

## CHAPTER 5

## MEDICAL EVACUATION IN SPECIFIC ENVIRONMENTS

## 5-1. General

This chapter addresses medical evacuation in specific environments or under special circumstances. The medical evacuation effort must be well planned and its execution synchronized to be effective. Further, medical evacuation personnel must be flexible and ready to improvise, if needed, to meet the demands of unique situations.

## 5-2. Mountain Operations

a. In the past, armies have experienced great difficulty in evacuating patients from mountainous areas. Mountain environments are extremely diverse in nature. Some mountains are dry and barren with temperatures ranging from extreme heat in the summer to extreme cold in the winter. In tropical regions, mountains are frequently covered by lush jungles and heavy seasonal rains occur. Many areas display high rocky crags with glaciated peaks and year-round snow cover. Elevations can also vary from as little as 1,000 feet to over 16,000 feet with drastic and rapidly occurring weather changes.

b. Operations in mountainous terrain require some procedure modifications. This is due to the environmental impact on personnel and equipment. Important physical characteristics and considerations which influence medical evacuation are—

- Rugged peaks, steep ridges, and deep valleys.
- Limited number of trafficable roads.
- Reduced communications ranges.
- Unpredictability of and severe changes in weather.
- Decreased partial pressure of oxygen.
- Limited availability of landing zones (LZs).

c. In order to effectively support the tactical plan, the HSS plan must provide maximum flexibility. The HSS planner should consider using all means of evacuation. Due to the length of evacuation times and the limited means of ground evacuation, it is important to prioritize and triage (FM 8-230) patients prior to movement.

(1) The availability of improved, hard-surfaced roads is extremely limited, if they exist at all. Usually, improved roads are only found in valley corridors. Such roads are often dependent upon a system of narrow bridges spanning mountain streams and ravines. They often twist along ridgelines and cling to steep shoulders.

(2) Secondary roads and trails are often primitive and scarce. However, they may provide the only routes capable of vehicular traffic. Cross-compartment travel between adjacent valleys is often impossible by ground vehicle. Off-road travel requires detailed planning, even for short distances.

(3) Because of rough terrain, the medical company may not be able to reach the BAS by ground vehicle. An ambulance shuttle system is established with an AXP for air and ground evacuation vehicles to meet litter bearers. Litter bearers and beasts of burden may be the only means of evacuation available. Any available personnel may be used as litter bearers. Close coordination between medical companies and BASs in establishing patient collecting points or AXPs is necessary to—

- Reduce distance traveled by litter bearers.
- Reduce evacuation time.
- Conserve personnel.
- Locate the best potential LZs for air ambulances.

(4) In mountainous areas, evacuation of patients by air is the preferred means. Air ambulances permit the rapid movement of patients

over rugged terrain. For example, to travel a distance of only 6 kilometers on foot could take up to 2 hours, while flying time could be less than 2 minutes.

(5) Frequency-modulated (FM) radios are the principal means of communication in this environment. The ability to transmit is hampered by the limitations of line of sight transmissions.

(6) The briefing of ambulance drivers needs to be extensive including detailed strip maps and overlays. Further, specific instructions on what to do in various situations should be covered (such as if the vehicle breaks down or the unit moves).

*d. The mountain environment, with its severe and rapidly changing weather, impacts on aircraft performance capabilities; accelerates crew fatigue; and requires special flying techniques. Having to rely on continuous aviation support for a successful mountain operation is risky.*

(1) Flying in mountainous areas requires special training. Both the terrain and the weather influence basic flying techniques and operational planning. Rugged, mountainous terrain complicates flight route selection. Direct routes can seldom be flown without exposing the aircraft to detection and destruction by the enemy.

(2) Important considerations for aeromedical operations in mountainous areas are—

*(a) Density altitude.* Density altitude is the most important factor affecting aircraft performance. Density altitude combines temperature, humidity, and pressure altitude, and provides the basis for lift capability. Density altitude can vary significantly between the pickup point and the LZ because of the time of day and changes in elevation. Frequent performance planning updates are essential.

*(b) Wind.* Unpredictable winds can produce significant turbulence, wind sheers, updrafts, and down drafts. This further increases the risk of a catastrophe in a seemingly routine mission. Adverse winds along with high density altitude demand current and accurate performance planning. Pilots must plan for greater margins of safety.

*(c) Icing.* Ice can clog intake ports, thus starving the engine of air, or it can collect on rotor blades resulting in a significant loss of lift. Asymmetrical shedding can cause severe out of balance rotor conditions.

*(d) Visibility.* Low clouds or fog greatly decrease the ability to navigate or to avoid obstacles.

*(e) Lack of landing zones.* The characteristics of mountain terrain do not usually afford adequate LZs. The terrain may only allow the aircraft to hover while loading patients on board.

*(f) Hoist operations.* Use of the internal rescue hoist can be expected in mountainous terrain. Mounting the rescue hoist in the aircraft as standard equipment in mountain operations may be required. When possible, orientation and training sessions with supported troops should be conducted to help minimize the difficulty of such missions. Depending on the terrain, the forest penetrator may also be needed to accomplish the mission. Refer to Chapter 11 for more information on hoist operations.

*(g) Enemy air defenses.* When enemy air defense capabilities preclude using air ambulances in forward areas, they should be used to evacuate patients from AXP's or from division clearing stations.

*(h) Ambulatory patients.* Some ambulatory patients may be reported as litter patients in mountainous terrain. These patients are unable to walk through the rugged ground. Once placed on the air ambulance, their status may be upgraded.

*(i) Crew training.* Ground and air evacuation crews should receive additional training and orientation in mountaineering skills, handling casualties, and survival skills; for example—

- Cold weather survival training, including cold injury prevention.
- Mountain (rock) climbing.
- Use of ropes and vertical rescue techniques.

- Individual and unit movement at high altitudes.
- Care and treatment of patients suffering high altitude illnesses and cold weather injuries.
- Techniques of patient evacuation by litter, emphasizing the use of pack animals (if available from the host country), and the improvised travois and tramway litter.

(j) *Patient loading.* Care must be taken when loading patients where there is a great deal of slope to the LZ. Emphasis on approaching and loading the aircraft from the down-slope side of the aircraft must be reinforced.

#### CAUTION

Approaching the aircraft from the up-slope side is hazardous.

e. Troops operating in mountainous areas are exposed to other injuries and illnesses that frequently occur in this environment. These conditions include—

- An increased rate of fracture, sprain, and dislocation injuries.
- Incidents of acute mountain sickness, high-altitude pulmonary edema, and cerebral edema caused by rapid ascent to heights over 7,500 feet.
- Cold weather injuries.
- Dehydration and heat exhaustion.
- Sunburns and snow blindness.
- Aggravated sickle cell anemia.

Although this condition is not considered a mountain illness, personnel with sickle cell traits can be seriously affected by the decrease in barometric pressure and lower oxygen levels found at high altitudes.

f. The proportion of litter cases to ambulatory cases is increased in mountainous terrain, for even the slightly wounded may be unable to move unassisted over rough terrain. Litter relay stations may be required along the evacuation route to conserve the energy of litter bearers and to speed evacuation.

g. It is important to be able to predict the number of patients that can be evacuated with available personnel. When the average terrain grade exceeds 20 degrees, the four-man litter team is no longer efficient and should be replaced by a six-man team. The average mountain litter team should be capable of climbing 120 to 150 vertical meters of average mountain terrain and return with a patient in approximately 1 hour.

h. Mountain operations may require medical personnel to carry additional equipment. Items such as ropes, pulleys, pitons, piton hammers, and snap links are all necessary for evacuating patients and establishing BASS. All unnecessary items of equipment including those for which substitutes or improvisations can be made should be left behind. Heavy tentage, bulky chests, extra splint sets, excess litters, and nice-to-have medical supplies should be stored. Such medical supplies, if stored, should be readily available for airdrop or other means of transport. Medical items that are subject to freezing should be safeguarded. They should not be exposed to the low temperatures experienced in mountainous areas.

i. Evacuation times may be extended when using litter teams with AXPs. Therefore, shelter for patients must be improvised if tentage is not available to prevent undue exposure. In the summer or in warm climates, improvisation may not be necessary; however, since there is a close relationship between extreme cold and shock, medical personnel must be conscious of the need to provide adequate shelter for patients. Satisfactory shelter may be found in caves, under overhanging cliffs, behind clumps of thick bushes, and in ruins. Shelters may be built using a few saplings, evergreen boughs, shelter halves, or similar items. The time a patient is to be held influences the type of shelter used. When patients are to be kept overnight, a weather-proofed shelter should be constructed.

j. For further information on mountain operations, refer to FM 90-6. For aviation-specific information, refer to FMs 1-202 and 1-400.

### 5-3. Jungle Operations

a. Health service support elements in a jungle environment retain the same basic capabilities as in other environments. Jungle operations, however, subject personnel and equipment to effects not found in other environments. The jungle environment degrades the ability to maneuver. Security problems are also increased and affect medical evacuation operations as much as they do the combat forces.

b. In jungle operations a combination of air and ground evacuation units are used to maximize the patient evacuation potential. Using this dual system of evacuation ensures that the inherent limitations of one system can be compensated for by the other. Jungle variations affect the organizing, positioning, and securing of HSS. Due to the terrain, aerial resupply is usually a common practice. The responsiveness provided by aerial resupply requires fewer supplies to be stockpiled in the combat trains.

c. Jungle combat operations are characterized by ambushes and other guerrilla-type operations. The security threat caused by infiltrators requires that LOCs be patrolled often and that convoys be escorted. It is, therefore, essential that HSS be performed as far forward as the tactical situation permits. Positioning assets forward—

- Improves response time.
- Reduces road movement.
- Allows the HSS elements to take the advantage of security offered by combat units.

d. The thick foliage often makes evacuation by ground more difficult than in other types of terrain. Factors such as the threat, limited road network, and reliance on nonmedical personnel for convoy security make air evacuation the preferred means. By using the ambulance shuttle system, patients can be transferred from forward operating ground ambulances to either ground or air ambu-

lances operating further to the rear. In situations where evacuation assets are delayed by various factors (weather, terrain, or enemy air superiority), patients are held for longer periods of time at forward locations. This will dictate the need for additional medical supplies. Health service support planners must try to anticipate these delays whenever possible. The increased disease and infection incidence associated with the jungle environment may worsen the patient's condition; therefore, timely evacuation is essential.

e. In some remote and densely foliated jungles, the only means of evacuation may be by litter. Ambulances may not be practical on trails, unimproved muddy roads, or in swamps. As in mountain operations, there is a higher proportion of litter cases than usual. In the jungle even a slightly wounded soldier may find it impossible to walk through dense undergrowth. At best, litter teams can carry patients only a few hundred meters over rough jungle terrain before needing rest or relief. Litter carries should be kept as short as possible and medical elements kept far forward.

f. Other special planning considerations in jungle operations include—

(1) *Water.* Water is vital in the jungle and is plentiful. Water from natural sources, however, should be considered contaminated. *Water purification procedures must be taught to all soldiers.*

(2) *Clothing.* Due to the tropical climate, units should pack hot weather clothing when deploying to jungle areas. Jungle fatigues and boots are recommended. The insect (mosquito) net, insect repellent, and sunscreen should be issued to all soldiers operating in this environment.

