UNIT 2

Personal Protection

CHAPTER 2-5

Shelters

A **shelter** can protect your from the Sun, insects, wind, rain, snow, and hot or cold temperatures. It can give you a feeling of well-being. It can help you maintain your will to survive.

In some areas, your need for shelter may take priority over your need for food and possibly even your need for water. For example, prolonged exposure to cold can cause excessive fatigue and weakness (exhaustion). An exhausted person may develop a "passive" outlook, thereby losing the will to survive.

The most common error in making a shelter is to make it too large. A shelter must be large enough to protect you. It must also be small enough to contain your body heat especially in cold climates.

The information in this chapter describes how the environment influences shelter site selection and factors which survivors must consider before constructing an adequate shelter. The techniques and procedures for constructing shelters for various types of protection are also presented.

Shelter: Is anything that protects a survivor from the environmental hazards.

Shelter Considerations

The location and type of shelter built by survivors vary with each survival situation. There are many things to consider when picking a site. Survivors should consider the time and energy required to establish an adequate camp, weather conditions, life forms (human, plant, and animal), terrain, and time of day. Every effort should be made to use as little energy as possible and yet attain maximum protection from the environment.

Time

Late afternoon is not the best time to look for a site which will meet the day's shelter requirements. If survivors wait until the last minute, they may be forced to use poor materials in unfavorable conditions. They must constantly be thinking of ways to satisfy their needs for protection from environmental hazards.

Weather

Weather conditions are a key consideration when selecting a shelter site. Failure to consider the weather could have disastrous results. Some major weather factors which can influence the survivor's choice of shelter type and site selection are temperature, wind, and precipitation.

Temperature. Temperatures can vary considerably within a given area. Setting up a campsite in low areas such as a valley in cold regions can expose survivors to low night temperatures and wind-chill factors. Colder temperatures are found along valley floors which are sometimes referred to as "cold air sumps." It may be advantageous to set up campsites to take advantage of the Sun. Survivors could place their shelters in open areas during the colder months for added warmth and in shaded areas for protection from the Sun during periods of hotter weather. In some areas a compromise may have to be made. For example, in many deserts the daytime temperatures can be very high while low temperatures at night can turn water to ice. Protection from both heat and cold are needed in these areas. Shelter type and location should be chosen to provide protection from the existing temperature conditions.

Wind. Wind can be either an advantage or a disadvantage depending upon the temperature of the area and the velocity of the wind. During the summer or on warm days,

survivors can take advantage of the cool breezes and protection the wind provides from insects by locating their camps on knolls or spots of land. Conversely, wind can become an annoyance or even a hazard as blowing sand, dust, or snow can cause skin and eye irritation and damage to clothing and equipment. On cold days or during winter months, survivors should seek shelter sites which are protected from the effects of wind-chill and drifting snow.

Precipitation. The many forms of precipitation (rain, sleet, hail, or snow) can also present problems for survivors. Shelter sites should be out of major drainages and other low areas to provide protection from flash floods or mud slides resulting from heavy rains. Snow can also be a great danger if shelters are placed in potential avalanche areas.

Life Forms

All life forms (plant and animal) must be considered when selecting the campsite and the type of shelter that will be used. For a shelter to be adequate, certain factors must be considered, especially if extended survival is expected.

Insect life can cause personal discomfort, disease, and injury. By locating shelters on knolls, ridges, or any other area that has a breeze or steady wind, survivors can reduce the number of flying insects in their area. Staying away from standing water sources will help to avoid mosquitoes, bees, wasps, and hornets. Ants can be a major problem; some species will forcefully defend their territories with painful stings or bites, or release particularly unpleasant odors.

Large and small animals can also be a problem, especially if the camp is set up near their trails or waterholes.

Dead trees that are standing, and trees with dead branches should be avoided. Wind may cause them to fall, causing injuries or death. Poisonous plants, such as poison oak or poison ivy, must also be avoided when locating a shelter.

Terrain

Scree and Talus: An accumulation of loose stones or rocky debris lying on a slope or at the back of a hill or cliff.

Terrain hazards may not be as apparent as weather and animal life hazards, but they can be many times more dangerous. Avalanche, rock, dry streambeds, or mud-slide areas should be avoided. These areas can be recognized by either a clear path or a path of secondary vegetation, such as 1- to 15-foot tall vegetation or other new growth which extends from the top to the bottom of a hill or mountain. Survivors should not choose shelter sites at the bottom of steep slopes which may be prone to slides. Likewise, there is a danger in camping at the bottom of steep **scree** or **talus** slopes. Additionally, rock overhang must be checked for safety before using it as a shelter.

Location

When you are in a survival situation and realize that shelter is a high priority, start looking for shelter as soon as possible. As you do so, remember what you will need at the site. Four requisites are:

1. It must be near water, food, fuel, and a signal or recovery site.

2. The area must be safe, providing natural protection from environmental hazards.

3. Materials must be available to construct the shelter.

In some cases, the “shelter” may already be present. Survivors seriously limit themselves if they assume shelters *must* be a constructed framework having predetermined dimensions and a cover of parachute material or a signal paulin. More appropriately, survivors should consider using sheltered *places* already in existence in the immediate area. This does not rule out shelters with a constructed framework and parachute or other manufactured material covering; it simply enlarges the scope of what can be used as a survival shelter.

4. The area chosen must be both large enough and level enough for the survivor to lie down.

Personal comfort is an important fundamental for survivors to consider. A satisfactory shelter provides physical and mental well-being for sound rest. Plenty of rest is very important if survivors are to make sound decisions. Their need for rest becomes more critical as time passes and rescue or return is delayed. Before actually constructing a shelter, survivors must determine the specific purpose of the shelter. The following factors influence the type of shelter to be built.

