training requirements before learning Winter Wilderness Search Fundamentals:

- Basic First Aid
- Basic CPR
- NIMS IS-100, (Introduction to ICS) and IS- 700a (NIMS, An Introduction)
- General Emergency Services Training

Additional copies of this manual are available by contacting:

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Introduction to Cold-Weather Operations

"Rangers in pairs look after each other; be faithful to your buddy; be loyal to your leaders." - Anonymous

Overcoming the Cold

The body must be protected. It must be kept clean, dry, and warm, with normal body processes maintained. Rest and nourishment are vital. The right approach to cold-weather living will keep you healthy and get you through challenging times. There are four basic rules to follow:

Keep in Shape - Cold-weather clothing and equipment are heavy, and add weight to your normal equipment load. This hinders movement in snow and uses much more energy with respect to warm weather operations. The importance of being in excellent physical condition cannot be overemphasized. Your unit must have a tough, challenging, demanding physical training program.

Drink Plenty of Water - Drink plenty of water (at least 3 quarts per day) to avoid dehydration and fatigue. Water may be difficult to obtain, so you may drink less than you need or drink only when thirsty. This will not give you the water needed to avoid dehydration. DO NOT eat snow as a water substitute; it will lower your body's core temperature.

Eat to Keep Fit - Regular, nutritious hot food is needed for top performance. Eat even when you are not hungry. Hot meals will assist in heating the body's core.

Maintain a Good Attitude – Your attitude toward the cold will reflect others. There will be many new challenges, but none that cannot be overcome.

Cold Conditions

Cold-Wet - Cold wet conditions occur when temperatures are near freezing, the high and low temperatures cause alternate freezing and thawing. These conditions can be accompanied by wet snow and rain, causing the ground to become slushy and muddy. Wear clothing that has a water proof/repellent, wind resistant/proof outer layer, and an inner layer with insulation that provides protection in moderately cold weather (above 14 deg. F). Waterproof footwear is essential.

Cold-Dry - Cold dry conditions occur when average temperatures are less than 14 deg. F. The ground is usually frozen and the snow dry. Low temperatures plus wind increase the need for protection of the entire body. **Wind Chill** - Wind chill is a measure of the combined effects of wind and temperature. Temperature alone does not give a true indication of the impact of the cold. In order to effectively gauge the difference between temperature and the impact of the cold, a wind-chill scale must be used. (See appendix – 1)

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Effects of Cold Weather on Operations

Cold has a numbing effect on skin, which hinders performance. This must be considered when accomplishing such routine tasks as vehicle maintenance, making and striking camp, and performing search functions. When conditions become extreme and the temperature drops, the problem of survival becomes critical. Under these circumstances, people may tend to withdraw emotionally, not wanting to leave the warmth and protection of their shelter or tent.

Cocoon-Like Existence - Many people, when wearing several layers of clothing and with their heads covered, tend to withdraw within themselves and assume a cocoon-like existence. When so clothed, hearing and field of vision are restricted; they tend not to notice their surroundings. Their thinking and reasoning become sluggish.

Individual and Group Hibernation - This process is characterized by individuals seeking the comfort of sleeping bags, and by the group remaining in tents or other shelter. Many important measures may be neglected, jeopardizing the security and safety of the unit.

Remedy– The remedy for these cold weather effects is physical activity; try to remain alert and active.

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Safety Briefing

The four minimum requirements in a safety briefing are:

- Explain task
- Identify hazards
- Take steps to minimize or eliminate hazards
- Identify required personal protective equipment

Report any injuries immediately to your team leader.

Positive Leadership and the Right Attitude

Most, after a few weekends of cold-weather training, will be able to cope with the environment. Some team members may not be as skilled as others, but most will succeed.

Set an example for other team members. Winter conditions can be frightening, trying to meet challenges never met before. Any mistake could make you a casualty. Aggressive leadership actions that overcome the challenges of the environment are essential to mission accomplishment.

There are two enemies to overcome in northern operations: the SAR mission and the cold. The first step in defeating either enemy is having the right attitude. The cold can defeat you psychologically if you are not aware of the symptoms of a poorly prepared unit.

The following are suggestions on how to defeat the cold:

- If someone becomes moody, or doesn't want to talk, get them involved with others. Don't leave out the weaker team members.
- Remind team members that for search and rescue, personal and team equipment must be kept in working order. Operations in a northern environment can easily become just a camping trip, with serious consequences. You must avoid this common mistake.
- Cold weather may slow down the common task, but that is no excuse for not doing it.
- Cold weather may make tasks harder and take longer to do, but it will not make them impossible. With knowledge, proper equipment, and proper training you can overcome the cold and be successful.

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Winter Operations

"Every mile is two in winter." -George Herbert

Walking in Cold Conditions

Traveling will be slower in cold conditions, moving will take more exertion because the body must use more energy to keep warm. The terrain may have snow or ice cover, which will further slow down your pace.

It is necessary to take frequent breaks. During these times fluids and snacks should be consumed. During breaks more clothing might be necessary since body movement will not be producing extra heat. Remove extra clothing before starting to move again or overheating may occur.

If walking in deep snow, pulling your feet out of the snow every step will be very tiring. Walking on top of the snow is ideal. Snow shoes distribute your weight over a larger area of snow so that you can walk on top of it and, therefore, expend less energy and move faster.

When walking on ice, it is difficult to keep your footing. There are a few products sold that can keep you from slipping and falling. The most common are metal cleats that strap onto your shoes. Always remember that a significant amount of time at temperatures below <32 deg. F is needed to freeze a body of water. Ice conditions at the shore may not be the same at the lake center.

Walking sticks can be helpful to test whether you can put your foot at any point. They also offer a third point of contact and can help you keep your balance and distribute your weight.

Hazards

The most common hazard from walking in cold conditions is simply slipping and falling. Ice and black ice can form on many surfaces. Black ice, is a thin slick coating of glazed ice on a surface, often a roadway. It is especially hazardous when driving or walking because it is both hard to see and extremely slick. A thin film of snow on a hard surface can also be very slippery. Snow tends to fill in the crevices between rocks and boulders. Places that look safe to walk may in fact, be large holes. It is very easy to get a twisted ankle or broken knee if care is not taken.

Cold Weather Search Techniques

When on a search line in cold weather, there are a few extra things to keep in mind. Objects can be buried by snow. If you suspect that something may be located under a snowdrift, it is important to check under it. The need for thorough search coupled with safety concerns will cause the search line to move more slowly.

Equipment, such as hoods will impede your vision and even make it more difficult to look around. Under these situations, it is necessary to make sure that you are still searching all around you, including front, back, left, right, up and down.

Personal Clothing and Equipment

Personal Protective Equipment (PPE)

Universal Precautions

Orange hard hats and vests should be worn in field operations. There are several methods of securing a hard hat on your head, but the chin strap is the most foolproof.

Hand protection must be worn during vertical operation for all tasks except inspecting rope. Leather gloves must be worn in the preparation and use of rope systems and while tying knots.

Safety glasses protect the eyes from physical damage. Travel in wooded areas without wearing safety glasses greatly increases the risk of eye injury. Safety sunglasses may be okay during the day, but substitution with clear glasses in limited light is required.

Wearing latex or nitrile gloves and safety glasses will increase a team member's safety through Body Substance Isolation (BSI). Nitrile gloves reduce the potential for latex allergic reactions but may reduce tactile sensitivity.

Minimum Equipment Required for Winter SAR Operations

These are items to be added to the standard SAR Operations Packing List.

Clothing

The base layer against the skin should be a wicking material like polypropylene that keeps the skin dry. Clothing made from cotton is not a good choice for winter operations, because it accumulates moisture then cold.

- BDU - modified for comfort in cold weather - don't forget your wallet, CAP ID card, and ES cards.
- Wool or synthetic material long underwear - NOT cotton
- Winter Coat: Parkas can be used, but four or five layers with the outer being windproof is a better solution than one big layer in the form of a heavy parka. Have the ability to dress up and down in layers according to the activity level. It is more important to be warm than to have an outer layer that "looks military." Expect to stand around inactive, loosing heat and getting cold. Expect to hike in the woods carrying heavy loads, getting rather heated.
- Heavy knit cap, adjust your hard hat to fit comfortably over it
- Insulated gloves or mittens with water resistant shell and leather palm. These are in addition to leather gloves.
- Thermal Socks - Ideally a wool, wool blend, or alpaca outer sock with polypropylene liner to wick away perspiration.
- WATERPROOF, INSULATED COLD WEATHER BOOTS ARE REQUIRED!! Standard combat boots ARE NOT sufficient.
- Optional Clothing Items
- Sweaters, vests, polypropylene shirts, nylon windbreaker
- Gaiters are effective for snow (cover boots and lower portion of legs for protection)
- Snow shoes
- Ice cleats
- Walking Stick

Web Gear/Rugged Day Pack

(For search and rescue activities, without the backpack)

- 2 quarts of water
- Lots of snacks and food that do not require cooking
- Rain gear / Poncho
- Spare socks
- Flashlight and extra batteries - headlamp is good
- Trash bags one large heavy duty bag can be used for an expedient shelter in emergency situations.
- Leather gloves
- Hand/foot warmers optional
- Matches storm proof matches are preferred. Vaseline impregnated cotton balls are an excellent fire starter and double for anti –chaffing ointment or chapstick.
- Pocket knife
- Compass
- Orange hard hat
- Orange vest
- Eye protection
- Small personal 1st Aid Kit and three days of personal medications or special needs.
- Toilet paper in a waterproof bag.