(3) *Disease and nonbattle injuries.* The jungle environment is ideal for the transmission of a large number of diseases. The rate of DNBI casualties is potentially the highest in this climate. The heat, humidity, and terrain places the troops at high risk for dehydration, heat injury, skin diseases, endemic diseases, and immersion foot. Small wounds can rapidly become infected and lead to loss of effectiveness and possibly require evacuation. High standards of personal hygiene must be taught, encouraged, and maintained by the command. Mos-

quitoes and other arthropods that carry disease flourish under jungle conditions. Use of all possible personal protective measures must be ensured. Food- and waterborne diseases leading to diarrhea or other symptoms will abound. Food service sanitation measures must be strictly followed. The potential for contamination of food and water increases with each time they are handled, stored, or transported. Soldiers must be encouraged to consume adequate amounts of water that has been purified and to eat only approved foods. In the jungle it is necessary for the commander to pay meticulous attention to the details of PVNTMED measures to maintain an effective fighting force. For additional information on PVNTMED measures, refer to FM 21-10 and FM 21-10-1.

(4) *Training.* Health service support personnel should be trained in survival and support techniques in jungle environments. For example, training should be conducted in—

- Hot weather acclimatization and survival.
- Prevention, early detection, and treatment of arthropod-, food-, and waterborne diseases.
- Land navigation in a jungle environment.
- Field sanitation and other PVNTMED measures.
- Care and maintenance of equipment and supplies.

(5) *Equipment.* Due to the increased heat and humidity, vehicles and equipment require additional maintenance. Equipment tends to rust quickly and must be cleaned and oiled more frequently. Canvas items rot and rubber deteriorates much faster than in more temperate climates.

(6) *Communications.* The range of FM communications in the jungle is significantly reduced due to the dense undergrowth, heavy rains, and hilly terrain. The range of a radio set operated in the jungle may be reduced by 10 to 25 percent. The heavy rain and high humidity of the tropics also reduce the range (about 20 percent) and reliability of

wire communications. The transmission range can be extended by using additional radio relays and field expedient antennas.

(7) *Aircraft performance.* Utility helicopters are not able to lift the same size loads that can be lifted in more temperate areas. This results in a reduced patient load in some evacuation aircraft. Again, frequent and accurate performance planning is essential for mission accomplishment.

(8) *Landing zones.* There may be few suitable LZs. Many LZs will only be large enough to support one or two helicopters at a time.

(9) *Hoist operations.* Hoist operations may be required more frequently in the thick jungle vegetation where LZs are not available. The forest penetrator should be carried on all operations. For additional information on hoist operations, refer to Chapter 11.

g. For additional information on jungle operations, refer to FM 90-5. For aviation-specific information, refer to FMs 1-202 and 1-400.

## 5-4. Desert Operations

### a. *The Environment.*

{1) Deserts are arid, barren regions of the earth incapable of supporting normal life due to a lack of fresh water (FM 90-3). Although deserts are often thought of as hot climates, it is important to note that temperatures range from over 136° Fahrenheit (F) in some deserts, to bitter cold in others. Day to night fluctuations in temperature can exceed 70°F. Desert terrain can have mountains, rocky plateaus, or sandy dunes; some desert areas may contain all of these characteristics. Rain, when it falls, often causes flooding in low-lying areas. Winds can have a devastating effect upon HSS operations by destroying equipment and supplies and causing dust storms. Dust storms make navigation and patient treatment difficult. Since deserts vary considerably in the type of terrain and temperature, and in their cultural makeup, current medical intelligence should be obtained prior to desert operations.

(2) People have lived and fought in desert areas for thousands of years. However, the

environmental effects on personnel can be extreme, especially for soldiers not prepared for these operations.

- **Acclimatization.** To be effective, soldiers must be properly acclimatized to the desert. Two weeks are usually required to satisfactorily acclimatize troops to hot environments, using progressive degrees of heat exposure and physical exertion. Other potential acclimatization problems that may be encountered are the effects of dry air and altitude on the respiratory system. Since many desert areas are located in mountainous terrain, soldiers must be acclimatized for both the altitude and the temperature. In some areas of the world, such as the Gobi Desert in East Asia, people must be acclimatized to the cold, in addition to the dryness. (For additional information, refer to FM 21-10, FM 8-250, and TB MED 507.)

- **Discipline.** Units deployed in desert areas typically have long LOCs and are widely dispersed. This necessitates a greater reliance on the junior leaders as commanders are required to decentralize operations. For a unit to be effective, a high level of discipline must exist at all levels of the organization.

- **Water.** Water is the most basic need in a desert. Without it, soldiers cannot function effectively for more than a few hours.

- Thirst is not an adequate indicator of the need for water. *It is necessary for each commander to establish and enforce a supervised drinking program.* Experience has shown many times that soldiers do not drink enough fluids unless forced to do so. It is important to cool the water, if at all possible, to make it more appealing. Water supplies should be carefully guarded against accidental loss, sabotage, or contamination.

- Extra water must be carried by medical vehicles for patients to drink and to cool heat casualties.

- **Endemic disease and environmental injuries.** Soldiers deployed in the desert are susceptible to endemic diseases and environmental injuries.

- Proper water discipline, vaccines, prophylactic measures, field sanitation

measures, personal hygiene, and other PVNTMED measures can reduce these risks.

- Cold weather injuries, heat injuries, and respiratory disease can also be prevalent. Proper clothing, equipment, and a water-discipline program must have command emphasis in desert operations.

- **Winds.** Winds may very easily damage material such as aircraft, antennas, and tents. Equipment is protected by using covers, tie-downs, and shelters. Terrain helps shield equipment from the wind if site selection is done carefully. In some cases, special tools, such as extra long metal tent stakes, are necessary.

- **Wind and sand.** The effects of wind and sand are interrelated. Desert sand starts to become airborne when the wind reaches about 20 knots. Sandstorms—

- Restrict visibility.
- Pose a hazard to eyes (especially for soldiers wearing contact lenses).
- Can contaminate water supplies, if they are not protected.
- Make navigation difficult.

- **Sun.** The sun may cause sunburn of the skin and eyes if protection is not used.

(3) Eight characteristics of the desert environment that may adversely affect equipment are—

- **Terrain.** Trafficability varies with the type of terrain covered. Open, flat, and rocky terrain affords higher trafficability than do mountainous areas, lava beds, or salt marshes. Drivers must be well trained in judging the terrain over which they are driving to select the best alternative.

- Tracked vehicles are best suited for desert operations. However, they can

throw tracks when traversing a rocky area. Their use is also limited in rough terrain with steep slopes.

- Wheeled vehicles may be used in desert operations; however, they normally have a lower average speed than tracked vehicles and a higher incidence of damage and malfunction. Wheeled vehicles often bog down in sandy areas and cannot traverse many of the rougher areas.

- In planning for desert operations, vehicles should carry extra repair parts (fan belts, tires, and other items apt to malfunction).

- *Heat.*

- Excessive heat causes vehicles to overheat, leading to greater than normal wear. The frequency of leaks on vehicles and aircraft is greater than in some other environments. Engine and transmission seals tend to dry out and crack; fuel lines wear out quickly; and water requirements for cooling vehicle engines are greater. Loss of water, through evaporation, must be included in logistical planning. Aircraft temperature limitations may be reached quickly, resulting in limited use during the hotter parts of the day. Aircraft performance is greatly reduced by the heat combined with the effects of ground elevation. This may result in the limited use of some LZs, reduced patient carrying capacity, and reduced fuel load. There may not be sufficient out-of-ground-effect hover power available for landing in confined areas or on pinnacles, for using the hoist, or for nap-of-the-earth (NOE) flights. Using vehicle and aircraft covers reduce the effects of heat while vehicles and aircraft are not in use.

- Batteries do not hold their charge efficiently in intense heat. Dry battery supplies should be increased to compensate for a higher usage rate.

- Communications equipment must be protected from the heat in the desert. Dust covers are used on this type of equipment. If the equipment has ventilating ports, these should be cleaned regularly to avoid clogging.

- Medical supplies must be protected from the heat to prevent deterioration.

The shelf life of some medical supplies decreases when stored in hot climates.

- *Radiant light.*

- The sun burns unprotected skin and it may damage unprotected eyes. Soldiers should dress in loosely fitting clothing, use sunburn cream or oils to protect exposed skin, and wear sunglasses or goggles to protect their eyes. Soldiers should remain fully clothed. Removing clothing increases direct exposure of the skin to the sun and eliminates the beneficial cooling effects of the moisture trapped in clothing.

- Radiant light or its heat effects may be detrimental to plastics, lubricants, pressurized gasses, rubber, and other fluids. All vehicles and aircraft should be kept well ventilated, and windshields should be covered to reduce heat buildup inside. Supplies of all types should be stored in a well ventilated, shady area. Placing supplies in covered holes in the ground may reduce adverse heat effects.

- *Dust and sand.*

- Dust and sand present one of the greatest dangers to the proper functioning of equipment. Sand mixed with lubricants forms an abrasive paste. Lubrication fittings, bearings, and filters should be inspected frequently and changed when required.

- Aircraft should not be exposed to dust and sand any more than is absolutely necessary. Ground handling instead of hovering reduces sand ingestion. Dust and sand increase failure of microphone switches, signal distribution panels, and circuit breakers, and cause electrical motors and generators to burn out. Wheel and flight control bearings require more frequent cleaning; engines should be flushed frequently.

- Communications equipment may be adversely affected by dust and sand. Over a period of time, electrical insulation is damaged by wind-blown sand. When combined with the effects of lubricants on the insulation, dust and sand can become a major communications problem. Special care should be taken to brush dust off of radio equipment and to keep ventilating ports and channels clear.

- Sand can accumulate in airframes, on the bottom of armored vehicles, and in bearings on all types of equipment. This accumulation, combined with oil and condensation, adds extra weight to aircraft and vehicles as well as jamming their control linkages. Sand and grease buildups must be removed from bearings to ensure safe operation and control of aircraft and vehicles.

- Dust trails created by hovering aircraft or ground vehicles can be seen in excess of 10 miles on a relatively flat desert. This exposes these assets to direct and indirect enemy fires. Ground vehicles should reduce their speed to the point that they do not create a dust signature.

- *Humidity.* Humidity is a factor in some desert areas of the world, especially in the Middle East. Humidity can become a problem for short periods of time in other desert areas. Light coats of lubrication can help prevent rust; however, these benefits should be weighed against the dust-gathering qualities of oil. Demisting equipment is used on optics and night vision equipment to combat the effects of humidity.

- *Temperature variation.* Temperature variation can cause condensation in humid desert areas affecting optics, fuel lines, air tanks, and weapons. Expansion and contraction of air and fluids cause tires to overinflate during the day and underinflate at night. Fuel tanks may overflow during the day causing a fire hazard. Oil fluid levels become overfull and cause leaks during the day, or insufficient lubrication occurs when the oil cools. Vehicle operators and crew chiefs must ensure that the effects of temperature variations do not become a significant problem.