- Rain or other precipitation.
- Cold.
- Heat.
- Insects.
- Available materials nearby (manufactured or natural).
- Length of expected stay.
- Number and physical condition of survivors.

If possible, survivors should try to find a shelter which needs little work to be adequate. Using what is already there, so that complete construction of a shelter is not necessary, saves time and energy. For example, rock overhangs, caves, large cracks, fallen logs, root supports, or snow banks can all be modified to provide satisfactory shelter. Modifications may include adding snow blocks to finish off an existing tree well shelter, increasing the insulation of the shelter by using vegetation or parachute material, or building a reflector fire in front of a rock overhang or cave. Survivors must consider the amount of energy required to build the shelter. It is not really wise to spend a great deal of time and energy in constructing a shelter if nature has provided a natural shelter nearby which will satisfy the survivor's needs. See figure 2-27 for an example of naturally occurring shelter.

The size limitations of a shelter are important only if there is either a lack of material on hand or if it is cold. Otherwise, the shelter should be large enough to be comfortable yet not so large as to cause an excessive amount of work. Any shelter, naturally occurring or otherwise, in which a fire is to be built must have a ventilation system which will provide fresh air and allow smoke and carbon monoxide to escape. Even if a fire does not produce visible smoke (such as heat tabs), the shelter must still be vented. If a fire is to be placed outside the shelter, the opening of the shelter should be placed 90 degrees to the prevailing wind. This will reduce the chances of sparks and smoke being blown into the shelter if the wind should reverse direction in the morning and evening. This frequently occurs in mountainous areas. The best fire to shelter distance is approximately 3 feet. If an aircrew member's situation, one place where it *would not* be wise to build a fire is near the aircraft wreckage, especially if it is being used as a shelter. The possibility of igniting spilled lubricants or fuels is great. Survivors may decide instead to use materials from the aircraft to add to a shelter located a safe distance from the crash site.

Types of Shelters

When looking for a shelter site, keep in mind the type of shelter (protection) you need. However, you must also consider:

- How much time and effort you need to build the shelter.
- If the shelter will adequately protect you from the elements (Sun, wind, rain, snow).
- If you have the tools to build it. If not, can you make improvised tools?
- If you have the type and amount of materials needed to build it.

To answer these questions, you need to know how to make various types of shelters and what materials you need to make them.

Immediate Action Shelters

The first type of shelter that survivors may consider using, or the first type they may be forced to use, is an immediate action shelter. An immediate action shelter is one which can be erected quickly with minimum effort; for

example, raft, aircraft parts, parachutes, paulin, and plastic bag. Natural formations can also shield survivors from the elements immediately, to include overhanging ledges, fallen logs, caves, and tree wells (fig. 2-28). It isn't necessary to be concerned with exact shelter dimensions. Survivors should remember that if shelter is needed, use an existing shelter if at all possible. They should improvise on natural shelters or construct new shelters only if necessary. Regardless of type, the shelter must provide whatever protection is needed and, with a little ingenuity, it should be possible for survivors to protect themselves and do so quickly. In many instances, the immediate action shelters may have to serve as permanent shelters for survivors. For example, many aircrew members fly without parachutes, large cutting implements (axes), and entrenching tools; therefore, multiperson liferafts may be the only immediate or long-term shelter available. In this situation, multiperson liferafts must be deployed in the quickest manner possible to ensure maximum advantages are attained from the following shelter principles:

- Set up in areas which afford maximum protection from precipitation and wind and use the basic shelter principle in topics discussed in the Shelter Considerations and Location.
- Anchor the raft for retention during high winds.
- Use additional boughs, grasses, etc., for ground insulation.

Improvised Shelters

Shelters of this type should be easy to construct and/or dismantle in a short period of time. However, these shelters usually require more time to construct than an immediate action shelter. For this reason, survivors should only consider this type of shelter when they aren't immediately concerned with getting out of the elements. Shelters of this type include the following:

- The "A frame" design is adaptable to all environments as it can be easily modified; for example, tropical para-hammock, temperate area "A frame," arctic thermal "A frame," and fighter trench.
- Simple shade shelter; these are useful in dry areas.
- Various paratepees.
- Snow shelters; includes tree-pit shelters.
- All other variations of the above shelter types; sod shelters, etc.

Shelters for Warm Temperature Areas

The first step is deciding the type of shelter required. No matter which shelter is selected, the building or improvising process should be planned and orderly, following proven procedures and techniques. The second step is to select, collect, and prepare all materials needed before the actual construction; this includes framework, covering, bedding, or insulation, and implements used to secure the shelter ("dead-men," lines, stakes, etc.).

For shelters that use a wooden framework, the poles or wood selected should have all the rough edges and stubs removed. Not only will this reduce the chances of the parachute fabric being ripped, but it will eliminate the chances of injury to survivors.

On the outer side of a tree selected as natural shelter, some or all of the branches may be left in place as they will make a good support structure for the rest of the shelter parts.

In addition to the parachute, there are other materials which can be used as framework coverings. Some of the following are both framework and covering all in one:

- Bark peeled off dead trees.
- Boughs cut off trees.
- Bamboo, palm, grasses, and other vegetation cut or woven into desired patterns.

The next step in the process of shelter construction is site preparation. This includes brushing away rocks and twigs from the sleeping area and cutting back overhanging vegetation.