Backpack

(Be prepared to hike with full gear)

- Closed cell foam sleeping pad
- Sleeping bag - extreme cold weather, down or synthetic filled but NOT cotton
- Ground "cloth " - plastic tarp or poncho
- Small lightweight tent
- Roll of toilet paper in plastic bag
- Spare socks
- Spare BDU trousers
- Food for 4 or 5 meals (hot) - consider snacks in day pack
- Eating Utensils
- Small Stove Optional
- Soap, small towel, toothbrush, toothpaste, deodorant, etc
- Another quart of water

This list does not include Team Gear.

Individual Clothing

"The freezing German troops were reduced to removing clothes from enemy corpses, improvising strawboots, and taking other emergency measures." - Russia, 1942

It is necessary to understand the design principles of cold-weather clothing. These principles are: insulate, layer, and ventilate. There are four ways to make these principles work: keep it **C**lean, avoid **O**verheating, wear it **L**oose, and keep it **D**ry. By remembering the "buzz word" **COLD**, you can quickly check clothing.

Insulate - Insulation material reduces the amount of heat loss. By regulating the amount of insulation, an individual can regulate the amount of heat lost or retained.

Layer - Several layers of clothing provide more insulation and movement than one heavy garment, even if the heavy garment is as thick as the combined layers. Air pockets trapped between the layers provide insulation and warmth.

Ventilate - Ventilation helps keep a comfortable body temperature by allowing excess heat and moisture to escape. Moisture will cause problems later when inactive.

**** THE KEY TO KEEPING WARM IN COLD CLIMATES IS THE WORD **C O L D**

keep it	**C** lean
avoid	**O** verheating
wear it	**L** oose in Layers
keep it	**D** ry

Keep Clothing Clean - Dirty clothes are cold clothes. Dirt and grease clog the air spaces in clothing and reduce insulation.

Avoid Overheating - Select comfortable clothing and do not overdress. In cold weather, it is better to be a little cool rather than risk being overheated.

Wear Loose Layers - All items in cold-weather need to be large enough to allow wear of the appropriate number of layers. Field jackets may appear too large without all of the layers designed to fit under them. If the uniform items do not fit loosely, the insulation that keeps you warm will be greatly reduced.

Keep It Dry - It is important to keep clothing dry, since wet clothing conducts heat away from the body more quickly than dry clothing. Moisture soaks into clothing from two directions: the inside and the outside. From the outside you must guard against melting snow; from the inside you must guard against sweating. Brush snow and frost from clothing before entering any heated shelter or vehicle, and avoid overheating. Boot Gaiters help keep the bottom of pants and boots snow and ice free. Proper ventilation when exerting yourself will help to evaporate sweat while you're warm.

The Cold-Weather Uniform

There are many layers of clothing that must be worn in a cold weather environment. Cotton should be avoided because it absorbs moisture and looses its insulating property. This increases cooling adjacent to the skin. The superiority of synthetic material is that it retains most of its insulating properties even when wet.

The first layer of clothing is the T-shirt and underwear. **Synthetic is best.**

The second layer is a set of thermal underwear. This consists of polypropylene, nomex, coolmax, or other synthetic undershirt and pants. Cotton is not good. It absorbs a lot of moisture. Synthetic thermal underwear is designed to wick moisture away from the skin, reducing conductive and evaporative heat loss at the skin surface.

Then wear the BDU layer as the third layer.

Endless combinations can be made over and under the BDU layer with polypropylene or wool shirts, sweaters, vests.

Wear of another set of trousers as an outer garment, or underneath the BDU. When conditions demand more insulation, normal uniform rules no longer apply.

The field jacket is worn with the liner in both cold-wet and cold-dry areas. Remove the liner in mild weather or when activity increases.

In a cold-dry environment a parka is worn. The waist is adjustable for ventilation and warmth with a drawcord. During a period of severe cold, when activity is reduced, wear the parka over your field jacket. To avoid sweating & overheating DO NOT overdress.

A windproof/ waterproof outer shell layer does not provide much insulation, but protects the first three layers from wind, rain and snow; this is good for both cold-wet and cold-dry. Under arm vents in outer garments help regulate body temperature.

Keep the head covered to stay warm; a warm head even warms the feet. Over half of our body heat can be lost through your head. Wear the cold-weather cap or balaclava under your hard hat or under the hood to your field jacket. In a cold-dry environment, wear the winter hood over the cap or the hard hat.

Waterproofed insulated gloves or mittens. In extreme cold, use inner liner gloves with outer shell mittens that are waterproof.

The feet are hard to keep warm and dry, so protect them. The insulated boots (black military QMC for cold-wet conditions and white Mickey-Mouse for cold-dry conditions) are warm and waterproof. Mukluks are excellent, but the military green canvass ones give no support for hiking. Real mukluks are rubber lowers and leather uppers.

When active, feet will sweat and, because of waterproofing, the moisture will remain in the socks or in the bottom of the boots.

If the boots are worn for long periods, the feet may become white and wrinkled when boots are removed. This is known as "Trench Foot." This is no cause for alarm. Drying, massaging with foot powder, warming and putting on dry socks will correct this. During long periods of inactivity, feet may become cold. Exercises such as knee bends, stamping, running in place, or wiggling toes will make them warm.

Elevate the feet whenever possible to aid blood circulation. Don't wear socks that are too tight, and wear only one pair of insulated cushion sole socks at a time, over a thin synthetic pair. Change socks at least twice a day. Most importantly, stay active.

Care of boots is important; in order to keep feet warm, and the insulation must be kept dry. Inspect boots often and repair any holes or punctures immediately. Temporary repairs can be made, by patching the hole with any kind of tape; even chewing gum can be used. Seal the hole quickly to prevent the insulation from becoming wet. If one boot feels heavier than the other, the insulation is probably wet.

Overshoes maybe worn over leather boots in wet or muddy conditions. The overshoes are not as warm and dry as the insulated boots. Make sure socks are dry and boots are loosely laced so as not to restrict circulation.

Drying Wet Clothing - Hang items separately on drying lines. Do not place anything too close to a stove, fire, or over steaming pots; they could catch fire, and steam will cause further dampness.

Drying Damp Clothing - Damp items can be hung on the backpack while moving. Pin damp socks to load-carrying equipment or shirt during movement or just inside the last layer of clothing. Do not place damp clothing in sleeping bags. This will only make sleeping bags wet and they are harder to dry than clothing.

Never warm feet in boots next to an open fire. The boots will melt and burn before the feet become warm, because of their insulation. Take boots and socks off, monitor the drying process carefully by hand.

When sleeping, remove boots, and place under bottom of sleeping bag, on top of foam pad, openings facing out to ventilate. Remove damp socks. Make sure boots including soles are dry.

Never wear boots in a sleeping bag.

Cold-Weather Equipment

Packing Your Backpack

Team members should carry two sets of equipment, called day gear and extended gear. It is important to consider that both sets of gear may have to be carried at the same time.

The purpose of day gear is to support a person for up to 24 hours while functioning as part of a team. A list will be provided with typical items to be included in the day gear. There are many options for day gear and some of the most popular are described below.

- Load Carrying Equipment (webbed gear) is usually cheap, long lasting and easy to adapt. The main drawback is that items are hung off the person causing increased fatigue. Hanging items are easily caught in heavy brush.
- Load Bearing Vests are an improvement to the military webbed gear by cutting down on the amount of items on the waist. The majority of the weight (canteens, butt packs, etc.) is still hung from a web belt.
- Air Force Survival Vests are constructed from nylon mesh and many different sized pockets. There is no place to attach canteens or other items.
- Fanny packs are similar to the military butt pack except they normally have their own built in PADDED waist belt. This type of pack is normally not large enough.
- Daypacks are small commercial backpacks with several compartments.
- Extended gear is used when a team must be self-sufficient for an unknown or extended period of time. A list will be provided with typical items to be included in extended gear.

When loading your pack for travel, place heavy items at the top, next to the frame. Items should be packed to distribute the weight low and close to your body. Place hard or sharp objects inside the load where they will not rub on your back. When trail walking, raise the center of gravity and take more of the load on your shoulders. Articles that are often needed are placed in the outside pockets for easy reach. Adjust the straps so that you can move the top part of your body and swing your arms freely.

Backpacks

An ALICE (All Purpose Lightweight Individual Carrying Equipment) pack is the most common form of military pack. It comes in medium and large. Both packs have a large inner compartment, three main exterior pockets, a "hidden" compartment in the top flap, and various attachment points for equipment on the outside of the pack. The large pack also has additional three smaller outer pockets for items such as socks, foot powder and snacks. ALICE frames are available as an accessory with these packs.

Commercial backpacks range in size from ones many people carry to school to ones large enough to sustain an experienced woodsman for many days. Many packs lack exterior pockets for equipment storage.

Commercial backpacks come with either internal or external frames. External frame refers to the fact that the frame is outside of the pack. This type of pack is generally best suited for longer duration excursions but is not available in as many sizes as other types of packs. Depending on size, these parks may hinder movement through brush and heavily wooded areas.

The internal frame pack has two aluminum bars make up the rigid support for the pack. These bars are bent to conform to the wearer's back and allow for a greater degree of comfort. The internal frame pack does sit against the wearers back allowing the jacket or shirt to become soaked with sweat. Great care must also be taken to have the pack properly adjusted since the entire system works together to support the load of the pack.

Sleeping Bags

The sleeping equipment or sleep system consists of a sleeping bag, an insulated sleeping pad, and a waterproof bag. There are two types of sleeping bags, down filled and synthetic. Some brand names of synthetic fibers are: Hollowfill, Quallofill, Thinsolate, Lanolite and Fiberfill II. Pick a bag with baffles that evenly distribute the insulation. The goal of bag construction is to avoid cold spots. Quality bags do this by using systems such as slant-walled baffles. This means the walls of the baffles are angled so each section partially overlaps the adjacent baffle.

