B-OG-302-005/FP-001

SPECIFIC OPERATIONS

VOLUME 5

MOUNTAIN OPERATIONS

PART ONE

TACTICS

OPI: FMC **13 DEC 76**

ISSUED ON AUTHORITY OF THE CHIEF OF THE DEFENCE STAFF

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FOREWORD

1. B-OG-302-005/FP-001, Specific Operations, Volume 5, Mountain Operations, Part One, Tactics, is issued on authority of the Chief of the Defence Staff.

2. This publication is effective upon receipt. It should be read in conjunction with CFP 302(5), Part Two, A Soldier's Guide to the Mountains.

3. Any loss or suspected compromise of this publication, or portions thereof, shall be reported in accordance with A-S1-100-001/AS-000, Chap 34.

4. Suggestions for changes shall be forwarded through normal channels to Mobile Command Headquarters, Attention SSO Doctrine.

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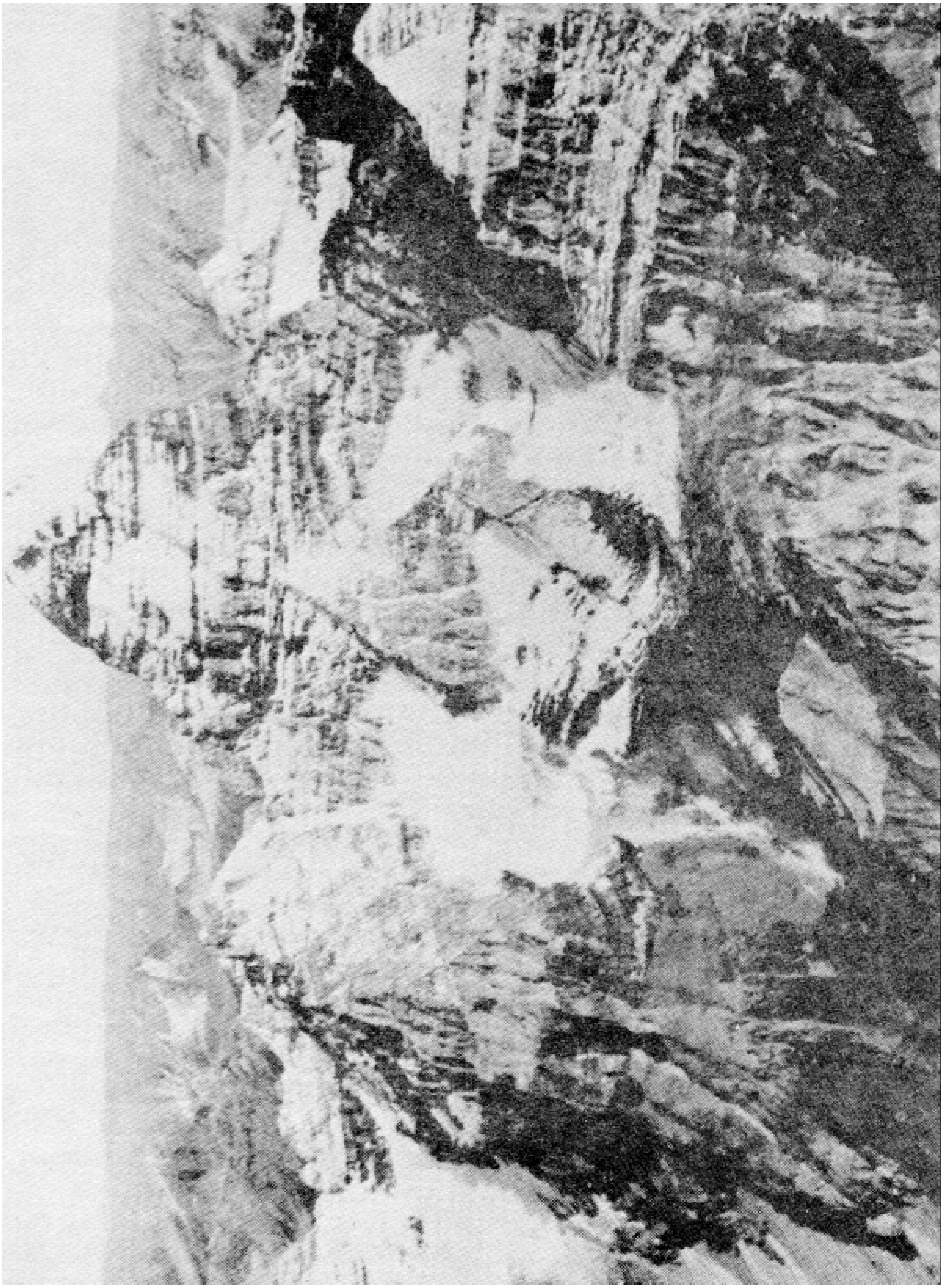

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CHAPTER 1

INTRODUCTION

SECTION 1 - GENERAL

Aim

1. The aim of mountain operations is to defeat the enemy through control of ground of tactical importance.

2. The aim of this manual is to introduce personnel to the techniques involved in operating in mountainous country and to show the effect that such country may have on the conduct of land operations.

Scope

3. B-OG-302-005 is the fifth of a nine-volume series which deals with specific operations. This volume is composed of two parts. Part two is entitled A Soldier's Guide to the Mountains.

4. This manual will be of use to personnel planning, conducting, and taking part in mountainous country operations from section to formation level. It covers non-nuclear, nuclear, and counter revolutionary operations, and deals with mechanized and non-mechanized forces. Not dealt with are those unique mountaineering techniques used by highly trained specialist troops.

5. Mountainous country is defined as country which is at least 600 metres in height, and which is characterized by steep slopes and deep valleys. Included are the villages and plains between mountain ridges, plateaux, passes, and the mountain passes themselves. The presence of such country is not limited to any one area of the world and the contents of this manual may also apply in highland areas or hill country not usually considered mountainous.

6. As may be supposed, material available in other manuals is not repeated here in detail. However, it must be recognized that for greater clarity, come repetition is necessary.

7. Elevations in this publication are in metres (m). It is to be noted that Canadian maps are marked in feet.

Tactical Principles

8. The general principles, fundamentals and methods of operating do not change substantially, no matter what terrain is encountered or under what climatic conditions operations are conducted.

9. All operational and administrative problems encountered in mountainous areas are to be appreciated in the standard manner, but one must always bear in mind the peculiarities inherent in such country.

SECTION 2 - THE CHEMICAL AND BIOLOGICAL THREAT

Explanation

10. It is the policy of the Canadian Government not to initiate the use of chemical or biological agents. A knowledge of their offensive use is, however, of fundamental military concern and is essential to the preparation of suitable defensive measures. Chemical weapons are mentioned in this pamphlet solely in order that the full tactical implications of their use by the enemy may be studied.

11. Under a chemical threat it will be for the commander to decide when the troops are to put on (nuclear, biological, chemical) (NBC) clothing and masks. When this has become necessary, extra burdens such as additional heat load and breathing resistance will be imposed; training and familiarization will help to overcome these problems, but commanders should in these circumstances allow extra time for the conduct of operations.

12. Commanders should also plan to have, if possible, reserves of men and equipment available to replace casualties from a chemical attack, and if persistent agents are used, to allow troops to be relieved in order to rest, feed and change contaminated clothing.

13. The use of biological warfare (BW) is quite feasible, but less likely than chemical warfare (CW) because of the possibility of it back-firing on the users and the untried nature of the weapon: if used it is more likely to be a strategic rather than a tactical weapon. Defensive measures against BW are similar to those against CW except that the problems of detection are greater; for this reason there will be a need for more prolonged wearing of full NBC protective clothing, and an increased requirement for collective protection. However, BW presents some specific medical problems which have a direct effect on the tactical employment of troops. Two of these are:

a. the length of the agent's incubation period; and

b. the requirements for isolation of suspect personnel.

CHAPTER 2

SPECIAL PROBLEMS TO BE OVERCOME

SECTION 1 - GENERAL

Types of Country

1. Mountainous country may be divided into the following types:

a. Temperate Wet - Comparatively low level hilly country which is liable to be covered with snow in winter, eg, the Lake District, Harz Mountains, the Laurentians.

b. Cold - Mountains high enough or far enough North to have their summits permanently covered in snow, eg, the Rockies, Norwegian Mountains. See frontispiece.

c. Hot Barren - Rocky, arid ridges and peaks often rising to considerable heights but located in a hot climate and therefore free of snow, eg, The Radfan, Muscat.

d. Jungle - Mountainous country covered with tropical jungle, eg, Malaysia, Borneo.