The fourth step is to actually construct the shelter, beginning with the framework. The framework is very important. It must be strong enough to support the weight of the covering

and possible buildup of snow. It must also be sturdy enough to resist strong wind gusts.

Construct the framework in one of two ways. For natural shelters, branches may be securely placed against trees or other natural objects. For parachute shelters, poles may be lashed to trees or to other poles. The support poles or branches can then by laid and/or attached depending on their function.

The pitch of the shelter is determined by the framework. A 60-degree pitch is best for shedding **precipitation** and providing shelter room.

The size of the shelter is determined by the framework. The shelter should be large enough for survivors to sit up, with plenty of room to lie down and to store all personal equipment.

After the basic framework has been completed, survivors can apply and secure the framework covering. The care and techniques used to apply the covering will determine the effectiveness of the shelter in shedding precipitation.

If survivors are to use parachute material, they should remember that "pitch and tightness" apply to shelters designed to shed rain or snow. Parachute material is absorbent and will not shed moisture unless it is stretched tightly at an angle of sufficient pitch which will encourage run-off instead of penetration. An angle of 40 to 60 degrees is recommended for the "pitch" of the shelter. The material stretched over the framework should be wrinkle-free and tight. Survivors should not touch the material when water is running over it as this will break the surface tension at that point and allow water to drip into the shelter. Two layers of parachute material, 4 to 6 inches apart, will create a more effective water repellent covering. Even during hard rain, the outer layer only lets a mist come through if it is pulled tight. The inner layer will then channel off any moisture which may come through. This layering of parachute material also creates a dead-air space that covers the shelter. This is especially beneficial in cold areas when the shelter is enclosed. Plenty of insulation can also be provided by branches, aircraft parts, snow, etc. These will be discussed in more depth in the area of cold climate shelters. A double layering of parachute material helps to trap body heat, radiating heat from the Earth's surface, and other heating sources.

Precipitation: A deposition on the Earth of hail, mist, rain, sleet, or snow.

If parachute material is to be used alone or in combination with natural materials, it must be changed slightly. Survivors should remove all of the lines from the parachute and then cut it to size. This will eliminate bunching and wrinkling and reduce leakage.

If natural materials are to be used for the covering, the shingle method should be used. Starting at the bottom and working toward the top of the shelter, the bottom of each piece should overlap the top of the preceding piece. This will allow water to drain off. The material should be placed on the shelter in ample quantity so that survivors in the shelter cannot see through it.

Maintenance and Improvements

Once a shelter is constructed, it must be maintained. Additional modifications may make the shelter more effective and comfortable. Indian lacing (lacing the front of the shelter to the bipod) will tighten the shelter. A door may help block the wind and keep insects out. Other modifications may include a fire reflector, porch or work area, or another whole addition such as an opposing lean-to.

Construction of Specific Shelters

A-Frame

The following is one way to build an A-frame shelter in a warm or temperate environment using parachute material or fabric for the covering. There are as many variations of this shelter as there are builders. The procedures here will, if followed carefully, result in the completion of a safe shelter that will meet survivors' needs. For an example of this and other A-frame shelters, see figure 2-29.

Materials:

- One 12- to 18-foot long sturdy ridge pole with all projections cleaned off.
- Two bipod poles, approximately **7** feet long.
- Parachute material or fabric.
- Suspension lines.
- "Buttons," small objects placed behind gathers of material to provide a secure way of affixing suspension line to the parachute material.
- Approximately 14 stakes, approximately 10 inches long.

Assembling the Framework:

- Lash the two bipod poles together at eye-level height.
- Place the ridge pole, with the large end on the ground, into the bipod formed by the poles and secure with a square lash.
- The bipod structure should be 90 degrees to the ridge pole and the bipod poles should be spread out to an approximate equilateral triangle of a 60-degree pitch. A piece of line can be used to measure this.

Applying the Fabric:

- Tie off about 2 feet of the apex in a knot and tuck this under the butt end of the ridge pole. Use half hitches and clove hitches to secure the material to the base of the pole.
- Place the center radial seam of the parachute piece (or the center of the fabric) on the ridge pole. After pulling the material tight, use half hitches and clove hitches to secure the fabric to the front of the ridge pole.
- Draw a line on the ground from the butt of the ridge pole to each of the bipod poles. Stake the fabric down, starting at the rear of the shelter and alternately staking from side to side to the shelter front. Use plenty of stakes to ensure the parachute material is wrinkle-free.
- Stakes should be slanted away from the direction of pull. When tying off with a clove hitch, the line should pass in front of the stake first and then pass under itself to allow the button and line to be pulled 90 degrees to the wrinkle.
- Indian lacing is the sewing or lacing of the lower lateral band with inner core or line which is secured to the bipod poles. This will remove the remaining wrinkles and further tighten the material.
- A rain fly, bed, and other refinements can now be added.

Poncho Lean-To

It takes only a short time and minimal equipment to build this lean-to. You need a sturdy, smooth, ridge pole (longer than the builder's body) long enough to span the distance between two sturdy trees. You will also need support poles, stakes, suspension lines, buttons, and fabric or parachute material.

Before selecting the trees you will use or the location of your poles, check the wind direction. Ensure that the back of your lean-to will be into the wind.

Assembling the Framework:

- Lash the ridge pole (between two suitable trees) about chest or shoulder high.
- Lay the roof support poles on the ridge pole so the roof support poles and the ground are at approximately a 60-degree angle. Lash the roof support poles to the ridge pole.