Mummy - shaped bags are warmest.

Military down-filled bags are common, sufficient, and cheap.

The bag must be kept dry if it is to keep you warm. Sleeping bags become wet from outside moisture, from sweating on the inside of the bag, and from water escaping from the mouth or nose into the sleeping bag. Avoid sweating by wearing a minimum of clothing necessary to stay warm and comfortable at the lower temperature ranges. Typically, long underwear, dry socks, and knit hat should be worn while sleeping.

Do not breathe into the bag or moisture will collect and wet the bag or form ice crystals. If your face gets cold, cover it with a towel, balaclava, or sleeping hood.

When it is not in use or being carried, open the sleeping bag wide so that fresh air can get into it. Turn it inside out so that the sun and wind can dry it. Always shake the bag out and fluff it up before use to provide for more trapped air between the layers of the wind-resistant/water-resistant outer shell. To warm sleeping bags, rub activated chemical hand/foot warmers over the inside of the sleeping bag just prior to entering. Warm clean and dry rocks from close to the fire can also be used; however do not use HOT rocks. A canteen of hot water can also be used to warm the inside of your sleeping bag, but care should be taken to make sure that it does not leak.

Down fill & synthetic fill both provide excellent insulation capabilities. Synthetics have the advantage of maintaining their insulating capabilities even when wet, which down will not do. Down has the advantage of being more compressible, meaning a smaller, lighter bag when compared to a comparable synthetic fill bag.

Always carry sleeping bags in the waterproof, brushproof carrying bag. This protects the bag and helps keep it dry. Ensure that the top of the bag is securely tied to prevent snow or other moisture from getting inside and wetting the sleeping bag.

Ground Pads

Self-inflating air mattresses tend to be more comfortable, but closed cell foam pads insulate better. Use the ground pad under the sleeping bag for warmth, comfort and to keep it dry. Twice the insulation is needed under you than above you. Any other equipment or even dry natural materials such as pine boughs can be used.

Eat just before getting into the bag. This gives you energy and helps you to stay warm.

Always relieve yourself just before going to bed. The act of getting out of a warm sleeping bag to go outside can be a chilling experience.

Tents

A tent with a built in bottom and detachable rain fly is best. These features will help any outside moisture from entering the tent, keeping it dryer. Evaporative water loss through respiration and perspiration will produce over a liter of fluid that will accumulate in bedding and clothing. This situation is preventable with purchase of breathable tent material and proper ventilation to prevent condensation forming inside the tent.

Keep in mind you will potentially have to carry your tent for many miles and set it up while tired and in poor conditions. When purchasing a tent, it may be worth paying a little more for a lighter, easy set up one.

Always put a waterproof ground cover under your tent. Pine boughs and/or leaves are great insulation from the cold frozen ground, snow or ice. Make sure the ground cover doesn't extend past the outside wall of your tent. This could cause water to pool under your tent. Warning: Never have an open flame in or near a tent.

Sunglasses & Sunscreen

Polarized sunglasses should always be worn on bright days when the ground is covered by snow. Even on overcast days when the need seems less, light reflection may result in snow blindness. Sunscreen should be used on all exposed skin. Exposed skin, typically on the face, may be susceptible to sunburn on bright days, when snow will reflect sunlight up.

Canteens and Hydration Systems

In cold weather personal hydration systems, camelbacks, and plastic canteens will freeze very quickly if not protected correctly. Think about how to keep the tubing and connectors from freezing. Be very careful placing directly over heat; plastic melts easily.

There is no quick method for thawing. Whenever possible, they should be carried in one of the interior uniform pockets, or wrapped in clothing and placed in the rucksack to ride against your back; however, remember that the cold container can rob you of body heat if it is not insulated properly. In extreme cold, **do not** fill the water container more than two-thirds full; this allows for expansion if the water freezes. Use warm water when possible. Metal canteens take less time to thaw.

Keep canteens and hydration systems clean. Wash them before and after every trip, and regularly during your time in the field. If a canteen is used to hold anything besides water, extra care should be taken while cleaning it, as sugar tends to breed bacteria.

Put canteens under your sleeping bag at your feet while sleeping to keep them from freezing. Make sure they do not leak. During fire watch, one of the responsibilities should be to keep sufficient water available for morning activities through melting ice or keeping water from freezing in tents.

An insulated canteen such as a stainless steel vacuum bottle will keep water from freezing for a long time.

Electronic Equipment

Electronic equipment tends to not work as well in the cold, particularly those with LCD screens. Batteries become discharged more quickly, and high-tech equipment may not function at all. This is important to keep in mind if you are planning on communicating by cell phone or radio, navigating with GPS as an aid, or seeing at night with the help of a flashlight. If you want your equipment to work, you must keep it warm. The easiest way to accomplish this is to keep it close to your body.

Camp Stoves

There are many stoves on the market, almost all having a unique feature that gives them their niche. Ultralight, ultra-small, ultra-blowtorch, they all have functions that give them a place in the gear closet. What is best is what's best for you.

BTU output or British Thermal Unit, is a standard measure of energy. One BTU is equal to the amount of heat required to raise the temperature of one pound of liquid water (approximately 8 ounces, or one pint) by 1 deg. F at its maximum density, which occurs at a temperature of 39.1 deg. F. To boil a quart (32 ounces) of water, from 40 deg. F to boiling (212 deg. F) will require approximately 688 BTUs. A stove that outputs 7000 BTUs per hour, will take almost 6 minutes to boil a quart of water. Therefore, the higher the BTU output, the hotter the stove.

When looking to purchase a stove, look for the type and cost of the fuel it uses. In the event you will be using the stove frequently, it might be better to choose one fuel over another, and therefore this will determine what brand of stove you purchase. Also, some stoves will burn a variety of fuels. Efficiency may determine what stove you buy, since the less efficient the stove, the more fuel you must carry into the woods. In addition, higher efficiency stoves tend to cost more.

Types of Stoves

Stoves are divided up into three main categories, liquid fuel stoves, compressed gas or canister stoves, and solid fuel stoves. Liquid fuel and canister stoves are often further divided into base camp and portable stoves.

Base camp Liquid Stoves and Canister Stoves

Base camp stoves can be lumped into one category; as they are more or less identical in their functions. These are the large, two-burner (or three) stoves. They're big, they put out a lot of heat, and they're great for recreating conditions that rival the home kitchen. This type of stove would be best used during a squadron-sized function, as these large stoves are not meant for individual use. These stoves typically use a bottled propane or butane blend fuel source.

Liquid Portable Stoves

These are very popular stoves, and can burn a multitude of fuels that include kerosene, white gas (Coleman® fuel), diesel fuel, aviation fuel (AV gas), alcohol or even gasoline. They are usually lightweight and portable, often stowing inside the pots and pans used for cooking. They're reasonably priced, and are almost always field-serviceable. They burn hot and are fuel efficient, and under normal conditions can typically boil a quart of water in less than 5 minutes.

There are few drawbacks to the liquid portable stoves. They are less convenient, requiring priming; the fuel line must be flared in order to operate correctly, and can be somewhat noisy, typically sounding like a small rocket engine. Liquid fuel stoves can also clog easily when the wrong fuel is used, although they can be cleaned.

Canister Stoves

These stoves have are relatively new, and rightfully have their place in the backpacking/camping world. These stoves are ultra-light and easy to use, setting up in moments and burning seconds later.

These stoves are gaining popularity, as the fuel mixture has been altered, using a hotter-burning propane-butane combination. They light more easily and they work better at colder temperatures than the old straight butane stoves. Canister stoves have a very controllable flame and their portability is a huge advantage.

The downsides are considerable for the traveler. Compressed gas cannot be transported on aircraft and finding the proper canisters when you arrive at your destination can be tricky. There is no "standard" canister. Each brand of stove has its own proprietary fuel canister. If you arrive at your destination, it may be difficult to locate the proper fuel for the stove you own. Mailing your fuel ahead of your arrival is possible, but keep in mind that regulations prohibit mailing of fuel, and at the very least, additional handling charges will be added. In some cases these fees can be more than what the fuel cost to purchase. When in doubt, call ahead or locate a local retailer close by before you travel.

Solid Fuel Stoves

Solid fuel stoves are still popular, and most are very inexpensive. There are several varieties on the market, each having their own advantages and disadvantages.

Sterno - One of the simplest stoves is a Sterno® Stove, which used an alcohol-based solid fuel gel. Sterno® Stoves are readily available, and very inexpensive for the occasional field exercise. The stove itself is made of steel or aluminum, and folds flat for easy storage in a pack. These stoves burn very quietly, but with a low flame. Time to boil water can be lengthy, since the heat output is not very intense. The other draw back is the canister. If not sealed properly when finished, the alcohol can evaporate from the can and render the rest of the fuel useless.

Trioxane - Trioxane is a compressed, solid fuel. It was made mainly for survival and military use and usually packaged 3 bars to a box. Each bar is individually sealed in a coated, water proof, foil wrapper and every bar is scored so that you can break it into thirds to vary the amount of fuel burned. There's nothing to spill and they are reasonably lightweight. This fuel is similar to the commercially available Esbit® Tablets.

One bar will burn for about 7 to 9 minutes, which is enough to bring a small amount of water to a boil. Trioxane is very easy to light, and can be used in a variety of ways. They can be used in the "Special Forces" folding stove, which is specially designed trioxane stove, or if you have nothing else, simply place one on dry dirt or a rock, and hold your pot or canteen cup over the flame for cooking.