2. Generally, troops can operate in such types of country without special training in mountaineering techniques. However, in Canadian mountains (especially in winter) and in other world locations equally or more severe, it is necessary to ensure that troops are specially trained in winter operations.

SECTION 2 - TERRAIN

Characteristics

3. The outstanding characteristics of mountainous country are:

a. its immense scale, which is often underestimated. This applies particularly to the Rockies and the Himalayas;

b. the steep precipitous slopes and vertical crags;

c. valleys which twist and turn, becoming narrower and more closely overlooked as they penetrate more deeply into the mountains;

d. an exaggerated grain which makes movement on foot from one valley to the next slow and difficult;

e. wide variations in ground, climate and vegetation, and, at the higher altitudes, lack of natural resources such as water and therefore little population; and

f. deep, swift-running rivers and streams, especially after rain or during a thaw.

4. Other Features -

a. Roads and railways are few, often of poor quality, and normally follow the valleys. The tactical importance of flanking mountains therefore depends on the extent to which they dominate the valley.

b. Lateral communications are fewer than normal. Those which are available are of great importance for the movement of reserves.

c. Maps are often indifferent, of small scale or non-existent. Air reconnaissance including air photography is therefore more needed than usual.

d. Where mountains are inhabited there will frequently be terracing of the hillside. See Figure 2- 1.

e. Mobility is the keynote of all mountain operations, so that increased use of the air has greatly added to the possibilities in this respect. However, lack of landing grounds for all types of aircraft and the restrictions of weather and altitude limit the use of air support.

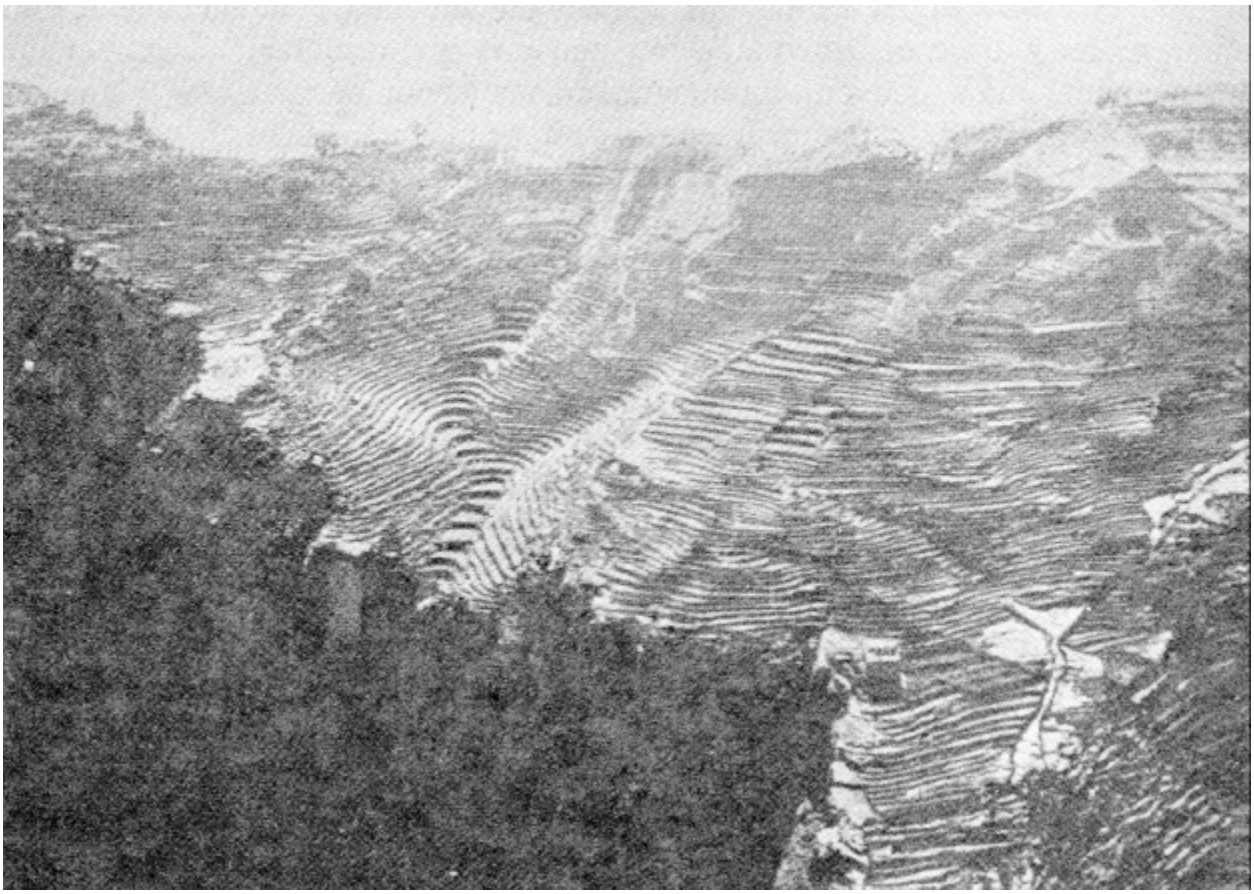

Figure 2-1 Terracing of Hillside

SECTION 3 - THE EFFECT OF ALTITUDE ON CLIMATE AND WEATHER

Unpredictability

5. Mountain weather is unpredictable. Gentle breezes can become hurricane force winds in minutes. The weather can change so much that in the same place in quick succession there may be hot sun and cold shade, chill wind and calm, thick fog or clear visibility, storms of rain or snow, and then perhaps hot sun again in a single day.

6. Weather often determines the success or failure of a mission. Fog or low cloud can provide valuable concealment for movement, but it can also prevent air support. Alternative plans must be produced and every effort made to anticipate the weather by obtaining accurate and up-to-date forecasts.

7. Notes and general weather hints applicable to the northern hemisphere which may prove helpful to troops operating in mountains, are at Annex A.

SECTION 4 - AVALANCHES

General

8. Avalanches are a serious danger in mountains and precautions must be taken against them. They occur when a mass of snow slides off a mountainside just as it does off the roof of a house during a heavy snowfall or thaw. A mass of snow may be released by the extra weight of a falling cornice (see Annex B) or of a skier or person on foot, or sometimes as a result of gunfire or explosions.

9. Avalanches often occur for no apparent reason, through the breaking of the tension within the snow structures, perhaps due to a rise in temperature, or a complicated set of circumstances.

10. The most common altitude for avalanches is between 1,800 and 2,800 m. Above 3,000 m avalanches are comparatively rare because slopes are generally steeper and accumulate little snow; winds are also stronger and snow is quickly dispersed. Below 3,000 m the most dangerous place for avalanches to form is on a very steep slope (over 35 degrees or 70 per cent). The snow can build up heavily on such inclines and can avalanche with devastating suddenness on an alarming scale when the time is ripe.

11. Avalanches can be artificially induced from fire from artillery, mortar, anti-tank weapons or other explosive charges, either to bring down a dangerous mass of new snow to make an area safe for friendly troops or to cause enemy casualties. In the former case it is essential that friendly troops and equipment should be well clear as avalanches can build up enormous speed and power and may run out a great deal farther than expected even on flat ground. A peace-time example of this type of activity is the Rocky Mountain avalanche control conducted annually by Mobile Command.

12. Although avalanche-craft cannot be summarized in a few lines, certain simple rules, the careful observance of which will reduce fatal avalanche accidents, are outlined at Annex B.

SECTION 5 - MEDICAL

Acclimatization

13. Altitude - Acclimatization to height varies with the individual, depending a great deal on physical make-up. Each individual reacts differently to height, a fact which needs to be understood. From heights of 2,000 m upwards some unacclimatized troops may lose up to 50 per cent of their normal physical efficiency through lack of oxygen. At heights of 3,000 or 4,000 m "mountain sickness" is likely to occur. This is characterized by headache, insomnia, shortage of breath, dizziness, lethargy, and occasional vomiting, and may last from two to five days. Acclimitization must be achieved by gradually increased amounts of exercise, and climbing a little higher each day over a period of two to three weeks. By the end of this period, troops should be back to 75 per cent of normal efficiency, but there is likely to be some shortage of breath for up to three months at an average height of 3,000 to 4,000 m. At lower altitudes the effects will be reduced, although they will vary considerably with the individual. It must be accepted that some troops may never acclimatize to altitude. After two or more months at low altitudes troops will require a period of reacclimatization before operating again on the mountains.