Applying the Fabric:

- Place the middle seam of the fabric on the middle support pole with lower lateral band along the ridge pole.
- Tie-off the middle and both sides of the lower lateral band approximately 8 to 10 inches from the ridge pole.
- Stake the middle of the rear of the shelter first, then alternate from side to side.
- The stakes that go up to the sides to the front should point to the front of the shelter.

- Pull the lower lateral band closer to the ridge pole by Indian lacing.
- Add bed and other refinements (reflector fire, bed logs, rain fly, etc.). See figure 2-30 for lean-to examples.

For additional protection from wind and rain, place some brush, your rucksack, or other equipment at the sides of the lean-to.

To reduce heat loss to the ground, place some type of insulating material, such as leaves or pine needles, inside your lean-to.

Note: *When at rest, you lose as much as 80 percent of your body heat to the ground.*

Nine-Pole Parachute Tepee

The tepee is an excellent shelter for protection from wind, rain, cold, and insects. Cooking, eating, sleeping, resting, signaling, and washing can all be done without going outdoors. The tepee, whether 9-pole, 1-pole, or no-pole, is the only improvised shelter that provides adequate ventilation to build an inside fire. With a small fire inside, the shelter also serves as a signal at night.

Materials:

- Suspension line.
- Fabric or parachute material.
- Stakes.
- Although any number of poles may be used, 11 poles, smoothed off, each about 20 feet long, will normally provide adequate support.

Assembling the Framework:

Assume 11 poles are used. Adjust instructions if different numbers are used.

- Lay three poles on the ground with the butts even. Stretch the canopy along the poles. The lower lateral band should be 4 to 6 inches from the bottoms of the poles before the stretching takes place. Mark one of the poles at the apex point.
- Lash the three poles together, 5 to 10 inches above the marked area. (A shear lash is effective for this purpose.) These poles will form the tripod (fig. 2-31).
- Draw a circle approximately 12 feet in diameter in the shelter area and set the tripod so the butts of the poles are evenly spaced on the circle. Five of the remaining eight poles should be placed so the butts are evenly spaced around the 12-foot circle and the tops are laid in the apex of the tripod to form the smallest apex possible.

Applying the Fabric:

- Stretch the parachute material along the tie pole. Using the suspension line attached to the middle radial seam, tie the lower lateral band to the tie pole 6 inches from the butt end. Stretch the parachute material along the middle radial seam and tie it to the tie pole using the suspension line at the apex. Lay the tie pole onto the shelter frame with the butt along the 12-foot circle and the top in the apex formed by the other poles. The tie pole should be placed directly opposite the proposed door.
- Move the canopy material (both sides of it) from the tie pole around the framework and tie the lower lateral band together and stake it at the door. The front can now be sewn or pegged closed, leaving 3 to 4 feet for a door. (A sewing "ladder" can be made by lashing steps up the front of the tepee (fig. 2-31.4).
- Enter the shelter and move the butts of the poles outward to form a more perfect circle and until the fabric is relatively tight and smooth.
- Tighten the fabric and remove remaining wrinkles. Start staking directly opposite the door, and alternate from side to side, pulling the material down and to the front of the shelter. Use clove hitches or similar knots to secure material to the stakes.
- Insert the final two poles into the loops on the smoke flaps. The tepee is now finished (fig. 2-31.5).
- One improvement which could be made to the nine-pole tepee is the installation of a liner. This will allow a draft for a fire without making the occupants cold, since there may be a slight gap between the lower lateral band and the ground. A liner can be affixed to the inside of the tepee by taking the remaining 14-gore piece of material and firmly staking the lower lateral band directly to the ground all the way around, leaving room for the door. The area where the liner

and door meet may be sewn up. The rest of the material is brought up the inside walls and affixed to the poles with buttons.

Three-Pole Parachute Tepee

If you have a parachute and three poles and the tactical situation allows, make a parachute tepee. It is easy and takes very little time to make this tepee. It provides protection from the elements and can act as a signaling device by enhancing a small amount of light from a fire or candle. It is large enough to hold several people and their equipment and to allow sleeping, cooking, and storing firewood.

You can make this tepee using parts of or a whole personnel main or reserve parachute canopy. If using a standard personnel parachute, you need three poles 3.5 to 4.5 meters long and about 5 centimeters in diameter.

Assembling the Framework:

- Lay the poles on the ground and lash them together at one end.
- Stand the framework up and spread the poles to form a tripod.
- For more support, place additional poles against the tripod. Five or six additional poles work best, but do not lash them to the tripod.
- Determine the wind direction and locate the entrance 90 degrees or more from the mean wind direction.

Applying the Fabric:

- Lay out the parachute on the "backside" of the tripod and locate the bridle loop (nylon web loop) at the top (apex) of the canopy.
- Place the bridle loop over the top of a free-standing pole. Then place the pole back up against the tripod so that the canopy's apex is at the same height as the lashing on the three poles.
- Wrap the canopy around one side of the tripod. The canopy should be of double thickness, as you are wrapping an entire parachute. You need only wrap half of the tripod, as the remainder of the canopy will encircle the tripod in the opposite direction.
- Construct the entrance by wrapping the folded edges of the canopy around two free-standing poles. You can then place the poles side by side to close the teepee's entrance.
- Place all extra canopy underneath the tepee poles and inside to create a floor for the shelter.
- Leave a 30- to 50-centimeter opening at the top for ventilation if you intend to have a fire inside the tepee.

One-Pole Tepee

You need a 14-gore section (normally) of canopy, stakes, a stout center pole, and inner core and needle to construct this tepee. You cut the suspension lines except for 40- to 45-centimeter lengths at the canopy's lower lateral band.

