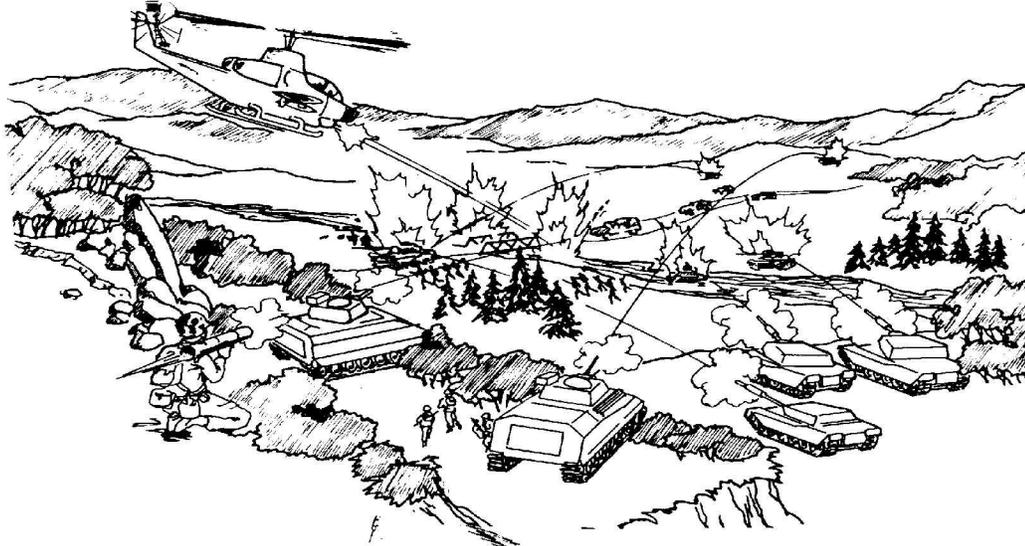


Chapter 4

Maneuver



The mountain environment requires the modification of tactics, techniques, and procedures. Mountains limit mobility and the use of large forces, and restrict the full use of sophisticated weapons and equipment. These limitations enable a well-trained and determined enemy to have a military effect disproportionate to his numbers and equipment. As such, mountain campaigns are normally characterized by a series of separately fought battles for the control of dominating ridges and heights that overlook roads, trails, and other potential avenues of approach. Operations generally focus on smaller-unit tactics of squad, platoon, company, and battalion size. Because access to positions is normally difficult, adjacent units often cannot provide mutual support and reserves cannot rapidly deploy. Attacks in extremely rugged

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terrain are often dismounted, with airborne and air assaults employed to seize high ground or key terrain and to encircle or block the enemy's retreat. While the mountainous terrain is usually thought to offer the greatest advantage to the defender, the attacker can often gain success with smaller forces by effectively using deception, bold surprise actions, and key terrain.

Although mountains often increase the need to employ light forces, commanders should not be misled into believing that this environment is the sole domain of dismounted units. On the contrary, the integrated use of mounted and dismounted forces in a mountainous environment, as elsewhere, increases a commander's capabilities while reducing his limitations. However, the employment of mixed forces must be based on sound mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC) analysis of the specific mountain area of operations (AO). The infantry, armor, and combined arms series of field manuals, at both battalion and brigade level, provide the capabilities and limitations for each type force, planning and safety considerations, as well as, various concepts for employment. In all cases, commanders should assign complementary missions to each type force that capitalizes on their strengths and reduces their weaknesses, and takes into consideration the differential in operations tempo. Working together on the mountain battlefield, armored and dismounted forces can offset each other's weaknesses and provide much greater lethality than any one alone.

SECTION I – MOVEMENT AND MOBILITY

4-1. To move decisively in all directions without losing momentum in a mountain area of operations requires meticulous planning and careful preparation. In a mountainous environment, numerous conditions exist that affect mobility. The force that can maintain its momentum and agility under these conditions has the best chance of winning. Reduced mobility is a primary limitation to be considered during all phases of planning for mountain operations. Rugged terrain, the time of year, the weather, and the enemy have a decisive influence on movement in the mountains. Commanders must ensure that they have sufficient time and space to deploy their forces for battle by maintaining constant security and selecting proper routes and movement techniques. Additionally, they must closely manage limited off-road areas. Tactical operations centers, artillery units, aid stations, air defense artillery, battalion trains, and other supporting units will compete for limited space in restrictive mountainous terrain.

4-2. At any elevation level, movement is generally considered to be either movement across or along terrain compartments. When moving across terrain compartments from one ridge to another, elements should use bounding overwatch. Lead elements should secure the high ground and provide overwatching fires as the rest of the element crosses the low ground. When

moving along a terrain compartment, forces should move on the high ground without silhouetting themselves or, at a minimum, place an element there to secure their flanks.

4-3. Maneuver forces should move by stealth and exploit the cover and concealment of terrain. Using rough, unlikely routes and movement during limited visibility helps avoid enemy detection. All movements must exploit known weaknesses in enemy detection capabilities. Whenever possible, movement should be planned to coincide with other operations that divert the enemy's attention.

4-4. Because of the narrow routes sometimes encountered, especially in the higher elevations, formations may be compressed to columns or files. To reduce vulnerability to the enemy, forces should move separated from each other on multiple and unlikely routes. When moving dismounted along unlikely routes, special teams construct fixed ropes, hauling systems, traverse systems, and other mountaineering installations to provide access to higher elevation levels and increased mobility.

4-5. The danger of surprise attack is most acute in terrain that makes deployment from the march impossible. Even with well-thought-out movement plans, maneuver elements must take both active and passive security measures at all times. Restrictive terrain facilitates templating and determining the movement of forces, making the actions of an armored force more predictable. Elements may avoid detection by using planned fires to destroy known enemy sensors and observation posts or by placing fires to divert the enemy's attention away from an exposed area through which the element must move. However, the placement of fires in a particular area or along a route may compromise operational security.

4-6. When the danger of rockslides or avalanches exists, the distance between elements should be increased as much as four to six times more than required on flat terrain. The more the conditions vary for each unit, the more thorough the planning must be, especially if units must reach the objective simultaneously. Often, a reserve of time must be programmed if units move on multiple routes, over unfamiliar terrain, or during limited visibility, or if they face an uncertain enemy situation.

MOUNTED MOVEMENT

WHEELED AND TRACKED VEHICLES

4-7. Generally, the mountain terrain above the valley floor severely limits movement of wheeled vehicles and is too restricted for tracked vehicles. Trafficable terrain tends to run along features with steep slopes on either side, making mounted movement vulnerable to vehicular ambushes and attack aircraft. Recovery vehicles must always accompany mounted forces in mountainous terrain to rapidly remove disabled vehicles from the limited and narrow trail network.

4-8. Tanks and other armored vehicles, such as infantry fighting vehicles (IFVs), are generally limited to movement in valleys and existing trail networks at lower elevations. Even at these levels, the trails may require extensive engineer work to allow tracked vehicles to pass over them. Tanks,

Bradley fighting vehicles (BFVs), and cavalry fighting vehicles (CFVs) can support by fire if accessible firing positions are available; however, it will rarely be possible for them to accompany dismounted infantry in the assault. In such cases, commanders may seek to use their increased firepower to isolate the objective for the dismounted assault. If employed above Level I, armored vehicles are forced to fight in smaller numbers, yet a single tank at a critical point may have a decisive effect. Although antitank weapons employed from higher elevations can easily penetrate the top of armored vehicles, in many situations, the inability to elevate the weapon system's main gun sufficiently to return fire may further increase its vulnerability.

4-9. Low atmospheric pressure considerably increases the evaporation of water in storage batteries and vehicle cooling systems, and impairs cylinder breathing. Consequently, vehicles expend more fuel and lubricant, and engine power is reduced by four to six percent for every 1,000-meter (3,300-foot) increase in elevation above sea level. This translates to a fuel and oil increase of approximately 30 to 40 percent or more.

4-10. Figure 4-1 contains questions that are part of any mounted movement plan. Limited road networks and restricted off-road mobility significantly increase their importance. In the mountains, failure to address these questions in detail may seriously jeopardize the overall mission.

HELICOPTERS

4-11. Utility and cargo helicopters are key to the rapid movement of soldiers and equipment in the mountains. However, any operation that depends primarily on continuous aviation support to succeed is extremely risky. High elevations and rapidly changing and severe weather common to mountainous regions is very restrictive to aviation operations and makes availability of aviation support very unpredictable.

At high altitudes, weather that appears to be stable to the ground observer may significantly affect heli-

copters. The effects of fog, frontal systems, winds, and storms are readily discernible. Additionally, higher altitudes may restrict aircraft lift capabilities and decrease aircraft allowable gross weight in mission profile. Aircraft icing is common at high altitude and may occur suddenly. De-ice/anti-ice capabilities exist for rotor blades, however, icing may still decrease lift and, in severe cases, prevent flight altogether. Therefore, commanders must become intimately familiar with the conditions that may limit the full effectiveness of Army aviation when operating in a mountain environment (see FM 3-04.203).

4-12. Additionally, commanders must consider the effect of altitude on soldiers when planning air assault operations (see Chapter 1). If possible, commanders should use soldiers acclimatized at or above the elevation level

- **How fast can the march be conducted?**
- **Will there be other traffic on the route?**
- **Are there potential areas that offer covered, off-road positions?**
- **Are there any locations along the route that could be used for resupply?**
- **Are there alternate routes?**

Figure 4-1. Mounted Movement Planning

planned for the air assault. Depending on the situation, it may be better to have troops walk in rather than fly them to the necessary elevation level.

4-13. Rugged, mountainous terrain complicates flight route selection and places an additional navigational load and strain on the entire crew, as they have little margin for error. Direct routes can seldom be flown without exposing aircraft to an unacceptable risk of detection and destruction by the enemy. Tactical flight routes follow valley corridors, where it is possible to obtain cover and concealment while maintaining the highest possible terrain flight altitude. Terrain flight in the mountains may preclude using closed formations. Multi-helicopter operations are normally flown in "loose" or "staggered trail" formations with increased spacing between aircraft.

4-14. Terrain suitable for multiple helicopter landing zones (LZs) in mountainous regions is limited. Level areas that are suitable for mountain LZs frequently require little preparation beyond the clearance of loose material, since the ground is usually firm enough to support helicopters. Conversely, if LZs must be developed, clearing may be difficult due to the rocky ground. Stand-off space from rock wall faces must be cleared and a level landing surface must be created. Demolitions may be required to clear large rocks but care must be used to prevent rockslides or avalanches started by the explosive shock. During the winter, snow must be packed to prevent whiteouts. Similarly, sandy or dusty LZs should be dampened with water to prevent brownouts.



4-15. When only single aircraft landing zones are available, in-flight spacing between helicopters must be significantly increased. Although helicopter LZs should be located on the windward side of ridges or peaks to take advantage of the more stable winds, concealment from enemy observation and the mission are the most important factors in site selection in forward areas. When it is impossible for helicopters to land, personnel may rappel and light equipment may be sling-loaded into a LZ or, in some situations, lowered by rope while the helicopter hovers. However, this may increase turnaround time and aircraft vulnerability. Since available landing sites are often limited, the enemy can be expected to target all likely locations. Personnel should secure terrain that dominates a landing site before using it. They must extensively suppress enemy air defense weapons during air assault or supply operations.

4-16. Attack helicopters can be well suited for a mountain environment; however, commanders must be continuously mindful of weather and elevation effects on their employment. They can be the commander's most mobile maneuver forces in mountain warfare, enabling him to concentrate combat power quickly and exploit enemy weaknesses. During stable weather conditions, attack helicopters equipped with a variety of ordnance can rapidly

engage targets beyond the range of other weapons or those masked by intervening crests. As discussed earlier, higher altitudes and icing conditions affect lift and subsequently armament loads. Ice can also prevent attack helicopters from firing their weapons altogether.

4-17. Employment time and fuel consumption increases because of the few direct routes. Terrain compartments provide excellent terrain masking and radar and visual acquisition avoidance, and allow for rapid movements to the flanks and rear of an isolated enemy force. However, these same compartments may limit aircraft maneuverability and necessitate smaller flight formations, which, in turn, may affect target engagement techniques. The compartmented terrain, combined with extended distances, may require engagement without the support of other combined arms. If terrain precludes placement of fuel and arming points in the forward area, turnaround time increases and on-station time decreases. Since ground-to-air communication is often degraded by intervening terrain, in-flight operational control over extended ranges may be difficult.

4-18. Enemy motorized and mechanized forces may be slowed and canalized as they move up steep grades, down narrow valleys, and along mountain trails. These types of conditions allow attack helicopters to engage slower moving targets that have little room to maneuver or hide. However, these same conditions also make it difficult for pilots to select positions that allow line-of-sight to the target, sufficient tracking distance, acceptable standoff range, and adequate cover and concealment. Positions located high on a ridgeline may support successful target acquisition, tracking, and standoff, but create dangerous silhouettes and look-down angles (the angle from the aircraft to the target) that exceed aircraft weapon constraints. Lower positions, possibly in draws or saddles, may provide concealment to the flanks and an extensive backdrop to help conceal positions, but can decrease a pilot's ability to locate and track targets. Intervisibility lines may mask targets, and extreme terrain relief within the aircraft's optics field of view may inhibit tracking.

4-19. Remote Hellfire engagements avoid most of these problems (see Figure 4-2), but they may increase the time of flight of the missile. A remote engagement limits the number of aircraft exposed for tracking and lasing targets. When engaging with remote fires, a designating team is placed in a position overlooking

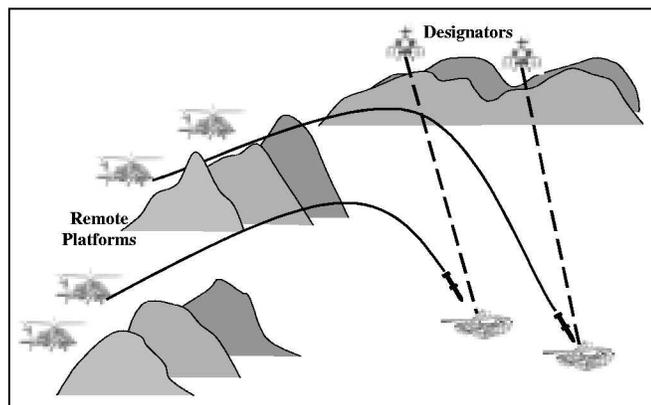


Figure 4-2. Remote Hellfire Engagements

the enemy's route of march. The remaining aircraft position themselves in covered and concealed battle positions oriented on the engagement area. If possible, these battle positions should be located below the reverse military

crest or the counterslope of the ridgeline paralleling the engagement area. Aircraft in these battle positions will act as remote platforms by providing missiles to the designators without unmasking. This tactic prevents the enemy from achieving line of sight on the firing aircraft.