14. Heat - Acclimatization is also necessary for a short period after a move by air to a hot climate from a cold or temperate one. For about two weeks after such a move, troops will sweat less freely than the higher temperature requires and the risk of heat exhaustion is increased. Full adaption to the new conditions may take three weeks. Exertion in mountainous areas should be started gently and only gradually increased to full activity by the end of this period. Sunbathing must be strictly controlled to avoid sunburn and consequent loss of productivity. In very hot dry climates the trunk and limbs should be kept covered with at least a light single layer of clothing even when sweating is heavy.

Fitness

15. Extreme physical fitness is essential for all troops operating in mountains. Stamina, endurance and the ability to sustain strenuous physical exertion and recover from it rapidly are the fundamental requisites of mobility in mountainous country.

Hygiene

16. The normal principles of hygiene and sanitation are just as applicable in the mountains as anywhere else, but there are added difficulties:

a. In intense cold at high altitudes men are often loath to remove clothing with the result that sweat and body oils tend to irritate the skin and decrease the insulation value of clothing. Although shortage of water often increases the difficulties of washing, men must wash daily if at all possible, and underclothing must be changed at least twice a week. Feet should be kept dry and powdered, and socks changed daily.

b. In rocky or frozen ground it is often impossible to dig latrines. In freezing conditions, a latrine area should be specified at some distance from the position. Excreta will freeze and can be covered with snow or pushed down a crevasse or precipice. In hot barren areas waste may be covered with stones.

c. Many casualties are caused by getting wet and then cold. Men should prevent heat build-up and resultant excess sweating by selectively removing clothing when climbing or otherwise exerting themselves. To avoid wetness, snow should be brushed off clothing and boots before entering tents and bivouacs. Wet clothes should be changed before men get cold. If spare clothes are limited, a damp undershirt should be removed and put on over a sweater with a dry shirt next to the skin-. Wet clothes should be dried as soon as possible.

Exposure

17. Exposure is a condition where the core body temperature falls below normal. The condition can arise at + 10E Celsius and not just in a very cold situation. Wind and rain or driven snow are likely causes of exposure, but it is the wind chill factor, combined with extreme fatigue which diminishes heat production, that is often the killer. Likely symptoms are:

a. shivering stops although the individual is still cold;

b. complaints of being tired combined with a listless, apathetic appearance;

c. the victim may do unusual things such as running and then lying down. Any abnormal or irrational behaviour should be regarded as a danger sign;

d. blurring of vision or hallucinations may occur; and

e. eventual collapse followed by coma and death unless treatment is started immediately. The time between collapse and death may be as little as one hour.

18. Treatment of Exposure - In general, the casualty should be provided with shelter and made warm and dry. If on the move, stop, set up a bivouac in a sheltered spot and give the casualty a warm drink and food such as glucose sweets or chocolate; wet clothing should be changed if possible. He should then be put in a sleeping bag which in turn should be put inside a survival sack. If necessary, another man should get into the sleeping bag or sack to give extra warmth. The casualty must be evacuated as a stretcher case as soon as possible. On no account should the casualty be given alcohol.

Other Mountain Ailments

19. The ailments suffered in cold climates are covered in CFP 302(2), Northern Operations. However, such of these that are contracted in mountains are described below.

20. Frost Bite - This is a condition where the flesh actually freezes, and is caused by the exposure of unprotected skin to very cold conditions including wind (which need not be strong), by spilling fuel on unprotected skin or by the wearing of wet tight clothing or boots. Owing to wind chill, frost bite can be experienced even in hot sunshine. Areas most commonly affected are the cheeks and nose, followed by the ears, fingers and feet. Initially the skin becomes red, and then later pale and waxy. Generally the pain of cold fingers is sufficient warning to the individual, but feet do not hurt enough to warn; they just feel cold. Men should work in pairs and watch each other's faces to give warning of frost bite. An early case is simply treated by rapid rewarming of the nose or ears with hands. If the hands are affected, they should be warmed gradually; under armpits or between the legs are two good warming places. Feet can be placed against a friend's abdomen. In more serious cases where the skin becomes blue or crusty and blisters appear, the risk of infection becomes particularly dangerous. Treatment is based on raising the temperature very gradually, DO NOT rub the affected part with snow, woollen garments, or in any other way. If a limb is affected it should be rested in a horizontal position and kept in contact with a non-abrasive material at body temperature (eg, lukewarm water, normal flesh, etc), although the rest of the body should be warmed as much as possible. Non-alcoholic warm drinks are useful. The casualty should be evacuated as soon as possible. Rubbing or pressure on the affected limb must be avoided, and the rest of the body should be kept warm. Smoking should not be permitted.

21. Sunburn - The risk of sunburn increases with altitude due to the thinner atmosphere. Light and ultra-violet rays are reflected by both snow and cloud, so the danger will be nearly as great on a cloudy day. The lips, nose and ears are especially vulnerable, and should be covered with glacier cream or anti-sunburn ointment before exposure. In very hot desert climates some form of shade in the middle of the day is essential and, if nothing else is available, face veils and camouflage nets should be used.

22. Snowblindness - This is also caused by increased ultra-violet rays in the thinner air at high altitude. The symptoms - feelings of grit and pain in the eyes - do not appear until six or eight hours after exposure. Treatment consists of resting the eyes and excluding all light behind a mask or handkerchief. All personnel should be in possession of polaroid style sunglasses or a pair of prescription sunglasses in a sturdy frame. Eyeshields with slits for the eyes should not be used. These reduce considerably the peripheral vision which is essential when operating in mountainous terrain where constant observation of footing and surroundings is required.

23. Heat Exhaustion - This is mainly due to lack of salt or water or both, and occurs when men are loosing more salt and liquid in sweat than they are absorbing from food and drink. It happens mainly in hot barren mountains or jungle where the loss of liquid through sweat is obvious. It can also occur at high altitudes in cooler climates, where sweat is not so apparent because it evaporates quickly in the dry thin atmosphere, and the individual may not be aware that he is dehydrated. Symptoms are weakness, exhaustion, and inefficiency. Dark urine is a warning of dehydration, and severe muscle cramps indicate lack of salt. The treatment is simply to drink more water with salt added at the rate of one salt tablet to a pint of water, or two teaspoonfuls of salt to a gallon of water. Salt tablets should not be crushed. Tablets currently issued are specially impregnated to control the dissolving rate and avoid stomach distress. The tablets are so firmly compacted that they defy any crushing attempt in any event.

First Aid and Counter Exposure Training

24. Men may be operating in small groups in isolated positions; they must therefore be trained in first aid and especially in looking after exposure casualties. This training is particularly necessary because evacuation of the casualty may be a long and difficult process.

Casualty Evacuation

25. Ground

a. Ground evacuation of casualties in mountainous terrain is slow and difficult. At high altitudes or in bad weather, cold will increase shock and reduce the chances of survival. Picketing of the route down may be necessary and will be expensive in the use of troops.

b. On steep, rough ground, casualties must be securely lashed to stretchers, and stretcher bearer parties may have to be increased significantly. Under expert guidance the casualty may be lowered down vertical or steep pitches. Combat troops will almost certainly have to be used for stretcher bearer duties.

c. On long carries, relays of stretcher bearers should be used. Each team should operate over comparatively short sections of the route, which they will soon get to know well and be able to use even in darkness.

26. Air

a. Because ground evacuation in mountains is so slow and difficult, casualties should be evacuated by air whenever possible. The survival rate will increase enormously, as will the saving in manpower. The improvement in morale is also an important factor.

b. Air casualty evacuation is limited by -

(1) the availability of aircraft,

(2) prevailing weather conditions,

(3) the degree of air superiority achieved, and

(4) the availability and altitude of landing pads.

c. it is therefore unlikely that all evacuation can be carried out by air and there must be alternative plans for ground evacuation.