- *Static electricity.* Static electricity is prevalent in the desert. This is important to remember during refueling operations and when oxygen is being used on board vehicles or aircraft. Proper refueling procedures must be followed. Static electricity also causes severe shock to ground personnel in sling load and hoist operations. The load must touch the ground before the ground crew can handle it. (For additional information on hoist operations, refer to Chapter 11.)

*b. Preparation for Desert Operations.*

(1) To ensure success in desert operations, detailed planning is required. Factors to consider include—

- *Water.* Additional quantities of water are required for HSS operations for the survival of both medical personnel and their patients. Load plans for all vehicles and aircraft must include water. *Water is as mission essential as any piece of unit equipment.* It should be a priority item when loading plans are developed.

- *Prescribed load lists (PLL).* These lists are expanded to carry sufficient quantities of repair parts easily degraded by the environmental factors. For example, rubber and plastic fittings and tubes, or spare parts for communications equipment.

- *Wind, sand, and sun.* Plan for the effects of wind, sand, and sun. All plastic and glass surfaces on vehicles, aircraft, and other equipment should be covered when not in use. Covers should be ordered or fabricated prior to deployment.

- *Fuel.* Fuel planning is critical due to power limitations, extended range requirements, and increased vulnerability of refueling sites in the relatively open desert terrain. Careful planning of forward arming and refueling points (FARPs) is essential for mission accomplishment.

- *Clothing.* Units should plan to pack both hot and cold weather clothing when deploying.

- *Petroleum, oils, and lubricants.* These products should be of the proper viscosity for desert operations. Maintenance services are also performed more frequently on ground vehicles and aircraft, thus requiring a larger amount of POL than normal.

- *Filters.* Extra filters of all types are planned for due to a higher consumption rate.

- *Pre-positioning of equipment.* Pre-positioning of camouflage materials and per-

sonal equipment the aircrews cannot carry on the aircraft is planned for each unit move.

(2) Training for desert operations is not significantly different than training for operations in other areas except for the following:

- **Mountain training.** Because many desert areas are in mountainous terrain and because high temperatures increase density altitude, aeromedical evacuation units should conduct mountain training to prepare for contingencies in desert areas. Further, procedures and techniques for evacuation in mountainous terrain must be practiced by all HSS personnel. Special equipment requirements (paragraph 5-2 f) must also be considered.

- **Navigation.** Navigation in desert terrain varies from simple to extremely difficult. Factors affecting navigation are the type of desert and the scale and quality of the available navigational charts. At times, aircraft may have to use dead-reckoning navigational techniques (time, distance, heading). Ground vehicles must have compasses available, as they have to rely on compass headings and odometer readings to navigate. Ground and air ambulance crews should be able to interpret navigational charts and maps of all types and scales. Use of convoys is a viable technique to improve security and to ensure that ground vehicles do not get lost. Aircraft may be used to assist in navigation by convoys in those areas in which there are poor road networks and the terrain offers no distinctive features by which to navigate.

*c. Medical Evacuation Operations in the Desert.* In principle, medical evacuation operations in the desert do not differ greatly from these operations in other environments. However, techniques exist which may increase the effective use of medical resources.

(1) Helicopter landing sites should be chosen with care. Common mistakes made by many units when establishing the LZ are—

- Locating the pad relative to the patient, tents, vehicles, and other obstacles. A common tendency is to locate the helipad downwind of MTFs so that approaches may be made into the wind towards the facility. In high winds, the helicopter must make its take-off over the facility or go

around it. This not only endangers personnel on the ground, but also the crew of the aircraft. It forces the pilot to take off with a strong crosswind or tailwind if he does not have the power to clear the obstacles in front of him. At times, crosswind take-offs are not possible because of higher terrain on either side of the landing area. In mountainous deserts, winds normally channel down the valleys and are more predictable along valley floors. A better site selection for a LZ is with the MTF along side the approach and take off zone. Thus, the landing direction is up or down the valley depending on the airflow, and MTF is not overflowed.

- **Situating landing sites in washes,** small confined areas between large rocks, or close to moving tracked vehicles. Map coordinates are rarely accurate unless the site is beside a major terrain feature. Therefore, LZs should be located next to major terrain features or on higher ground where they can be seen from the air at a distance of 2 to 3 kilometers, if possible. Lack of distinctive features in the open desert and on large scale maps makes pinpoint navigation difficult, especially at night.

- **Marking of helicopter LZs** is done so that the pad can be seen from the air, but the markings should not be a hazard in themselves. If engineer tape is used, it should be firmly secured to prevent it from blowing loose. Panel markers are not a good tool to use as they are difficult to see. If panel markers are used, they need to be secured. If used, flares or marker smoke should not be deployed on or directly upwind from the pad. Smoke grenades or flares should not be thrown under the aircraft as it lands. Avoid using white smoke to mark the LZ. Colored smoke is probably the best daylight marking method. It is difficult to detect a smoke grenade more than 2 to 3 kilometers away, but an aircraft in the general vicinity can normally see it. Radios are used to guide aircraft to the LZs, but this creates an electronic signature. Units requesting medical evacuation must be prepared to signal the evacuation aircraft upon its arrival. Normally, map coordinates will guide the aircraft to within 2 to 3 kilometers of the LZ. Even from NOE altitudes, the aircrew may be able to see several units in the area. The requesting unit must signal the aircraft to ensure the designated LZ is used.

(2) Considerations for night flight include the following:

(a) Moonlight aids the medical evacuation pilot by providing him with the light to see with either unaided vision or night vision goggles (NVG). When adequate ambient light exists, medical evacuation crews function almost as effectively at night as they do during daylight. The small arms threat is somewhat reduced at night, although it still exists from radar-guided weapons, infrared-sited weapons, and passive night vision device equipped weapons systems. Flying into a bright moon with NVG on can be compared to flying into the sun during the day. The goggles darken and visibility becomes extremely poor. Flight routes should not be planned directly into bright moon if NVG are used.

(b) Flight at dusk or dawn presents severe visual problems. The threat cannot be detected until it is too close to avoid. Missions should be carefully planned or even delayed if the visibility is inadequate.

(c) The lack of visual cues over sand is similar to that over water. It is very easy for pilots to become disoriented and fly into the ground. Reliance on radar altimeters is a must over flat sandy areas of the desert.

(d) Frequently, desert areas do not have sufficient ambient light to allow adequate night vision, even with the aid of NVG. A pilot wearing NVG is often unable to see the ground at an altitude of 100 feet using a landing light equipped with a pink light filter. Under these conditions, dead reckoning is the only effective navigation method unless Doppler equipment or NAVAIDS are available. Unfiltered light can be used with or without NVG; however, this increases the risk of exposing the aircraft's position to the enemy.

(3) Desert warfare is usually characterized by extended battle zones which increase evacuation distance and time. Health service support units are located further to the rear in the desert. Establishing an ambulance shuttle system or patient collecting points is useful. Health service support units require a greater number of vehicles for operating in deserts than in other environments.

Air evacuation by fixed- and rotary-wing aircraft is the preferred method due to their speed and range. Further, using aircraft reduces the load on ground vehicles. Augmentation from higher echelon HSS may also be required to meet the extended evacuation needs.

(4) Smoke is used extensively on the modern battlefield by both sides. It can be effectively used to mask friendly actions to include medical evacuation. (Refer to Appendix B for further information.)

- Smoke can be a major hazard, especially to medical evacuation helicopters. Smoke reduces visibility and forces an aircraft higher where it can be acquired by threat weapons systems. The phenomenon of inversion occurs often in the desert. When this happens, medical evacuation vehicles and aircraft may be able to work underneath the smoke using the smoke layer for overhead concealment.

- Medical units must coordinate closely with supported organizations on smoke operations. Smoke can either help or hinder the evacuation mission, depending upon how it is used.

(5) Communications in the desert are affected by a number of factors. Atmospheric interference and the skip of signals occur frequently. Mineral deposits in the desert may unexpectedly disrupt communications. Many of these problems can be overcome by using additional radio relays, preestablished control measures, and visual signals.

(6) Artificial lights may be used at times in the desert. They are very easily detected. Even with blackout, vehicles using lights can be detected for miles with NVG. Serious consideration should be given to driving without using lights when the tactical situation dictates. Ground guides are used to help vehicles navigate through areas that are not clearly marked.

(7) Wind is one of the most significant environmental factors affecting medical evacuation in the desert. Wind can be destructive to both structures and equipment; tents, antennas, and aircraft can be easily damaged. Wind direction and speed vary greatly within the space of a few miles. Velocity is substantially increased when wind

channels between hills and direction changes due to interference of terrain features. The wind frequently makes aeromedical evacuation impossible by exceeding the operating limitations of the aircraft. At other times, it may limit the use of some potential LZs. Blowing sand and dust can slow down the evacuation system by making navigation by either ground or air ambulance difficult, if not impossible. High winds are predictable to a certain extent. For example, at certain times of the year in the Mojave Desert high winds occur every day at dusk and last for 3 to 4 hours. At other times high winds, based on frontal weather patterns, can remain for several days at a time. These factors should be taken into account by medical planners and medical evacuation assets should be massed or relocated accordingly.

(8) The desert provides little or no protection from enemy air defenses except in mountainous terrain. Aircraft may have to be flown above NOE altitudes to prevent dust signature. These factors cause increased exposure and vulnerability of air ambulances to enemy air defenses and may limit their employment.

*d. Further Information.* Refer to FM 90-3 for additional information on desert operations. For aviation-specific information, refer to FMs 1-202 and 1-400.

## 5-5. Extreme Cold Weather Operations

*a.* Operations in the extreme cold have many of the limiting factors found in desert operations. The tundra and glacial areas are harsh, arid, and barren. Temperatures may reach lows of -80°F to -100°F which, combined with gale force winds, make exposure unsurvivable.

*b.* The greatest environmental detriment to operations is blowing snow. This results in a loss of depth perception from total white conditions. Blowing snow is caused by the wind or can be caused by the rotorwash of helicopters which reduces visibility to zero.

*c.* Other environmental considerations are as extreme but easier to circumvent. Solid footing is suspect in both the dead of winter and in the summer. Snow and ice cover crevasses, holes, and otherwise unstable ground. In traversing suspect

ground situations, consider linking soldiers by rope. During the summer, ground transportation is more restricted than in any other environment due to the marsh and muskeg composition of the arctic tundra. Patients must be sustained for a longer duration due to terrain delays and the lack of direct lines of evacuation.

*d.* Greater responsibility has to be placed on each soldier, especially for maintenance of food and water consumption. It is imperative to stress that leadership and training are important in the prevention of cold weather injury. Strict adherence to the guidelines found in FMs 21-10 and 31-70 assures an effective fighting force. Water conservation is essential; however, adequate consumption by the individual should be enforced.