One drawback to using this type of fuel is that there isn't any real practical way to vary the heat intensity. Once you ignite the fuel bar there's only one real heat setting - High. This is not ideal for any true wilderness cooking, but they work great for boiling water, or heating a can of soup. They can be useful if you mainly rely on dehydrated foods that only require boiling water for a few minutes, or making coffee or tea.

Another solid fuel stove is the Sierra® Stove. This stove burns twigs, bark, pine cones, scrap wood or charcoal. The Sierra stove heats like a blacksmith's forge. The heat is easy to control through an adjustable draft. The one disadvantage is that this stove runs on one AA battery. This might not be a problem during the spring, summer and fall, but winter may pose a problem when the battery gets cold, and power output is reduced. The one advantage is that you do not need to carry additional fuel. You can collect it when you need it.

Selecting a Stove

Which stove is the best stove? The best thing to do is decide what you're going to do first, and then choose a stove that matches your needs. Most people have more than one. Also, when going out into the field, make a mental note of what other people use, and what they like and dislike. If someone has a stove, ask them how it works, try it out in the conditions you are going to be using it in. Starting a stove in the summer is not the same as starting a stove with frozen fingers in December. If you purchase a stove in the store, be sure to learn how to use it. It makes no sense to buy a stove, and throw

it right into your pack until you need it. You might end up in a situation that you might actually need it.

An equally appealing alternative to acquiring hot food is chemical heat generation packs. An example of this kind of heat generation system is found in Meals Ready to Eat (MRE). They require water to start the process that must never be consumed once in contact with the chemicals. You must also insure that unused chemical heat packs aren't thrown in trash bags or exposed to other sources of moisture in your pack or clothing.

Rations, Diet, and Heat Exchange

"I ate my boots and a pair of pants. . . tea and seal-skin gloves for dinner." ~ Greely, Arctic Expedition, 1883

General

Our greatest defense against environmental injury and exposure is our intellect. Understanding how we gain or lose heat is essential to success in the wilderness search and rescue setting. There are four routes of heat exchange: radiation, evaporation, convection, and conduction.

Radiant heat is exchanged directly with the environment via emission. Thus, heat loss is a measure of the difference between your generated heat conveyed to your skin and the surrounding environment (air, snow, ice, rocks, etc.). As ambient temperatures becomes colder, radiation heat loss increases. Conversely, when the ambient temperature is greater than skin temperature, heat will be absorbed. Our ability to maintain efficiency in the field rests within a narrow range of body temperature regulated by our ability to generate heat, maintain our level of hydration, and release excess heat. Surprisingly, clothing has little consequence on radiant heat loss.

Evaporation or insensible loss of water occurs via the skin through perspiration and through the lungs during respiration. For each cubic centimeter of sweat produced, 575 calories of heat energy are consumed. Depending on exertion, altitude, and fitness, 2,300 calories of heat energy and 2 to 4 liters of water are lost daily through respiration. Most of what we eat and drink is used in maintaining our body heat, while only a small portion is used in producing energy for physical work. You must ensure adequate caloric intake in cold-weather operations. Estimate 4,000 calories per day are necessary for personnel performing physically demanding work in the cold at a minimum.

The body loses liquid at a very fast rate in arctic conditions, regardless of how carefully you adjust and ventilate your clothing. The exertion of movement on foot, preparation of campsites in the snow, etc., takes a toll in sweat and loss of moisture in the breath. These liquids must be regularly replaced, preferably by hot drinks, which provide extra calories if they contain sugar. Dehydration reduces our ability to extract and produce heat from available fuel so both are required. Insensible loss of heat and fluid is not preventable but is irrelevant if personnel are adequately hydrated and eat properly. Thus, it becomes a leadership issue in mission environments.

Convection heat exchange is a dynamic process. Air is warmed at the skin's surface. This air is displaced by colder air which extracts heat from the skin. As long as ambient temperature is cooler than that at the skin surface, heat loss will occur. If the rate at which the exchange increases, like during high winds, the equivalent temperature is considerably lower. This process is called "Wind Chill." In the wilderness environment, convection heat loss is the most important factor in exposure or hypothermia.

Proper clothing, appropriate layering for conditions, and adequate consumption of food and water greatly impact convection heat loss. The correct clothing material with layering creates a micro-environment reducing the heat exchange while outer wind proof shells reduce the effects of wind chill.

Conduction heat loss occurs when the skin is in direct contact with a heat conductor. Snow, ice, metal, cold rocks, and water can produce substantial heat loss. This type of heat loss is usually not a major factor and can be effectively eliminated by keeping dry, using ground insulation, and good leadership. Air is a poor conductor. This is a secondary reason that wearing loose layers trapping heated air improves heat retention.

Food

Good food contains the right amount of complex carbohydrates, fats, protein, and vitamins. Carbohydrates are by far the biggest requirement. The appropriate intake of these essential items depends on eating several spaced meals rather than one large meal.

The lack of desire to eat caused by the cold, combined with the difficulties and inconvenience of cooking, may tempt people to miss meals. The principles of sound leadership and discipline in cold weather require that hot meals be prepared and eaten.

Save snacks (cookies, chocolate bars, protein bars etc.) for between meals and when on the move. The seasoned rescuer has mixtures of essential fats and carbohydrates in the form of GORP or trail mix that are readily available during breaks. However, do not eat food that will dehydrate you. i.e. poptarts, dehydrated meats, and heavily caffeinated supplements.

Protein bars and energy supplements such as protein gel pack can be helpful, but they should not be your main source of nourishment. Too much of anything is bad for you.

Depending on your water sources you might not want to pack foods that require water.

Liquids

Ensure that as much of the daily liquid intake as possible is hot drinks, such as soups and cocoa. Take advantage of local sources on missions, get fresh fruits when available. Main meals should begin with soup and a hot drink. Do not eat or allow others to eat snow or ice, as this lowers the body's core temperature.

Because there is a large amount of fluid loss in the cold, you should drink a minimum of 3 quarts of water a day when heavy physical activity is involved. In high altitude terrain, 3-5 quarts a day may be required. Water is usually available either from streams or by melting snow or ice, which wastes much time and fuel. To save time and fuel, water should be obtained from running streams.

When running water is not available, ice or snow must be melted. Ice produces more water in less time than snow. It is important to get your ice or snow from a clean source. Your source should be located uphill and upwind of your latrine, as the latrine could contaminate it. When melting snow, put a small amount of snow into a cup. Once that melts, more can be added since there is water to melt it. You should use as many stoves as possible, since this is a very slow process. The melted snow or ice should be purified by boiling rapidly for at least 10 minutes, or adding iodine. If water purifiers are available, these should be used. Before going to bed, ensure that there is enough water for breakfast. Keep this melted.

When you are adequately hydrated, urine is clear and light yellow. Morning voids are

concentrated due to the fasting that occurs with sleep, so mid-day and evening assessment of urine color and volume is usually best. Humans require a volume of approximately 1 liter of urine to excrete the osmolar load and excrete waste products.

Never drink alcohol on operations or when exposed to low temperatures. Alcohol is a diuretic resulting in dehydration, higher water requirements, and impaired reasoning. In a mission environment, it is a prescription for disaster.

Hygiene and First Aid

Hygiene Tips

Cleanliness in the field, particularly in the cold, is important. It's easy to let yourself go for long periods without bathing, but if you wish to be effective, you must keep clean.

Face and hands should be washed daily. If out for several days, the rest of the body will need washing. When water is not available, take a "bath" using foot powder, cornstarch, or rub your body briskly with a dry towel. The powder removes excess oil and perspiration from skin and hair. Body wash towlettes are compact, lightweight, and sanitary. These should be used in your tent where wind chill is reduced. Many contain alcohol which evaporates quickly; thus, work on small areas allowing time to rewarm.

Shave regularly if water is available. Shaving just before sleeping will allow the face maximum recovery time before going out into the cold, reducing the possibility of superficial frostbite.

Teeth should be cleaned daily. If a toothbrush is not available, a clean piece of cloth wrapped around a finger or a chewed twig may be used as a substitute. Toothpaste embedded dental floss has multiple survival uses and requires no water to get the job done.

The bladder and hose assembly of a hydration system should be cleaned before re-supply and following each activity.

The "bathroom" area of a wilderness camp should be set up downhill and just in sight. After having a bowel movement in the woods you should bury the waste. When the ground is frozen, you must cover the excrement sufficiently to prevent unsanitary conditions from developing. If the camp is supporting a large group for an extended period, consider portable facilities. When this is not possible, build a fire over an area large enough to create a latrine to support your unit. Alternating fire with digging will get through the frost line. Maintain and close the latrine according to field medical doctrine. Lastly, wash your hands, use a cleansing wipe or alcohol gel. The field is not the place to start a diarrhea epidemic.

Completely cook food. When cooking in the can, remove the label and open the can lid before a can of food is heated in a fire. Can lids are sharp and produce nasty cuts. If you need to use the lid as a handle, roll the edges with your multi-purpose tool. Clean the lid of food products before handling with your gloves. Food products on gloves in bear country make you particularly appealing. Clean all eating and cooking utensils after each use. Store your food in animal proof containers or bring them in packages suitable to complete in one sitting.

Burn the trash after everyone is done cooking and away from the fire. Remove and crush what is left of the burnt trash after the fire is extinguished. Burning trash will help keep unwanted animals from your campsite. All trash should be carried out of the field. In the rare occasion the trash is not carried out, it must be burned, crushed, and buried.