4-20. The AH-64D Longbow Apache will provide an even greater killing capability for the mountain commander. It is able to detect, classify, prioritize, and engage targets with Longbow Hellfire missiles without visually acquiring the target. The commander of the AH-64D Longbow Apache utilizes the its fire control radar and mast-mounted site to target all of the vehicles in the enemy's march formation. A data transfer handover is then executed to all other AH-64D Longbow Apaches within the company. After the data transfer has been completed, the company can then engage the enemy march column without exposing the remote platforms. When employing the AH-64D Longbow Apache with radar guided Hellfire missiles, engagement times are greatly reduced and aircraft exposure to the enemy is limited. Regardless of the type of helicopter, a thorough terrain analysis and early involvement of aviation operational planners are key to successful application of Army aviation assets in mountainous terrain.

DISMOUNTED MOVEMENT

4-21. Dismounted movement is often extremely slow and arduous, and may require the skills of technical mountaineering teams to secure the advance. For example, movement in Level II may dictate that elements secure the high ground in Level III. As with any type of movement, proper movement techniques and formations and constant security to avoid unplanned enemy contact are some of the keys to successful dismounted movement.

4-22. Foot marches in the mountains are measured in time rather than distance. When making a map reconnaissance, map distance plus one-third is a good estimate of actual ground distance. One hour is added for each 300 meters of ascent or 600 meters of descent to the time required for marching a map distance. Figure 4-3 on page 4-8 shows dismounted movement calculations for an estimated 16-kilometer march on flat and mountainous terrain. Although not included in this example, commanders must also consider acclimatization, fatigue, soldiers' loads, limited visibility, and other factors that affect movement times (see FM 3-25.18 for additional factors influencing dismounted march rates).

4-23. Commanders cannot permit straggling or deviations from the selected route. Every aspect of march discipline must be rigorously enforced to keep a column closed with the knowledge that the interval between individuals depends on terrain and visibility.

4-24. To prevent an accordion effect, soldiers must allow enough distance between themselves to climb without causing the following individual to change pace. In mountainous terrain, a slow, steady pace is preferred to more rapid movement with frequent halts. Commanders must incorporate scheduled rest halts into their movement plans based on distance, availability of covered and concealed positions, and other factors described above. If possible, commanders should not conduct rest halts during steep ascents or descents. At the start of a march, soldiers should dress lightly so that they begin slightly

chilly. However, a short halt should be taken to adjust clothing and equipment after the first 15 minutes of movement. In addition, soldiers must put on special mountaineering equipment before reaching steep terrain.

| Flat Terrain | Mountain Terrain |
|--|--|
| Total 16 kilometers / 4 kilometer per hour = 4 hours | Normal Time 16 kilometers / 4 kilometer per hour = 4 hours |
| | Ascent 600 meters / 300 meters per hour = 2 hours |
| | Descent 600 meters / 600 meters per hour = 1 hour |
| | Total 4 + 2 + 1 = 7 hours |

Figure 4-3. Example Dismounted Movement Calculations

4-25. In glacial areas, the principal dangers and obstacles to movement are crevices, snow and ice avalanches. Exposure to the hazards of glaciated mountains is increased at company-level and above, and movement should be limited to separate platoon and lower levels. When moving on glaciers, an advance element should be used. This group identifies the best routes of advance, marks the trail, and provides directions and distances to follow-on units. A marked trail is especially important during inclement weather and low visibility, and provides a route for retrograde. Commanders must carefully weigh the advantages of a marked route against the possibility of ambush and the loss of surprise.

MOBILITY

4-26. During mountain operations where limited mobility exists, it is critical that units maintain security and control of available road/transportation networks. This includes securing key bridges, fords, crossing sites, intersections, and other vulnerable choke points. These locations must be protected against enemy air, obstacle, and ground threats. However, commanders must carefully balance their available combat power between protecting their freedom of mobility/maneuver and allocating forces to critical close combat operations. Effective risk analysis and decisions are essential. Route clearance operations, patrols, traffic control points (TCPs), and other security operations aid commanders in securing routes. During offensive operations, commanders may need to commit forces to seize key terrain and routes that afford their forces greater mobility and tactical options against the enemy.

4-27. Engineer support in front of convoys and combat formations is often necessary to clear and reduce obstacles, such as washouts, craters, mines, landslides, and avalanches, as well as, snow and ice in colder regions. Reducing obstacles is more difficult in mountainous areas because of reduced maneuver space, lack of heavy equipment, and an increased competition for engineer support. Minefields should normally be breached, since bypassing properly sited obstacles is often impossible. In the mountains, using mechanical mine plows and rollers is frequently impossible due to the lack of roads

and trails, and removal of mines by hand or through demolitions is often required. Commanders must exercise extreme caution when employing demolitions in the vicinity of snow and rock covered slopes because they can cause dangerous rockslides, avalanches, and secondary fragmentation. FM 3-34.2 has information on breaching operations and synchronization required.

4-28. Creating new road systems in mountainous regions is usually impractical because of the large amount of rock excavation required. Therefore, roadwork is generally limited to the existing roads and trails often requiring extensive construction, improvement, maintenance, and repair to withstand the increased military traffic and severe weather conditions. In certain mountainous areas, materials may be difficult to obtain locally and impossible to make full use of conventional heavy engineer equipment for road and bridge construction or repair. In such cases, large numbers of engineers are required and units must rely heavily on hand labor, light equipment, and demolitions.

4-29. Secondary roads and trails should be steadily improved to accommodate trucks and infantry fighting vehicles, and, eventually, heavier vehicles. Their selection depends on necessity and the speed with which the routes can be put into service. Abnormal gradients on roads may be necessary to ensure that construction keeps pace with tactical operations. Sidehill cuts are the rule, and the same contour line is followed to avoid excessive fills or bridging. Turnouts should be installed approximately every 500 meters to reduce traffic congestion on single-lane roads or trails. Drainage requirements must be considered in detail because of the effects of abnormally steep slopes, damaging thaws, and heavy rains.

4-30. Stream and river crossing operations are difficult and must usually be accomplished by expedient means. Bridging operations in mountainous terrain are normally limited to spanning short gaps and reinforcing existing bridges by using prefabricated materials and fixed spans from floating bridge equipment. However, standard design or improvised suspension bridges may still be needed for longer spans. Because existing bridges may have low vehicle load classifications, standard fixed tactical bridges and bridging materials should be on hand to quickly reinforce or replace them. In extremely rough terrain, cableways and tramways may be constructed to move light loads and personnel across gorges, and up and down steep slopes.

COUNTERMOBILITY

4-31. Obstacles become more important because of the compartmented terrain and already limited road and trail networks. It is easy to create effective obstructions in mountains by cratering roads, fully or partially destroying bridges, or inducing rockslides and avalanches. Units can use antitank minefields effectively to canalize the enemy, deny terrain, or support defensive positions. Commanders should remember that clearing or reducing these same obstacles may be extremely difficult and a hindrance to future operations. Using reserve and situational obstacles, lanes and gaps, and plans to rapidly reduce friendly obstacles must be an integral part of all defensive operations. Commanders must also consider the enemy's ability to create similar obstacles and minefields when developing courses of action that hinge on speed of movement or a particular avenue of approach.

4-32. Reinforcing obstacles can be used effectively with the natural ruggedness of mountains to deny the enemy terrain and to delay and impede his movement. As in all environments, the engineer and maneuver force commander must site obstacles based on terrain and the availability of weapon systems.

4-33. Antitank mines are laid along the comparatively narrow approaches suitable for mounted attacks. Flash floods and excessive runoff may dislodge mines from their original location; however, they normally remain armed. Family of scatterable mines (FASCAM), particularly artillery-delivered and helicopter-delivered mines, increases the flexibility of the maneuver unit commander, reduces the engineer effort, and is a valuable resource in protecting rear areas from enemy envelopment and breakthroughs. Using FASCAM should be weighed against the time in delivery, displacement of the artillery, and the additional logistics burden that may be involved.

ENGINEER AUGMENTATION AND EMPLOYMENT

4-34. Because mountain terrain requires small-unit decentralized operations, an engineer platoon or company should be allocated to each maneuver battalion, light or heavy. Allocation in this manner may leave division and brigade rear areas short of engineer support.

4-35. An additional corps engineer battalion (wheeled) and an engineer light equipment company may be needed to augment an infantry division. Platoons from the engineer light equipment company may be tasked to assist divisional platoons with the engineer effort in each maneuver battalion area. The corps combat engineer battalion (wheeled) provides heavy equipment and dump trucks required to support road improvement and maintenance in division and brigade rear areas. Also, this corps combat engineer battalion (wheeled) can accomplish such tasks as constructing or reinforcing bridges. To operate efficiently, additional items, such as compressors, jackhammers, power drills, chain saws, and bulldozers, may be necessary, as well as large amounts of explosives and obstacle materials.

SPECIAL PURPOSE TEAMS

4-36. On steep, exposed, or technically difficult terrain, soldiers with advanced mountaineering skills may be required to maintain or improve mobility. Advanced climbers may deploy ahead of maneuver forces during limited visibility or inclement weather to erect aids that will help maneuver elements move in difficult terrain. They may also be committed to lead forces or to operate independently to strike the enemy suddenly over unlikely routes and to occupy certain key heights that can be defended easily because of their position. The specific employment of special purpose teams is based on the mission, tasks, and requirements of the commander.

4-37. Commanders must analyze operational terrain levels and identify the mobility requirements necessary to obtain and maintain freedom of both tactical maneuver and operational movement (see Figure 4-4). It is critical that special purpose teams are properly organized *before* a mission begins. Once movement is underway, unplanned deviations have little chance of success. Bypassing obstacles in mountainous terrain is almost always difficult or

impossible. In many instances, the best available bypass will channel friendly forces into enemy kill zones or ambushes.

4-38. To enable a force to move personnel, equipment, and supplies on the mountain battlefield with limited delays due to terrain, visibility, or obstacles, commanders should organize soldiers with advanced mountaineering training as guides, lead climbing teams, installation teams, and evacuation teams (evacuation teams are covered in the combat health support portion of Chapter 5).

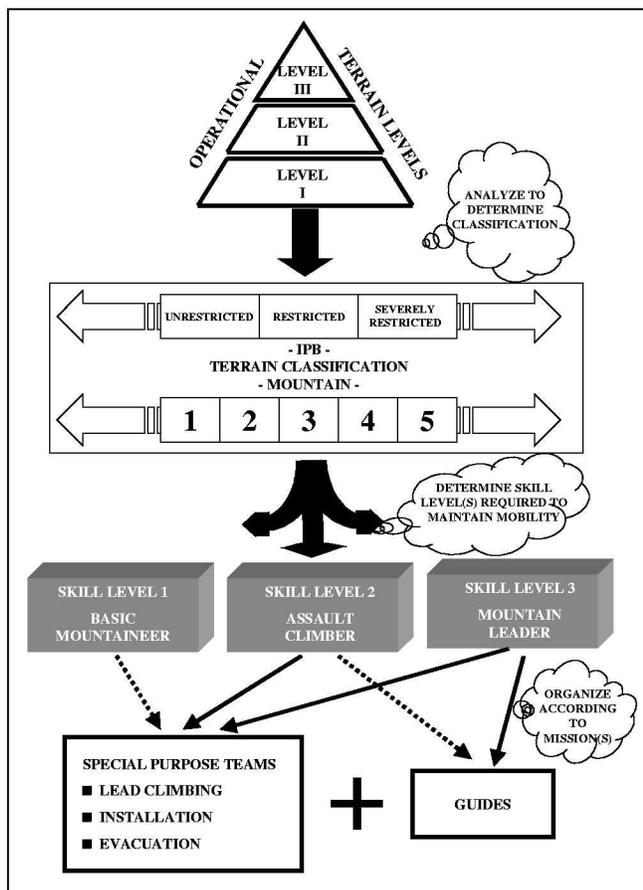


Figure 4-4. Relationship of Terrain to Skills and Special Purpose Teams

HISTORICAL PERSPECTIVE

The 10th Mountain Division and Riva Ridge (February 1945)

After attempts to capture Bologna in Italy's Po Valley during the winter of 1944-1945 failed, Allied commanders focused on the possibility of wide sweeping movements aimed at encircling Bologna and all the German armies in the region. The plan called for using the 10th Mountain Division to capture a series of mountain peaks and ridges dominating a 10-mile section of Highway 64, one of two main routes leading from Pistoia through the northern Apennines to Bologna. This would provide the Allies with a better position before starting the spring offensive, since seizure of this terrain would result not only in the Germans' being unable to protect their vital lines of communications, but also in the Americans' being able to observe German activity almost all the way to the Po Valley, approximately 40 miles away. The Division's baptism-by-fire was to be in a region dominated by two ridges whose highest peaks rose 3,000 to 5,000 feet. One of these ridges, Pizzo di Campiano-Monte Mancinello, became known as Riva Ridge (see Figure 4-5).

These heights appeared to be impregnable, as it was doubtful that any force large enough to overwhelm the Germans could be massed unobserved for an assault. The Germans had all the advantages of the commanding heights, and there was little cover for troops crossing the barren, snow-covered ground. It was clear that Riva Ridge would have to be cleared before the decisive attack could advance up Mount Belvedere and along the ridge towards Monte della Torraccia. Therefore, the plan was for the mountain troops to climb the 1500-foot cliff and surprise the Germans, who would not be expecting the attack up the face of the cliff.