*e.* Factors to consider for conducting evacuation in arctic operations include the following:

- Arctic warfare is usually characterized by extended battle zones which increase evacuation distance and time. Establishing an ambulance shuttle system or patient collecting points is useful. Augmentation from higher echelon HSS may also be required to meet the extended evacuation needs.

- Additional supplies of water should be carried by ambulances and maintained at patient collecting points.

- Due to the decreased temperature and frozen environment, ambulance maintenance requirements are increased. Lubricants must be of the correct viscosity for the temperature. In extreme cold, batteries perform less efficiently. The use of a 28-volt nickel cadmium battery with two additional cells is recommended for aircraft. Batteries may need to be removed from the aircraft and kept in a warm area so that the aircraft can be promptly started. Engines may have to be left running to avoid freezeups or long warmup periods. *All ambulances are considered deadlined without a functional heater for the patient compartment.*

- The proper storage of medical supplies is essential to prevent loss from freezing.

- There are few terrain features or road networks; therefore, evacuation routes must be

surveyed and marked over open terrain. At extreme latitudes, operations during the winter months are conducted in extended hours of darkness. The use of NVGs may be required. Compass accuracy is inconsistent due to a geomagnetic phenomenon. Beacons and homing devices are essential for air navigation.

- Weather is extremely unpredictable. There are few observers to allow for accurate assessment of weather patterns. Unfavorable weather conditions cause unexpected delays; therefore, medical personnel must be prepared to provide survival measures for their patients and themselves.

- Landing zones must be chosen with extreme care in both winter and summer. Blowing snow mandates instrument-assisted takeoffs and running landings. Landing areas must be correspondingly larger. The full weight of the aircraft cannot be allowed to settle on the skis until after firm ground conditions are established. Movement of patients to and from the aircraft is difficult. Where an aircraft lands is where it stays. A rocking motion, to free the skis prior to lift off, is performed using the cyclic and antitorque controls.

f. Thorough planning and strict preparation are the keys to survival. Factors to consider include the following:

- Mud obstacles at noon may become an avenue of approach at midnight.

- Snow complicates all work. Snow-covered terrain hampers reinforcements, muffles noise, makes cross-country driving hazardous, and creates different camouflage requirements.

- Because of thermal sights, a complete reappraisal of concealment is required.

- Tracks in the snow destroy concealment.

- No soldier is assigned to any job alone. The buddy system is used at all times.

- Anticipate that all maintenance tasks will take twice as long.

- Bare metal can stick to skin or wet garments in subfreezing temperatures.

- Fuel spilled on skin or garments increases the freezing factor; it is one of the greatest causes of injury in winter operations.

- When operating in the cold, anticipate increased POL needs. Fuel consumption can rise as much as 25 percent for vehicles operating in deep snow, slush, or mud.

- The recommended fuel for Yukon stoves is motor gasoline (MOGAS).

- Make every effort to warm gear boxes and engines before starting.

- A higher paraffin content is contained in JP-5 fuel. At extremely cold temperatures, the aircraft fuel controls are likely not to work even with preheating.

- The first consideration in the AO is heat; followed by shelter for sustained work.

- Soldiers need to stand clear of taut cables; steel tends to be brittle and breaks in extremely cold temperature.

- Fire extinguishers are winterized by adding 15 percent nitrogen to the carbon dioxide.

- Degradation of battery life requires changes as much as six times more frequently than in a more temperate environment.

- Radio sets are warmed up prior to transmission. The sets may be turned on but should not transmit for at least one-half hour.

- Frost shields (such as using the plastic bag in which the batteries are packed) should be placed over microphones.

- Grounding rods have to be buried horizontally instead of pounded in vertically. Recovery of stakes and rods placed in the ground is significantly more difficult.

- Flooring is needed in heated areas because of the thawing of the tundra.

- Soldiers must take breaks for water and warmth.

- Static electricity presents a serious safety hazard especially around flammable materials.

*g.* For additional information, refer to FM 31-70. For aviation-specific information, refer to FMs 1-202 and 1-400.

## 5-6. Medical Evacuation in a Nuclear, Biological, or Chemical Environment

*a.* Evacuation of patients in an NBC environment forces the commander to consider to what extent he will commit evacuation assets to actually enter the contaminated area. Since the combinations of evacuation methods are nearly endless, the commander has greater flexibility in tailoring an evacuation system to meet his particular tactical situation and to deal with the NBC environment.

*b.* On the modern battlefield there are three basic modes of evacuating patients (personnel, ground vehicles, and aircraft).

(1) In using personnel to physically carry the casualties, the commander must realize the inherent stress involved. Cumbersome mission-oriented protection posture (MOPP) gear needed in a contaminated environment (added to climate, increased work loads, and the fatigue of battle) greatly reduces the effectiveness of unit personnel.

(2) If the commander must send evacuation personnel into a radiologically contaminated area, he must establish operational exposure guidance for the medical evacuation operation. Radiation exposure records are maintained by the battalion NBC NCO and are made available to the commander, staff, and surgeon. Based on operational exposure guidance, the commander decides which medical evacuation unit to send into the contaminated environment.

*c.* Commanders should make every effort to limit the number of evacuation assets which are contaminated.

(1) It is expected that a certain number of both ground and air ambulances will become contaminated in the course of battle. The commander can, therefore, segregate the contaminated

ones. This results in the smallest impact on his available assets and the greatest possibility for continuing the patient evacuation mission. *Optimize the use of resources, medical or nonmedical, which are already contaminated before employing uncontaminated resources.*

(2) Once a vehicle or aircraft has entered a contaminated area, it is highly unlikely that it will be able to be spared long enough to undergo a complete decontamination. This depends upon the contaminant, the tempo of the battle, and the resources available. Normally, contaminated vehicles (air and ground) have restricted use and are confined to dirty environments.

(3) Introducing uncontaminated aircraft into a contaminated area should be avoided. Ground ambulances should be used instead of air ambulances. Ground ambulances are more plentiful and can be more easily decontaminated or replaced. This does not, however, preclude using aircraft in a contaminated environment or in the evacuation of contaminated patients.

(4) The relative positions of the contaminated area, FLOT, and threat air defense systems determine if and where helicopters are to be used. The commander may choose to restrict one or more helicopters to the contaminated areas and use ground vehicles to cross the line separating contaminated and clean areas. The ground ambulance can proceed to a personnel decontamination station. The patient can then be transferred to a clean ground or air ambulance if further evacuation is required. The routes used by ground vehicles to cross between contaminated and clean areas are considered dirty routes and should not be crossed by clean vehicles. The effects of wind and time upon the contaminants must be considered.

(5) The rotorwash of the helicopters must always be kept in mind when evacuating contaminated casualties. The intense winds disturb the contaminants in the area and further aggravate the condition by additionally spreading the contaminants. Ideally, the aircraft must be allowed to land and reduce to flat pitch prior to bringing any patients near. This will be dictated by the tactical situation, but allows some reduction in the effects of the downwash. Further, a helicopter must not land too close to a decontamination station (especially

upwind) because any trace of contaminants in the rotorwash will compromise the decontamination procedure.

*d.* Hasty decontamination of aircraft and ground vehicles should be accomplished to minimize crew exposure. Units should develop their own procedures for deliberate decontamination and document them in their SOPs. A sample aircraft decontamination station that may be tailored to a particular unit's needs (ground and air assets) is provided in FM 1-102 and FM 3-5.

*e.* Evacuation of patients must continue even in a contaminated environment. The commander must recognize the constraints placed upon him by resources and plan and train to overcome deficiencies.

## 5-7. Naval Operations

*a.* It is imperative that Army aeromedical evacuation units be able to interface on the first day of battle with US Navy air-capable ships. Lessons learned from past operations, such as Vietnam and Grenada, have shown that US Army helicopters should be able to operate to and from US Navy air-capable ships. An interservice agreement between the Army and the Navy allows for deck-landing qualification of Army pilots.

(1) It is important that units having contingency missions requiring Navy support establish training requirements to obtain naval operations orientation, water egress training, water survival, and deck-landing qualification. This enhances the successful accomplishment of the aeromedical evacuation mission to naval vessels.

(2) In past joint operations, communications have been burdensome for both Army and Navy elements. Commonality of communication requirements should be established during training exercises. Communication equipment and frequencies for medical evacuation to Navy vessels must be established. This will provide smooth integration of Army helicopters into the Navy airspace management system during actual operations.

(3) As the Navy vessels may operate relatively long distances from the ground combat

operations, Army aeromedical evacuation units need to be proficient in over-water navigation. The use of NAVAIDS from the Navy element in support of the operation is the first priority for over-water navigation. Basic dead-reckoning remains a secondary measure.

(4) Detailed information on amphibious operations can be found in FM 31-11.

*b.* Another important aspect of joint operations is the medical capabilities of Navy vessels servicing the CZ. Knowledge of ship's medical capabilities assists the medical regulator to direct patients to proper treatment sites. There are many classes of ships which can meet the medical needs of ground forces. Destroyer tenders, battleships (BB), and aircraft carriers (CV or CVN) have helicopter landing areas, one operating room and, at a minimum, one medical officer. Amphibious ships have the most extensive medical facilities of any Navy combat ship. The Navy has fifty-nine amphibious ships in active commission plus two tank landing ships (LST), which are operated by the Navy Reserve Force. The primary mission of the amphibious ships is to transport and support the Fleet Marine Force. The ships have the additional duty of casualty receiving and treatment ships (CRTS). During normal operations, the medical staff is kept to a minimum. The medical staff is augmented when expanded capabilities are needed. Current information regarding landing requirements and medical capabilities should be obtained during training periods with the Navy. Casualty care is secondary to the combat mission of all US combat ships.

(1) Amphibious assault ships "WASP" class are designated by the Navy as LHD (followed by a number) and have the largest patient care facilities on any US combat ship. The WASP class ships have six main operating rooms, four dental operating rooms, bed capacity which can be expanded to 600, and it carries 1,500 pints of frozen blood. This ship can receive casualties from helicopters or landing craft.

(2) Amphibious assault ships "TARAWA" class are designated by the Navy as LHA (followed by a number). The TARAWA class ships have three main operating rooms, two dental operating rooms, an overflow bed capacity of 300, and carries 1,500 pints of frozen blood. The ship can receive casualties from helicopters or landing craft.

(3) Amphibious assault ships “IWO JIMA” class pre-designated by the Navy as LPH (followed by a number). These ships were specifically designed to operate helicopters. The IWO JIMA class ships have two operating rooms and an overflow bed capacity of 200.

(4) The amphibious transport dock is designated LPD (followed by a number) and has less medical capabilities than the LHD, LHA, or LPH ships. It can be designated as secondary casualty receiving ship.

(5) The older dock landing ship is designated LSD (followed by a number). It can be used as a secondary casualty receiving and treatment ship when augmented. The newer class of LSD currently under construction can be used as a casualty receiving ship with a capacity for 50 wounded.

(6) The tank landing ship is designated LST (followed by a number). It is another type of ship used in amphibious operations. It is designed with a helicopter platform and a stern ramp. Patients can be delivered by air or boat when required by tactical or mass casualty situations. When the LST is augmented with medical personnel and materiel, it can be used for the emergency treatment and evacuation of patients.