Hypothermia

Hypothermia is a condition of impaired heat regulation resulting in low core body temperature. Consequently, the body's heat loss is faster than heat production. You must be able to recognize symptoms of hypothermia and to treat the condition immediately. The progression from mild to severe hypothermia is the critical point in determining whether you become a victim or just suffer a close call.

Prevention

- Stay physically fit
- Keep active, layer clothing, and stay dry
- Eat properly and often.
- Drink plenty of liquids
- Be ready for changes in weather.
- Sleep early before judgment is weakened by fatigue.

Symptoms

Mild Hypothermia

- Shivering at the onset, skin numbness, and minor impairment of fine motor control. Example: buttoning small buttons.
- Weak pulse due to vasoconstriction
- Mild confusion, apathy – not caring mental sluggishness.
- A late sign of this stage is stumbling, retrograde amnesia, and inability to use the hands with dexterity

Severe Hypothermia

- Paradoxical undressing take your clothing off for no reason
- Shivering ceases, incoherence, confusion, inability to stand.
- Loss of feeling, muscular rigidity
- Late signs are semiconciousness, inapparent heart beat and/or respirations
- Pupillary dilation large pupils
- Unconsciousness leads to eventual death

Treatment Of Hypothermia

- Prevent any further heat loss.
- Get victim out of the wind and into the best shelter.
- Replace any wet clothing with dry, and place the victim in a sleeping bag, if one is available.
- Add heat by the best available means to the victim's neck, legs, and torso. This

can be done by using a hot water bottle, stove, campfire, or your own body heat.

- Provide something warm and nutritious to drink if victim is conscious. Add calories with sugar in hot drinks. Victims are usually in a calorie deficit, dehydrated, and require recovery in a warm environment for a minimum of 24 hours.
- DO NOT massage the victim.
- DO NOT give alcohol to the victim.
- The above steps will work for mild hypothermia only
- For severe hypothermia-evacuate to the nearest medical facility by air evacuation.
    - This condition is life- threatening until normal body temperature is restored. This often requires active core rewarming with warm IV fluids, heated and humidified air, heated peritoneal dialysis, heated gastric lavage, or cardio-pulmonary bypass. Remember-"You are not dead until you are warm and dead"
    - The hypothermic heart is extremely susceptible to ventricular fibrillation (VFib) during the cooling and rewarming process. This is a potentially fatal heart rhythm unless it is electrically converted. Stretcher evacuation with inherent jarring may induce Vfib. Even if an AED (automated electronic defibrillator) is available, the ability to effectively convert the person's Vfib to a normal rhythm while hypothermic is unlikely. If evacuation is greater than an hour and CPR is required the victim is in a hopeless situation.
    - Thus, severely hypothermic individuals that can't be evacuated by air must be rewarmed at the scene. This requires protection from the elements, external heat, and central warming. An experience rescue medical team is prepared to do this because essentially no one has survived a long overland evacuation in this condition. Cold weather rescue medical preparedness is beyond the scope of this brief but produces real world survivors.

Frostbite

"...the first frostbite cases have made their appearance. We amputated two feet and will probably amputate many more." ~ Amosoff

Frostbite results when tissues freeze from exposure to temperatures below 32 deg. Fahrenheit (F). The extent of injury depends upon the wind-chill factor, length of exposure time, and proper protection. The injury can be extended by freeze-thaw cycles, improper handling, and delay in appropriate treatment.

Persons with a history of cold injury are prone to frostbite. Initially, there may be a tingling, stinging, an aching sensation, or a cramping pain. The skin first turns red (chilblains) and then becomes pale gray or waxy white. Frostbite can be classified as superficial (partial thickness) or deep (full thickness).

Winter Wilderness Search Fundamentals

WIND CHILL - The combination of wind and low temperatures creates a condition known as wind chill. For example, with the wind calm and a temperature of –20 deg. F there is little danger of wind chill. If the temperature is –20 deg. F and there is a wind of 20 MPH, the equivalent chill temperature is –48 deg. F. (See appendix 1)

Under these conditions there is GREAT DANGER and your exposed skin can freeze within 30 seconds. You also create your own wind when you walk, run, or ski. As examples, walking creates a wind speed of about 5 mph and running 10 mph. Wind is also created by moving vehicles, aircraft propellers, and rotors. The wind-chill chart is provided, on the last page, to show how wind and temperature combine to create wind chill; use it. Cold injury disables you AND your team.

PREVENTION OF FROSTBITE - Frostbite is preventable and seldom occurs in people who are maintaining enough body heat. It is most commonly associated with an overall body heat loss resulting from poor equipment, reduced food intake, dehydration (water loss), overtiring, injury, or a combination of these factors. The two pillars of frostbite prevention are knowledge and leadership.

The feet, hands, ears, and exposed areas of the face are most susceptible to frostbite and must receive constant care.

Prevention

- Do not wear overly tight boots and socks.
- Use the "buddy system" to check exposed areas, especially when wind is present.
- Carry extra socks and mitten liners.
- Do not stay still for long periods. Immobility increases risk.
- Use caution when cold and wind are combined.
- Check feet often.
- Ensure that you eat well and have hot drinks as often as possible.
- Keep the torso warm
- Reduce or eliminate cigarette smoking because they constrict blood vessels

Symptoms of Superficial Frostbite

- Redness occurs, followed by powdery flaking of the skin. Small areas like the skin of the finger tips, nose, and ears may experience "frostnip" that leaves no permanent damage.
- Larger affected areas may appear dull and grayish.
- Blister formation may occur 24 to 30 hours after exposure, followed by flaking of superficial skin. Clear blisters usually predict good recovery

Symptoms of Deep Frostbite

- Loss of feeling occurs in the affected area, leaving it pale yellow & waxy looking.

- When the frostbitten area thaws, it is painful.
- Frozen skin may feel solid or "wooden" to the touch.
- When exposed to inside temperatures, blisters may appear in 12 to 36 hours. Blisters in deep frostbite are filled with red fluid predicting poor recovery of underlying tissue.
- Discoloration (red-violet) appears 1 to 5 days after the injury.
- Gangrene usually develops by a week to ten days. The thick black covering called an eschar is a hallmark of full thickness injury. By 4-6 weeks, the dead tissue may separate with loss of appendages.

Treatment

The proper treatment of a patient with frostbite is to rapidly warm the area in a water bath if the warmth can be maintained and seek medical attention. If the exposure time was short, the frostbite will probably be superficial. If the exposure time was long, frostbite may be deep, so rapid rewarming may not be prudent in the field setting. Rapid evacuation may be a better recourse.

- Move the casualty to a warm and sheltered area.
- Do not rub the area with snow or apply cold water soaks.
- Do not rewarm by massaging or exposing to open fire.
- Rewarm the face, nose, or ears by placing your hands on the frozen area. Rewarm frostbitten hands by placing them under clothing and against the body.
- Close the clothing to prevent further loss of body heat. Rewarm the feet by removing boots and socks. Place bare feet under clothing, against the abdomen of a buddy. Once the feet are warmed, put on dry socks and boots.
- If available, rewarm with water of temperature ranging between 100-108 deg. F in a bath. Once thawed, protect from trauma, avoid pressure, do not puncture blisters, and provide pain medication. Evacuate expeditiously. Immediately
- Do not allow the victim to use alcohol or tobacco. Alcohol increases loss of body heat; tobacco causes narrowing of blood vessels in the arms and legs.
- If you require evacuation before thawing frozen tissue, protect them from further cold or trauma, and evacuate to the nearest medical treatment facility.

Deep frostbite is most common and harmful to the feet. When deep frostbite does occur, the victim should be moved to a sheltered area and evacuated to a medical treatment facility immediately. If possible, do not allow the victim to walk if feet are frozen and avoid treating or thawing the affected area. Thawing of deep frostbite in the field increases pain, invites infection, and greater damage. Do not try to thaw deep frostbite in the field unless directed by a physician and evacuation is imminent.

Dehydration

Dehydration can lead to poor decisions and cause serious physical problems making you more susceptible to other problems, such as frostbite and hypothermia. By the time you feel thirsty you are already dehydrated. Dehydration is more prevalent in cold weather conditions than in hot ones because it is unpleasant to remove gloves, etc. and look through the pack for your water. Also, since you feel cold already, you do not think about needing water.

Prevention

- The minimum daily liquid requirement when performing strenuous physical labor in the cold is 3 quarts per day.
- Drink whenever possible, particularly during halts and rest periods.
- Ensure that canteens are full when water is available.
- As a leader, set camp and keep warm beverages available.

Symptoms

- Check your urine spots in the snow. Dark yellow or brown indicates dehydration. Red indicates a severe condition needing immediate medical evacuation to the nearest medical treatment facility. The best is clear yellow. Check urine color mid-day and early evening in ambient light. Morning urine is concentrated and the color of urine by flashlight is not as reliable.
- Lack of appetite
- Dry mouth, tongue, and throat
- Muscle cramping
- Stomach cramps and/or vomiting
- Headaches

Treatment

- Keep the victim warm.
- Give plenty of warm liquids, require rest, and provide food for energy production.

Carbon Monoxide Poisoning

Whenever a stove, fire, gasoline heater, or internal combustion engine is used indoors, there is danger of carbon monoxide poisoning. Fresh air in living and working quarters is vital. Carbon monoxide is a deadly, odorless gas.

Prevention

- Use stoves and lanterns in well-ventilated areas.

- Ensure that stoves and lanterns are functioning properly.

Symptoms

- Headache, dizziness, confusion, yawning, weariness, nausea, and ringing in the ears.
- Bright red color on lips and skin.
- Victim may become drowsy and collapse suddenly.