Assembling the Framework:

- Select a shelter site and draw a circle about 14 feet in diameter on the ground.
- The parachute material is staked to the ground using the lines attached at the lower lateral band. After deciding where the shelter door will be located, stake the first line (from the lower band) down securely. Proceed around the circle that was drawn and stake down all the lines from the lateral band, making sure the parachute material is stretched tight before the line is staked down.
- Once all the lines are staked down, loosely attach the center pole, and through trial and error, determine the point at which the parachute material will be pulled tight once the center pole is placed upright—securely attach the material at this point.
- Using a suspension line (or innercore), sew the end of the material together leaving 3 or 4 feet for a door (fig. 2-32).

Parachute Tepee

No-Pole

For this shelter, you use the same materials, except for the center pole, as for the one-pole parachute tepee.

Assembling the Framework (fig. 2-33):

- Tie a line to the top of parachute material with a previously cut suspension line.
- Throw the line over a tree limb, and tie it to the tree trunk.
- Starting at the opposite side from the door, place a stake on the drawned 3.5- to 4.3-meter circle.
- Tie the first line on the lower lateral band.
- Continue emplacing the stakes and tying the lines to them.
- After staking down the material, unfasten the line tied to the tree trunk, tighten the tepee material by pulling on this line, and tie it securely to the tree trunk.

Sod Shelter

A framework covered with sod provides a shelter which is warm in cold weather and one that is easily made waterproof and insect-proof in the summer. The framework for a sod shelter must be strong, and it can be made of driftwood, poles, willow, etc. (Some natives use whale bones.) Sod, with a heavy growth of grass or weeds, should be used since the roots tend to hold the soil together. Cutting about 2 inches of soil along with the grass is sufficient. The size of the blocks are determined by the strength of the individual. A sod house is strong and fireproof.

Shelters for Tropical Areas

In tropical areas, especially moist tropical areas, the major environmental factors influencing both site selection and shelter types are:

- Moisture and dampness.
- Rain.
- Wet ground.
- Heat.
- Mud-slide areas.
- Dead standing trees and limbs.
- Insects.

Survivors should establish a campsite on a knoll or high spot in an open area well back from any swamps or marshy areas. The ground in these areas is drier, and there may be a breeze which will result in fewer insects. Underbrush and dead vegetation should be cleared from the shelter site. Crawling insects will not be able to approach survivors easily due to lack of cover. A thick bamboo clump or matted canopy of vines for cover reflects the smoke from the campfire and discourages insects. This cover will also keep the extremely heavy early morning dew off the bedding.

The easiest improvised shelter is made by draping a parachute, tarpaulin, or poncho over a rope or vine stretched between two trees. One end of the canopy should be kept higher than the other. Insects are discouraged by few openings in shelters and smudge fires. A hammock made from parachute material or fabric will keep the survivor off the ground and discourage ants, spiders, leeches, scorpions, and other pests.

In the wet jungle, survivors need shelter from dampness. If they stay with the aircraft, it should be used for shelter. They should try to make it mosquito proof by covering openings with netting or parachute cloth.

A good rain shelter can be made by constructing an A-type framework and covering it with a good thickness of palm or other broad leaf plants, pieces of bark, and mats of grass (fig. 2-34).

Nights are cold in some mountainous tropical areas. Survivors should try to stay out of the wind and build a fire. Reflecting the heat off a rock pile or other barrier is a good idea. Some natural materials which can be used in the shelters are green wood (dead wood may be too rotten), bamboo, and palm leaves. Vines can be used in place of suspension line for thatching roofs or floors, etc. Banana plant sections can be separated from the banana plant and fashioned to provide a mattress effect.

Raised Platform Shelter

The raised platform shelter has many variations. One example is four trees or vertical poles in a rectangular pattern which is a little longer and a little wider than the survivor, keeping in mind the survivor will also need protection for equipment. Two long, sturdy poles are then square lashed between the trees or vertical poles, one on each side of the intended shelter. Cross pieces can then be

secured across the two horizontal poles at 6- to 12-inch intervals. This forms the platform on which a natural mattress may be constructed. Parachute material can be used as an insect net and a roof can be built over the structure using A-frame building techniques. The roof should be waterproofed with thatching laid bottom to top in a thick shingle fashion. See figure 2-35 for examples of this and other platform shelters. These shelters can also be built using three trees in a triangular pattern. At the foot of the shelter, two poles are joined to one tree.

Raised Parachute Platform Shelter. A variation of the platform-type shelter is the parachute platform. A quick and comfortable bed is made by simply wrapping material around the two "frame" poles. Another method is to roll poles in the material in the same manner as for an improvised stretcher (fig. 2-36).

Hammocks. Various parachute hammocks can also be made. They are more involved than a simple parachute wrapped framework and not quite as comfortable (fig. 2-37). You can make a hammock using 6 to 8 gores of parachute canopy and two trees about 4.5 meters apart.

Hobo Shelter

On tropical coasts and other coastal environments, if a more permanent shelter is desired as opposed to a simple shade shelter, survivors should build a “hobo” shelter. To build this shelter:

- Dig into the lee side of a sand dune to protect the shelter from the wind. Clear a level area large enough to lie down in and store equipment.
- After the area has been cleared, build a heavy driftwood framework which will support the sand.
- Wall sides and top with strong material (boards, driftwood, etc.) that will support the sand; leave a door opening.
- Slope the roof to equal the slope of the sand dune. Cover the entire shelter with parachute material to keep sand from sifting through small holes in the walls and roof.