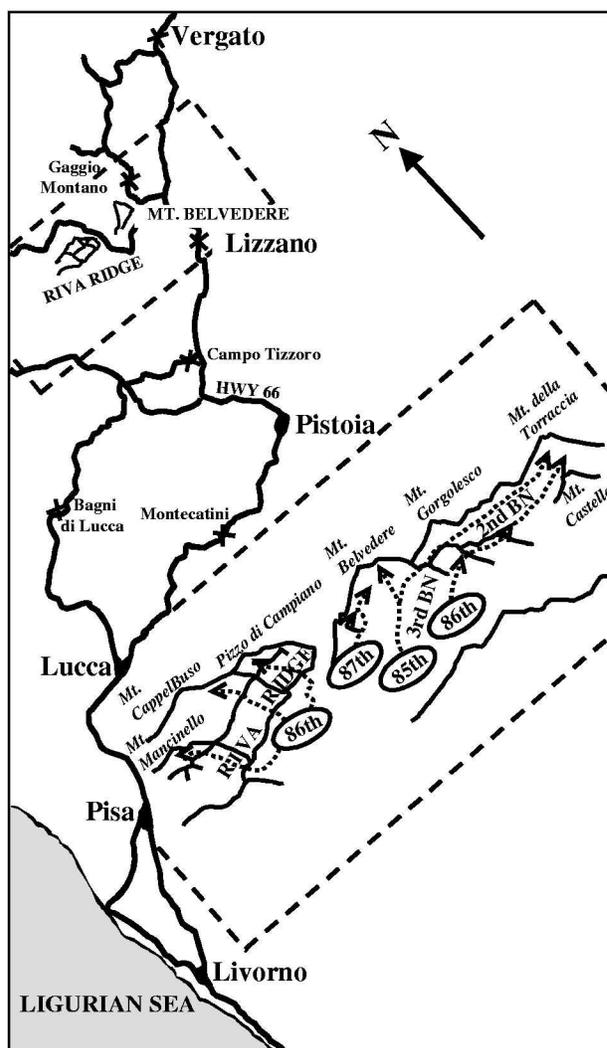


Figure 4-5. Riva Ridge

The 86th Mountain Infantry Regiment's 1st Battalion and one company from its 2nd Battalion were assigned to negotiate the cliff and capture Riva Ridge, thereby setting the conditions for other assault elements to achieve their objectives. Select teams of climbers assembled their ropes, pitons, and other gear. The teams climbed in the dead of night, hammering pitons into the rock, attaching links to them, and fastening ropes to the links. These served as fixed lines to assist those who followed in their ascent of the vertical face of the ridge. The lead climbing teams reached the top around midnight, and battalion units began their ascent in force. By 0400 on 20 February, all three of 1st Battalion's companies and the company from the 2nd Battalion had reached their individual objectives on top of the ridge without being seen. They attacked the defending Germans and completely surprised them. German daylight counter-

attacks were repulsed and the division's left flank was secured on Riva Ridge – opening the way for the rest of the division to accomplish its mission.

The capture of Riva Ridge was the only significant action in which the division put to use its specialized stateside training. Nevertheless, no one would deny that this single mountain operation justified all the demanding training the 10th Mountain Division had undergone.

Adapted from *See Naples and Die*, Robert B. Ellis.

GUIDES

4-39. Mountain guides are useful for any operation, particularly on terrain above Class 3, which requires accurate judgment and extensive technical knowledge. They act primarily as advisors to unit commanders and assist with planning when technical mountaineering problems affect the tactical scheme of maneuver. They must be experienced in all aspects of mountaineering (usually a Level 3 mountaineer) and capable of ensuring that the force is never beyond the margin of its operational capabilities while operating on mountainous terrain. Mountain guides must possess the skills, knowledge, and experience necessary to develop a true perspective of the obstacles and conditions that must be overcome.

4-40. Mountain guides should perform the following functions for the commander:

1. Conduct a terrain analysis of the assigned area.
2. Select the best march routes
3. Identify danger areas, obstacles, and hazards.
4. Estimate the effects of elevation on force capabilities.
5. Determine the technical means necessary to employ the force.
6. Estimate the time of unit movements.
7. Develop a movement sketch indicating the azimuth, time, and mountaineering requirements.
8. Lead units, usually company-level and above, on difficult terrain.
9. Supervise all aspects of mountaineering safety.

LEAD CLIMBING TEAMS

4-41. As with all special purpose teams, lead climbing teams have highly skilled soldiers qualified in advanced mountaineering techniques (normally Level 2 mountaineers). To a lesser degree, lead climbing teams perform many of the same functions as guides. They also accompany a unit over unprepared routes and assist with actually conducting its mission by maintaining and improving mobility. In some instances, lead climbing teams may operate independently of other forces to accomplish specific missions.

4-42. These teams are capable of climbing at night with the aid of night-vision goggles and can conduct operations over any type of terrain. Lead climbing teams should be utilized to install fixed ropes to assist personnel over exposed terrain. They make the most difficult climbs and act as rope leaders. Members of the lead climbing teams must be extremely proficient in the technical aspects of mountaineering, since they select the specific routes to be climbed. This responsibility emphasizes the importance of accurate judgment, since a single mistake could jeopardize the success of the unit's mission. Commanders should consider assigning lead climbing teams to, or developing an organic capability within:

- Ground reconnaissance elements.
- Forward observer parties.
- Air defense sections.
- Communications sections.
- Security elements.
- Assault elements.
- Sniper sections.

4-43. The number of lead climbing teams required is dependent on the mission and difficulty of the elevation level or dismounted mobility classification. If more than one point of attack is to be used or a more mobile patrol is needed, it may be necessary to employ additional lead climbing teams. Lead climbing teams may also assist in the attack of very steep objectives by negotiating the most unlikely avenues of approach. They can be dispatched ahead of the attacking elements to secure the advance at night and during periods of inclement weather. The commander's imagination and their limited availability are the only restraints toward using lead climbing teams.

4-44. In precipitous terrain, lead climbing teams can be used alone to conduct small reconnaissance patrols or to form the nucleus of larger patrols. They may also be used to expedite movement of flank security elements over difficult terrain and during poor visibility. At least one team should be attached to each element, depending on the size of flank security and the operational terrain level in which operations take place. When the AO dictates a rate of march on the flanks that is slower than that of the main body, flank security elements should be located adjacent to the advance echelon. Lead climbing teams are detached as necessary to reconnoiter and hold dominant terrain features on the flanks of the line of march. As the trail element passes and the security position is no longer required, the lead climbing team's flank outposts join the main body or proceed forward to another security location.

INSTALLATION TEAMS

4-45. Installation team members are qualified in the construction and maintenance of technical mountaineering systems, referred to as installations, which facilitate unit movement. These teams deploy throughout the AO, in any weather or visibility conditions, to erect mountaineering installations that overcome obstacles to the movement of friendly forces and supplies.

4-46. In most situations, installation teams should consist of six qualified members, enough to build most installations. Installation teams deploy early and prepare the AO for safe, rapid movement by constructing various types of mountaineering installations (see Figure 4-6). Following construction of an installation, the team, or part of it, remains on site to monitor the system, assist with the control of forces across it, and make adjustments or repairs during its use. After passage of the unit, the installation team may then disassemble the system and deploy to another area as needed.

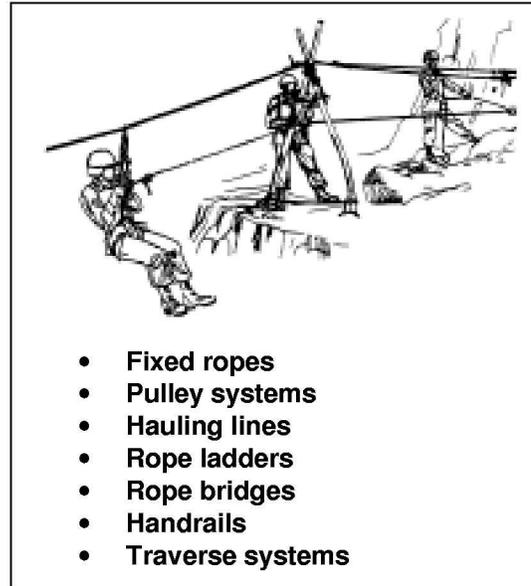


Figure 4-6. Types of Installations

4-47. Although installation teams can assist, commanders remain responsible for establishing a traffic control system and the rate of negotiation to expedite tactical movement and prevent unnecessary massing of personnel and equipment on either side of the obstacle. Plans for the traffic control system include arrangements for staging and holding areas, as well as movement. A prearranged order of movement, disseminated to all elements of the force, facilitates rapid movement. The traffic control plan also includes instructions for dispersing forces on the far side once they negotiate the obstacle. The successful negotiation of systems depends on how quickly a force can consolidate on the far side and continue its mission.

4-48. Commanders must carefully consider the proportion of installation team assets allocated to maneuver with those assigned to sustain essential logistics activities. When considering a unit's scheme of maneuver, the number and types of installations depend on METT-TC, emphasizing factors listed in Figure 4-7.

- Number of routes required by the maneuver force
- Size of the maneuver force
- Amount and type of maneuver force equipment
- Number of installations required to extend logistics support
- Weather and visibility conditions
- Number of installation teams available

Figure 4-7. Factors Influencing Mountain Installations

4-49. Once operations stabilize, installation teams can direct and assist engineers in the construction of fixed alpine paths. Fixed alpine paths consist of permanent or semi-permanent mountain aids that assist troops in traversing rugged mountain terrain and facilitate the movement of equipment and supplies to and from forward areas.

SECTION II – OFFENSIVE OPERATIONS

4-50. Offensive operations in the mountains vary depending on the degree of restrictions dictated by mountains of different heights and character, but are normally planned and conducted utilizing the movement to contact and the attack. Exploitation and pursuit are conducted, but less frequently than in other environments.

4-51. Mountain operations will most likely be fought to gain control of key or decisive terrain. The goal is to seize objectives that are important for continuing the battle, such as lines of communication, passes, ridges, and choke points. Every attempt must be made to fight from the heights down. Frontal attacks against defended heights have little chance of success and attacks are usually made along the flanks and to the rear of the enemy. Consequently, envelopment becomes the preferred form of maneuver.

4-52. The missions assigned to units operating in a mountainous region remain the same as those in lowland regions. Commanders should place an increased emphasis on:

- Limited-visibility operations.
- Mobility and survivability.
- Securing friendly lines of communications while severing those of the enemy.
- Reconnaissance and security.
- Centralized planning and decentralized small-unit actions.
- Environmental factors favoring operations of short duration and violent execution.

PLANNING CONSIDERATIONS

4-53. When conducting offensive operations in the mountains, surprise is often a dominant consideration, rather than a supporting one. Units achieve surprise by achieving superior situational understanding, especially of the terrain, and by using that knowledge to do the unexpected. Friendly forces should conduct bold and imaginative operations to exploit enemy weaknesses or inability to operate in a mountainous environment. A well-trained force can achieve surprise by infiltrating and attacking the enemy's rear or attacking during periods of limited visibility, such as night, rain, or snow. They can use helicopters and their technical mountaineering skills to conduct decisive operations anywhere in the AO. The effects of surprise can be dramatically increased if commanders select objectives in restrictive terrain that decrease the enemy's mobility and ability to react effectively.

4-54. The mountainous terrain increases the threat to concentrated formations. Usually, it is difficult to coordinate all forces by time and location so that they can rapidly support each other and achieve massed effects. The compartmented terrain separates adjacent units, precluding mutual support, and may adversely affect supporting distances. Therefore, it is critical to anticipate the concentration of forces and fires before the battle begins to achieve effective synchronization.

4-55. Commanders usually select decisive points for the attack based, in part, on their ability to seize and control key terrain. Each of these objectives often necessitates the seizure of one or more intermediate objectives. The compartmented terrain and resulting dispersion make it difficult for commanders to visualize the entire AO and complicates command and control, while the terrain often affords the defender excellent observation and decreases the attacker's ability to concentrate forces undetected.

4-56. Once a battle is joined, helicopters are the only rapid means for massing forces on terrain higher than Level I. When weather conditions permit, attack helicopters and tactical air assets are essential because they can move and strike over a large AO in a short time. Therefore, the suppression of enemy air defense may become a high priority during offensive operations.

4-57. Commanders must personally acquaint themselves with the terrain to the fullest extent possible. They combine this knowledge with other factors of METT-TC to develop simple, yet precise plans and orders. As previously discussed, compartmented terrain tends to divide the battle into many isolated engagements that are difficult to control. A complex and inflexible plan will not withstand the changing situations associated with this type of decentralized combat. An uncomplicated plan with a well-thought-out intent that is clearly communicated ensures understanding at the lowest level and allows subordinates to exploit battlefield opportunities even if communications fail.

PREPARATION

4-58. The length of the preparatory phase is typically longer in a mountainous environment. An offensive action against an enemy defensive position must be based on thorough reconnaissance and orderly preparation. The primary factor in determining the technique to be used in destroying the enemy position is the strength of the enemy's defenses. The stronger the defenses, the more deliberate the attack must be. In mountainous terrain, evaluation and exploitation of the ground are essential. Commanders must prepare plans of attack that take advantage of the weaknesses found in the enemy's defensive system. In the mountains, a larger number of reconnaissance assets and additional time may be needed to determine the strength of enemy positions on the objective and all surrounding heights, and favorable routes to and past the objective.

4-59. Difficult approach routes should be marked and prepared for safe passage. Easily traversed slopes, broad hills, plateaus, and valley floors, as well as mountainous terrain with well-developed road and transportation nets, permit deployment in breadth. High ranges with ridges and crests leading to the objective require organization in depth with extended lines of communications.

4-60. In trackless mountain terrain, company-sized teams usually conduct attacks. If the area assigned to a battalion permits, companies should approach the objective separately on multiple routes. In restrictive terrain, adequate maneuver space may not always be available and several units may be required to move along the same avenue of approach. It may even be necessary to conduct shaping operations to seize sections of terrain from which the enemy can dominate the forces' movement and approach.

4-61. The preparatory phase may also include feints and demonstrations to shape the battlefield. In mountainous terrain, the defending force has a number of advantages that allow it to defeat an attacking force much larger than its own, such as long-range observation, rugged natural cover, concealment, advance siting of weapons, and operations on familiar terrain. Feints and demonstrations mask friendly operations, expose enemy vulnerabilities, disorganize the defense, and allow the attacking force to engage the enemy discriminately. In a mountain area of operations, the benefits achieved from a successful deception effort may well outweigh the difficulties involved in mounting it.