Treatment

- Move the victim to open air, keep them warm. If oxygen is available, administer this at a rate of 10 L/min via a non-rebreathing mask.
- If the victim is not breathing, administer mouth-to-mouth resuscitation, CPR if necessary.
- Immediately evacuate the victim to the nearest medical treatment facility.

Burns

Team members can get burns from several sources including heat, chemical or electrical sources. Burns are generally categorized as first, second, and third degree with first degree being the least severe. Infection is always a potential hazard with all types of burns.

Prevention

- Always bring sunscreen with you, even if it is not sunny
- Light reflects well off snow and water surfaces resulting in sunburn
- Never touch something that may be hot without using gloves. This includes putting food in the fire and taking food out of the fire
- Do not work around fire, chemicals, or electrical equipment when you are extremely tired.
- Exercise great caution when handling fuels, loading generators, and energizing electrical equipment in snow conditions.

Symptoms of 1st Degree Burns (Called Superficial Burns)

- Localized redness/swelling around affected area
- Pain at the site of burn
- Sunburn is a 1st degree burn.
- There is no blistering with 1st degree burns.
- Only injures the epidermis and superficial layer of the dermis. Complete recovery is expected.

Symptoms of 2nd Degree Burns (Called Partial-Thickness Burns)

- Skin blisters at site of burn
- Swelling
- Pain
- Burns the epidermis and a portion of the dermis.
- Most of these burns resolve without consequence.; however, infection can increase the depth of injury to full thickness

Symptoms of 3rd Degree Burns (Called Full Thickness Burns)

- Charred black or white skin
- Burns deep through all layers of the skin
- Can burn nerves
- May not be painful at site of burn
- Usually surrounded by regions of 2nd and 1st degree burns which are painful

Treatment

- Remove the victim from the source of the burn taking special care with chemicals and de-energizing electrical power.
- 1st degree burns should be cooled with water
- Aloe may be applied to first degree burns. Apply sunblock if exposure to the sunlight is expected.
- Cool 2nd degree burns with water and wrap area with sterile bandage to prevent infection. Do not rupture or puncture blisters in the field if possible.
- If 2nd degree burns occur on the face, hands or groin, seek medical attention
- If blisters are larger than the size of a quarter or if greater than 10% of the body surface is affected, seek medical attention
- 3rd degree burns can be life threatening
- Seek immediate medical attention for any 3rd degree burn
- Do not put water on a 3rd degree burn
- Cover the 3rd degree burn loosely with dry sterile bandage to prevent infection
- Keep victim warm, as they may go into shock

Chemical burns can occur if the skin is exposed to chemicals such as battery acid or liquid vehicle maintenance products. Remove clothing and brush dry chemicals off of the skin then rinse with water. To treat a chemical burn, rinse affected area with a lot of water for at least fifteen minutes. Contact the poison control center and check the treatment recommended on the Material Safety Data Sheets (MSDS) if they are

available. Wrap the burned area in dry, sterile dressing and seek medical help. Electrical burns can be deceiving. These require advanced medical assessment and care in a hospital setting.

Snow Blindness

Snow blindness is caused by ultraviolet rays of the sun being reflected from a snow-covered surface into the eyes. This condition can occur even in cloudy weather. In fact, it is more likely to occur in hazy, cloudy weather than in sunny weather.

Prevention

- Wear sunglasses transmitting less than 10% of sunlight below 320 nm. Glasses should provide protection from the sides as well as the front of the eyes.
- If sunglasses are not available, make slitted glasses from cardboard, thin wood, tree bark, or similar material.
- If glasses are not available, apply sunblock to the eyelid area and alternate exposure to light one eye at a time.

Symptoms

- Development of symptoms may be delayed 8-12 hours.
- A scratchy, sandy feeling under your eyelids is characteristic.
- Redness and watering of the eyes, lid swelling, and sensitivity to light set in.
- A headache may be associated. Severe cases can lead to corneal ulceration.

Treatment

- Blindfold the patient using a dark cloth. Apply cool compresses.
- Evacuate the patient to a medical treatment facility. Most cases heal spontaneously without consequence.

Sunburn

Sunburn is a serious hazard because of the reflective qualities of the snow, especially at higher elevations.

Prevention

- Sunscreen on face, especially the nose

Symptoms

- Redness of skin with slight swelling

Treatment

- Treat with soothing skin creams if the swelling is not severe. See Burns above.

Tent Eye

Tent eye is inflammation of the eyes caused by fumes from stoves and lanterns used in a poorly ventilated shelter. This can be prevented by proper ventilation of tents or shelters. Treatment is fresh air. From a leadership standpoint, use of stoves and lanterns that require combustible fuels should be discouraged. See Burns and Carbon Monoxide poisoning above.

Trench Foot/Immersion Foot

Trench foot is a non-freezing, wet-cold injury and immersion foot is an injury resulting from prolonged wet conditions. Neither condition requires prolonged immersion in water only wet/damp conditions. The cold temperature and wetness induces vasoconstriction. Continued wetness maceration, decreased oxygen delivery, and local trauma result in pain, swelling, and redness. Deep furrows and cracks may develop. In extreme cases, the skin dies, infection sets in, and amputation may be necessary.

Prevention

- Change to dry socks at least twice daily.
- Dry and massage your feet regularly with foot powder.
- If leather boots are worn, dry them whenever possible.
- At night, air shoes out, do not stuff dirty socks into them.

Symptoms

- In early stages, the feet and toes are cold, numb, and still.
- Walking becomes challenging.
- The feet swell and become painful.

Treatment

- In early stages, keep the feet dry, clean, and exposed to the air.
- In later stages, evacuate the victim to a medical facility.

Constipation

At very cold temperatures, personnel tend to put off the natural urge to have a bowel movement, resulting in constipation. This can be a painful casualty producer.

Prevention

- Eat fresh or canned fruit and eat regularly.
- Drink plenty of liquids.
- Try to have a daily bowel movement at your normal time.

- If you are prone to constipation, consider using a fiber supplement using sufficient water for effectiveness.

Symptoms

- Stomach cramps, rectal pain, and abdominal bloating.
- Dizziness
- Headaches

Treatment

- Prevention is the best treatment.
- If symptoms persist, get medical help.

Diarrhea

Diarrhea is characterized by watery stools with increased frequency. There are multiple causes for this including bacterial, protozoal, viral, chemical, and more. The majority of cases are self limited and viral. The usual course of illness is complete in 24-36 hours. Although this may not seem significant, diarrheal disease can spread quickly through rescuers in close quarters. The mission can rapidly change course requiring cessation of efforts and evacuation of your team. DO NOT TREAT THIS LIGHTLY.

Prevention

- Good field sanitation
- Wash your hands after visiting the latrine, close contact with people ill with diarrheal disease, after work in the area of latrines, or work in the medical area. Use an alcohol gel sanitizer at a minimum.

Symptoms

- Frequent watery stools
- Fever
- Chills, headache, muscle aches

Treatment

- Drink plenty of liquids, preferably warm like soups and tea. Fluids like Gatorade and Powerade are also helpful.
- Acetaminophen (Tylenol)
- If symptoms persist more than 24 hours, seek medical assistance.

Heat Cramps

Heat cramps are caused by an excessive loss of salt in the body or intake of salt poor fluids without salt replacement. This causes muscles to spasm, and they are unable to relax. After prolonged physical activity in a cold-wet environment, signs and symptoms of heat cramps could appear in the arms legs, and stomach. It is possible to experience heat cramps in cold-weather when undergoing extreme physical exertion.

Symptoms

- Severe muscle cramps in arms, legs, and/or stomach. Most commonly, the legs
- Skin is pale and wet.
- Dizziness and extreme thirst may be present.

Treatment

- Have the person drink one fourth of a canteen of water.
- Stretch the muscle immediately. Do not knead or pound the muscle as this may only produce soreness.
- Give one canteen of water with one packet of salt stirred in. Drink the canteen of salted water over a 30-minute period. Eat salted foods like pork, potato chips, and peanuts. If cramping continues, evacuate to the nearest medical treatment facility.
- Do not give the saltwater to one who has an upset stomach. Have them sip a canteen of unsalted water while awaiting medical assistance.

Heat Exhaustion

Heat exhaustion is caused by dehydration and loss of body salt from extreme physical activity in a cold-wet environment. It is possible to experience heat exhaustion in a cold-weather environment when undergoing extreme physical exertion.

Symptoms

- Feeling dizzy, weak, and/or faint
- The skin feels cool and moist to the touch.
- One may feel nauseated or have a headache.
- A brief loss of consciousness is not uncommon.

Treatment

- Drink one canteen of water to relieve the symptoms. Offer salted pork, potato chips, or peanuts.
- If complaint of cramps, give one canteen of water with one packet of salt stirred in. Drink the salt solution over a 30-minute period. Do not administer salt if one has an upset stomach. Give a canteen of unsalted water.
- Loosen all tight-fitting clothes.
- Elevate the feet above the level of the heart
- If the person recovers, provide a hot meal, fluids, and rest.

- If unable to drink water due to an upset stomach or if the symptoms have not improved within 30 minutes, evacuate to the nearest medical treatment facility.

Effects of Illicit Drugs, Alcohol, and Tobacco

Cold weather multiplies the effects of alcohol, tobacco, or other drugs to a serious level. Under the influence of these drugs you lose your reasoning abilities resulting in mistakes that can lead into dangerous situations. Alcohol increases loss of body heat; tobacco causes narrowing of blood vessels in the arms and legs. There can be a variety of other complications due to use of various drugs.