NOTE - See Annex G for a discussion of altitude illness.

SECTION 6 - CLOTHING AND EQUIPMENT

Clothing

27. Temperate Wet Mountains - Normal combat clothing is perfectly satisfactory except in the winter months, when special cold weather clothing will be needed. Combat boots, however, are not suitable for snow or ice climbing. In addition, in cold, wet weather, a waterproof outer garment should be worn over a windproof garment if the effects of wind chill are to be minimized. The importance of the helmet should not be forgotten.

28. Cold Mountains - In cold mountains (and in temperate wet mountains in winter) at heights of over 1,500 m, special cold weather clothing and equipment will be needed.

29. Hot Barren Mountains - Tropical weight clothing will be required for use in these mountains, however, attention should be paid to its colour when considering camouflage.

30. Jungle Mountains - Special jungle clothing and equipment will be needed.

Equipment Hints

31. Pocket altimeters are useful in mountain navigation.

32. Large numbers of manpack carriers may be required for porterage.

33. Plastic water containers are invaluable for operations in hot barren mountains.

34. Survival sacks on the scale of one per section should be carried in cold wet climates. These are large plastic bags approximately 2.4. m by 1.2. m (8 ft by 4 ft) into which an exposure casualty in a sleeping bag can be put until he recovers or is medically evacuated.

35. Ropes, crampons, ice axes, karabiners (snap links), and pitons are available for special mountaineer troops trained in their use.

36. Communications and logistics are covered in Chaps 4 and 9 respectively.

CHAPTER 3

THE EFFECT ON BASIC OPERATING PRINCIPLES

SECTION 1 - GENERAL

Limitations on Deployment

1. In mountains, one must always assume that one is moving under enemy observation. Because of the unfavourable terrain and the necessity to picket any movement, many more men are needed to take a small objective than would be so in more conventional country. In addition, the maintenance of modern armies requires an elaborate system of roads, railways, and airfields which are not to be found in mountainous country. Therefore, the size of a force fighting in mountains is limited by the capacity available to maintain it, and will be relatively small.

2. Routes for movement are few and generally lie in narrow valleys, where dispersion off roads for all except light vehicles and animal transport is difficult and often impossible. This limits to the absolute essential the amount of transport which can accompany troops and severely restricts deployment.

3. Tanks, and to a lesser extent, armoured reconnaissance vehicles, can only operate in small numbers and will often be restricted to main axes until other routes can be made for them. However, their ability to climb hills should not be discounted.

4. It will be difficult to find gun positions for the artillery, which will also have the problem of crest clearance. Mortars do not suffer these limitations to the same extent and are extremely valuable in mountain terrain.

5. Initial deployment errors cannot easily be corrected, and there is no time to execute last minute changes of plan. A well considered appreciation followed by clear and detailed forward planning is therefore of the utmost importance.

The Need for Infantry

6. The demand for infantry will be even greater than normal. Dismounted, they can still move almost anywhere in the mountains, provided they are fit and acclimatized. Only the infantry can occupy the vital high ground which dominates the approaches and gives observation over the enemy, while preventing the enemy from observing our own positions and supply routes. Often quite small forces of company or even platoon size can, by occupying key positions on a pass or summit ridge, hold up or delay much larger enemy forces out of all proportion to their own strength. Small parties are more effective when they call on the support of artillery and/or FGA aircraft, and direct their fire to give the maximum effect. However, infantry are only effective on the mountains if they can move quickly uphill, and over extremely rough ground, and are still capable of fighting. Therefore, troops must be trained to move at a speed which will conserve strength for the action on the objective.

SECTION 2 - TROOP MOVEMENT

General

7. Mobility is the keynote of all mountain operations. The difficulties of movement on foot in steep rocky country are considerable, but fitness, determination, and the correct technique will overcome them.

8. Helicopters may play a large part in moving men and material in the mountains, but it must be borne in mind that they are often not available.

9. Routes for vehicles are normally found in valleys and passes. They are likely to be narrow and winding with steep grades and sharp corners. Because of the requirement for armoured vehicles and APCs to conform to defile, ambush, and cornering drills, movement will be slow.

10. In soft snow, troops on foot will have to use skis or snow-shoes. Several weeks training is required to enable them to move effectively on skis, but they can operate on snow-shoes after only two or three hours familiarization.

Hill Walking

11. Ascent - The first essential is to economize effort by moving slowly but steadily without frequent halts. Wherever possible, men should walk on the flat of the foot, not the toe only, to avoid unnecessary strain on the leg muscles. The pace on steep ground must be regular and rhythmical with an equal distance and time interval between each step. It helps to synchronize breathing with steps in order to maintain rhythm. To increase speed, lengthen the stride without breaking the rhythm. On very steep slopes shorten the stride and place the feet carefully, wherever possible with the heel on a stone or lump of turf to make the foot level and to avoid slipping and wasting energy. It is always better to use a zigzag route up the steeper slopes. Always avoid scree (a slope covered with small loose stones) when climbing.

12. Descent - Downhill movement can be more tiring than uphill particularly with heavy loads. Keep the knees slightly bent and use long strides in easy gradient zigzags, thus avoiding jumping and jolting. Good scree with small loose stones gives the quickest and most economical way of getting downhill if long striding steps are taken, digging the heels well in. Scree with big ankle twisting stones will not slide easily and should therefore be avoided.

13. Halts - These should be infrequent and should be at features which give protection from weather and enemy observation rather than by the clock, ie, just below a crest line rather than on a col or ridge. Point out the next halting place as early as possible to induce troops to keep up a steady climb until they reach it.

14. Observation - There is a constant tendency when walking on steep slopes to keep the eyes on the ground picking out the next steps ahead and although this is necessary at times on very rough ground, it is a dangerous habit which must be controlled. Troops must be taught to observe frequently on the move as well as at halts, to avoid enemy ambush or other unexpected contact.

15. Rate of March - This of course depends on the going, the weight of loads being carried and also the weather. A rough guide on average going is 4.5 kilometres (km) per hour (3 mph) with one hour added for every 300 m (325 yards) of ascent or 600 m (650 yards) of descent. For example: an 18 km (11 mile) march on flat going will take four hours. If the march includes a total of 600 m ascent and 600 m descent, seven hours should be allowed for it. Over bad going and at night, rates of march will be greatly reduced and distances will nearly always take longer to cover than expected.

16. Planning the Route - The route for any troop movement in the mountains should be thoroughly planned. If possible an air reconnaissance should be made; if not, the ground should be studied from OPs, air photographs, and maps. Every effort should be made to avoid losing height by contouring, eg, a ridge detour of 3 kms (2 miles) could well be worthwhile to avoid a down and up of say 600 m. The presence or expected presence of the enemy will naturally affect the choice of route. In high mountains and in snow the danger of rock falls and avalanches must be considered as must the danger of falling over precipices, particularly at night. Routes should normally follow ridge lines rather than gullies and streams which tend to be full of scree, often have vertical pitches and follow the line of least resistance downwards. In bad visibility the route should be divided into legs beforehand, and bearings, distances, and changes in height should be measured off map and air photographs and entered on a route card or sketch. See Annex C for specimen route card or sketch.

Navigation

17. Map Reading - Navigation in mountainous country is a matter of accurate map reading, compass work and pacing, but there are added difficulties in the mountains. The value of pacing as a navigational aid in mountains will oftentimes be limited due to the very nature of the terrain itself:

a. Maps are often inaccurate or of small scale, and place names differ from those used by the locals. Air photographs, if available, are a valuable aid.

b. There are few features such as roads, buildings or woods by which to check direction or distance.

c. Due to the frequency of low cloud and hill fog, visibility is often poor or reduced to a few metres. Accurate compass work is essential.

d. The ground is always difficult, for movement and there are often ravines, rock faces, and avalanche slopes which need detours and add to the trials of marching by compass.

18. Fixing Position - Air photographs are of little value for this purpose unless they have previously been interpreted. The following methods can be used provided an accurate map is available:

a. Normal Methods of Resection

b. Bearing and Altitude - If a single back bearing is plotted to an identified point and the altitude of the observer is known, his position will be where the bearing cuts the appropriate contour. This method is particularly useful during a brief clearing in fog or cloud, when there is only time to identify one point and take the bearing.

c. Altitude and Direction of Slope - In thick fog when no objects are visible, altitude can be measured by altimeter and the direction of slope by compass. There will be only a limited number of places on the map where slopes at the same altitude face the same way. Most of these can be eliminated as being too steep or too gradual.

d. Altitude Alone - If the observer is on a known feature such as a ridge, valley bed, sloping road or track, he only requires his altitude to find out how far he is up the feature.