FORMS OF MANEUVER

4-62. The forms of offensive maneuver are common to all environments, to include mountainous terrain. While frequently used in combination, each form of maneuver attacks the enemy in a different way, and some pose different challenges to the commander attacking in the mountains.

INFILTRATION

4-63. Infiltration is frequently used in the mountains. The difficult terrain and recurring periods of limited visibility allow for undetected movement. Infiltration in a mountainous environment is used to shape the battlefield by attacking enemy positions from the flank or the rear, securing key terrain in support of the decisive operations, or disrupting enemy sustaining operations. Infiltration is normally conducted using one of three techniques: movement in small groups along one axis, movement in one group, or movement in small groups along several routes at the same time. Regardless of the technique used, units must move in a covert manner to reduce the chance of enemy contact.

4-64. With movement in small groups along one axis, all members of the force use the best route. Small groups are harder to detect and easier to control, and do not compromise the total force if detected. This technique may require an excessive amount of time and an increased number of guides and lead climbing teams, and does require an assembly area or linkup point prior to conduct of the decisive action. If the lead group is detected, other groups may be ambushed.

4-65. The enemy can more easily detect movement in one group. If the force is detected, the overall mission may be endangered. However, this technique has no reassembly problems, since reassembly is not required. Everyone uses the same route, easing navigation and reducing the number of guides and lead climbing teams required. A large force can fight out of a dangerous situation more easily than a small one. This technique minimizes coordination problems with other infiltrating units.

4-66. Movement in small groups along several routes at the same time has several advantages. It avoids putting the total force in danger and is less likely to be seen. It forces the enemy to react in many locations and makes it harder for him to determine the size of the force or its mission. Groups travelling over severely restrictive terrain may have significant assembly,

control, and sustainment difficulties, and may require more guides, lead climbing teams, and installation teams.

ENVELOPMENT AND TURNING MOVEMENT

4-67. The envelopment and its variant, the turning movement, are used extensively in mountain operations. Both forms of maneuver seek to avoid the enemy's strength and attack the enemy at a decisive point or points where the enemy is weakest or unprepared, and both rely on superior agility. In the mountains, the ability to react faster than the enemy may be achieved through greater mountaineering skills, using airborne and air assaults, and, depending on the specific AO, amphibious assaults.

PENETRATION

4-68. Mountainous terrain normally makes penetration extremely dangerous or impossible because of the difficulty in concentrating overwhelming combat power in the area of penetration. Due to mobility restrictions, it is also difficult to develop and maintain the momentum necessary to move quickly through a gap and on toward the objective. The area of penetration is always vulnerable to flank attack, and this vulnerability significantly increases in mountainous terrain. A penetration may be useful when attacking an enemy that is widely dispersed or overextended in his defense. If a penetration must be conducted, flank defensive positions must be eliminated before the initial breach of enemy positions. Successful penetration of a defensive position in restrictive mountainous terrain requires using limited visibility, stealth, and covered and concealed terrain at selected breach points.

FRONTAL ATTACK

4-69. Frontal attacks in hilly or mountainous areas, even when supported by heavy direct and indirect fires, have a limited chance of success. Mountain terrain adds to the relative combat power of the defender. The frontal attack exposes the attacker to the concentrated fire of the defender while simultaneously limiting the effectiveness of the attacker's own fires. In the mountains, the frontal attack is an appropriate form of maneuver to conduct as a shaping operation designed to fix a force, while the decisive operation uses another form, such as the envelopment, to defeat the enemy.

MOVEMENT TO CONTACT

4-70. The fundamentals regarding movement to contact also apply in a mountainous environment with the added likelihood of surprise attack and ambush. Limited mobility and dependence on restrictive terrain make it difficult to rapidly deploy from the movement formation. Plans and movement formations and techniques should be based on maintaining flexibility and providing continuous security.

4-71. During a movement to contact, the advance guard normally advances in column, moving continuously or by bounds, until it makes contact. While requiring less physical exertion, movement along the topographical crest of a ridgeline increases the possibility of enemy observation and should normally be avoided. Given adequate concealment, this exposure may be reduced by

moving along the military crest. Ridgelines and crests can often provide a tactical advantage to the force that controls them. Their control may allow rapid movement from one terrain compartment to another and afford excellent observation into lower terrain levels. In all cases, commanders must address the control or clearance of ridgelines that dominate their planned avenues of approach.

4-72. The main body should never be committed to canalizing terrain before forward elements have advanced far enough to ensure that the main body will not become encircled. This is a critical factor when employing mixed heavy and light forces that have sharp differences in operational tempo. Combat service support must be decentralized and readily available to sustain the combat elements. Major terrain compartments may physically separate maneuver units moving as part of a larger force. Continuous reconnaissance to the front and flank security is essential to prevent the enemy from infiltrating the gaps between units.

4-73. As the enemy situation becomes better known, commanders may shorten the distance between elements to decrease reaction time, or they may begin to deploy in preparation for the attack. Lateral movement between adjacent columns is frequently difficult or impossible. However, every attempt should be made to maintain at least visual contact. Commanders must emphasize the use of checkpoint reporting, contact patrols, and phased operations to coordinate and control the movement of the overall force. Control measures should not be so numerous as to impede operations and stifle initiative. Proper control ensures that units and fires are mutually supporting, objectives are correctly identified, and units are in position to attack.

ATTACK

4-74. Speed, flexibility, and surprise, normally advantages enjoyed by the attacker, are limited by restrictive terrain and the defender's increased ability to see and acquire targets at greater distances. These limitations make it difficult for units above the company team level to conduct a hasty attack against prepared positions. In the mountains, commanders usually need more time to coordinate fire support, pick routes to prevent enemy observation and detection, and select control measures to coordinate and control the operation. Therefore, deliberate attacks requiring a detailed scheme of maneuver and well-developed fire support plan become the norm at battalion-level and above. Since daylight contributes to the defender's ability to see and, thereby, reduces the attacker's chances of success, commanders should seek opportunities to exploit the advantages of limited visibility. Although these conditions slow movement even more and make coordinating forces more difficult, they decrease the enemy's ability to accurately sense what is happening and react effectively.

4-75. In planning and conducting the attack, commanders should recognize that the enemy will generally seek to control the valleys and trail networks, including adjacent slopes and high ground. Defenses normally be anchored around obstacles, and long-range, direct fire weapons employed in poorly trafficable terrain, often on slopes and protruding high ground. The enemy will attempt to engage the attacker in the valleys and low ground with flanking

fires and artillery, often in a direct fire mode. Commanders must analyze the terrain to determine not only how the enemy will organize his defensive positions, but also how the terrain might contribute to the enemy's ability to counterattack. As friendly forces attempt to deploy for the attack, the enemy, using his advance knowledge of the terrain and prepared routes, may maneuver forces to counterattack from the flank or rear.

4-76. All terrain features that can be occupied by even a small enemy force should be secured. In many instances, overwatch positions may not be readily available within the range capability of organic weapons. Infiltration, technical climbing, and extensive breaching may be required to position weapons to support the assault. On many occasions artillery support, especially in high mountains, may not be available. In other instances, commanders may need to identify intermediate objectives for maneuver forces based on the need to ensure that artillery units have suitable, secure firing positions to range the enemy and support the attack. As in all environments, commanders must identify fire support requirements and allocate fires based on the ability to support and available ammunition. Because resupply may be limited and extremely difficult, they may need to place restrictions on the amount of ammunition expended on specific targets.

4-77. Fire and movement during the assault are extremely difficult. In situations where machine guns can be positioned effectively, a rifle platoon can provide itself with support from a flank or from a height. However, during an assault up a slope, supporting fire cannot come from an overwatch position and must originate from the flanks or through gaps between the assaulting soldiers. Control is difficult to maintain when the assault is in steeply rising terrain. Commanders must pay special attention to the dangers of fratricide.

4-78. Fire and movement are easier in an assault over a downward slope. Down-slope assaults often have the advantage of good observation, but dead spaces and intervening terrain may reduce the effectiveness of supporting fires. Defensive positions laid out by a skillful enemy on a reverse slope significantly increase the effect of unfavorable down-slope conditions. This type of defense compels the attacking force to position its supporting weapons and observation posts on exposed crests. In this situation, support elements must be positioned to avoid terrain masking and crest clearance problems.

4-79. Breaching obstacles and preparing bypass routes that allow the assault force to move into the defensive position must be an integral part of the commander's plan. In rugged terrain, man-made obstacles that are covered by fire create a particularly dangerous and formidable barrier. Command and control of a covert, in-stride, deliberate, or assault breaches is more difficult than in open terrain, and mobility support is extensive if the obstacle cannot be reduced. Assaults in mountainous terrain almost always involve preparing routes that allow the assault force to rapidly move over difficult natural obstacles and into the objectives.

4-80. Commanders should maintain a strong reserve, if possible. In the mountains, as elsewhere, commanders can use their reserves to restore the momentum of a stalled attack, defeat enemy counterattacks, and exploit success. Reserves must be carefully positioned and organized so difficult terrain, limited road networks, or unpredictable weather does not delay their arrival.

Once committed, commanders make every effort to reconstitute another reserve from available units.

4-81. An attack should not be halted on a summit or on a ridgeline objective, which enemy artillery and mortar fire will likely target. Reorganization is generally best conducted well forward of a crest line on the next suitable slope. Commanders must ensure that the enemy is not allowed the opportunity to counterattack to recapture key terrain. Rapid adjustment of positions and coordination with flanking units are essential. Support weapons, especially mortars, should be brought forward as quickly as possible. Helicopters are useful for this purpose and may be used for backhaul of casualties.

COUNTERATTACK

4-82. Counterattacks in the mountains must exploit the aspects of terrain that impair enemy momentum and make it difficult for him to mass and maneuver. Obstructing terrain that canalizes movement and restricts mobility significantly increases the potential for counterattacks. In planning a counterattack, the commander must carefully consider the enemy's weaknesses or inability to operate in a mountainous environment. A counterattack, even on a very small scale, can have a decisive impact in mountainous terrain.

RAID AND AMBUSH

4-83. The restrictive terrain also affords increased opportunities to conduct raids and ambushes. These operations should take advantage of limited visibility and terrain that the enemy may consider impassable. In steep terrain, movement time increases significantly, and only light equipment can be taken. The force should use special climbing techniques to negotiate the difficult routes during limited visibility. Commanders must carefully consider the routes and methods used for extraction to ensure that the combat force does not become isolated after executing the mission. They can ensure a successful operation by avoiding detection through proper movement techniques and by skillfully using natural cover and concealment. It may be necessary to reposition some indirect fire support assets to cover dead space or use attack helicopters and close air support. The ambush or raid commander must know in advance if supporting fires cannot cover his routes to and from the objective.

DEMONSTRATIONS AND FEINTS

4-84. Because maneuver space is usually limited or confined and restricts the number of avenues of approach for heavier forces, deception plays an important part in the mountain battle. To mislead the enemy regarding friendly intentions, capabilities, and objectives, commanders should plan systematic measures of deception.

EXPLOITATION AND PURSUIT

4-85. In a mountainous environment, exploitation and pursuit operations must be conducted discriminately and the mountain commander must always prepare for success. A battalion may exploit its own success to a limited extent, but it normally participates in the exploitation as part of a larger force. Air assault and attack helicopter units can be used to augment exploitation

and pursuit operations. The exploiting commander must compensate for the ground mobility restrictions imposed by terrain and weather. Speed can best be achieved by isolating enemy positions with the smallest force possible. Engineer support should be well forward with the necessary equipment to allow combat troops to maintain momentum and avoid delay by enemy obstacles. The commander must be careful to prevent overextending either the exploiting force or its sustaining logistics. A withdrawing force is capable of establishing numerous strong points and firing positions on heights that allow it to quickly dissipate the combat power of the exploiting force.

MOTTI TACTICS

4-86. Motti tactics are presented here to demonstrate how forces can exploit superior mobility skills and knowledge of the mountainous terrain and environment to defeat the enemy. The Finns developed these tactics during the Finnish-Russian War in 1939-1940. They are characterized by attacks on rear areas, bivouac sites, and command posts.

4-87. The Finnish word "motti" means a pile of logs ready to be sawed into lumber – in effect, setting the conditions so that a larger force can be defeated in detail. These tactics were most successful in the forested areas of Finland during the arctic winters. During the Finnish-Russian War, the Soviets were neither prepared for, nor trained for, warfare under such conditions. They were almost totally trail-bound, with few ski troops. In the 1980s, the Soviet Union experienced similar difficulties in the mountains of Afghanistan. In both instances, the road and trail-bound nature of their forces and their basic tactics left them vulnerable to motti tactics in mountainous terrain.

4-88. Generally, the force utilizing motti tactics never becomes decisively engaged. It disrupts the enemy's supply lines, denies him warmth and shelter, infiltrates his bivouacs, and destroys his rear areas to the point where he must remain in a high state of alert. These attacks, in combination with the environment, help to destroy the enemy's will to fight. Commanders should not only develop a thorough understanding of how to apply these tactics, but also understand the conditions that may leave their own forces vulnerable to its use (see Figure 4-8 on page 4-24).

Motti tactics generally follow the sequence of:

1. Locating and fixing the enemy.
2. Isolating the enemy.
3. Attacking to defeat or destroy the enemy.

4-89. Reconnaissance is conducted to locate an enemy force moving in or toward an area that will restrict his movements to roads, trails, or linear terrain. Once identified, the force must be fixed so that it presents a linear target along the axis of advance to which it is bound. This is accomplished using obstacles and a series of squad and platoon sized ambushes and raids. Obstacles may be natural, such as snow, crevices, deep mud, steep terrain, and

water obstacles, or man-made, for example mines, landslides, avalanches, or destroyed bridges.