Treatment

- Keep them as warm as possible
- Keep them under supervision at all times. They may not be thinking clearly.
- Evacuate them as soon as possible.
- Provide education on smoking cessation, effects of drug and alcohol abuse.
- Evaluate the individual for retention on the team. Poor choices in life usually put others at risk or reduce the effectiveness of your rescue crew.

Fires

Fires can provide warmth, light, a cooking source and be used for signaling in an emergency. The three things needed for fire are fuel, heat, and oxygen. A fourth element, chain reaction, is required for flames and continued fuel consumption.

Generally dead, dry hard woods found low in trees are the best fuel for starting fires. There are three categories of fuel based on size:

- Tinder is used to start the fire and includes bark, wood shavings, small twigs, pine needles, dry grass and some dried leaves
- Kindling or "medium" sized wood is then added to support the flame
- Fuel (large logs) are then added to support the fire long term.

Have plenty of sticks and twigs in various sizes ready to place onto the fire as it starts. Remember small dry sticks burn quickly, so make sure you have more than enough at hand.

The firewood should be stored at least 20 feet from the fire pit in such a way that it can be easily pulled into the fire. The wood must be positioned so that it can't accidentally roll into the fire. If camping in wet weather, it is important to cover the wood pile with a tarp. Dry out fuel next to the fire before placing logs on the fire to burn.

The fire pit should be about 20 yards from tents. Construct a fire pit in an area clear of overhead hanging branches. Before lighting a fire, always clear the ground of combustibles. Always have an extinguishing agent nearby.

One way to construct a fire is by pushing a stick upright into the ground to make a

support for the small twigs and tinder. Around the base of the stick, place plenty of easily ignitable material. Wood can also be arranged in a log cabin style, a teepee style, or lean too style. The heat needed to light the fire can come from many sources including:

- Matches or a lighter
- Flint and steel
- Magnifying glass
- Battery and steel wool
- A road flare

The air in most outdoor places contains more than enough oxygen to allow fire to burn once lit. Providing more air will speed the process of lighting the fire. Place wood as not to obstruct air flow into the center of your fire. Light the fire from the side the wind is blowing. Putting your lips almost together and blowing at the base of the fire will greatly speed fire growth.

Slowly add small pieces of wood, then larger pieces as flame grows. Use plenty of tinder, but do not smother the flame. Maintain the fire size sufficient for your purposes.

Campsite Selection

When considering where to set up shelters keep the following in mind.

- Shielded from wind
- Camp on level ground or only a slight grade
- Does campsite allow drainage of water from melting snow or rain
- Remove as many roots or rocks as possible
- Access to water
- Availability of firewood
- Presence of gullies, slopes, cliffs, or swamps
- No dead overhead trees or branches
- No branches that carry a lot of snow overhead
- Is the campsite high enough that a severe rain won't wash it out?

Obtain permission of private property owners if your operation involves camping on or crossing their property. Respect shrubbery and crops. Leave the area better than you found it. Clean up after yourself. An emergency is no excuse for trespassing.

Shelters

Poncho Shelters - The simplest type of shelter can be made by pulling the poncho over your sleeping bag. For additional comfort, various types of shelters and lean-tos can be made by attaching your poncho to trees, tree branches, or poles.

To build a one-man shelter from one poncho, spread the poncho on the ground, hood side up. The hood opening must be tightly closed by adjusting and tying the drawstrings. The poncho is raised in the middle of its short dimension to form a ridge, with the stake outs at the corners and sides. Snow, sod, or branches are used to seal the side and one end of the shelter to provide additional protection from the wind and to retain heat.

A two-man shelter can be made from two ponchos. Spread the ponchos on the ground with the hood side up and the long sides together so that the snap fastener studs of one poncho may be snapped into those of the other poncho. The ponchos are raised where they are joined to form a ridge. The shelter is then staked out at the sides and corners. A third poncho may be snapped into the other ponchos to form a ground cloth.

Lean-to Shelters - The lean-to shelter is built in forested areas and is made of trees and tree limbs. A poncho, a piece of canvas, or a natural material in addition to pine bough, may be used for covering. Depending on the number of people to be sheltered, two types of lean-tos (single and double) are built. Pine boughs should be laid in the shelter like overlapping shingles (the same as on a live tree).

To save time and energy, use two trees the right distance apart and sturdy enough to support the crosspiece. If suitable trees are not available, use two forked poles or build two A-frames to hold the crosspiece. A large log is laid at the back for added height. Stringers about 3 meters long and 10 centimeters in diameter are then placed 45 centimeters apart from the crosspiece over the top of the log in the rear. Available coverings, ponchos, boughs, and so forth are then placed on top of the stringers. A double lean-to is made by building two single lean-tos facing each other with the fire in between.

Tree Shelters - In wooded areas, the tree-pit shelter furnishes temporary protection. Select a large tree with thick lower branches and surrounded with deep snow. Enlarge the natural pit around the tree. The walls and floor are lined with branches and boughs. Try not to disturb the snow that may be on the branches.

Suggest other references.

Search

Search Types

The type of search and the number of available searchers determines the number of searchers that are placed in a search area. It is never okay to search alone. The smallest team is two.

A Type I (Hasty) - search is the rapid response to high probability areas by immediately available resources. A type I search requires 3 to 4 trained personnel that are clue conscious. A fast moving small team would check areas and trails. First checked are the Point Last Seen (PLS) and/or the Last Known Position (LKP) and the suspected route of travel.

A Type II (Efficient) - search is a relatively fast, systematic open grid search in a high probability area, often where a clue was found.

A Type III (Thorough) - search is a slow, highly systematic search using thorough techniques to achieve the highest Probability of Detection (POD) possible.

Type I, II, and III searches can all flag (placing a visible boundary) and search at the same time. No search operation should be performed alone.

A route search is used to search a specific path or route of travel.

A contour search follows terrain features. On the contour search, the team members on the downhill side must travel more distance so they will require more time.

The words subject or object are used to describe what you are looking for during the search. It is a good practice to assume the search is criminal in nature so you keep a questioning attitude. It may be important to detail your exact actions at a later time.

The Federal Aviation Administration (FAA) investigates aircraft crashes. The FAA might request aircraft crash security from a wilderness emergency services team. Security is preventing disturbance to a crash site.

The National Transportation Safety Board (NTSB) may respond to an aircraft crash with a fatality or extensive damage. They would investigate with the FAA.

Search definition:

- PLS Point (or Place) Last Seen- The location where the missing subject was actually seen by another person.
- LKP – Last Known Position – The last known location for the missing subject as determined by physical evidence such as a discarded object or a footprint. In the case of an aircraft, the LKP may be the last reported point or the last observed radar position.

- POD Probability of Detection
- LPQ – Lost Person Questionnaire

Search Tactics

Search tactics are the techniques used to find clues, and the subject of the search. The more commonly used tactics are listed in this text.

A passive search is a combination of techniques used while not actively looking for clues or looking for the subject. The three main components of a passive search are Attraction, Confinement and Investigation.

Attraction is trying to get the subject to move to a desired location. This assumes that a person is able to travel. Attempt to attract the person by using sound, lights, and objects. Sirens, whistles, yelling, bells, and public address (PA) systems have all been used. Periodically, be quite and LISTEN. Methods of visual attraction include lights, beacons, strobes, flares, fires, smoke, balloons, and aircraft.

Confinement (containment) is an initial tactic used to limit the search area. It is very important to make boundaries for the search area before the subject has a chance to pass beyond the rapidly established perimeter. Road blocks, trail blocks and signs should be used on all routes leading into and out of the confinement perimeter. Look-outs placed at high points and camp-ins at natural travel routes identify and help preserve perimeter boundaries.

Track traps are established on dirt roads or bare areas by dragging or brushing them off. Footprints are looked for afterwards. This technique can be significantly altered in a short period of time during snow fall.

Large search areas can be subdivided into smaller, more manageable areas. String lines are tied from tree to tree in long boundaries at waist level, and then paper arrows attached that show the way to road or trail.

If your team receives search interview information that does not seem relevant, the information should be reported as you would any other information.

Investigation or fact finding is collecting any information that can help focus the search. The Lost Person Questionnaire (LPQ) is used as a guide to assemble and record information to develop strategy and tactics based on the responses to the questions from interviews with family and friends.

The Lost Person Questionnaire is a large list of predetermined questions that are asked of friends and family as the searchers are initially responding. It is usually best to have a trained investigator record the answers to the questions on the LPQ.

The team leader will receive operational tasking information and then brief the team.

If you and another team member are walking in the woods and closing in on another group of searchers walking toward you using flashlights, your group should listen to your team leader's instructions and avoid shining lights into other people's eyes.

Flagging

Flagging or blazing are terms used to describe placing a visible boundary with surveyor tape or toilet paper. Toilet paper boundaries do not work well in the wind or wet.

Snowfall presents a significant complication to flagging. The far greater period of biodegradability for colorful survey tape may be justified in the winter.

Flagging would be placed as a visible boundary by the team member on the right if the person on the left of the search line is using a road as a boundary. When the team turns to make the next search sweep, the flagging will be the new boundary on one side while the other side places new flagging.

Flagging should be positioned so that the person following the flag on the return sweep will have no trouble in sighting the marker. This can be accomplished by attaching each marker to the back side of the tree, relative to the direction of travel.

Flagging is often used after the search objective is located to make the best access for transportation.

Night Searches

Night searches should only be considered when the payoff is high and the risk to the team is low or moderate. Proceed slowly and with caution using good lighting.

When there is a moderate or low payoff, the team should rest and be ready to begin the search at first light.