(7) The troop transport, designated AP (followed by a number), is not in active service. When available, the troop transport can be outfitted with special medical facilities and carry sick, injured, and wounded personnel.

c. The Military Sealift Command operates two hospital ships. The USNS MERCY T-AH 19 and the USNS COMFORT T-AH 20. One ship is based on each coast and, when needed, will be assigned medical staffs from military hospitals, getting underway within 5 days. The MTF on the MERCY class hospital ships were designed for a total capacity of 1,000 casualties, including 500 acute care beds and 500 recuperation beds. The hospital ships have 50 trauma stations in the casualty receiving area; 12 operating rooms; a 20-bed recovery room; 80 intensive care beds; and 16 intermediate, light, limited care wards. The maximum patient flow rate, for which the helicopter facility and the casualty reception area were

designed, is 300 patients per 24 hours. There is a limited capability to receive casualties from boats.

## 5-8. Airborne and Air Assault Operations

a. The airborne and air assault operational forces are specialized forces employed to maximize their design characteristics. Airborne units are a flexible force that can be strategically or tactically deployed. They can be inserted rapidly anywhere in the world as either a deterrent or strike force. Air assault units are flexible and lethal fighting organizations. They are ideally suited for rapid employment to critical areas beyond the reach of ground forces.

b. After airborne forces have landed in the objective area, they reorganize and maneuver to seize objectives. When it is necessary for assault aircraft to land in the drop zone, they are parked and unloaded rapidly. Then, they may be used to transport soldiers injured during the parachute assault. It must be understood that organic medical units may experience an overload of patients during the early phases of an airborne assault. These units have to hold the patients until either ground link-up is made or evacuation can be established at airheads. Aeromedical evacuation from the airhead is accomplished using tactical and strategic USAF aircraft.

c. The air assault division’s organic aircraft have the ability to attack from any direction, overfly obstacles, and bypass enemy positions. Evacuation of patients in the assault phase is accomplished by division air ambulances. Air ambulances may accompany the air assault task force (AATF) (Figure 5-1) or respond from larger sites once the initial assault has taken place. If air ambulances are providing on-call support, it will be necessary to fly secure air avenues of approach.

d. When both airborne and air assault divisions have been employed and become a part of other conventional forces, their operations are similar to that of light infantry forces. During initial deployment, division medical evacuation assets may be used to evacuate patients to the airhead for air evacuation directly to corps hospitals.

A good technique used in the employment of MEDEVAC helicopters is to have them trail the AATF while it is en route. This ensures that the helicopters are immediately available to take on wounded, and ensures pilot familiarity with the route to the objective area. If evacuation is required later, faster response is possible.

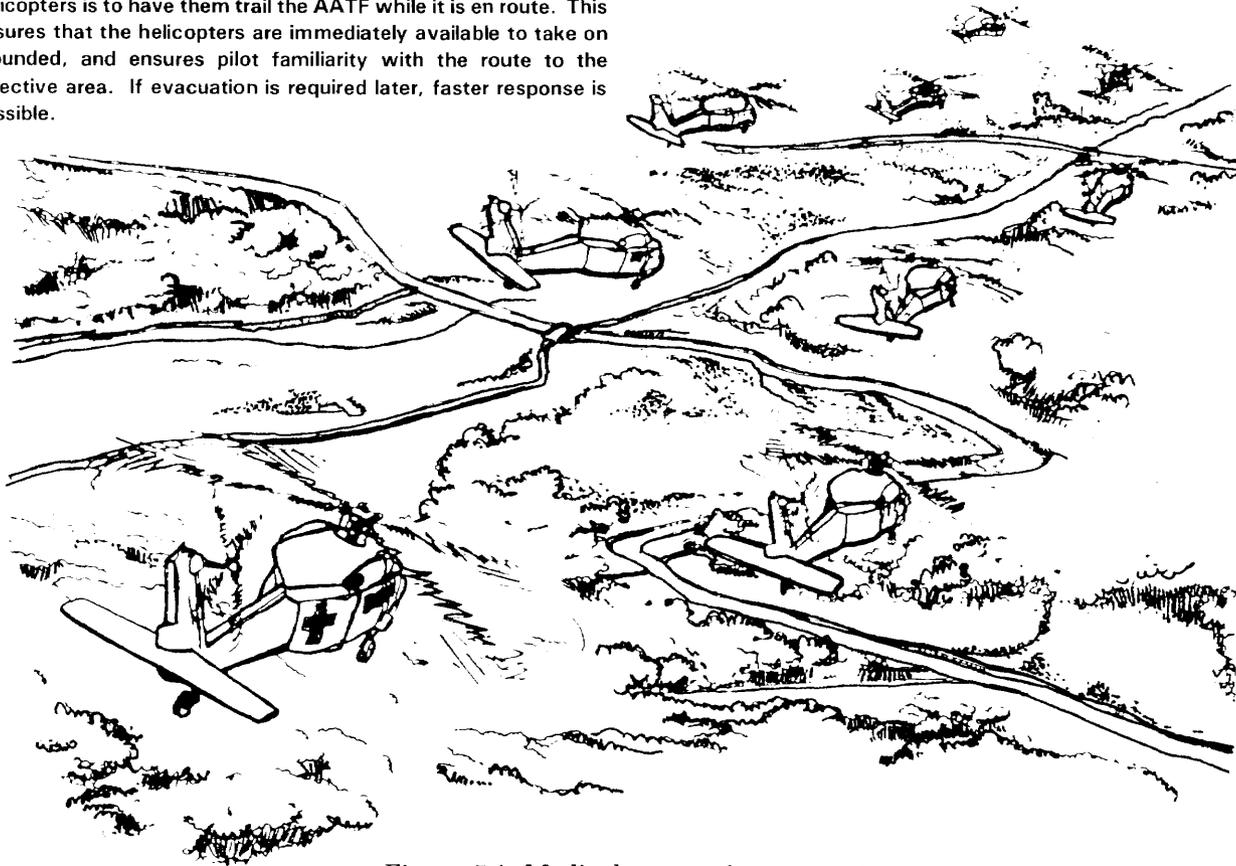


Figure 5-1. Medical evacuation support.

(1) Organic to the medical battalion, air assault division is a medical company (air ambulance). The headquarters element of the air ambulance company is usually positioned in the DSA, collocated with the medical battalion, headquarters and support company. Ambulance crews are deployed forward in direct support of maneuver brigades or AATFs. When deployed in this mode, they are collocated with the supporting FSMC in the BSA, or as an element of the AATF. In either case, it is important to employ the minimal number of aircraft to accomplish the mission. The remaining aircraft are field sited in the DSA for support of other areas in the division requiring immediate evacuation support.

(2) Aeromedical evacuation to the airborne division is provided by a medical company (air ambulance) assigned to the corps medical evacuation battalion. Employment characteristics of this unit are similar to that of the medical company (air ambulance) organic to the air assault division.

e. For a discussion of using patient collecting points in airborne or air assault operations, refer to Appendix C.

### 5-9. Special Operations Forces

a. Army Special Operations Forces (ARSOF) often operate far removed from conventional HSS and must be more self-reliant and sustaining than conventional forces. Accordingly, Special Forces (SF) medical personnel receive enhanced medical training above that provided for a combat medic. The SOF medic is trained as an independent care practitioner and is qualified to provide ATM to combat casualties. When deployed on independent operations, the two SF medics are the sole source of medical care for their operational detachment and the indigenous forces (and their families) that the detachment supports. They can train the indigenous populace in basic medical skills and set up an austere HSS system. Nonmedical

ARSOF personnel receive medical training at the combat lifesaver level.

*b.* Although the ARSOF health care provider receives enhanced medical training exceeding the level and scope found in conventional forces, he depends heavily on the conventional HSS system to conserve the combat strength of the ARSOF (particularly in the area of medical evacuation where the ARSOF does not have a dedicated system). Ideally, medical evacuation of ARSOF personnel should follow the doctrinal flow sequence. The ARSOF HSS planner must be innovative and follow the tenets of immediate far forward stabilization. He directs evacuation to the appropriate MTF when the condition of the patient warrants it, with whatever means of transportation are available. Medical evacuation of ARSOF casualties is an operational matter. That is, it must reflect the commander's concept of the operation. It can only succeed when the HSS planner integrates the medical evacuation plan with the tactical plan and logistics air flow.

#### 5-10. Military Operations on Urbanized Terrain

*a.* Throughout history, battles have been fought on urbanized terrain. Some recent examples include Hue, Beirut, and Panama City. Military operations on urbanized terrain (MOUT) are those military actions planned and conducted on a terrain where man-made structures impact on the tactical options available to the commander. This terrain is characterized by a three-dimensional battlefield, having considerable rubble, ready-made fortified fighting positions, and an isolating effect on all combat, CS, and CSS units. In this environment, the requirement for a sound and understandable evacuation plan cannot be overstated. Of concern to HSS and tactical planners is the need to plan, train, prepare, and equip for evacuation from under, above, and at ground level.

*b.* Conducting medical evacuation operations in the MOUT environment challenges the HSS planner. He must ensure that the HSS plan includes special or unique materiel requirements or improvised use of standard equipment. The plan must be sufficiently flexible to support unanticipated situations.

(1) Special equipment requirements include, but are not be limited to—

- Axes, crowbars, and other tools used to break through barriers.

- Special harnesses; portable block and tackle equipment; grappling hooks; collapsible litters; lightweight, collapsible ladders; heavy gloves; and casualty blankets with shielding. This equipment, using pulleys, is for lowering casualties from buildings or moving them from one building to another at some distance above the ground.

- Equipment for the safe and quick retrieval from craters, basements, sewers, and subways. Casualties may have to be extracted from beneath rubble and debris.

(2) Air ambulances equipped with a rescue hoist may be able to evacuate casualties from the roofs of buildings or may be able to insert needed medical personnel and supplies.

(3) Effective communications will be degraded in the MOUT environment. Line of sight radios will be ineffective and individual soldiers will not have access to radio equipment. The task-organized medical evacuation teams will have difficulty in locating injured or wounded soldiers due to their isolation within buildings, or by being hidden by rubble and debris. Alternate forms of communications, such as markers, panels, or field expedients (fatigue jackets or T-shirts) can be displayed by the wounded or injured soldiers indicating where they may be found.