4-90. The ambushes and raids not only fix the enemy, they also disturb his composure, create an air of uncertainty, and prevent uninterrupted sleep and rest. Friendly units attack the enemy from the high ground. They make maximum use of night vision devices, as well as the difficult restrictive terrain. They avoid enemy security and interdict his operations. As a further result of these actions, the enemy is compelled to use more forces on security tasks. Unless the enemy can be easily defeated or destroyed, the attacking force rapidly withdraws after forcing the enemy to deploy. In general, this series of attacks confuses the enemy as to the friendly unit's exact location and intent, and slows his decision-making cycle so that he reacts ineffectively to subsequent operations.

4-91. The attacking force then isolates the enemy into smaller groups. Once isolated, the friendly force maneuvers to envelop and attacks to defeat or destroy the isolated elements. As the enemy exhausts himself in an effort to break out, the attacking force may regroup and repeat the sequence. It is imperative that the attacking force seal off the enemy and keep avenues of approach closed, and not ignore the threat to its flanks, which may increase as the attack progresses.

4-92. Overall, motti tactics wear the enemy down to a point where he is vulnerable to more direct attacks or to the point where it is no longer beneficial or feasible to continue operations in the area. Motti tactics employed alone only prove decisive over a long period of time, depending on the enemy's capabilities, strength, and resolve. Based on METT-TC, friendly forces normally must increase the operation's tempo to gain a quick, decisive outcome. Still,

**FORCES CAN USE MOTTI TACTICS
WHEN THEY:**

- **Have superior technical mobility skills necessary to negotiate Class 4 and 5 terrain**
- **Are able to operate effectively in a noncontiguous area of operations with limited support, and despite temperature extremes and inclement mountain weather**
- **Are able to navigate in high mountainous terrain, dense vegetation, darkness, storms, and fog while making good use of available cover and concealment**
- **Maintain the element of surprise**

**FORCES ARE VULNERABLE TO
MOTTI TACTICS WHEN THEY:**

- **Operate within noncontiguous areas of operations**
- **Have limited mobility skills restricting their movements to roads, trails, and Class 1 and 2 terrain**
- **Have inadequate reconnaissance and security**

Figure 4-8. Conditions Affecting the Use of Motti Tactics

these type tactics may complement other more direct offensive operations in support of the overall plan.

SECTION III – DEFENSIVE OPERATIONS

4-93. In the mountains, more so than in the lowlands, the strength of the defense depends on its selection and use of key and decisive terrain. Key and decisive terrain provides the defender—and usually denies the attacker—excellent observation and fighting positions. Reinforcing obstacles significantly enhance the natural obstacles of rugged mountainous terrain.

4-94. The immediate objective of a mountainous defense is to deny the enemy access to key terrain that helps him conduct further operations. Therefore, it is necessary to defend in terrain that restricts and contains the enemy, as well as control the high ground that dominates this terrain. The effects of rapidly changing weather, visibility, and mountain hazards must be continually assessed. The terrain provides the defender with cover, concealment, and camouflage that can deceive the enemy regarding the strength and dispositions of friendly forces. The advantages of knowing the terrain, having fortified positions, siting weapons in advance, stockpiling supplies, and identifying or preparing lateral trail networks favor the defense. They allow the defender to shift forces on the ground more rapidly than the attacker. Delaying operations are particularly effective in the mountains and can be accomplished by a smaller force. These advantages combine to make the mountains an ideal place for defensive operations. Regardless of the scale of defensive operations, key factors in achieving success in the mountains are having good observation and aggressive reconnaissance, while denying the same to the enemy.

PLANNING CONSIDERATIONS

4-95. Defending commanders must develop flexible plans for control of fire, maneuver, communications, and logistics. Initially, the attacker has the initiative and decides where and when combat will take place. The defender must be agile enough to maintain control of the heights, strike effectively, and shift his effort quickly without losing momentum and flexibility. Tactical flexibility depends on planning in detail, organizing in depth, and retaining an adequate, mobile reserve.

4-96. Although the mountains generally allow observation at greater distances, intervening terrain features and weather often prevent commanders from seeing the area of operations beyond the area to their immediate front and flanks. Consequently, commanders normally allocate more assets for reconnaissance and security, echeloned in depth and in height, to ensure that they are able to sense all aspects of the AO and gain the time needed to decisively apply combat power.

4-97. Commanders must prevent the enemy from concentrating overwhelming combat power against isolated sections of their defense. The restrictive terrain is one of the primary advantages of the mountain defender, as it interferes with the attacker's synchronization, canalizes his movement, and impedes his ability to maneuver. However, unless commanders carefully

analyze the terrain from both the friendly and enemy viewpoints, to include the horizontal and vertical perspectives, they leave themselves vulnerable to infiltration and possible attack from the flanks and rear along difficult and unexpected routes.

4-98. In the mountains, commanders usually organize for a perimeter defense to be prepared to defeat the enemy from any approach, to include those that may appear impassable. Although preparing for an all-around defense, they should weight a portion of the perimeter to cover the most probable direction of enemy attack. Rocky terrain may make it more difficult to prepare defensive positions and rapidly changing weather may halt preparations altogether. If sufficient forces are not available, the commander must economize in some areas and rely more heavily on prepared positions, to include alternate and supplementary positions, obstacles, and well-planned indirect fires to cover gaps and dead space.

4-99. The width of an area to be defended depends mainly on the degree to which terrain is an obstacle. Terrain that significantly restricts enemy movement tends to favor a larger AO. Normally, an area should be approximately as deep as it is wide, and may include the entire length and surrounding heights of a valley. Ridges that run at right angles to the enemy's direction of attack also permit increased width with less depth. A defense in depth is required in valleys that run in the direction of the enemy's attack. In either case, it is essential to have forces deploy on the dominating heights that control approach routes.

4-100. Ideally, reserves should be mobile enough to react to enemy action in any portion of the perimeter. Less mobile reserves are positioned to block the most dangerous avenues of approach and assigned on-order positions on other critical avenues. Sharply compartmented terrain may require the creation of more than one reserve. Helicopters may be used to deploy reserves, but their use depends on the availability of suitable, secure LZs and favorable weather conditions.

PREPARATION

4-101. The process of preparing the defense must begin with a thorough reconnaissance. Preparations for a mountain defense require more time than in other terrain, and as units arrive they must begin immediate preparation of their defensive positions. In some instances, technical mountaineering skills may be needed to establish effective security and to emplace crew-served weapons properly. However, commanders must weigh the advantages gained from these inaccessible positions against difficulties in repositioning and resupply. Preparations for the defense must also include installing communications, stocking forward supply points with particular attention to Class IV, emplacing medical elements, adjusting air defense coverage, and arranging for security of installations in the rear area. Commanders must ensure that time is available to develop alternate routes and positions, rehearse and time movements between positions and along routes, and rehearse counterattacks.

4-102. Commanders must seek every opportunity to recapture the initiative from the attacker and transition to offensive operations. Preparations for a counterattack in the mountains must include caching ammunition, preparing

counterattack positions and routes to attack downhill, identifying crew-served weapon positions, and establishing rally points that are usually on the reverse slope.

ORGANIZATION OF THE DEFENSE

4-103. Defensive operations in the mountains derive their strength, balance, and freedom of action from the effective use of terrain. The mobility restrictions found in mountainous areas, combined with the necessity to hold dominating ground, dictates that an area defense be used. Mountain defenses use security forces, continuous reconnaissance and combat patrols, as well as numerous observation posts. The mountain AO is usually organized into a security area, main battle area (MBA), and rear area.

SECURITY OPERATIONS

4-104. While a screening force is often thought to be the most preferable form of security in extremely rugged mountainous terrain, all forms of security operations, to include guard, cover, and area, may be employed effectively in a mountain AO based on the factors of METT-TC with particular emphasis on:

- Forces available for security operations.
- Ability to maintain a mobility advantage.
- Size of the security area and the number of avenues of approach.
- Likelihood of enemy action.
- Size of the expected enemy force.
- Amount of early warning and reaction time needed.

4-105. A screen primarily provides early warning to the protected force and is usually an economy-of-force measure. The compartmented nature of mountainous terrain often serves to create multiple gaps and exposed flanks. The rugged terrain may also serve to restrict the movement of not only advancing enemy forces, but also the movement and mobility of larger friendly security forces. In these instances, commanders may choose to use minimum combat power to observe, identify, and report enemy actions at these locations, and engage and destroy enemy reconnaissance within the screening force's capability. The screening force may be able to avoid decisive contact by withdrawing into restrictive terrain that forces the enemy to utilize difficult climbing techniques if he continues the pursuit.

4-106. In the mountains as elsewhere, the screening force should adjust to the enemy advance and continue to screen as far forward as possible, even though elements of the force may have to withdraw. Retention of selected forward positions may allow surveillance and targeting forward of the MBA, upsetting the enemy's coordination. By allowing the enemy to bypass advance positions, the screening force can facilitate counterattack to the front of the forward edge of the battle area (FEBA) by providing observation of, and access to, the flanks and rear of attacking forces.

4-107. If a significant enemy force is expected or a significant amount of time and space is required to provide the required degree of protection, commanders usually resource a guard or cover mission instead of a screen. As long as

the security force can maintain a mobility advantage over the enemy, it can effectively delay and attack the enemy force by using obstacles and the restrictive terrain to its advantage. Although utilizing a greater proportion of his combat power, the appropriate use of a guard or cover force should provide the mountain commander greater depth in his security area and the ability to defeat, repel, or fix lead elements of an enemy ground force before they can engage the main body with direct and indirect fires.

4-108. No matter the type of security used, defending forces must prevent enemy infiltration by carefully positioning observation posts (OPs) and conducting continuous patrols and ambushes. Combat reconnaissance patrols and other intelligence gathering assets observe the enemy as far ahead of friendly positions as possible and report his strength and composition, as well as his route of movement. To accomplish this, reconnaissance patrols may need to rely heavily on technical climbing skills. Ground surveillance radar and unattended ground sensors can be used effectively, but the defender must be sure to cover all gaps and dead spaces. The defender must make best use of his time to study the ground and determine all possible infiltration routes.

MAIN BATTLE AREA

4-109. In rugged mountainous terrain, it may be difficult to maintain mutual support and overlapping observation. Elements should be employed to man observation posts, assist the passage of security forces into the MBA, cover obstacles and avenues of approach by fire, screen gaps between defensive positions, and ambush enemy infiltrators.

4-110. Defensive positions along ridges or dominating heights should include as much of the forward and reverse slopes as possible to add depth and all-around security. The actual size of unit positions is terrain-dependent. At a minimum, fighting positions and observation posts should be echeloned vertically, as well as in depth. When defending a mountain valley, forces should establish fighting positions that are located on adjacent heights and in depth to permit covering the valley with interlocking fire. These positions must also be anchored to restrictive terrain or adjacent defensive forces to prevent enemy envelopment. In wooded terrain, defensive positions may be organized on the forward edge of the woods, as well as on commanding heights. Obstacles should be widely employed to slow or stop enemy movement throughout.

4-111. Mountain warfare demands that forces conduct an aggressive defense. Defending units must infiltrate enemy units and attack headquarters, supply lines, and rear areas. Smaller patrols and OPs should be deployed well forward to direct artillery fire and attack aircraft on targets of opportunity, and to conduct personnel and antiarmor ambushes. Disruption operations should be conducted to force the enemy to deploy additional assets to protect lines of communication and delay and upset preparations for the attack. In the mountains, enemy forces can frequently be isolated if they are discovered in time and reserves are effectively placed and highly mobile.

4-112. In the defense, the reserves' primary purpose must preserve the commander's flexibility. In mountainous terrain, the commander may need to rely on the reserves as his principal means of restoring his defense's integrity

or exploiting opportunities through offensive action. Because of the difficulties of movement, small reserves may be located near primary defensive positions, ready for immediate counterattack. This type of small, responsive counterattack may be much more effective than a large-scale, major counterattack. It can catch the enemy exhausted after an uphill assault and before position consolidation. Large, centrally placed counterattack forces are normally unable to intervene in time unless the terrain permits mounted movement, or sufficient helicopter lift assets are committed to the reserve force or made rapidly available.

REAR AREA

4-113. To minimize the vulnerability of sustaining operations and extended lines of communication, command and control, as well as support operations, in the rear area must be dispersed, redundant, and as far from potential enemy approaches as possible. Because of limited space available in the rear area, the commander must be careful in selecting and locating positions for combat service support activities. These positions are likely to be confined to small valleys. Therefore, they are high-priority targets for enemy artillery and air attack or raids by small combat patrols, particularly at night or in bad weather. When possible, combat service support elements must avoid the most obvious positions and occupy atypical sites. However, they should be in the vicinity of a defined road network and an air loading area, even if the network or area is within Level II. Locating base defenses at Level II elevations may allow more access to supply bases for air resupply during inclement weather, such as the heavy fog often encountered in valleys and at lower elevations.

4-114. A perimeter defense is planned for each combat service support unit within the defensive area. Defensive positions should be selected on the dominating high ground. Sensors, OPs, and radars are used to cover avenues of approach and gaps between positions. Rear area forces must routinely conduct patrols and ambushes around the perimeter, especially at night and during other periods of limited visibility. Air defense assets should be located to protect rear area facilities. Tactical combat forces (TCF) must be prepared to respond rapidly to rear area threats and should be prepared to move to any of their objectives by multiple routes. However, units within the rear area must not fall into the trap of relying solely on a TCF for their security. No matter how well-organized or mobile the TCF, rear area units must provide their own well thought-out and active security measures, even at the cost of a reduced ability to sustain the force.

REVERSE SLOPE DEFENSE

4-115. Reverse slope defenses apply particularly well to mountain operations and pursue offensive opportunities through surprise and deceptive operations by defending in a manner for which the enemy is unprepared. This defense seeks to reduce the effects of massed indirect fire from mortar, artillery, and close air support, and draws the battle into the small arms range of infantry weapons. The overall goal is to make the enemy commit his forces against the forward slope of the defense, causing his forces to attack in an uncoordinated fashion across the exposed topographical crest. Once this type of defense is

employed, subsequent use may be of limited value, due to the loss of the key element of surprise.

4-116. All or parts of the defending force may use reverse slope techniques. In many instances, mountainous terrain favors a defense that employs combined forward and reverse slope positions to permit fires on enemy approaches around and over the crest and on the forward slope of adjacent terrain features. Key factors to this type of defense are mutually supporting covered and concealed positions, numerous natural and man-made obstacles, the ability to bring fire from all available weapons onto the crest, and a strong and mobile counterattack force.