Silt: A sedimentary material consisted of fine mineral particles intermediate in size between sand and clay.

- Cover with 6 to 12 inches of sand to provide protection from wind and moisture.
- Construct a door for the shelter (fig. 2-38).

Swamp Bed

In a marsh or swamp, or any area with standing water or continually wet ground, the swamp bed (fig. 2-39) keeps you out of the water. When selecting such a site, consider the weather, wind, tides, and available materials.

To make a swamp bed:

- Look for four trees clustered in a rectangle, or cut four poles (bamboo is ideal) and drive them firmly into the ground so they form a rectangle. They should be far enough apart and strong enough to support your height and weight, to include equipment.
- Cut two poles that span the width of the rectangle. They, too, must be strong enough to support your weight.
- Secure these two poles to the trees (or poles). Be sure they are high enough above the ground or water to allow for tides and high water.
- Cut additional poles that span rectangle’s length. Lay them across the two side poles, and secure them.
- Cover the top of the bed frame with broad leaves or grass to form a soft sleeping surface.
- Build a fire pad by laying clay, **silt**, or mud on one corner of the swamp bed and allow it to dry.

Another shelter designed to get you above and out of the water or wet ground uses the same rectangular configuration as the swamp bed. You very simply lay sticks and branches lengthwise on the inside of the trees (or poles) until there is enough material to raise the sleeping surface above the water level.

Shelters for Dry Climates

Natives of hot, dry areas make use of light-proof shelters with sides rolled up to take advantage of any breeze. Survivors should imitate these shade-type shelters if forced to survive in these areas. The extremes of heat and cold must be considered in hot areas, as most can become very cold during the night. The major problem for survivors will be escaping the heat and sun rays.

Natural Shelters

Do not overlook natural formations that provide shelter. Examples are caves, rocky crevices, clumps or bushes, small depressions, large rocks on leeward sides of hills, large trees with low-hanging limbs, and fallen trees with thick branches. However, when selecting a natural formation:

- Stay away from low ground such as ravines, narrow valleys, or creek beds. Low areas collect the heavy cold air at night and are therefore colder than the surrounding high ground. Thick, brushy, low ground also harbors more insects.
- Check for poisonous snakes, ticks, mites, scorpions, and stinging ants.
- Look for loose rocks, dead limbs, coconuts, or other natural growth that could fall on your shelter.

In some desert mountains, it is possible to find good rock shelters or cave-like protection under tumbled blocks of rocks which have fallen from cliffs. Use care to ensure that these blocks are in areas void of future rock falling activity and free from animal hazards.

Vegetation, if any exists, is usually stunted and armed with thorns. It may be possible to stay in the shade by moving around the vegetation as the Sun moves. The hottest part of the day may offer few shadows because the Sun is directly overhead. Parachute material draped over bushes or rocks will provide some shade.

Debris Hut

For warmth and ease of construction, this shelter is one of the best. When shelter is essential to survival, build this shelter.

To make a debris hut (fig. 2-40):

- Build it by making a tripod with two short stakes and a long ridgepole or by placing one end of a long ridgepole on top of a sturdy base.
- Secure the ridgepole (pole running the length of the shelter) using the tripod method or by anchoring it to a tree at about waist height.
- Prop large sticks along both sides of the ridgepole to create a wedge-shaped ribbing effect. Ensure the ribbing is wide enough to accommodate your body and steep enough to shed moisture.
- Place finer sticks and brush crosswise on the ribbing. These form a latticework that will keep the insulating material (grass, pine needles, leaves) from falling through the ribbing into the sleeping area.
- Add light, dry, if possible, soft debris over the ribbing until the insulating material is at least 1 meter thick—the thicker the better.
- Place a 30-centimeter layer of insulating material inside the shelter.
- At the entrance, pile insulating material that you can drag to you once inside the shelter to close the entrance or build a door.
- As a final step in constructing this shelter, add shingling material or branches on top of the debris layer to prevent the insulating material from blowing away in a storm.

Beach Shade Shelter

This shelter protects you from the sun, wind, rain, and heat. It is easy to make using natural materials.

To make this shelter (fig. 2-41):

- Find and collect driftwood or other natural material to use as support beams and as a digging tool.

- Select a site that is above the high water mark.
- Scrape or dig out a trench running north to south so that it receives the least amount of sunlight. Make the trench long and wide enough for you to lie down comfortably.
- Mound soil on three sides of the trench. The higher the mound, the more space inside the shelter.
- Lay support beams (driftwood or other natural material) that span the trench on top of the mound to form the framework for a roof.
- Enlarge the shelter's entrance by digging out more sand in front of it.
- Use natural materials such as grass or leaves to form a bed inside the shelter.

Desert Shelters

In an arid environment, consider the time, effort, and material needed to make a shelter. If you have material such as a poncho, canvas, or a parachute, use it along with such land features as rock outcroppings, mounds of sand, or a depression between dunes or rocks to make your shelter.

Using rock outcroppings:

- Anchor one end of your poncho (canvas, parachute, or other material) on the edge of the outcrop using rocks or other weights.
- Extend and anchor the other end of the poncho so it provides the best possible shade.

In a sandy area:

- Build a mound of sand or use the side of a sand dune for one side of the shelter.
- Anchor one end of the material on top of the mound using sand or other weights.
- Extend and anchor the other end of the material so it provides the best possible shade.

Note: *If you have enough material, fold it in half and form a 30-centimeter to 45-centimeter airspace between the two halves.*

Belowground Shelter:

This airspace will reduce the temperature under the shelter.