*c.* Patient collecting points must be preplanned and established at relatively secure areas accessible to both ground and air ambulances. The location of these points should be indicated on the medical overlay to the OPLAN. Patient collecting points should—

- Offer cover from enemy fires.
- Be located as far forward as the tactical situation permits.
- Be identified by an unmistakable feature (natural or man-made).
- Allow rapid turn around of ambulances.

d. Route markings to the MTF and display of the Geneva Red Cross at the facility must be approved by the tactical commander. (Camouflaging or not displaying the Geneva Red Cross can forfeit the protections, for both medical personnel and their patients, afforded under the Geneva Conventions. Refer to Appendix A and FM 8-10 for additional information.) The location of the MTF must be as accessible as possible, but well separated from fuel and ammunition depots, motor pools, reserve forces, or other lucrative enemy targets, as well as civilian hazards such as gas stations or chemical factories.

e. Medical evacuation in the MOU environment is a labor-intensive effort. Due to rubble, debris, barricades, and destroyed roadways, much of the evacuation effort must be accomplished by manual litter teams. When this occurs, an ambulance shuttle system or litter shuttle should be established. The shuttle system reduces the distance that the wounded or injured soldiers have to be carried by the litter teams. This enhances the litter teams effectiveness by providing brief respites and reducing fatigue. Further, the litter teams are retained in the forward areas. They are familiar with the geography of the AO and what areas have or have not been searched for casualties. In moving patients by litter, you should—

- Use covered evacuation routes such as sewers and subways.
- Use easily identifiable points for navigation and collecting points.
- Rest frequently by alternating litter teams.

(1) When using ground evacuation assets in support of MOU, the HSS planner must be aware that built-up areas will have significant obstacles to vehicular movement. Factors requiring consideration include the following:

- Transportation operations within the urban terrain are complicated and highly canalized by rubble and other battle damage.
- Bypassed pockets of resistance and ambushes pose a constant threat along evacuation routes.

- Land navigation with most tactical maps proves to be difficult. Using commercial city maps when available can aid in establishing evacuation routes.

- Ambulance teams must dismount from the ambulance, search for, and rescue casualties.

- Movement of patients becomes a personnel intensive effort. There are insufficient medical personnel to search for, collect, and treat the wounded. Assistance in the form of litter bearers and search teams is required from supported units, as the tactical situation permits.

- Refugees may hamper movement into and around urban areas.

- Civilian personnel, detainees, and enemy prisoners of war are provided medical treatment in accordance with the command policy and the Geneva Conventions.

(2) When using aeromedical evacuation assets in support of MOU, the HSS planner must consider enemy air defense capabilities and terrain features, both natural and man-made, within and adjacent to the built-up areas. Aeromedical evacuation (helicopters) is the preferred means of evacuation in MOU. Considerations in the use of air ambulances include the following:

- Movement is highly restricted and is canalized over secured areas, down wide roads, and open areas.

- Telephone and electrical wire and communications antennas hinder aircraft movement.

- Secure LZs must be available.

- Landing zones may include buildings with helipads on their roofs or sturdy buildings, such as parking garages.

- Snipers with air defense capabilities may occupy upper stories of the urban area's taller buildings.

f. Medical personnel require special training in the tactics, techniques, and procedures required

to operate in a MOUT environment. If they are to survive in this environment, they must know how to—

- Cross open areas safely.
- Avoid barricades and mines.
- Enter and depart safely from buildings.
- Recognize situations where booby traps or ambushes are likely and would be advantageous to the enemy.

Detailed information on the conduct of combat operations in the urban environment is contained in FMs 90-10 and 90-10-1.

#### NOTE

Medical personnel do not engage in offensive-type actions. They must rely on the supported unit to provide covering fires and to clear rooms and buildings prior to entry.

(1) Many of the techniques used in a mountainous terrain for the extraction and evacuation of patients can be modified and applied to medical evacuation in an urbanized terrain (paragraphs 9-11 through 9-15).

(2) Health service support personnel must practice and become proficient in using a grappling hook, scaling walls, and rappelling. Rappelling techniques can be used to gain entry into upper levels of buildings as well as accompanying the patient during vertical extraction and evacuation. By using the SKED litter, the patient can be secured inside the litter for ease in vertical extractions and evacuations.

(a) When using a grappling hook, care must be taken to select a suitable grappling hook and rope. The grappling hook should be sturdy, portable, and easily thrown, and be equipped with hooks that can hold inside a window. The scaling rope should be 5/8 to 1 inch in diameter

and long enough to reach the objective window. Knots are tied in the rope at 1-foot intervals to make climbing easier.

- When throwing the grappling hook, stand as close to the building as possible (Figure 5-2). The closer you stand, the less the exposure to enemy fires. The closer the range, the less horizontal distance the hook must be thrown.

- Allow the rope to play (pay) out freely. Make sure you have enough rope to reach the target. Hold the hook and a few coils of rope in your throwing hand. The remainder of the rope, in loose coils, should be in your other hand. The throw should be a gentle, even, upward lob of the hook, with the other hand releasing the rope as it plays (pays) out.

- Ensure that the grappling hook has a solid hold before beginning to climb. Once the grappling hook is inside the window (or on the roof), pull on the rope to obtain a good hold. When using a window, pull the hook into one corner to ensure the chances of a good “bite” and to reduce exposure to lower windows during the climb.

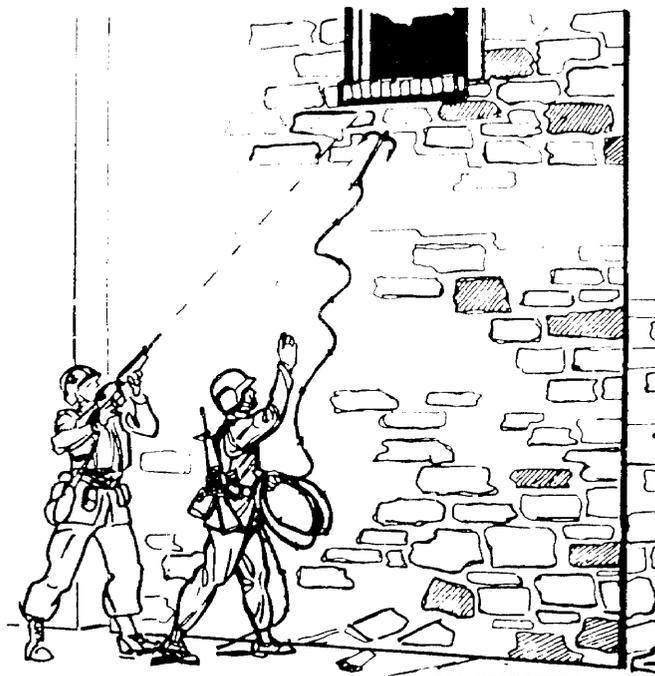
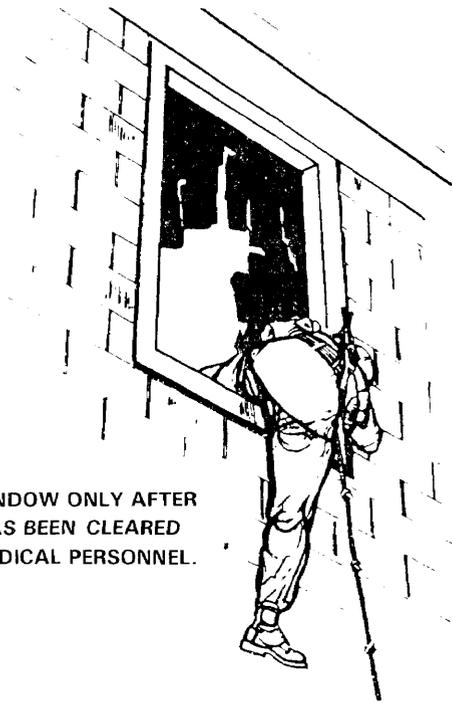


Figure 5-2. Hook thrown at close range.

(b) When forced to scale a wall during exposure to enemy fire, all available concealment must be used. The employment of smoke and diversionary measures improve the chances of a successful exposed movement. When using smoke for concealment, soldiers must plan for wind direction and the tactical use of smoke (Appendix B).

- A soldier scaling a wall with a rope should avoid silhouetting himself in windows of uncleared rooms and avoid exposing himself to enemy fires from lower windows. Combat medics will require support from the combat elements to provide covering fires and precede the medic to clear rooms which must be bypassed to reach the casualty.

- The soldier enters the objective window with a low silhouette (Figure 5-3). Entry can be head first; however, the preferred method is to hook a leg over the windowsill and enter sideways, straddling the ledge.



ENTER WINDOW ONLY AFTER ROOM HAS BEEN CLEARED BY NONMEDICAL PERSONNEL.

Figure 5-3. Medic entering the objective window.

(c) Rappelling is a combat technique soldiers can use to descend from the rooftop of a tall building into a window. Soldiers conducting operations on urbanized terrain should learn the basic seat-hip rappel. When using this technique to lower a litter, one or two soldiers rappel down along the sides of the litter patient. By escorting the litter, the soldiers can ensure that the patient is not further injured by slamming into the wall as he is lowered. When the patient is safely on the ground, the individual who lowered the patient rappels down.

g. The scenario presented in this subparagraph is provided to illustrate a way in which evacuation operations can be conducted in MOUT.

(1) The following information is provided as a basis for this scenario:

(a) In preparation for the upcoming battle, the tactical planners determine that the battlefield will include combat within the confines of a city with a population of approximately 750,000. The medical planners are involved early-on in the planning process. The medical evacuation mission is complicated by the terrain features and will require special equipment to satisfactorily accomplish the mission.

(b) The enemy has already entered the city and is preparing defensive positions.

(c) Preparatory fires and bombing runs made on key industrial targets within the city have disrupted sanitation efforts by destroying sewer lines, breaking water mains, and canceling garbage pick up and disposal.

(d) The downtown area of the city has numerous multistoried buildings. Further, a number of parking garages are within the downtown area. Residential housing consists of apartment complexes and low-cost housing projects. There are a few small parks; however, the downtown area is considered quite crowded.

(e) Residential and small business suburbs spread out from the downtown area.

- North of the city is an industrial park and most of the city's heavy

industry is located in this area. The major heavy industries are fertilizer, ammunition, and plastic manufacturing.

- East of the downtown area is comprised of some larger residential estates, track housing, parks, golf courses, small businesses, and some multifamily dwellings. A river flows along the eastern border of the city which has commercial interests in transportation of commodities and fishing.

- West of the downtown area is the largest residential population with middle income housing, duplexes, and large apartment complexes. Small businesses which support the population density are also found here. Numerous schools, parks, and churches are contained in this sector. There is also some light industry, such as clothing manufacturers, located here. The western limits of the city are bordered by high mountains. This eliminates access to the northern section of the city from this direction.

- South of the downtown area is mainly residential with a gradual shift from single family homes and apartment complexes to small farms, landfills, and junkyards.

(f) The friendly forces are approaching the city from the southwest. Intelligence reports indicate that enemy concentrations are within the downtown area and to the north. Due to the natural terrain features of the city, friendly forces will be required to fight through residential and the downtown areas to reach the mission objective of neutralizing the ammunition plants in the northern sector.

(2) Prior to actual deployment of combat forces, the evacuation elements—

- Train nonmedical personnel on litter carrying techniques.

- Obtain necessary nonmedical equipment for extraction and evacuation.

- Provide instructions on alternate forms of communications for indicating where wounded soldiers are located.

- Predesignate patient collecting points and AXPs and include these positions on the medical overlay.

- Prepare strip maps of evacuation routes, if applicable.