4-117. The reverse slope defense is organized so that the main defensive positions are masked from enemy observation and direct fire by the topographical crest (see Figure 4-9). It extends rearward from the crest only to the maximum effective range of small arms fire. Observation and fires are maintained over the entire forward slope as long as possible to continue to destroy advancing enemy forces and prevent him from effectively massing for a final assault. A successful reverse slope defense is based on denying the topographical crest to the enemy, either by fire or by physical occupation. Although the crest may not be occupied in strength, control of the crest by fire is essential for success. For more detailed discussions of the reverse slope defense, see FM 3-100.40 and FM 3-21.30.

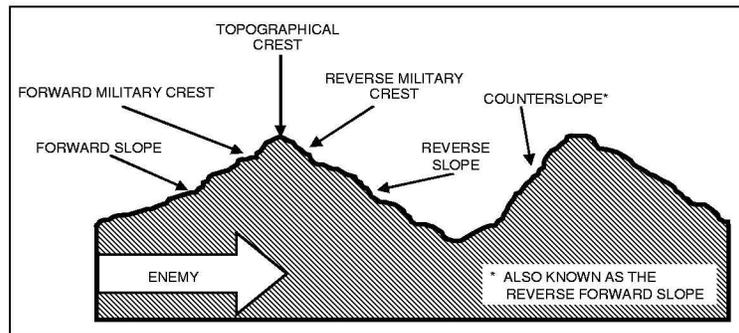


Figure 4-9. Reverse Slope Defense

It extends rearward from the crest only to the maximum effective range of small arms fire. Observation and fires are maintained over the entire forward slope as long as possible to continue to destroy advancing enemy forces and prevent him from effectively massing for a final assault. A successful reverse slope defense is based on denying the topographical crest to the enemy, either by fire or by physical occupation. Although the crest may not be occupied in strength, control of the crest by fire is essential for success. For more detailed discussions of the reverse slope defense, see FM 3-100.40 and FM 3-21.30.

RETROGRADE OPERATIONS

4-118. Retrograde operations of delay and withdrawal can be conducted in mountainous terrain with fewer assets because of the mobility difficulties of an advancing enemy. Delaying operations are particularly effective in the mountains. Numerous positions may exist where elements as small as a machine-gun or sniper team can significantly delay a large force. When conducting retrograde operations in mountainous terrain, the friendly force must accomplish several tasks.

- It must make maximum use of existing obstacles. However, the addition of relatively few reinforcing obstacles, such as the antitank mining of a route with very steep sides, often increases the value of existing obstacles.
- The force must conduct detailed reconnaissance of routes to rearward positions. Routes of withdrawal are not as numerous in mountainous terrain and often do not intersect as they do on flat terrain. These

factors complicate subsequent link-up operations and necessitate meticulous planning.

- It must protect the flanks and rear to prevent encirclement, particularly by air assault. There are only a few LZs and they can significantly influence the outcome of a battle. At a minimum, they must be covered by fire.

STAY-BEHIND OPERATIONS

4-119. The compartmented terrain in the mountains lends itself to the employment of stay-behind forces as a tool for offensive action. Stay-behind operations involve the positioning of friendly elements within operational areas before the enemy advances through the area. Stay-behind forces conceal their location and allow themselves to be bypassed as the enemy advances. (Figure 4-10 outlines the important tasks that stay-behind forces can accomplish for the mountain commander.)

4-120. Stay-behind forces may be positioned forward of the FEBA, in the MBA, and not participate in the initial fight, or, under certain conditions, in the MBA after the fighting has started. When planning for stay-behind operations in the mountains, commanders must consider the following:

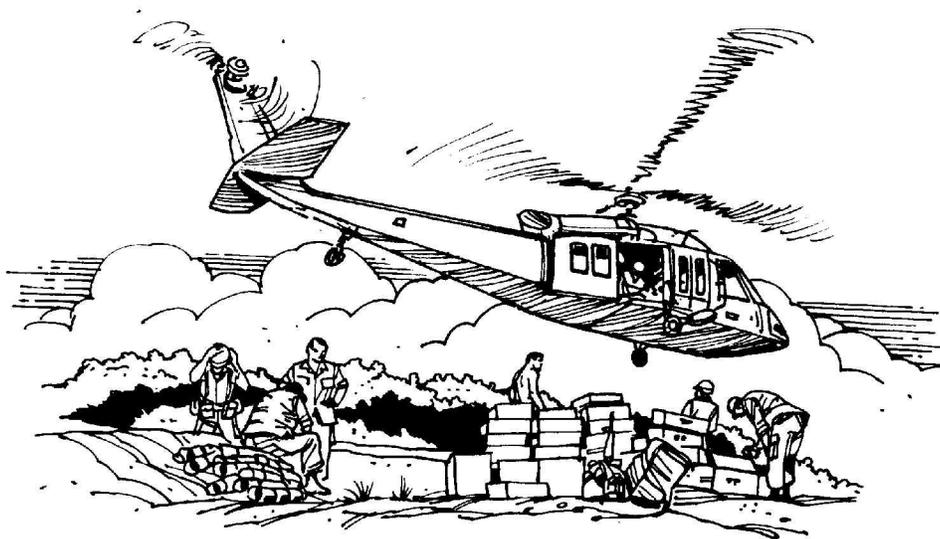
- Stay-behind forces should be a combined arms force that includes engineers.
- Indirect fire support or close air support should be available throughout their operations.
- Return routes must be well planned and reconnoitered in advance. Exfiltration, regardless of element size, should follow covered and concealed routes, and rally points should be designated forward of and behind the lines of friendly forces. Reentry must be carefully coordinated to prevent fratricide.
- After an attack, stay-behind forces may be unable to reach a hide position to subsequently return to friendly lines by exfiltration. If this occurs, they must be prepared to conduct a breakout.
- The tactical situation and logistics supplies that were stockpiled or cached in the AO have an impact on the length of time stay-behind forces remain in enemy territory.

- **Attack the enemy throughout the depth of his formations**
- **Disrupt the cohesion of the enemy offense by interrupting lines of communication and logistics**
- **Detract from the enemy's main effort by forcing him to allocate combat forces to rear areas**
- **Provide immediate intelligence**
- **Call for and control indirect fire and close air support**

Figure 4-10. Tasks for Mountain Stay-Behind Forces

Chapter 5

Logistics and Combat Service Support



Mountainous terrain poses great challenges to combat service support (CSS) forces and complicates sustaining operations. Existing roads and trails are normally few and primitive, and cross-country movement is particularly demanding. Highways usually run along features that have steep slopes on either side, making them vulnerable to disruption and attack. Rivers become major obstacles because of rapid currents, broken banks, rocky bottoms, and the lack of bridges. Landslides and avalanches, natural as well as man-made, may also pose serious obstacles to CSS operations. Mountainous areas have wide variations in climate and are subject to frequent and sudden changes of weather that may preclude reliance on continuous aviation support. Together, these conditions compound the obstacle-producing effects of mountainous terrain and create major challenges for the CSS planner. Therefore, the forward distribution of supplies may depend upon the knowledge, skill, and proficiency of CSS personnel in both basic mountaineering and aerial resupply operations.

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HISTORICAL PERSPECTIVE

The Importance of Lines of Communications: The Satukandav Pass (Soviet-Afghan War, November-December 1987)

One of the characteristics of the Soviet-Afghan War (December 1979 - February 1989) was the attempt by both sides to control the other's lines of communications (LOCs). In an effort to deprive the guerrillas of their source of sustainment, the Soviets used various methods to drive the rural population into exile or into cities. For their part, the Mujahideen regularly interdicted supply routes through the establishment of blocking positions and vehicular ambushes. In some regions, they were able to effectively interdict supply routes for weeks, months, and even years at a time. The Soviet main supply route was a double-lane highway network winding through the rugged and inhospitable Hindu Kush Mountains. The continued Soviet presence in Afghanistan depended, in large part, on their ability to keep the roads open. Therefore, much of heavy Soviet combat was a fight for control of this road network, with this control often changing hands during the course of the war.

In the fall of 1987, the Mujahideen had established a series of blocking positions that severely limited the supply of weapons, ammunition, and food to Soviet forces in the Khost district. In response, the Soviets planned and

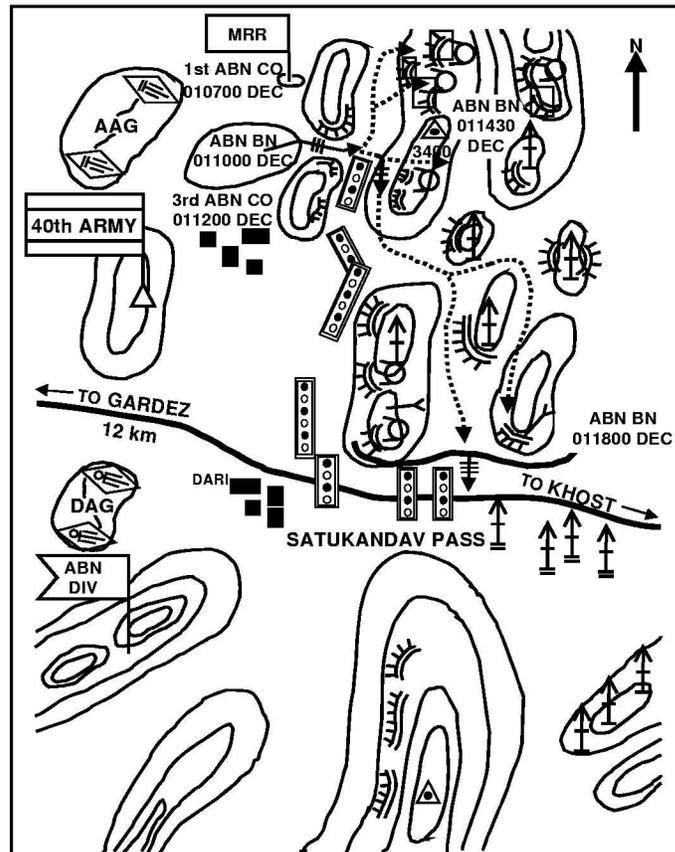


Figure 5-1. Satukandav Pass

conducted Operation Magistral, “main highway,” to open the LOCs (see Figure 5-1). The guerrilla forces had established strong positions in the Satukandav Pass, virtually the only way through the mountains between Gardez and Khost. For the operation, the Soviets massed a motorized rifle division, airborne division, separate motorized rifle regiment (MRR), separate airborne regiment, various 40th Army regiments, special forces, and other subordinate units, and regiments from the Afghan Armed Forces. On 28 November, in order to determine the location of Mujahideen positions, particularly air defense systems, the Soviets conducted a ruse in the form of an airborne assault using dummy paratroopers. When the Mujahideen fired at the dummies, Soviet artillery reconnaissance was able to pinpoint enemy strong points and firing positions. The Soviets hit these positions with air strikes and a four-hour artillery barrage. The next day, however, an MRR failed to make its way up the foothills to seize the dominant terrain along the crest, and suffered heavy casualties. The 40th Army Commander, General Gromov, nevertheless, decided to continue to press his advance using the 1st Airborne Battalion and a battalion of Afghan commandos. On 1 December, two airborne companies captured key terrain and used this to support the decisive operation against the dominant peak to the south. This flanking attack took the Mujahideen by surprise and they began to withdraw. While calling in artillery fire on the retreating guerrilla forces, primarily on the reverse slope and along the probable avenue of approach for the commitment of enemy reserves, the Soviet battalion commander used this hard-won, key terrain to support a simultaneous, two-prong attack to the south toward the Satukandav Pass. Now it was the Soviets who were in a position to cut off supplies, especially fresh drinking water, from the Mujahideen. The latter were forced to withdraw, and the two battalions captured the pass. However, while the operation itself was a success, Soviet and Afghan Army forces could keep the road open for only 12 days, after which the Mujahideen once again cut off the supply route to Khost.

Both sides recognized the vital importance of LOCs, and this shift of LOC control was a constant feature throughout the entire duration of the Soviet-Afghan War. The Mujahideen’s ability to interdict the LOCs prevented the Soviets from maintaining a larger occupation force there, a key factor in the eventual Soviet defeat.

Compiled from *The Other Side of the Mountain* and *The Bear Went Over the Mountain*.

SECTION I – PLANNING CONSIDERATIONS

5-1. Mountainous areas of operations dictate that commanders foresee needs before demands are placed upon CSS personnel. The main logistical differences between mountain operations and operations in other terrain are a result of the problems of transporting and securing material along difficult and extended lines of support. Logistics support must emphasize a continuous flow of supplies to specific locations, rather than the build-up of stocks at supply points along the main supply routes. Supply point operations alone are insufficient; the proposed support structure must plan for redundancy in the ability to distribute supplies directly to units operating from predetermined supply routes. If possible, commanders should plan to

use multiple supply routes designed to support maneuver elements moving on separate axis.

5-2. Commanders must be concerned not only with the sustainment of current operations but also with the support of future operations. A detailed logistics preparation of the theater (LPT) to identify the potential lines of communication plays a major part in determining the conduct of CSS operations. A detailed reconnaissance should be conducted to determine:

- The type and maximum number of vehicles that the road network can support in the area. New roads may need to be constructed or improvements made to existing ones to support protracted operations in isolated areas.
- Classification of bridges.
- Suitable sites for drop zones (DZs), loading zones (LZs), and short, tactical airstrips.
- Availability of water sources.
- Availability of local resources, facilities, and service and support activities.

5-3. Because of terrain constraints, it may be necessary to disperse support units over a wider area and ensure that supplies are positioned closer to supported units. Dispersion reduces vulnerability of CSS assets, which also creates problems with command, control, and security. CSS units are often high-priority targets, and must ensure adequate protection against ground and air attacks.

5-4. In mountainous terrain, battalion CSS elements are normally echeloned into combat and field trains to increase responsiveness, provide adequate space, and decrease the logistics footprint. Combat trains are routinely located in ravines or valleys on the rear slope of the terrain occupied by the unit. This permits the personnel officer (S1) and logistics officer (S4) to operate in close proximity to the tactical operations center (TOC), and allows them to keep abreast of unit requirements.