Search Lines

The search line is the most often used search configuration. Search lines are often used on missing person searches with either a small area or a lot of searchers. They are also often used in bordered area to locate clues.

The distance between searchers is called the search interval. The interval will be set by the team leader based on both the size of what the team is looking for, and how far each searcher can effectively see. Each searcher must know exactly what they are looking for. Areas of dense brush must be completely searched.

Maintaining interval can be challenging for untrained or undisciplined searchers. Darkness and dense terrain will also make maintaining interval difficult. When moving on a search line, walk at a steady pace, and move in as straight a line as possible.

The search line normally guides off of the team member following the flagging or other

border. Each searcher must also keep aligned with the team members on either side. Variations in terrain and underbrush from one end of the line to the other may slow the progress of some team members, forcing others to adjust their speed. Do not become so concerned with alignment that your Probability of Detection (POD) suffers.

The search line should move no faster than its slowest member. While searching, scan in front, above and behind. It takes self-discipline to scan the search area properly, while maintaining interval and moving safety.

Team members will need to watch where they are walking, but be careful not to mostly look at the ground. Slow down in difficult terrain. Be quiet and listen unless otherwise directed. Coordinated shouting or calling in unison might be very effective in certain missing person searches, and is at the team commander's discretion.

Using breaks after each sweep is a good idea because it gives the team leader a chance to assess the team and their efforts as well as to boost morale. During these breaks logbook entries should be made to portray detail of coverage of the search area. This information is later used to calculate coverage of the search area and to determine Probability Of Detection (POD).

Clues

Clue - preservation of the LKP and PLS is essential in the case of the lost person search. It should be surrounded by tape, cord, or some very visible indication, and kept under observation. Search Dogs that function from the LKP will have a better scent trail with fewer people contaminating the LKP. A room or a vehicle as LKP should be kept closed and preserved.

- The search subject is a clue generator. Searchers are clue seekers.
- There are more clues than subjects. Clues can include:
  - Physical - footprints, wrappers, broken brush, human feces
  - Recorded - trail register, travel plan, flight plan
  - People - family, friends, eyewitnesses
  - Events – campfire or lights
  - Scavengers (birds or other animals)

Electronic – Where the subject's cell phone has been in the cell network or ELT. A team leader would be likely to see NTAP (National Tracking Analysis Program) information on a missing aircraft search.

Winter Wilderness Search Fundamentals

Working with Aircraft

Teams can often see aircraft but the aircrew needs the teams help in locating the team. Some ways of assisting the aircrew in locating the team include:

- Giving their location relative to some easy-to-spot landmarks
- Telling the aircrew the magnetic heading to adjust to fly over the team, and then count down as aircraft approaches overhead.
- The team can make itself more visible with:
    - Bright colors
    - Unusual activity
    - Signal mirror
    - Ground to Air Signals

The aircrew takes over giving the team directions on how they should proceed once visual contact with an aircraft is made. The most common procedure for this is to assume that the team is in the center of a clock. The present direction of travel of the team is always called twelve o'clock. The aircrew will give clock face directions to the team.

Sign Cutting

Sign cutting or perimeter cutting is a method used to detect clues. Sign cutters travel ahead of a track or route looking for discoverable clues. Lack of sign means that the subject went a different way. Cutting for sign is fundamental for tracking.

Security

Security is defined as; "The state of being safe and free from danger or risk."

Scene preservation means doing as little damage as possible during rescue, this can be done by only allowing a minimum of personnel into the area and sealing-off as soon as practical with security line or tape. Note everything that was moved in the logbook and make a map of the original position.

Clue preservation requires not coming in with contact potential clues, while noting and recording so the clue is not contaminated.

A perimeter can be established to preserve a scene or a clue. Security personnel keep others out from a position outside the perimeter. There could be several perimeters, one around immediate scene (hot zone), and another for much larger area (warm/cold zones.)

When on security detail the team member investigates their area of responsibility using their senses. The team member should report any discovery to the person that was designated during the briefing. The designated person will make sure it was recorded in the log.

If you see a questionable activity, challenge by saying "who goes there?" and check their identification (ID) by either having them hold it for you to see or have them removing it from their wallet and hand only the identification to you.

Be professional, brief, and use good grammar. Aggressive actions can be construed as force. Holding objects in your hands (sticks, rocks, a knife or flashlight) can be considered force.

Teams cannot deny entry to a scene but should attempt to discourage entry. If violators are observed, note details and report to law enforcement. A photograph will not only help to discourage intruders but will make law enforcement's job easier.

Winter Wilderness Search Fundamentals

Survival

"Each day the number of my dogs dwindled and the sleds were broken up to cook those animals that we ate ourselves." ~ Peary, Arctic Expedition, 1906

Surviving an Emergency

Stop. Sit down, or find a safe place to make an assessment.

Think. Consider what you know and what you have.

Observe. Is there anyone else nearby? What can benefit you?

Plan. What are your immediate needs?

Survival priorities include:

- Medical Care
- Shelter & Fire
- Signaling and Communication
- Water and food

Avoiding Getting Lost

Conduct a complete briefing to all team members on the route, destination and emergency procedures before setting out. Memorize details if possible. One can become separated from the team, especially if in a wide open search. This applies more at night or in bad weather. It can also happen if discipline is poor. The briefing before going into the field will keep a team from becoming unintentionally separated. Memorize and write down the details. Use a Personnel Accountability Report (PAR) system often. Accountability is the process used to know the whereabouts of everyone at all times.

One technique for insuring that all team members are alert and present is the "count off." About every 20 minutes or when the team hits any milestone such as the end of a search sweep or break the count off is used. A team leader can check search interval from behind by listening to the count off if the team was placed by their assigned count off number.

When Lost Within A Known Locality

- If separated from your team. Stop and call out and whistle immediately. Start to think. If all is quiet and there are no sounds to guide you back either go back to the last known position or stop and wait depending on your briefing. If you cannot go back, consider carefully the journey already made and the distances and directions from the starting point.

Winter Wilderness Search Fundamentals

- Admit you are lost and don't panic. A positive mental outlook, reinforced by knowledge and skills can help supply the confidence needed to combat panic. STOP where you are, take stock of what you have including water and food. Think about clues that may lead you or your group back to a known point. Develop a plan of action.
- One person must take charge if lost in a group and the group must stay together. Survival depends on clear thinking and resourcefulness. The main things to remember are to keep calm, think, try to help each other, keep together, and keep warm.
- Knowledge of where you are is critical in a survival situation.
- If all is quiet and there are no sounds to guide you to your start point, go back to the last known position.
- Opinions should be taken from the group, yet leadership maintained. Search parties should be sent out to find the next known steering mark. Trails must be marked carefully so that the search party can return to guide the main group forward or to rejoin the group, should their search be unproductive. Meanwhile, the rest of the group should seek shelter.
- If the search party fails to find any known location, perform the steps below, but remember to think clearly and keep calm.

Conduct When Lost

When you are certain that you are lost:

- Stay together. Meet your emergency as a group; don't wander off as individuals; never allow stragglers.
- Check communications.
- Use your whistle 3 short blast. 3 of any sound is the international signal for distress
- Take shelter. If you have a tent, set it up and get in it. If you do not have a tent, build one of the improvised shelters. The type of shelter is not important as long as you protect yourself from the weather.
- Keep warm. If you are lost in a forest, light a fire. If you are lost in an area where there are no trees, do not use a stove to heat your shelter. Use your stove only to prepare hot food and drinks. Conserve your fuel supply. Get into your sleeping bag to stay warm.
- Check food supply. All the food and water in the group should be collected and rationed systematically.
- If you are in a forest, prepare fires to attract.
- Use things that contrast with the terrain such as logs, footprints in the snow, etc. to make ground to air signals.
- Smoke is better by day and flame at night. Mirrors, ground signals, etc., are helpful in attracting search parties. Arrange necessary ground/air signals for search planes.

Winter Wilderness Search Fundamentals

- Rest. The more you rest the less energy you expend and the less food you need.
- Adhere to survival tips. Carry safety matches and candles, which are easy to light, provide heat and light, and help in starting a fire. If you have no matches, fire may be produced by striking the flint on your waterproof matchbox with the blade of a knife and collecting sparks in dry tinder. Dry moss and bark make good tinder to start your fire. Fires should be built in layers with sticks being laid out like the spokes of a wheel. A sparklite firestarter is an item to be carried in the day pack.
- Keep a disposable lighter in a shirt pocket.
- Carry a two-cell flashlight. It can be seen from the air or on the ground as far as line-of-sight will permit.
- Ground/air signals can be made with small fires to form the identification characters.
- Survival depends on clear thinking and resourcefulness. The main things to remember are to keep calm, think, try to help each other, keep together, and keep warm.

Appendix 1

Temperature (°F)

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

Frostbite occurs in 15 minutes or less

http://www.nws.noaa.gov/om/windchill/index.shtml

To reflect the new formula, National Weather Service Forecast Offices have adjusted the threshold values of Wind Chill Temperatures that trigger Wind Chill Warnings and Wind Chill Advisories.

- When the wind chill temperature is forecast to be minus 25 degrees or lower, **a wind chill warning will be issued.**
- When the wind chill temperature is forecast to be between minus 10 to minus 24 degrees, **a wind chill advisory will be issued.**

In 2002, adjustments for solar radiation (i.e., the impact of sun) for a variety of sky conditions (sunny, partly sunny and cloudy) will be added to the calculation model.

Here's the formula:

$$\text{Wind Chill (F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where V = the wind speed value in mph and
T = the temperature in F

Note: Frostbite occurs in 15 minutes or less at wind chill values of -18 or lower

Add regular pack list