(3) The medical evacuation mission is undertaken by—

- Establishing the initial BAS in an elementary school playground and gymnasium. The playground area provides sufficient space to establish an LZ for aeromedical evacuation assets and turnaround for ground ambulances. Site selection for the BAS is important as it must be easily accessible by both ground and air and not close to lucrative enemy targets or civilian hazards, such as gas stations.

- Echeloning the medical treatment element. This enables the HSS to maintain contact with and be accessible to the combat forces. A portion of the evacuation resources are deployed with the medical treatment element to assist in quickly clearing the battlefield of wounded.

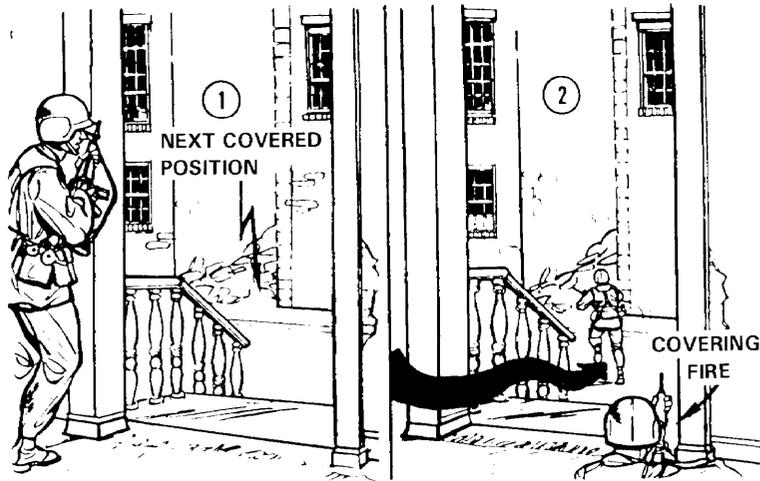
(4) Fighting is light through the residential area; however, caution must be used as the combat elements bypass pockets of resistance and pose a threat to medical treatment elements and evacuation assets.

(5) Entering the downtown area, the fighting intensifies. As the downtown area has not been secured, the threat to air ambulances is too great during the initial phase of the battle. When the roads become impassable due to rubble, debris, barricades, or artillery damage, the ambulance crews dismount from their vehicles, search for, and administer EMT to the wounded. During the heat of the battle, combat soldiers will be unable to serve as litter bearers. Ambulance crews, therefore, are responsible for evacuating litter patients, directing ambulatory patients to patient collecting points, and administering EMT if the casualty has not already been treated by the combat medic.

(6) A shuttle system is established to enable litter teams to carry the wounded to the fringes of the downtown area. Ground ambulances can evacuate the wounded to the BAS site where air ambulances can evacuate those patients requiring

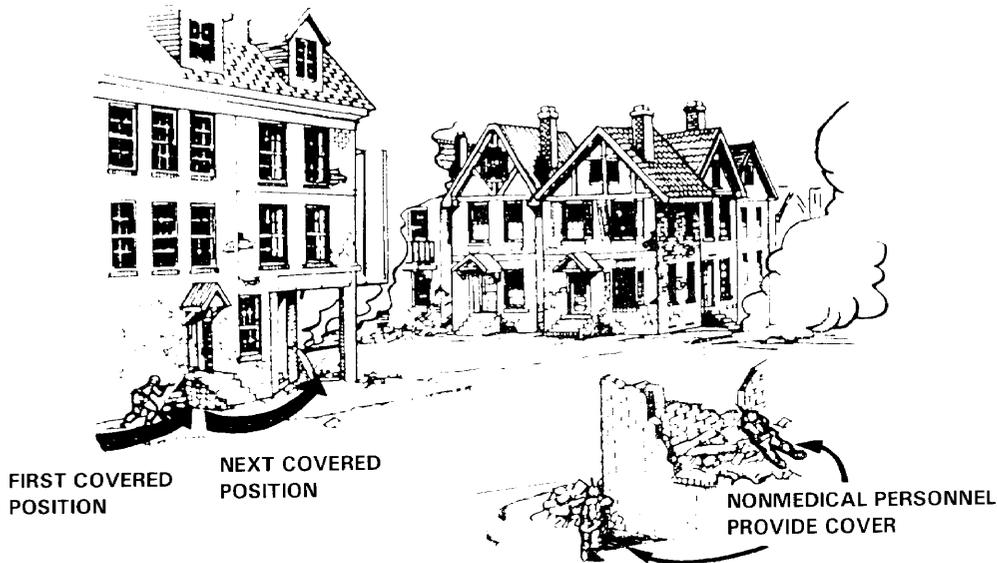
further evacuation to the rear. As the tactical mission evolves and control of the various sectors is gained by friendly forces, aeromedical evacuation resources can be deployed farther forward. However, caution must be exercised because bypassed and isolated pockets of resistance still remain a threat to evacuation assets.

- Combat medics maintain contact with the combat elements and employ techniques necessary to operate in this environment, such as using doorways, moving parallel to buildings, selecting his next position, and crossing open areas (Figures 5-4 through 5-6).



Doorways should not routinely be used as entrances and exits since they are normally covered by enemy fire. If a medic must use a doorway as an exit, he should move quickly through it to his next position, staying as low as possible to avoid silhouetting himself. Before exiting the building, the soldier selects his next covered position. He quickly exits the doorway, keeping as low as possible, and moves quickly to his next position. Preselection of positions, speed, a low silhouette, and use of covering fires by nonmedical personnel must be emphasized in exiting doorways. If possible, litters should be vertically lowered from windows, rather than attempting to exit through a doorway. However, if it becomes necessary to exit through a doorway, the supported unit should provide covering fire for the litter team.

Figure 5-4. Use of doorways.



Medics may not always be able to use the inside of buildings for an evacuation route. Therefore, they may have to move on the outside of the buildings. Smoke and covering fires provided by the supported unit should be used to hide movement. In correctly moving on the outside of a building, the medic hugs the side of the building, stays in the shade, presents a low silhouette, and moves rapidly to his next position.

Figure 5-5. Moving outside of building.



Doorways should not routinely be used as entrances and exits since they are normally covered by enemy fire. If a medic must use a doorway as an exit, he should move quickly through it to his next position, staying as low as possible to avoid silhouetting himself. Before exiting the building, the soldier selects his next covered position. He quickly exits the doorway, keeping as low as possible, and moves quickly to his next position. Preselection of positions, speed, a low silhouette, and use of covering fires by nonmedical personnel must be emphasized in exiting doorways. If possible, litters should be vertically lowered from windows, rather than attempting to exit through a doorway. However, if it becomes necessary to exit through a doorway, the supported unit should provide covering fire for the litter team.

Figure 5-6. Crossing of open area.

- Combat medics and ambulance crews will encounter obstruction, barricades, and booby traps which will detract from the accom-

plishment of the evacuation mission. Medics must be familiar with these antipersonnel devices (Figure 5-7) and know how to circumvent or neutralize them.

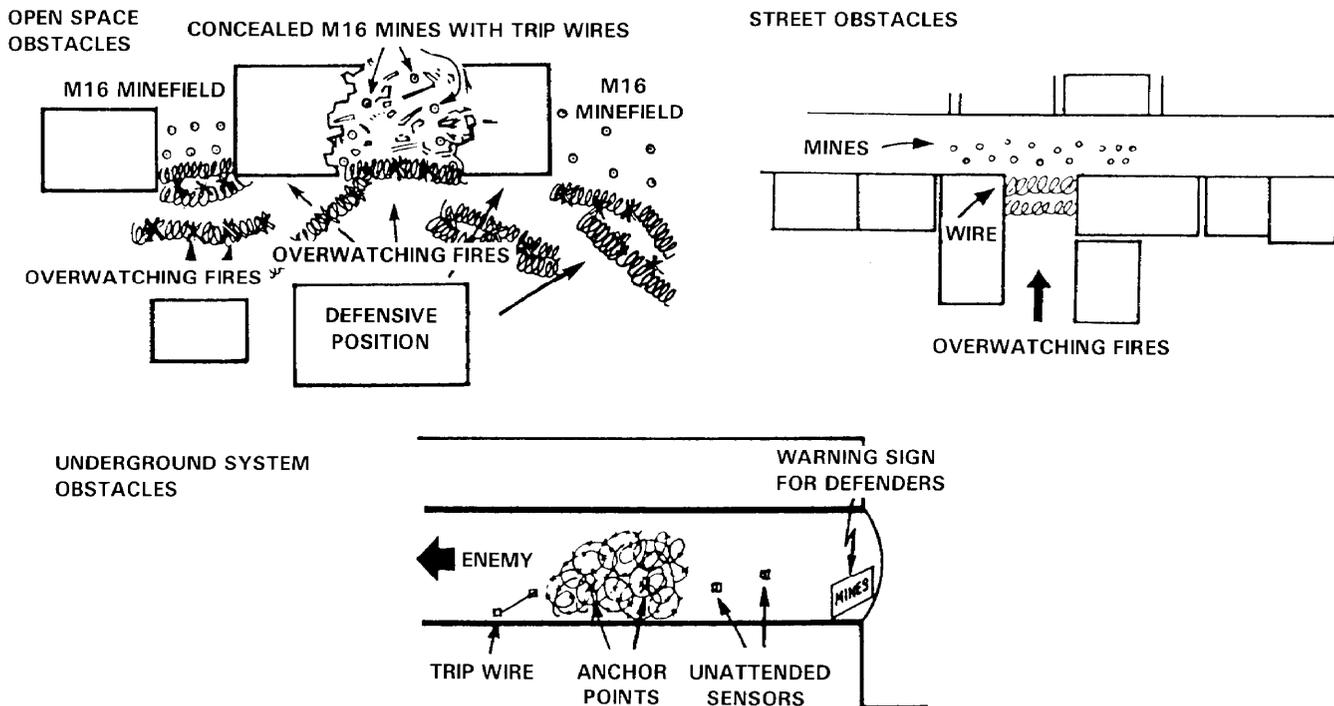
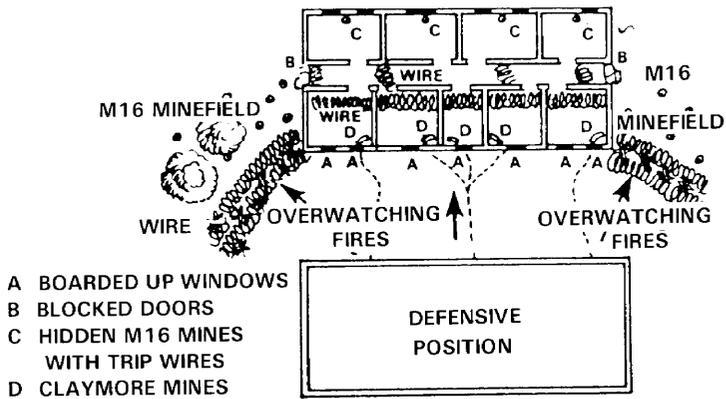


Figure 5-7. Antipersonnel obstacles.