5-5. In the mountains, unresolved logistical problems can quickly lead to mission failure. Ground operations may increase fuel consumption rates of individual vehicles by 30 to 40 percent, requiring more frequent resupply operations. The operation of equipment in mountainous terrain has proven that maintenance failures far exceed losses due to combat, and most breakdowns can be attributed to operator training. Air operations are characterized by a significant increase in lift requirements; however, increased elevations decrease aircraft lift capabilities.

5-6. Commanders must carefully consider combat loads in the mountains, based upon a thorough mission analysis. Excess equipment and supplies reduce the efficiency of the individual soldier and seriously impede

operations. In steep terrain above 1,500 meters (5,000 feet), soldier loads may need to be reduced by nearly 50 percent. Commanders must develop priorities, accept risk, and require the combat force to carry only the bare essentials needed for its own support. Nonessential equipment should be identified, collected, and stored until it is needed. In situations where there are conflicts between the weight of ammunition and weapons, experience has shown that it is better to carry more ammunition and fewer weapons. In the mountains, commanders should strive to achieve the imperatives indicated in Figure 5-2.

- **Limit supplies to essentials.**
- **Lighten the individual soldier's combat load.**
- **Improvise methods and supply sources, to include utilizing captured enemy supplies and equipment.**
- **Use aviation assets to increase responsiveness.**
- **Anticipate maintenance requirements.**
- **Develop plans that place realistic demands on the CSS system.**

Figure 5-2. Mountain Supply Imperatives

SECTION II – SUPPLY

5-7. Units operating in mountainous terrain transport supplies by a combination of wheeled vehicles, oversnow vehicles, indigenous pack animals and personnel (see FM 3-05.27), assisted by Army and Air Force lift assets. These combinations depend on equipment availability, location of combat units, type of terrain, and weather. However, any combination of resupply usually includes combat soldiers man-packing supplies to their positions.

5-8. Since combat operations in the mountains are decentralized, CSS operations are correspondingly decentralized. This decentralization serves to create heavier man-loads, while rough, steep terrain decreases the amount soldiers are able to carry. Although most soldiers are eventually able to acclimate themselves to higher elevations, their pace and subsequently the overall pace of the entire operation slows down as elevation increases.

5-9. Mountain warfare is highly dependent on accurate logistical planning if supply operations are to function smoothly. To win in any area of operations (AO), commanders normally seek to move and strike as rapidly as possible. Rapidly changing tactical situations may cause long supply lines, resulting in delay or complete disruption of supply operations. To mitigate these risks, situational understanding, rapid decisions, and continuous coordination between tactical and logistical planners are essential. Stockpiling and caching supplies may also help to decrease the risks to resupply.

5-10. The total tonnage of supplies required by the force may also decrease. For example, while individual vehicle petroleum, oils, and lubricants (POL) consumption may increase, overall consumption may decrease because of lower vehicle movement. The quantity of supplies needed by the individual soldier normally increases. Soldiers consume more food because of increased

energy expenditure, and need many additional items of equipment, such as extra clothing, sleeping bags, climbing equipment, tents, and stoves, all of which must be stored and transported.

SUPPLY ROUTES

5-11. Main supply routes are generally limited to the roads located along major valleys and, through necessity, to the smaller, more restrictive trails that follow or parallel the ridgelines. The limited number of routes increases the volume of traffic and places heavy demands on engineer units to maintain them. In most cases, engineer units require assistance in clearing and developing, as well as in securing, these routes. Travel times for ground transportation assets are significantly increased due to the generally poor quality of mountain roads and trails, frequent switchbacks, and steep grades that require lower vehicle speeds. Traffic control assumes increased importance due to the limited number of routes in the mountains, and may require an increased number of military police dedicated to the task of battlefield circulation control. In particular—

- Existing roads should be rapidly analyzed for bottlenecks, deployment areas, passing places, and turnarounds for various vehicles.
- Routes should be classified as one- or two-way, and schedules developed for the use of one-way routes.
- Signs should be placed for both day and night moves on difficult and dangerous routes.
- Whenever possible, separate routes should be designated for vehicular and dismounted movement. Additionally, separate routes should be designated for wheeled and tracked vehicles, particularly if the latter are likely to damage road surfaces.

5-12. The enemy will emphasize destroying logistical units and interdicting supply activities. Enemy units will infiltrate and seize key terrain that dominates supply routes in an effort to disrupt and isolate units from their logistics support. Using mountain trails and roads without securing the high ground on both sides invites ambush. Patrols must be continually conducted at irregular intervals to verify the status of roads and prevent enemy infiltration. Patrols must be continuously alert for ambush and they must be skilled at locating and identifying mines. However, a combination of patrols and aerial reconnaissance is the best means of providing route security. Observation posts on dominant terrain along supply routes are also essential for early warning of enemy infiltration into rear areas.

5-13. Most often, units have to use the narrow ridge trails as alternate supply routes, in some instances as main supply routes, to reduce the volume of traffic on the main supply routes located along valley floors. This involves movements in much more restrictive terrain and exposure to excellent observation and fire by the enemy. Supply columns moving along separate

routes face the same problems as combat units; they face the difficulties of being able to provide mutual support due to compartmented terrain, should one column come under attack. Movement of supplies at night may reduce vulnerability to enemy attack, but night marches present other hazards due to the difficult terrain, and require daylight reconnaissance, careful route preparations, and using guides.

CLASSES OF SUPPLY

CLASS I: RATIONS AND WATER

5-14. The strenuous activities required during mountain operations increase caloric requirement to 4,500 calories or more per day. Improper or too little food means soldiers will lack the stamina to accomplish the mission. Although combat rations are normally used, unitized group rations (UGRs) should be provided once a day if the situation permits. Individual packages of oatmeal and dehydrated soup mixes should be issued if the UGR cycle cannot be maintained.

5-15. In abrupt ascents to high altitude, soldiers do not have time to acclimate themselves, so their entire circulatory system labors to supply oxygen to the body. In this situation, standard rations are hard to digest and special rations, such as the ration, cold weather (RCW), that allow soldiers to eat light and often should be procured. The totally self-contained operational ration consists of one full day's feeding in a flexible, white-camouflaged meal bag. It contains cooked, freeze-dried, or other low moisture entrees, as well as a variety of items such as oatmeal, a nut-raisin mix, and fruit-cookie bars. The RCW provides sufficient calories (approximately 4,500 kilocalories) to meet the increased energy expenditure during heavy exertion, while limiting sodium and protein content to reduce the risk of dehydration. Because of rapidly changing weather conditions and the difficulty of resupply, each soldier may need to carry two to three days' supply of rations. However, this increases the soldier's load by approximately 10 to 15 pounds.

5-16. Proper water production, resupply, and consumption are essential and a constant challenge during mountain operations. In low mountains, planners should count on at least four quarts of water per soldier per day when static and up to eight quarts per day when active. In high mountains, planner should increase those requirements by about two quarts per soldier. In the mountain environment, medical care often requires an increased water supply and must be considered as part of the original planning and contingency factors.

5-17. Units should always be prepared to use natural water sources to help reduce the logistics burden. However, far above the timberline, water is extremely difficult to find. Special measures must be taken to protect it from freezing in cold weather, such as placing canteens in the chest pockets of the extended cold weather clothing system (ECWCS) coat, hanging a two-quart canteen on a strap under the coat, or utilizing a camel-back type, commercially available, canteen under overgarments. Purification and chemical sterilization are always necessary no matter how clean mountain

water may appear. Micro-organisms present in mountain water may cause serious illness and rapidly degrade the strength of a unit. If above ground water sources cannot be located or are not reasonably available, drilling for underground sources may become a critical engineer task. Once engineer units access the water, quartermaster units have responsibility for completing the water points and purifying the water.

CLASS II: GENERAL SUPPLIES

5-18. General supplies include expendable administrative items, individual clothing and equipment, tentage, and other items authorized by common tables of allowance. All units must deploy with enough Class II items to last until routine resupply can be established. Special items, such as extended cold weather clothing, gloves, climbing equipment, extended cold-weather sleep systems, batteries, and one-burner cook stoves, will be in great demand. Due to the rugged nature of the terrain, mountain operations also increase requirements for replacement items of individual clothing and equipment. Combat boots, for example, may be expected to last approximately two weeks in harsh rocky terrain.

CLASS III: FUEL AND PACKAGED PETROLEUM PRODUCTS

5-19. Individual vehicles need much more fuel in mountainous terrain. However, limited road nets and steep slopes reduce the volume of vehicle traffic and overall fuel consumption. The heavy reliance on aviation assets for resupply and movement increases aviation fuel requirements. A commander must routinely plan for the emplacement of a forward arming and refueling point (FARP) within their AO to support intensive aviation operations. Battalions should establish a fuel point in the field trains using collapsible fuel drums. These drums should be operational as soon as the field trains are established and prepared to receive fuel from the forward supply company as soon as it arrives. When terrain makes refueling operations vulnerable to attack, units should conduct forward refueling using supply point distribution, and dispense fuel to unit vehicles using the tailgate technique. The lack of suitable terrain normally increases the percentage of forward refueling done by this method.

5-20. At 600 meters (2,000 feet), multi-fuel cook stoves operate at about 75 percent efficiency. When soldiers refuel cook stoves, they must avoid using automotive fuel. Fuel points must supply units with refined or white gasoline that is specifically produced for pressurized stoves. Relatively large quantities of this fuel will be used when procuring water and preparing food. Adequate quantities of five-gallon cans, nozzles, and one-quart fuel bottles must be on-hand before deployment.

CLASS IV: CONSTRUCTION, BARRIER, AND FORTIFICATION MATERIALS

5-21. Soldiers should make maximum use of local materials to reduce Class IV requirements and demands on the transportation system. Gabion-type material is especially versatile during mountain operations. Gabions are widely used in the mountains for constructing obstacles, fighting positions,

anchors, mountain installations, traverse platforms, and helicopter LZs; for creating landslides or rockfalls; and for repairing roads. Units should stock adequate quantities of easily transportable sizes of reinforcing mesh and other suitable materials for constructing gabions.

CLASS V: AMMUNITION

5-22. Because of terrain, ammunition resupply is difficult, making strict fire control and discipline an absolute necessity. Ammunition transfer points need to be as far forward as possible without revealing friendly unit locations or placing ammunition stocks at risk of capture or destruction. Direct delivery to the user may be required using aerial resupply. Innovation and flexibility are critical. In the mountains, the traditional mixes of tank ammunition may be less effective. Depending upon the specific threat, more rounds may be needed to attack light vehicles and fortified positions and less may be needed to engage tanks. Ammunition consumption for direct fire weapons may be low, however, consumption of indirect fire munitions, such as grenades, mortars, and artillery, may be high because of the dead space common to mountainous terrain. Planners must ensure that increased consumption of indirect fire munitions is included in computing required supply rates.

CLASS VII AND IX: MAJOR END ITEMS AND REPAIR PARTS

5-23. Rugged terrain and climate extremes cause an increase in repair parts consumption. However, overall vehicle utilization decreases in many situations. Because it is difficult to transport large end items to forward units, the commander must place additional emphasis on preventive maintenance and repair.

CLASS VIII: MEDICAL SUPPLIES

5-24. The medical platoon obtains medical supplies for the battalion from the supporting forward support medical company (FSMC) or similar task organized medical element. Medical supply organizations may distribute supply by various means: supply point distribution, unit distribution, or a combination of both. Mountainous terrain necessitates using supply point distribution to a great extent. Medical supply activities must maximize use of empty evacuation assets moving forward to execute unit distribution of supplies as often as possible. The terrain will severely constrain ground movement operations. Pre-planned unit distribution via air assets is a must for emergent situations, such as mass casualty scenarios. Medical supplies must have a high priority for movement. Distribution of Class VIII via air lines of communications (LOCs) should occur as often as tactically feasible.

SECTION III – TRANSPORTATION AND MAINTENANCE

5-25. Transportation assets for mountain operations are often limited, and their use requires sound planning. Although vehicles are used to move supplies as far forward as possible, they may not be able to reach deployed units. Using smaller cargo vehicles with improved cross-country mobility and

dedicated aircraft is paramount to sustaining units in the mountains. Locally obtained animals, indigenous personnel, or combat soldiers must often move supplies from roads and trails to unit positions. The poor quality of road networks requires increased engineer effort. The rugged mountain terrain aids in infiltration increasing security requirements along the route.

5-26. Air resupply should always be considered to reduce the transportation burden on ground assets. Therefore, support personnel should be well-trained in aerial resupply and sling-load operations. Aerial resupply, either by parachute drop, free drop, or cargo helicopter, may be available for a variety of tactical situations. However, unpredictable weather and air currents, cloud cover, and lack of suitable landing zones make aerial delivery unreliable, and higher elevations decrease overall aircraft lift capabilities. The integrated use of available helicopter transport should be used for forward transport of mail, replacements, returnees, and personnel service support providers, such as chaplains and finance support teams.

5-27. Fixing equipment as far forward as possible takes on added importance during mountain operations. In low mountains, equipment recovery and maintenance teams are critical in keeping limited routes clear and returning damaged vehicles to the battle in the shortest possible time. In high mountains, these teams are generally less critical to units operating there because terrain often limits vehicle use. Helicopter repair teams are critical in all mountainous environments due to helicopters flying at or near the maximum limits of their operational capabilities to meet increased needs for helicopter support. In all cases, maintenance turn-around time increases to compensate for fatigue and the other effects of the environment on maintenance personnel. Figure 5-3 lists some of the critical repair parts that often fail or require frequent replacement during mountain operations.

- Tires
- Tracks
- NVG Batteries
- Communications Equipment
- Cooling Systems

Figure 5-3. Key Repair Parts

5-28. Drivers well trained in proper maintenance and driving techniques eliminate a great deal of unnecessary maintenance and reduce maintenance requirements and vulnerable bottlenecks. All soldiers must devote increased attention to applicable FMs and TMs for their weapons and equipment and must conduct preventative maintenance, to include the availability and use of suitable cleaning solvents and lubricants, appropriate for the weather and terrain conditions.