A **belowground shelter** (fig. 2-42) can reduce the midday heat as much as 16 to 22ºC (30 to 40ºF). Building it, however, requires more time and effort than for other shelters. Since your physical effort will make you sweat more and increase dehydration, construct it before the heat of the day.

To make this shelter:

- Find a low spot or depression between dunes or rocks. If necessary, dig a trench 45 to 60 centimeters deep and long and wide enough for you to lie in comfortably.
- Pile the sand you take from the trench to form a mound around three sides.
- On the open end of the trench, dig out more sand so you can get in and out of your shelter easily.
- Cover the trench with your material.
- Secure the material in place using sand, rocks, or other weights.

If you have extra material, you can further decrease the midday temperature in the trench by securing the material 30 to 45 centimeters above the other cover. This layering of the material will reduce the inside temperature 11 to 22ºC (20 to 40ºF).

Principles of Desert Shelters

Another type of belowground shade shelter is of similar construction, except all sides are open to air currents and circulation. For maximum protection, you need a minimum of two layers of parachute or canopy material (fig. 2-43). White is the best color to reflect heat; the innermost layer should be of darker material.

Materials that can be used to build desert shelters include the following:

- Sand, though difficult to work with when loose, may be made into pillars by using sandbags made from any available cloth.
- Rock can be used in shelter construction.
- Vegetation such as sagebrush, creosote bushes, juniper trees, and desert gourd vines are valuable building materials.
- Canopy and suspension lines are perhaps the most versatile building materials available. When used in layers, fabric protects you from the Sun's rays.

The shelter should be made of dense material or have numberous layers to reduce dangerous ultraviolet rays. The color of the materials used make a difference as to how much protection is provided from ultraviolet radiation. As a general rule, the order of preference should be to use as many layers as practical in the order of orange, green, tan, and white.

Ultraviolet Tests on Parachute Canopy Material

% Ultraviolet (Short Wave 2537 Aº Sunburn Rays) Blocked as compared to Direct Exposure

	1 Layer	2 Layers	3 Layers
Orange	78.2%	96.2%	99.36%
Sage Green	79.5%	96.2%	98.7%
Tan	64.1%	84.6%	93.6%
White	47.5%	61.6%	70.5%

% Ultraviolet (Long Wave 3660 Aº) Blocked as Compared to Direct Exposure

	1 Layer	2 Layers	3 Layers
Orange	63.4%	92.3%	97.8%
Sage Green	60.0%	88.95%	97.8%
Tan	38.9%	66.7%	82.3%
White	28.9%	47.8%	58.9%

The roof of a desert shelter should be multilayered so the resulting airspace reduces the inside temperature of the shelter. The layers should be separated 12 to 18 inches apart (fig. 2-43).

Survivors should place the floor of the shelter about 18 inches above or below the desert surface to increase the cooling effect.

In warmer deserts, white material should be used as an outer layer. Orange or sage green material should be used as an inner layer for protection from ultraviolet rays. In cooler areas, multiple layers of material should be used with sage green or orange material as the outer layer to absorb heat. The sides of shelters should be movable in order to protect survivors during cold and windy periods, and to allow for ventilation during hot periods.

In a hot desert, shelters should be built away from large rocks which store heat during the day. Survivors may need to move to the rocky areas during the evening to take advantage of the warmth heated rocks radiate.

Build desert shelters on the windward sides of dunes for cooling breezes. It is best to build shelters during early morning, late evening, or at night. However, potential survivors should recall that survivors who come down in a desert area during daylight hours must be immediately concerned with protection from the Sun and loss of water. In this case, canopy material can be draped over a liferaft, vegetation, or a natural terrain feature for quick shelter.

Aircraft parts and liferafts are also good improvised shade shelters. Survivors may use sections of the wing, tail, or fuselage to provide shade. However, the interior of the aircraft will quickly become super-heated and should be avoided as a shelter. An inflatable raft can be tilted against a raft paddle or natural object such as a bush or rock to provide relief from the Sun (fig. 2-44).

Shelters for Snow and Ice Areas

The differences in arctic and arctic-like environments create the need for different shelters. Basically, there are two types of environments which may require special shelter characteristics or building principles before survivors will have adequate shelter.

They are:

- Barren lands which include some seacoasts, icecaps, sea ice areas, and areas above the tree line.
- Tree-line areas.

Barren lands offer a limited variety of materials for shelter construction. These are snow, small shurbs, and grasses. Ridges formed by drifting or wind-packed snow may be used for wind protection (survivors should build on the lee side). In some areas, such as sea ice, windy conditions usually exist and cause the ice to shift forming pressure ridges. These areas of unstable ice and snow should be avoided at all times.

Shelters which are suitable for barren-type areas include:

1. Molded dome. (fig. 2-45)
2. Snow cave. (fig. 2-46)
3. Fighter trench.(fig. 2-47)
4. Igloo. (fig. 2-48)
5. Para-snow house. (fig. 2-49)

Note: Of these, the ones that are quick to construct and require minimum effort and energy are the molded dome, snow cave, and fighter trench. It is important to know which of these shelters is the easiest to build since reducing or eliminating the effect of the wind-chill factor is essential to remaining alive.

In tree-covered areas, plenty of natural shelter building materials are normally available. Caution is required. Shelters built near rivers and streams may get caught in the overflow.

Tree-line area shelter types include:

1. Thermal A-frame construction. (fig. 2-50).
2. Lean-to or wedge. (fig. 2-51).
3. Double lean-to. (fig. 2-52).
4. Fan. (fig. 2-53).
5. Willow frame. (fig. 2-54).
6. Tree well. (fig. 2-55).