BUILDING OBSTACLES



- A BOARDED UP WINDOWS
- B BLOCKED DOORS
- C HIDDEN M16 MINES WITH TRIP WIRES
- D CLAYMORE MINES

ROOF OBSTACLES

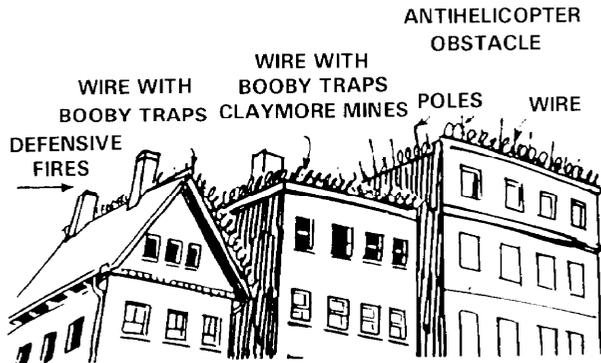


Figure 5-7. Antipersonnel obstacles (continued).

• Combat medics and ambulance crews will also need to be familiar with lower-level

entry techniques (Figure 5-8) to gain access to areas where casualties have occurred.



1

TWO SOLDIERS BEND OVER FACING ONE ANOTHER WITH THEIR HANDS CUPPED TOGETHER.



2

A THIRD SOLDIER RAISES HIS FEET INTO THE CUPPED HANDS OF THE TWO OTHERS.



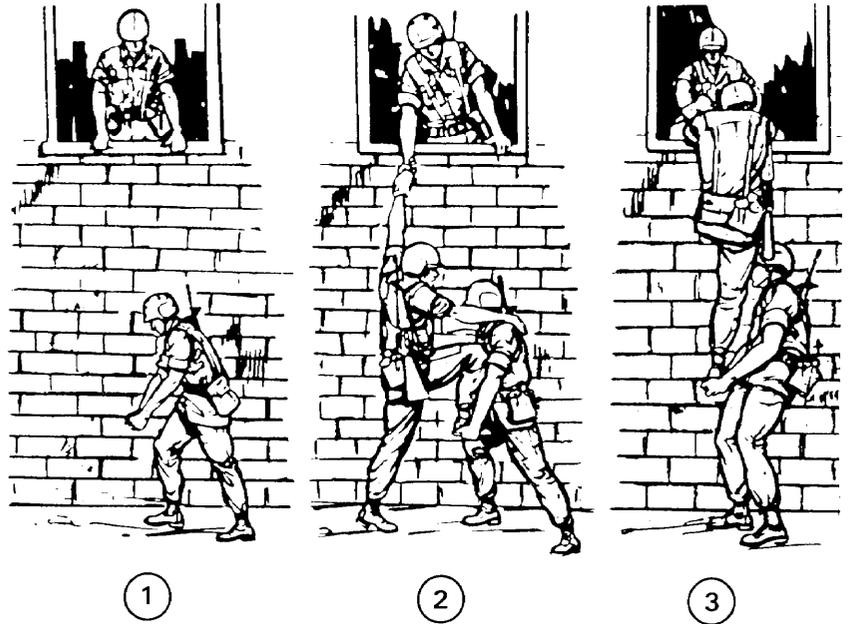
3

ONCE BOTH FEET ARE IN THE CUPPED HANDS, THE TWO SOLDIERS PUSH UP ON THE THIRD SOLDIER'S FEET, LIFTING HIM UPWARD AND INTO THE ENTRANCE.

Figure 5-8. Lower-level entry techniques.

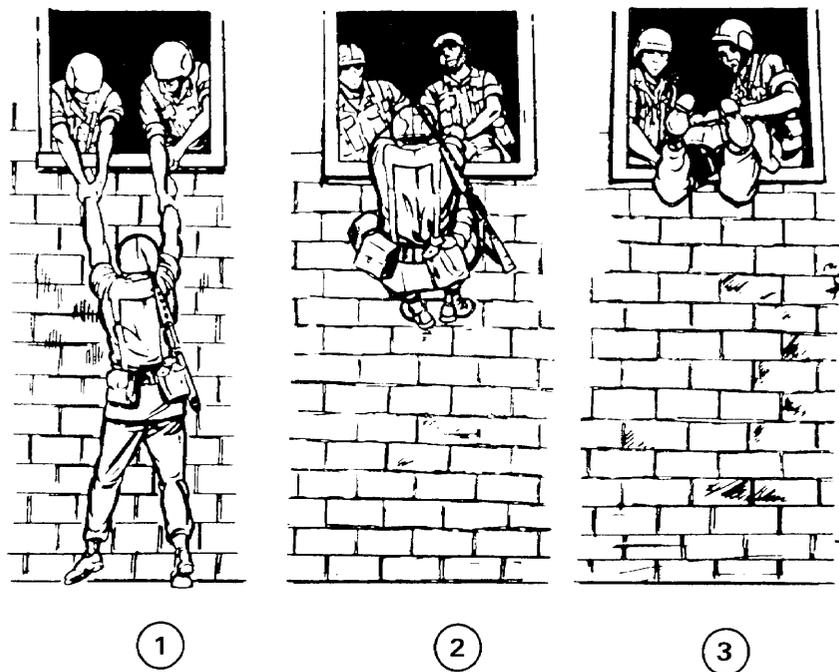
**THE ONE-MAN LIFT**

ONE SOLDIER, WITH HIS BACK OR SIDE BRACED AGAINST THE BUILDING AND WITH HIS HANDS CUPPED, ALLOWS ANOTHER SOLDIER TO RAISE ONE FOOT UP INTO HIS CUPPED HANDS, AND THEN LIFTS HIM UP AND INTO THE ENTRANCE.



**THE TWO-MAN LIFT**

WHEN THE FIRST TWO SOLDIERS ARE INSIDE THE BUILDING AND ANOTHER SOLDIER SEEKS ENTRANCE, THE TWO ALREADY INSIDE MAY ASSIST THE OTHER BY PULLING HIM UP INTO THE BUILDING.



*Figure 5-8. Lower-level entry techniques (continued).*

- Once the main battle pushes through the downtown area and friendly forces gain control of this terrain, air ambulances can be employed to hasten the evacuation effort. Air ambulances can be used to rescue wounded personnel from on top of buildings or downtown parking garages.

- As control over the terrain is gained, the BAS can be echeloned further forward, thereby reducing the distance required for evacuation. If possible, the medical treatment element should be housed in a structure, as parks within the city area may not be secure from sniper fire.

- On those roads which remain passable, a control problem may be encountered as refugees will be using these roads to escape the battle. Evacuation vehicles and crews should be prepared for these delays and have sufficient supplies to care for the patient being evacuated.

- As troops are relieved of their combat, CS, and CSS duties, they can be used as litter bearers. The distance that the patients are required to be moved by litter teams will determine the number of relay points established in the litter shuttle. The relay points should be spaced so that the litter bearers are not overly fatigued nor taken too far away from the terrain in which they are familiar.

- Medical evacuation teams will need to systematically search the battle area for casualties. Those casualties who can provide a signal for their location (paragraph *b* (3) above) will hasten their rescue and evacuation. The special equipment needs for the extraction and evacuation of casualties become evident during this phase of the evacuation effort. Some casualties will need to be evacuated from upper floors of buildings where access from ground level is not possible. Entry to some locations will be from the roof going down to lower floors, or from neighboring buildings across the intervening space. Techniques and procedures for these extractions must be practiced before the actual operation.

- The initiation of intravenous (IV) fluids by combat lifesavers, combat medics, and evacuation crews will enhance the casualties

chances of survival with the delayed evacuation process existing on urbanized terrain.

- As the main battle enters the industrialized sector of the city, the number of multifloored buildings decreases. However, many of the same obstacles face the medical personnel responsible for evacuation. Added to the types of injuries incurred during MOUT, the increased chance of fire, explosion, and toxic fumes or vapors are present in the industrial sector. Medical resources and evacuation assets must be positioned to decrease the vulnerability to these types of hazards.

- Medical personnel must be familiar with their responsibilities in regards to the Geneva Conventions and civilian refugees, detained persons, and EPWs (Appendix A). Procedures should be established in the unit SOP.

### 5-11. Cross-FLOT Operations

Medical evacuation support of cross-FLOT operations is a difficult mission requiring detailed planning. Although there are a number of different types of cross-FLOT operations, only two will be discussed in this paragraph. Medical evacuation support for these operations is normally provided by a corps air ambulance company (GS) working in concert with the corps aviation brigade. A medical evacuation team will be task-organized to provide this support.

*a. Deep Attack/Raid.* This operation is normally the responsibility of an attack helicopter battalion in the corps aviation brigade. While it is feasible that air ambulances could accompany the attack helicopters to the objective, it is more likely that the evacuation team will be field sited in a larger site. The larger site (hide position) is located in the vicinity of the FLOT. By forward stationing the air ambulances, the risk and possible compromise of the operation is lessened. The medical evacuation team provides downed aircrew rescue, EMT, and evacuation support. The air ambulances should be equipped with the rescue hoist, extraction equipment, personnel locator system (PLS), and enhanced position location and reporting system (EPLRS). The air ambulances remain in the hide position, with only passive systems turned on,

tracking the process of the raid via limited secure communications. The attack team should report, in the blind, only at prearranged communications check points, or upon the downing of an aircraft. If the wingman is able to retrieve the downed crew, they are taken to a preplanned patient collecting point for transfer to an air ambulance. If there are injured crew members or the terrain precludes landing, the wingman requests medical evacuation support. The wingman should provide cover and armed escort for the air ambulances during the rescue and back across the FLOT. The patients are evacuated to the nearest Level II treatment facility in the brigade sector.

**b. Brigade Task Force Cross-FLOT Operations.** This type of operation employs airborne or air assault insertions into the objective, followed by a penetration and linkup. Medical evacuation teams are normally attached directly to the task force to provide medical treatment and evacuation support, both en route and at the objective. Air ambulances accompany the assault aircraft, carrying the treatment teams and medical supplies and equipment; this enables the assault aircraft to carry more combat troops. Following the assault aircraft into the landing zone, the medical evacuation team provides immediate evacuation support during the insertion and consolidation. Ground ambulances normally do not accompany the assault forces, thereby limiting the medical evacuation assets to air ambulances. The tactical commander may determine that casualties will be held until linkup rather than being evacuated out. The commander's decision is influenced by the expected duration of the operation, casualty density, METT-T, and acceptable risk in evacuating URGENT or URGENT-SURG patients from the objective area. Once linkup is achieved, ground evacuation assets will become available.

**c. Planning Considerations and Factors.** The planning considerations and factors for cross-FLOT operations include, but are not limited to—

- Expected duration of the operation.
- Casualty estimates.
- Evacuation distances and time factors.
- Location of preplanned patient collecting points.
- Location of AXPs.
- Requirements for Class VIII supply/resupply.
- Requirements for medical equipment.
- Aircraft operational readiness (maintenance support will not be available; aircraft, therefore, must have sufficient bank time available to support the entire mission).
- Aircraft configuration requirements.
- Evacuation routes/air corridors.
- Signal operating instructions.
- Equipment (less medical) destruction procedures and policies.
- Nuclear, biological, and chemical decontamination procedures.