Use of Altimeter

19. The altimeter is a useful navigational aid in the mountains. The measurement of height is based on the measurement of the pressure of the atmosphere, which diminishes at a known rate with the increase of height. The altimeter should be set when the bearer is at a known height. The altimeter should be set when the bearer is at a known height, making use of a trig point or spot height if possible.

20. Effect of Weather - The pressure of the air is affected by the weather, so the altimeter is also a pocket barometer, rising slightly in good weather and falling in bad. To allow for this, the altimeter should be looked at frequently in doubtful periods, especially when travelling over level ground or during halts, and the instrument should be reset at every known altitude.

Night Movement

21. When in contact with the enemy, who will certainly be holding high ground with good observation, movement will normally be by night. Night movement in mountains is very difficult, slow and sometimes dangerous, but it is generally the only way of getting close to enemy positions.

22. Thorough daylight reconnaissance, if possible by air, is essential. Routes must be well marked, and taped if necessary. Preparation of a route may have to include the positioning of ropes by specially trained mountaineer troops to overcome steep rocky sections. All this will take time, and a route may have to be prepared and marked one night for use by the main body the next or on subsequent nights. Alternatively sub-units or small parties may be moved independently from one hide to another over one or more nights. These preparations must be concealed from the enemy.

23. The formation for night movement is normally single file. The difficult going makes it easier than usual for gaps to occur in the column and for parties to lose their way. To avoid this, frequent halts are necessary and also whisper checks by radio to ensure that each sub-unit is closed up. Should a sub-unit become detached from the column the last two men from the halted,

preceding sub-unit, must return to look for them. As soon as a sub-unit knows that it has become detached, it must halt until contacted.

24. Silence is important but difficult to maintain on steep rocky paths. Dislodging a single stone may start a stone slide that not only can be heard a long way off, but can also be a danger to following troops. The pace must therefore be very slow. Mountain streams are noisy and help to drown the sound of movement, and the route should be selected near them if this is possible.

SECTION 3 - FIELD DEFENCES

General

25. In rocky ground, digging trenches is often impossible, or very difficult. If rock drills and explosives are available, holes may be blasted in rock to give some degree of protection. More often it will be necessary to build sangars.

26. Construction of Sangars - Sangars must be properly built of the largest rocks available wedged securely together. The walls should be built with a slope on each face of 4/1, and to prevent penetration by small arms fire they must be not less than 0.75 m (30 inches) thick at the top. A shaky Wall of stones one on top of the other is more of a liability than an asset, as the first shell burst or burst of small arms fire will cause it to fall in on the defenders. Even solidly constructed sangars will not stand up to a direct hit from heavy anti-armour weapons. A layer of sand bags should, if possible, be built round the inside of the sangar to prevent stone chips and splinters from flying around, because shells, bombs, and even small arms have a considerable splintering effect on rock. Overhead cover should be added if time and materials permit.

27. Scale - Three sangars per infantry section is the normal scale with three or four men in each. Communication between sangars is difficult unless there is sufficient soil to make shallow crawl trenches possible. Temporary flank or night protection pickets in section strength may build only one sangar to save time, but more permanent defences should consist of three- or four-man sangars for greater protection.

28. Concealment - The old Indian Continent Frontier picket sangar, which was big enough to hold a platoon, would nowadays be too vulnerable to artillery and mortar fire. Even the four-man sangar is difficult to conceal, if it is above the tree line. Every use should be made of camouflage nets and background rocks to break up the outline.

Defences in Snow

29. If the snow is deep enough, ordinary defensive positions can be dug in it. Snow shelters and sleeping bays should be dug with narrow entrances, which must be covered with ground sheets or other wind-proof material; they will then be warm enough to sleep in provided the body is insulated by pine branches or some form of air mattress.

30. Communication trenches should be dug in the snow in the ordinary way, and then covered with boards, wire netting or branches with snow piled on top. When the snow has frozen solid, the boards, etc, can be removed and concealed tunnels will be left. If trenches are left open, they will quickly fill with new snow and become useless.

31. The following thickness of snow is needed to give protection against small arms fire and shell fragments:

Material	Minimum Thickness
Newly fallen snow (no wind)	4 m
Wind driven snow	2.5 m
Packed snow	2.2 m
Ice	1.1 m
Ice-crete	300 cm
Snow-crete (frozen snow - water mixture)	1.3 m

Mines and Obstacles

32. A simple obstacle plan will be very effective in the mountains because roads are few and routes are narrow and restricted.

33. Most mountain roads cross numerous bridges and culverts, which can be demolished. In many cases the road can be cut even more effectively by well sited craters, often in series on a side hill cut. Such a demolition is often extremely difficult to repair.

34. Routes may be blocked by creating a landslide or rockfall on to them. This is not usually as effective as cutting the route, unless:

a. a very large quantity of explosive, eg, an atomic demolition munition (ADM), can be used; or

b. the route is extremely restricted, running through a narrow defile or a tunnel.

35. In certain climatic conditions an avalanche can be created with a small demolition to block a route. This requires skill and probably local knowledge.

36. Large barrier or defensive minefields are unlikely to be used in this type of country; instead many small minefields may be laid to seal exits from routes, thereby inhibiting both armour and artillery from deploying onto the rare pieces of flat ground. Because the places where troops can go are more restricted, there is scope for effective use of anti-personnel mines and booby-traps, including delayed action fuses. The use of booby-traps will have to be authorized by the highest tactical commander. The long ranges of observation will give opportunities for command detonation of mines and demolitions to seal the obstacles. Mines laid in snow require special consideration. In the mountains, where movement is canalized to a great extent, our mines can pose a threat to friendly troops as much as to the enemy; their use must therefore be carefully controlled and whenever possible they should be lifted when they are no longer required.

37. Wire obstacles can be effective, especially when combined with a slope. Anchorage may be a problem on rocky ground or on snow. Rocks may be used to anchor concertina wire and extra long pickets are necessary in snow, but even then it is fairly easy to burrow under a wire obstacle in snow, especially at night.

38. The supply of sufficient materials for making obstacles is frequently a problem where the access routes are few.

Temporary Halting Positions

39. Troops.will move from one firm base to another. These bases or night harbour areas must be selected in advance from the map or air reconnaissance and should be on high ground. If it is impossible to get the main body out of a valley due to lack of roads, a suitable all-round defensive position must be selected near the main axis. All neighbouring high ground from which the enemy could bring down fire or obtain observation must then be, occupied by outposts, pickets or standing patrols.

40. Positions should not be occupied too close to or astride mountain streams. In the space of a few minutes, sudden heavy rainstorms, which often occur in mountains, can change a normally jumpable stream into a unfordable raging torrent several yards wide.

41. Special care must be taken to avoid showing lights at night, as these are visible at great distances in mountains. Fire and cooking stoves should be lit only in wooded areas or in specially dug holes in the ground. Command posts (CPs) must be more carefully screened than usual.

SECTION 4 - THE EFFECT OF CHEMICAL OPERATIONS

General

42. In mountain operations, weather and terrain may be so unfavourable as to deter an enemy from using chemical weapons. Given suitable meteorological conditions, however, the enemy may well use both persistent and non-persistent agents.

43. In the attack, the enemy will probably use non-persistent agents on those parts of the defence he wishes to occupy or pass through and persistent agents on those parts he wishes to neutralize but not occupy. Because they are area weapons, chemical agents could be used against troops or positions on summits and narrow ridges which are difficult to hit with other weapons. The physical exertion required of all troops working and moving at altitude makes them especially vulnerable to low concentrations or respiratory agents. The restriction on mobility imposed by the wearing of masks and NBC protective clothing can be reduced by familiarization and training.

44. The prediction of the direction and extent of cloud travel is particularly difficult and the effects of mountain winds can only be turned to tactical advantage with some knowledge of local conditions. Chemical clouds are generally funnelled along the valleys with a higher vapour concentration along the valley floor than on the slopes. As a very general guide, when winds are light and skies are clear, winds tend to blow down slopes and valleys at night and in the early morning, and up slopes and valleys after midday.