Regardless of the type of shelter used, the use of thermal principles and insulation in arctic shelters is required. Heat glows from bare ground and from ice masses over water. This means that shelter areas on land should be dug down to bare earth if possible (fig. 2-56). A minimum of 8 inches of insulation above survivors is needed to retain heat. All openings except ventilation holes should be sealed to avoid heat loss. Leaving vent holes open is especially important if heat producing devices are used. Candles, sterno, or small oil lamps produce carbon monoxide. In addition to the ventilation hole through the roof, another may be required at the door to ensure enough circulation of air. (As a general rule, unless persons can see their breath, the snow shelter is too warm and should be cooled down to preclude melting and dripping.)

Regardless of how cold it may get outside, the temperature inside a small well-constructed snow cave will probably not be lower than -10ºF. Body heat alone can raise the temperature of a snow cave 45 degrees above the outside air. A burning candle will raise the temperature 4 degrees. Burning sterno stove (small size, $2^5/_8$ oz) will raise the cave temperature about 28 degrees. However, since they cannot be heated many degrees above freezing, snow shelters provide a rather rugged life. Once the inside of the shelter "glazes" over with ice, this layer of ice should be removed by chipping it off or a new shelter built since ice reduces the insulating quality of a shelter. Maintain the old shelter until the new one is constructed. It will provide protection from the wind.

The aircraft should not be used as a shelter when temperatures are below freezing except in high wind conditions. Even then a thermal shelter should be constructed as soon as the conditions improve. The aircraft will not provide enough insulation, and the floor will usually become icy and dangerous.

General Construction Techniques

All thermal shelters use a layering system consisting of the frame, parachute (if available), boughs or shrubs, and snow. The framework must be sturdy enough to support the cover and insulation. A door block should be used to minimize heat loss. Insulation should be added on sleeping areas.

If a barren land-type shelter is being built with snow as the only material, a long knife or digging tool is a necessity. It normally takes 2 to 3 hours of hard work to dig a snow cave, and much longer for the beginner to build an igloo.

Survivors should dress lightly while digging and working; they can easily become overheated and dampen their clothing with perspiration which will rapidly turn to ice.

If possible, all shelter types should have their openings 90 degrees to the prevailing

wind. The entrance to the shelter should also be screened with snowblocks stacked in a L-shape.

Snow on the sea ice, suitable for cutting into blocks, will usually be found in the lee of pressure ridges or ice mounds. The packed snow is often so shallow that the snowblocks have to be cut out horizontally.

No matter which shelter is used, survivors should take a digging tool into the shelter at night to cope with the great amount of snow which may block the door during the night.

Shelter living

Survivors should limit the number of shelter entrances to conserve heat. Fuel is generally scarce in the arctic. To conserve fuel, it is important to keep the shelter entrance sealed as much as possible (fig. 2-57). When it is necessary to go outside the shelter, activities such as gathering fuel, snow or ice for melting, etc., should be done. To hurry matters, a trash container may be kept inside the door, and equipment may be stored in the entry way. Necessities which cannot be stored inside may be kept just outside the door. Any firearms (guns) the survivor may have must be stored outside the shelter to prevent increasing pressure building which could cause them to malfunction.

A standard practice in snow shelter living is for people to relieve themselves indoors when possible. This practice conserves body heat. If the snowdrift is large enough to dig connecting snow caves, one may be used as a toilet room. If not, tin cans may be used for urinals, and snowblocks for solid wastes (fecal) matter.

Survivors should use thick insulation under themselves when sleeping or resting even if they have a sleeping bag. They can use a thick bough bed in shingle-fashion, seat cushions, parachute, or an inverted inflated rubber raft.

Outer clothing makes good mattress material. A parka makes a good footbag. The shirt and inner trousers may be rolled up for a pillow. Socks and insoles can be separated and aired in the shelter. Drying may be completed in the sleeping bag by stowing around the hips. This drying method should only be used as a last resort.

Keeping the sleeping bag clean, *dry,* and fluffed will give maximum warmth. To dry the bag, it should be turned inside out, frost beaten out, and warmed before the fire—taking care that it doesn't burn.

To keep moisture (from breath) from wetting the sleeping bag, a moisture cloth should be improvised from a piece of clothing, a towel, or parachute fabric. It can then be lightly wrapped around the head in such a way that the breath is trapped inside the cloth. A piece of fabric dries easier than a sleeping bag. If cold is experienced during the night, survivors should exercise by fluttering their feet up and down or by beating the inside of the bag with their hands. Food or hot liquids can be helpful.

Snow remaining in clothing will melt in a warm shelter. When the clothing is again taken outside, the water formed will turn to ice and reduce the CLo value. Brush clothes before entering the shelter. Under living conditions where drying clothing is difficult, it is easier to keep clothing from getting wet than having to dry it out later.

If all the snow cannot be eliminated from outer clothing, survivors should remove the clothing and store it in the entry way or on the floor away from the source of heat so it remains cold. If ice should form in clothing, it may be beaten out with a stick.

In the cramped quarters of any small emergency shelter, pots of food or drink can be accidentally kicked over. The cooking area, even if it is only a sterno stove, should be located out of the way.

Shelter for Open Seas

Personal protection from the elements is just as important on the seas as it is anywhere else. Some rafts come equipped with insulated floors, spray shields**,** and canopies to protect survivors from heat, cold**,** and water. If rafts are not so equipped or the equipment has been lost, survivors should try to improvise these items using parachute material, clothing, or other equipment.