SECTION IV – PERSONNEL SUPPORT

5-29. Personnel support in the mountains is not unlike that provided to other types of operations except for the limitations on soldiers and equipment posed by the environment. Key personnel support missions are to provide manning and personnel service support to unit commanders, soldiers, and Army civilians.

5-30. Personnel units normally depend on large quantities of automation equipment to successfully accomplish their mission. Adverse weather and rugged terrain may decrease their reliability and commanders should take extra precautions to protect this equipment. Additionally, the difficulty in establishing and maintaining communications may require an increased reliance on manual strength reporting until communications and automated systems are firmly established.

5-31. Postal services establish the link between soldiers and their family and friends and assist in defeating the isolation caused by the compartmented terrain and the resulting dispersion of units. However, the limited lines of communications in mountainous terrain may adversely affect mail distribution. Inefficient distribution of mail can quickly undermine morale, regardless of the AO. The timely delivery of mail is especially important in countering the shock of entering a new environment. Commanders should consider devoting a high priority to the distribution of mail on arrival in the theater of operations. FM 1-0 describes in detail the critical personnel systems and functions essential to providing manning and personnel service support.

SECTION V – COMBAT HEALTH SUPPORT

PLANNING

5-32. Combat health support (CHS) in the mountains is characterized by–

- Difficulty in accessing casualties in rugged terrain.
- Increased need for technical mountaineering skills for casualty evacuation.
- Longer periods of time needed for casualties to be stabilized.

5-33. When planning CHS, commanders must consider the tactical situation, the nature of the terrain, and speed of movement along the chain of evacuation. Aid stations should be centrally located in relation to supported units. The exact location should be based on the ability to provide shelter from the elements, cover and concealment from the enemy, ease of evacuation, and expected casualty rates.

5-34. The decentralization in the mountain area of operations also forces the decentralization of CHS. Commanders may need to establish casualty collection points, operated by aidmen from the evacuation section, to support isolated elements. These points are designated at intermediate points along the routes of evacuation where casualties may be gathered. Additionally, multiple ambulance exchange points may be required to transfer casualties from one type of transportation to another.

EVACUATION

5-35. Aeromedical evacuation remains the preferred form of casualty evacuation in mountain operations. Aircraft provide the best capability of evacuating casualties from isolated locations and transporting them to treatment centers. However, in many instances, even lightly wounded personnel may not be able to move unassisted over rough terrain and LZs may not be available.

5-36. Medical evacuation teams must complete reconnaissance and install necessary evacuation systems along each evacuation route before the onset of casualties. Litter relay stations may be required at predetermined points to conserve the stamina of litter bearers and accelerate evacuation. The evacuation plan must include measures to care for wounded soldiers at points along the route of evacuation where delays are possible. The plan must also depict all evacuation routes and provide for proper disposition of medical personnel along the lines of evacuation (see FM 4-02.2). Evacuating the

wounded from mountain combat zones normally requires a larger number of medical personnel and litter bearers than on flat terrain. The number and type of evacuation systems depend on mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC) and the factors listed in Figure 5-4.

- **The patient's condition**
- **Anticipated casualty rate**
- **Importance of rapid movement**
- **Number of available evacuation teams**
- **Number of evacuation routes available**
- **Transportation assets and equipment available**
- **Availability of suitable and secure LZs**

Figure 5-4. Factors Affecting Evacuation Systems

MOUNTAIN EVACUATION TEAMS

5-37. As the battle to control the heights evolves, combatants attempt to exploit technical aspects of terrain. Consequently, commanders must anticipate the need for evacuation teams, normally Level 2 mountaineers, that have the capability to reach, stabilize, and evacuate casualties in rugged terrain. Ground evacuations are generally classified as steep slope (non-technical) or high angle (technical). The mission of trained mountain evacuation teams is to move casualties over cliffs, obstacles, and other technical terrain that would significantly impede the mobility of standard litter bearers. Using evacuation systems to negotiate obstacles shortens routes and increases the speed of evacuation.

5-38. Because units normally deploy over a wide area and the availability of qualified technical evacuation teams is likely to be limited, all soldiers should be trained to conduct less technical, steep-slope evacuations. Two of the most qualified evacuation teams should be identified in each battalion-sized unit prior to planned operations. They should be designated as the battalion's technical evacuation assets and should undergo more advanced

mountaineering training and rigorous evacuation training. These soldiers can also develop and teach a program of instruction that will increase the proficiency of the company evacuation teams.

5-39. Mountain evacuation teams must install the necessary evacuation systems before casualties occur. They must man the systems, move casualties over the obstacle until the evacuation route is no longer required, disassemble the system, and redeploy as necessary. Depending on the specific terrain, evacuation teams may demand extensive additional training in some of the areas listed in Figure 5-5.

TREATMENT

5-40. Treatment of the wounded in forward areas by medical personnel is extremely difficult in restrictive terrain, since even a single company is often deployed over a wide area. Combat in the mountains demands a greater reliance on self-aid, buddy-aid, and unit combat lifesaver techniques. Emphasis must be placed on lifesaving and life-preserving measures to be performed before medical personnel arrive. Unit combat lifesavers must be identified and trained to perform in the absence of medics. Units operating in mountainous areas should strive to meet or exceed Army standards for the number of combat lifesavers required for their specific unit. See FM 4-02.92 for more information on combat lifesavers.

5-41. Soldiers in mountain regions are exposed to many and varied types of illnesses and injuries. Appendix A describes the cause, prevention, symptoms, and treatment of common mountain illnesses and injuries.

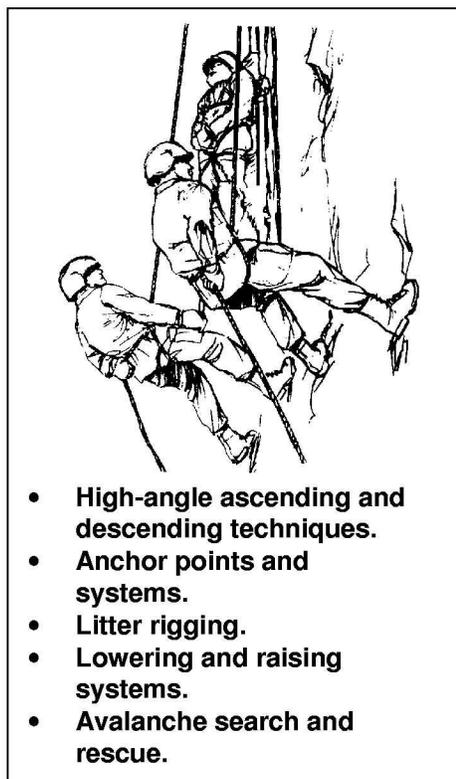


Figure 5-5. Mountain Evacuation Team Tasks

Appendix A

Mountain Illnesses and Injuries

Table A-1. Chronic Fatigue and Its Effects

| CHRONIC FATIGUE (ENERGY DEPLETION) | | | |
|--|--|---|--|
| CAUSE | PREVENTION | SYMPTOMS | TREATMENT |
| <p>Low blood sugar.</p> <p>Sources of energy are depleted.</p> <p>Insufficient caloric intake.</p> | <p>Provide adequate food (type and quantities).</p> <p>Monitor food intake and ensure soldiers eat 4,500 calories or more per day.</p> <p>Eat small, frequent meals rather than large, infrequent meals.</p> <p>Snack lightly and often.</p> <p>Increase amounts of fat in diet.</p> | <p>Difficulty sleeping.</p> <p>Fatigue, irritability, and headache.</p> <p>Difficulty thinking and acting coherently -- impaired judgement.</p> <p>Victims begin to stumble and become clumsy and careless.</p> <p>Energy depletion resembles and aggravates hypothermia. The body does not have enough fuel to maintain proper body temperature. As a result inadequate sources of energy, coupled with cold, create a compound or synergistic effect.</p> | <p>Proper diet and rest.</p> <p>Treat synergistic effects if required.</p> |

Table A-2. Dehydration and Its Effects

| DEHYDRATION | | | |
|--|---|---|---|
| CAUSE | PREVENTION | SYMPTOMS | TREATMENT |
| <p>Loss of too much fluid, salt, and minerals due to poor hydration.</p> <p><u>Contributing Factors:</u> Water loss occurs through sweating, breathing, and urine output. In cold climates, sweat evaporates so rapidly or is absorbed so thoroughly by clothing layers that it is not readily apparent.</p> <p>In cold weather, drinking is inconvenient. Water is hard to resupply, heavy to carry, and freezes in colder climates.</p> <p>Lack of humidity in the dry mountain air.</p> <p>Diminished thirst sensation induced by hypoxia.</p> | <p>Drink 3 to 4 quarts of water per day when static and up to 8 quarts during increased activity.</p> <p>Adequate rest.</p> <p>Avoid caffeine (coffee, tea, soda) and alcohol, as they compound dehydration.</p> <p>Increase command supervision.</p> <p>Keep canteens full.</p> <p>Use flavored powdered drink mixes to encourage water consumption.</p> | <p>Generally tired and weak.</p> <p>Mouth, tongue, and throat become parched and dry, and swallowing becomes difficult.</p> <p>Darkening of urine.</p> <p>Constipation and painful urination.</p> <p>Loss of appetite.</p> <p>Rapid heartbeat.</p> <p>Headache, dizziness, and nausea with or without vomiting.</p> <p>Difficulty focusing eyes.</p> <p>Dehydration compounds the effects of cold and altitude.</p> | <p>Sufficient hydration to offset water loss.</p> <p>Rest.</p> <p>Severe cases may require an IV.</p> <p>Insulate as required and evacuate.</p> |

Table A-3. Giardiasis and Its Effects

| GIARDIASIS (PARASITICAL ILLNESS) | | | |
|---|---|--|---|
| CAUSE | PREVENTION | SYMPTOMS | TREATMENT |
| <p>Parasitical illness contracted from drinking unpurified water.</p> | <p>Drink only potable water.</p> <p>Boil water for 3 to 5 minutes.</p> <p>Use approved water purification tablets or filters.</p> <p>Keep water containers clean.</p> | <p>Abdominal pain.</p> <p>Weakness and nausea.</p> <p>Frequent diarrhea and intestinal gas.</p> <p>Loss of appetite.</p> | <p>Proper hydration with potable water.</p> <p>Evacuation and prescribed medications.</p> |

Table A-4. Hypoxia and Its Effects

| HYPOXIA | | | |
|--|---|--|-------------------------------|
| CAUSE | PREVENTION | SYMPTOMS | TREATMENT |
| Rapid ascent to high altitudes (above 3,000 to 4,000 meters or 10,000 to 13,000 feet). | Acclimatization. Slow ascent. Limited activities. Long rest periods. | Impaired judgment, perception, and higher mental functions increasing with altitude. | Evacuation to lower altitude. |

Table A-5. Acute Mountain Sickness (AMS) and Its Effects

| ACUTE MOUNTAIN SICKNESS (AMS) | | | |
|--|---|--|---|
| CAUSE | PREVENTION | SYMPTOMS | TREATMENT |
| Rapid ascent to high altitudes (2,400 meters or 8,000 feet). | Acclimatization. Staged and/or graded ascent. During stops, no strenuous activity and only mild activity with frequent rest periods. Increased carbohydrate intake (whole grains, vegetables, peas and beans, potatoes, fruits, honey, and refined sugar). Acetazolamide prescribed by a physician. | Headache and fatigue. Insomnia, irritability, and depression. Coughing and shortness of breath. Loss of appetite, nausea, and vomiting. Dizziness. Swelling of the eyes and face. | Stop and rest. Symptoms will normally subside in 3-7 days if soldiers do not continue to ascend. Observe for the development of HAPE or HACE. If symptoms do not disappear, a rapid descent of 150 to 300 meters (500 to 1,000 feet) or greater is necessary. Re-ascent should take place only after symptoms are resolved. |

Table A-6. High Altitude Pulmonary Edema (HAPE) and Its Effects

| HIGH ALTITUDE PULMONARY EDEMA (HAPE) | | | |
|---|--|---|--|
| CAUSE | PREVENTION | SYMPTOMS | TREATMENT |
| <p>Unacclimatized soldiers rapidly ascending to high altitudes (2,400 meters or 8,000 feet)*.</p> <p>Acclimatized soldiers ascending rapidly from a high to a higher altitude.</p> <p>Usually begins within the first 2-4 days after rapid ascent and generally appears during the second night of sleep at high or higher altitudes.</p> <p>Fluid accumulation in the lungs.</p> | <p>Acclimatization.</p> <p>Staged and/or graded ascent.</p> <p>Sleeping at the lowest altitude possible.</p> <p>Slow assumption of physical activity.</p> <p>Protection from the cold.</p> | <p>Wheezing and coughing (possibly with pink sputum).</p> <p>Gurgling sound in chest.</p> <p>Difficulty breathing.</p> <p>Coma.</p> <p>Death may occur if rapid descent is not initiated.</p> | <p>Rapid evacuation recommended.</p> <p>Observe for the development of HACE.</p> <p>Seek qualified medical assistance.</p> |

*HAPE **most often** does not occur until above 3,500 meters (12,000 feet).

Table A-7. High Altitude Cerebral Edema (HACE) and Its Effects

| HIGH ALTITUDE CEREBRAL EDEMA (HACE) | | | |
|---|---|--|--|
| CAUSE | PREVENTION | SYMPTOMS | TREATMENT |
| <p>Unacclimatized soldiers rapidly ascending to high altitudes (2,400 meters or 8,000 feet)*.</p> <p>Acclimatized soldiers ascending rapidly from a high to a higher altitude.</p> <p>Excessive accumulation of fluid in the brain.</p> | <p>Acclimatization.</p> <p>Staged and/or graded ascent.</p> <p>Slow assumption of physical activity.</p> <p>Protection from the cold.</p> | <p>Most severe high altitude illness.</p> <p>Severe headache, nausea, and vomiting.</p> <p>Staggering walk/sway.</p> <p>Confusion, disorientation, and drowsiness.</p> <p>Coma, usually followed by death.</p> | <p>Immediate evacuation; preferably by air evacuation.</p> <p>Seek qualified medical assistance.</p> |

*HACE, like HAPE, **most often** does not occur until above 3,500 meters (12,000 feet).