45. Aircraft spray is likely to be the most effective form of delivery for releasing the agents over the heights and taking advantage of downslope wind. This method will also avoid the supply problems of ground delivery.

46. It must be borne in mind that the wearing of NBC protective clothing and masks is difficult and must be practised. As temperatures drop, the usefulness of the mask may be degraded.

CHAPTER 4

THE EFFECT ON THE ARMS

SECTION 1 - ARMOUR

Restricted Mobility

1. Mountains, snow, and ice seriously restrict the use of armour. The approaches to the mountains, including the rocky plains in the foot-hills, are often as restrictive as the mountains themselves. Despite the difficulties of such country, a commander should be extremely reluctant to believe that armoured vehicles cannot work in it. Imagination, patience, careful reconnaissance, and determination can enable them to reach the most surprising places. The appearance of even a few armoured vehicles in areas believed by the enemy to be inaccessible produces an effect out of all proportion to their numbers. Time spent in reconnaissance and possibly in constructing special routes will be well worth while in spite of the labour involved. Also the night driving aids now available enable vehicles to move forward under cover of darkness to good supporting fire positions. When planning, the heavy administrative support requirement must be considered early.

Tanks

2. Tanks can still provide accurate supporting fire at all practicable ranges, but will seldom be able to accompany infantry in an assault. They will operate in small numbers, but even one tank brought to a critical point may have a decisive effect. Their use as a direct fire support base or in a sniping role are but two examples. In defensive operations they will still be a vital component of the force whenever there is an enemy armoured threat. In a withdrawal they can be used with great effect to delay an enemy advance.

Armoured Reconnaissance Vehicles

3. The use of armoured reconnaissance vehicles on their primary task of obtaining information will be limited, but rarely prevented, by the difficulty of deploying them off the axes. They will be frequently used as escorts for transport columns on routes which are vulnerable to ambush, or patrolling such routes and for communication tasks.

SECTION 2 - ARTILLERY

General

4. Artillery, whether self-propelled (SP) or towed, is subject to the same terrain difficulties of mobility, deployment, and fire support as other arms and services.

Factors to Consider

5. In mountainous country, the following factors assume special significance and must be considered carefully:

a. Mobility -

(1) Non-essential vehicles should be left out of the order of battle to reduce congestion on the few available routes.

(2) It will often be necessary to bring light artillery into gun positions which can be reached only by manhandling, using drag ropes or animals. All gun detachments likely to operate in mountains should be trained in these techniques.

(3) Light and air defence artillery may also be airlifted into and out of gun positions by helicopter and will in all probability require air resupply of ammunition. Gun positions on high ground will reduce some crest clearance problems and will make the gun positions easier to defend.

b. Deployment - Good gun positions are hard to find, particularly those free from crest clearance difficulties. High crests result in large areas of dead ground, and therefore high angle engagements are normal. A reduction in maximum range may result if the GPOs crest is greater than 800 mils (45E). Positions should be chosen for defilade, cover, and accessibility to routes. Guns may be sited in sections or even singly. Because of the problem of crest clearance, little mutual support will be available.

c. Observation of Fire

(1) Ops should normally be on the highest suitable points within defended localities, but care should be taken to stagger them in height so that all will not be blanketed by fog or cloud at the same time.

(2) Observation of fire in the mountains may be difficult especially in deep snow. Coloured smoke may alleviate the problem.

(3) First round accuracy is difficult because of the problem of fixing gun positions, Ops, and targets on unreliable maps. Estimation of range requires practice where visibility is exceptionally good.

(4) Artillery fire in mountains should be observed, especially close covering and defensive fire, because rapidly changing meteorological conditions and poor maps make predicted fire inaccurate.

(5) The use of helicopters and airborne Ops to adjust fire should be exploited to the maximum; they will be invaluable for adjusting fire into dead ground. Helicopters will also be useful for carrying out route and gun position reconnaissance and for acting as relay stations.

(6) Artillery sighted to allow direct fire over open sights can be very effective against an unprepared enemy.

d. Fire Support

(1) Range -

(a) Light artillery often has insufficient range to provide forward troops with the necessary support. An alternative method is to move one or two guns up with the forward support troops either by helicopter, mule or man pack.

(b) Medium artillery may give the longer range required, but at present may be limited by the problem of crest clearance.

(c) High altitudes over 2,400 m (8,000 feet) and high temperatures will give marked increases in range, because the air density is lower.

(2) Fire Effect

(a) Impact-fuzed high-explosive shells are very effective on rocky ground, scattering stones which themselves become missiles. They are relatively ineffective in deep snow.

(b) Shells with variable time fuzes are particularly effective against troops on reverse slopes and should be used in deep snow conditions.

(c) Variable winds and steep mountains slopes will reduce the effectiveness of smoke.

(d) Artillery fire may be used to start rock or snow slides to block supply routes or overwhelm enemy positions.

e. Logistics - The difficulties of supplying ammunition, especially if helicopters are not available, make the selection of targets and the allotment of ammunition of great importance; waste on unprofitable targets must be avoided. The ratio of ammunition to guns requires special consideration.

f. Manpower - Deployment of isolated gun detachments makes heavy demands on manpower - both gunners and porters. This applies particularly to OP parties and the maximum number of other arms personnel should therefore be trained to call for and to control artillery fire.

g. Air Safety - In mountainous country with steep, high-sided valleys, aircraft will be confined more to flying up and down the valleys and so putting themselves in jeopardy from artillery and mortar fire. Close control of air space in the operational area is thus even more important under these conditions and will probably be conducted at formation level.

h. Air Defence - The general principles of air defence remain unaltered. There is still the need for a coordinated layout of air defence artillery and for coverage of all heights from ground level up to the maximum height at which the enemy can fly. The main additional problems which arise are -

(1) the selection of sites affording adequate radar coverage, particularly for the low-level air defence artillery,

(2) access to the selected gun positions and radar sites,

(3) local defence of gun positions and radar sites, and

(4) logistics, particularly ammunition resupply.

SECTION 3 - ENGINEERS

Tasks

6. Engineer tasks in mountain operations will be the same as in conventional operations. Drainage and bridging will play a considerable part because of the large number of mountain streams and rivers, and their susceptibility to flash flooding in hill storms. Additional equipment and manpower is likely to be required, including pioneer and labour units. Engineer reconnaissance must be well forward so that an early assessment of the requirement of stores and labour can be made. The infantry will be required to assume a greater share of the minor engineering tasks of the unit.

7. The following engineer tasks assume particular importance:

a. mine clearance and mine-laying, especially nuisance minefields (because routes are so vital, mine warfare can play a decisive part in operations);

b. creating demolitions and obstacles, which are usually more effective in mountains than elsewhere (see Figure 4-1). Conversely, clearing and breaching obstacles may also be required;

c. construction and maintenance of airstrips and helicopter landing sites;

d. construction and improvement of maintenance areas;

e. in dry mountains additional troops may cause limited supplies of water to become even scarcer. On counter-insurgency operations, particularly when a hearts and minds policy is being followed, the provision of new water sources or repairs to existing sources must come high on the engineer's task list. The civilian population must not be given justification for blaming friendly forces for shortage of their vital and already meagre water supplies; and

f. additional help to other arms, eg, construction of run-ups for tanks.

8. Survey and map production may be necessary in mountainous areas where existing maps are inadequate.

Figure 4-1 Route Denial - Possible Site

SECTION 4 - SIGNALS

General

9. There are three main environmental characteristics which have an adverse effect on signals effectiveness in mountainous terrain:

a. Terrain - Obstacles such as steep slopes, cliffs, peaks, deep valleys, and swift and deeply embanked rivers not only hinder the physical movement of communicators and their equipment but seriously affect the effectiveness of radio communication, not only in the UHF and VHF bands but also to a lesser extent, in the HF band.

b. Climate - The wide range of temperatures, the rapid changes in climatic conditions as well as the considerable variation between adjacent areas inhibit radio communications and prevent the timely deployment of radio stations by airborne means. VHF and UHF radio will be affected by ducting caused by temperature inversion whilst clouds and snow will affect HF in the ground wave mode.

c. State of development - Signals will have to rely entirely or mostly on its own tactical means even to go back into strategic system because access to strategic or commercial high-capacity trunk system is highly unlikely. This task will be further complicated by the lack of lateral communication roads or the low capacity of valley roads, tracks and bridges.

Planning

10. Because of the environmental characteristics outlined above, the signal plan must be based on the following factors:

a. Siting of HQ - Because few sites for HQ shall be adequate and will normally be found in valleys, retransmission of radio communication shall require enormous deployment of personnel and equipment resources. The vulnerability of high and isolated radio rebroadcast (RRB) stations to enemy electronic warfare (EW) and physical attack may well require the use of constant airborne RRB/relay stations if one is not ready to pay the price of providing adequate protection parties to signal RRB stations.

b. Radio -

(1) Because of poor ground conductivity, complete antennae systems including counterpoises should be used to provide both a sky wave and ground wave component.

(2) Portable HF radio with CW attachments should be used in preference to VHF radios.

(3) Because of extreme climatic conditions (very cold to very hot) special battery and equipment protection measures will be required.

(4) Whenever VHF radio is used, channelling of circuits along valley axis must be attempted to prevent reliance on high, naked RRB spots, and escape enemy detection.

c. Line - Despite difficult movement conditions, lines should be laid whenever possible between static positions; the use of helicopters for line laying should become standard practice.

d. Signal Dispatch Service - Weather permitting, maximum use of ADS should be made to alleviate ground movement density and terrain difficulty.

SECTION 5 - INFANTRY

General

11. Infantry, because of its versatility and ability to move virtually anywhere, will play the dominant role in mountain operations. To do so, the highest standard of junior command and leadership, physical toughness, fieldcraft, and individual skill at arms will be necessary. Rugged country gives more opportunity for infiltration by small parties; there will be greater scope for the use of independent pickets, outposts, ambushes, and sniping and sabotage tasks; hence the need for good command and leadership at platoon, section, and patrol level.

12. Owing to the difficulty of deploying armour, infantry battalions will operate mainly without armoured support.

Special Training Required

13. Particularly good observation is often possible and every infantryman must be capable of siting and manning an observation post effectively. This capability will include the use of night viewing devices.

Cooperation with Other Arms

14. The ability to operate with helicopters is particularly important as is the selection and preparation of landing zones (LZs) and winching areas. Marshalling and normal loading and unloading drills must be thoroughly understood.

15. The increased number of small parties, pickets, patrols, Ops, and outposts needing mortar, artillery, and close air support requires a high standard of target and FAC training. In addition, the problem of ammunition resupply makes fire control and accuracy of fire more than usually important.

16. Engagements with small arms tend to be at long range, and infantrymen must be able to shoot accurately with the rifle at ranges up to 300 m, and to maximum range with the GPMG. In mountain areas covered in jungle, engagements tend to be short and sharp at close ranges; men must therefore be trained to have quick reactions, resulting in accurate shooting.

17. Good cover and visibility give excellent opportunities for snipers. The commanding officer may well decide to redistribute his unit's snipers in order to make the best possible use of his resources.

Weapons and Equipment

18. Light Loads - Infantry moving on foot in difficult country should be loaded lightly. Heavy weapons, ammunition, and supplies should therefore be brought to forward positions by helicopter whenever possible. As sufficient air lift will seldom be available, economies must be made and only essential weapons and equipment carried, the choice of which will depend on the

climate, the ground, and the type of opposition expected. Commanders at all levels must decide the priorities and issue precise orders. Where there is conflict between weight of ammunition and weight of weapons, experience has shown that it is better to take more ammunition and fewer weapons.

19. Support Weapons

a. Mortars are the most valuable infantry support weapon in mountains, and other material may have to be sacrificed to ensure an adequate supply of ammunition for them.

b. The GPMG is useful to engage the long-range targets likely to be encountered.

c. Heavy anti-tank weapons can normally be left behind unless part of the country is passible for armour. A small proportion of other antitank weapons should be carried to deal with enemy bunkers and sangars.

20. Grenades - A plentiful supply of grenades is essential, particularly for reorganization and defence. They can be lobbed downhill for considerable distances and with great effect in rocky places but it is considered unwise to throw grenades uphill, as they can roll back on the thrower. Coloured smoke grenades are useful for marking positions.

21. Radios - Additional lightweight radios will be required for the extra Ops, pickets, and relay stations that will be deployed, and also for ground to air communications.

22. Night Fighting Aids - New aids (including ground surveillance radars), currently available or planned for the future, can be effectively employed in the mountains. Skilfully sited, their line of sight characteristics can be fully exploited in covering areas which would otherwise absorb large numbers of men in Ops and patrols. Siting is critical and screening will often be difficult to avoid. Due to weight, this equipment should be air delivered.

SECTION 6 - SPECIALIST FORCES

General

23. Other NATO countries possess specialist forces which are particularly well suited for operating in the mountains. As it is likely that the Canadian Forces will be engaged in operations with these specialists, a knowledge of their capabilities and tasks will be useful.

24. A proportion of the personnel of these units is trained in mountaineering techniques and is capable of preparing routes in precipitous country for the passage of non-specialist troops. All personnel are accustomed to carrying heavy loads for long distances in rugged hill country. They usually operate in small parties in independent missions and can thus take advantage of the excellent opportunities for infiltration.

Deployment and Tasks

25. These forces will normally be deployed in the rear of the enemy on tasks of strategic importance, although they may also be employed tactically. Patrols can be deployed by a variety of means including foot, parachute, and helicopter. Lay-back patrols are especially effective. The duration of the operation will depend to a certain extent on the ability of the patrol to be resupplied. Either a favourable air situation or the cooperation of local inhabitants is needed.

26. The specialist forces tasks are:

a. Intelligence Gathering - Patrols can be tasked to produce topographical intelligence in addition to intelligence on the enemy such as -

(1) the strength and direction of enemy movement, and

(2) the location and observation of static installations, including enemy communications centres, headquarters, and base camps.

b. Direct Offensive Action - Sabotage attacks can be mounted on key static locations, including headquarters or communications systems, and ambush tactics can be used against the lines of communication.

c. Indirect Offensive Action - Combined with the tasks already listed, these forces can acquire targets for artillery or ground attack aircraft. They are capable of directing the fire of both.

d. Cooperation with Irregular Forces - Mountainous country normally offers a good secure base area for irregular indigenous forces. Specialist forces may be tasked to cooperate with and train these forces.

CHAPTER 5

NAVAL, MARINE, AND AIR SUPPORT

SECTION 1 - NAVY AND MARINES

General

1. Information in this chapter is necessarily of a general nature. Commanders at all levels are to use this chapter as a guide, and to ensure that close liaison with other elements of the Canadian Forces and allied services brings out the details necessary for close and effective cooperation.

Naval Support

2. Naval gunfire is not particularly suitable for mountain operations owing to its high muzzle velocity and flat trajectory. Some guns can, however, deliver a shell up to a range of about 24 km, without interfering with the land supply routes. In coastal mountains where land-based artillery is difficult to deploy and supply, naval guns can make a valuable contribution to supporting fire.

Marines

3. Role - The primary role of marines is to provide personnel for amphibious operations. Because of their training, with emphasis on operating on undeveloped terrain, marines are well qualified to fight in the mountains.

4. Basic Training - The basic training for all marines includes instruction in cliff climbing and rope work, hill walking, and toughening survival training. The majority of all ranks are experienced in living and working in hill country.

5. Specialized Training - Usually one sub-unit specializes in mountain and arctic warfare techniques and is equipped for operations in sub-freezing temperatures. All ranks are trained to ski. The remaining sub-units receive only basic training.

6. Instructors - Normally, each unit has a reconnaissance organization troop which contains a proportion of personnel who are qualified as mountain and arctic warfare specialists. They are capable of acting as ski instructors, leading on rock and ice up to "severe" standard, and preparing routes with fixed ropes in mountainous and glacial conditions for the remainder of the unit.

7. Employment - In conjunction with a ship and its associated helicopters, a unit possesses both strategic and tactical mobility and is eminently suitable for coastal mountain operations. In conjunction with a larger force of all arms it might well be employed on:

a. flank protection, holding flanking heights to prevent enemy observation;

b. outflanking movements, making use of its cross-country capability; and

c. long-range raids on special targets or infiltration by small parties.

SECTION 2 - AIR FORCE

Close Air Support

8. The difficulties of deploying and supplying artillery in the mountains may cause an increased demand for close air support, but the following factors will affect the performance of fixed-wing aircraft in the close support role:

a. Weather - Low cloud, hill fog, blizzards, thunderstorms or turbulence will seriously restrict mountain flying.

b. Terrain

(1) Deep, narrow valleys, and the accentuated grain of the country will limit the direction of attack.

(2) Accuracy of weapon delivery may be affected by a possible increase in firing range caused by the pull out problems of an attack in mountainous country.

(3) The nature of the terrain may limit the choice of weapons.

9. The problem of identifying targets in the mountains is made more difficult by:

a. the technical problem of attack patterns in narrow valleys;

b. the shorter range of FAC communications which must have.line of sight to the aircraft. It is therefore desirable that FACs should be airborne; and

c. the increased demand for close air support which will in turn increase the need for FACS.

Air Reconnaissance

10. The restrictions of land movement, the large areas of dead ground and indifferent maps will make the requirement for tactical air reconnaissance, both photographic and visual, greater. The problem will be to find the target in rugged mountainous country.

11. Air reconnaissance will be affected by:

a. shadows formed by steep ridges and peaks;

b. the comparative ease of concealment of troops and vehicles in broken hill country; and

c. the longer time taken to find the target and cover it, and therefore the slower response time in completing a mission.

12. Infra-red and radar can still be used in mountain air-reconnaissance but these aids will also be limited by terrain and crest clearance problems.

13. Night air-reconnaissance at low level may be impractical.

Tactical Air Transport Support

14. General - Tactical air transport is of the greatest value in assisting mobility in mountain warfare. Many of the problems of weather and terrain affecting aircraft in the close air-support role are equally applicable to tactical air-transport aircraft, but there are additional factors which are outlined in the following paragraphs.

15. Airborne operations - The frequency of strong and variable winds and scarcity of level dropping zones (DZs) of adequate size and free of rocks or trees severely limits the employment of parachute troops, apart from those using free-fall equipment and techniques. Great use, however, will be made of heliborne troops, which are less susceptible to low cloud and reduced visibility and can be more easily landed. See para 17.

16. Air Supply

a. Air Dispatch -

(1) The restrictions of strong variable winds and lack of suitable DZs do not apply to the same degree as with parachute troops, although they still have some relevance.

(2) The size of the DZ for stores is less than that for parachute troops, and can be further reduced if the recipient is prepared to accept some of the drop landing wide.

(3) The difficulty of identifying the DZ in rugged hill country is another problem. Balloons may be used, and electronic marking aids can be used if necessary.

(4) Air drop may, however, be uneconomical compared with air landing, owing to the weight of dropping equipment such as parachutes, platforms, etc, and the difficulty of recovering it.

b. Air Landing - The majority of supplies, ammunition, and equipment in mountain operations will be air landed. Short-range fixed-wing aircraft deliver to forward air strips, whence support helicopters ferry loads to a formation distribution point, or more often direct to units.

Helicopters

17. Tasks

a. Helicopters will be used in all their normal tasks but because of the difficulties of movement on the ground, they become all the more valuable in mountains.

b. In particular they will be especially useful for positioning small isolated parties such as gun detachments, OPs, radio relay and RRB stations. Because of the susceptibility of helicopters to bad weather these parties should be positioned if at all possible so that an alternative means of withdrawal could be used if necessary.

c. Armed helicopters will be very effective against sangars or bunkers as well as for normal fire support.

d. Again because of the difficulty of moving men, ammunition, and supplies in mountains, any helicopters which are available should be utilized to the fullest extent. In particular, in dry mountains the carriage of water in containers, and the return of the containers themselves, will inevitably take up a large percentage of the payload on any sortie.

e. Route reconnaissance, flank guards, casualty evacuation, and the laying of field telephone cable are examples of other tasks which helicopters can effectively perform.

18. Mountain Helicopter Flying - Flying in the mountains presents pilots with extra problems due mainly to height and mountain formation. Wind strengths at height are normally stronger than those on the plains, and the air is less dense. Mountain formations cause winds to be turbulent and uncertain. On the windward side the air flow should remain fairly steady in direction, but may fluctuate in strength. Leeward of a mountain the wind is likely to be turbulent with rapid changes of direction and strength, not only in the horizontal,but also in the vertical plane, causing up-draughts and down-draughts which increase in severity in direct proportion to the wind strength. Low cloud and the possible formation of ice on aircraft are additional mountain flying hazards; these hazards reduce aircraft performance to some extent and impose extra strain and workload on aircrew, because margins for error are generally rather less than normal. The thinner air and temperature variations are less of a problem to the modern helicopter than for the old types. As a guide, the best lift capability can be expected at first flying light. Close liaison with the helicopter force commander will provide accurate information on helicopter height and weight performance.

19. Landing Sites - Details of dimensions and requirements of helicopter landing sites are contained in CFP 311(6), Tactical Employment of Helicopters. The following are some additional points for mountain landing sites.

a. Selection - Landing sites should normally be on the windward side of mountain ridges or peaks to ensure a reasonably smooth air flow, but in forward areas concealment from enemy observation is the most important factor in selecting a site.

b. Slope - Sites should be as level as possible, but may be on a slope not exceeding 125 mils (7 degrees). On slopes greater than this the helicopter will not be able to land, but provided its rotors do not hit the hill side it will be able to hover.

c. Marking - In addition to normal markers, a ring of stones can be used to outline the perimeter of a LZ. Care must be taken not to use objects which might be sucked up by the rotor blades and so cause damage to the aircraft. Snow covered LZs can be effectively marked with coloured dye, but they must be camouflaged with more snow when not in use.

d. Preparation - Mountain LZs do not normally need much preparation, as the ground is generally hard enough to support helicopters. Loose rocks must be cleared and rocky outcrops may have to be blasted. If the slope is too great, it may be possible to blast a ledge wide enough for an LZ. LZs in soft snow must be stamped hard to avoid snow clouds blinding the pilot. Sand or dust should similarly be dampened with oil or water, but care must be taken to avoid standing water.

e. Rapelling - Troops or stores being landed at temporary positions where it is impossible to touch down can be rapelled, thus avoiding the need for any site preparation, but with a slight increase of turn-around time. A reduction in payload may also be necessary due to the aircraft having to hover outside ground effect.

f. Vulnerability - If the choice of LZs is limited, as well may be the case, it is possible that the enemy may be able to forecast those which will be used; helicopters should therefore not use a LZ until it has been secured. This means that the ground which dominates the LZ must first be covered by observation and fire.

20. Airstrips for short-range transport and light aircraft will be hard to find but of great importance, while both the altitude and short runways will reduce payloads.

CHAPTER 6

THE EFFECT ON CONVENTIONAL OPERATIONS

SECTION 1 - CHARACTERISTICS OF MOUNTAIN OPERATIONS

General

1. Mountains limit modern armies in putting their operational techniques and equipment to the best use: they enable comparatively much weaker enemies to have an effect out of all proportion to their numbers and capability, provided they are both determined and well-trained.

Characteristics

2. From what has already been discussed in this manual it will be understood that operations in mountainous country are characterized by:

a. Ground and Observation - Whatever the scale of operations, a key factor in achieving success is good observation - and its denial to the enemy; the battle will invariably be for control of the dominant ground. In mountainous country this factor is of overriding importance and confers an advantage on the defender.

b. Climate - Extremes of climate and very sudden changes make it necessary for troops to be fully acclimatized and trained to the highest standards of physical and mental fitness. Climate similarly has a marked effect on both the scales and maintenance of equipment and clothing.

c. Land Communications - The scarcity or complete lack of roads make mobility, particularly of mechanized forces, a problem; both the amount of movement and its speed are critically limited by mountainous terrain. Movement of wheels and tracks is very largely confined to the valleys (where the going is often very bad), and its direction dictated by the grain of the country; all vehicle movement requires strict control, and navigation presents constant difficulties. The man on foot faces the same problems to a lesser degree, but with the added difficulty that he must carry his essential needs - water, rations, and ammunition - without unduly impairing his mobility and endurance. The time taken to move troops, vehicles, and equipment overland is very difficult to assess accurately, and usually is underestimated. It is difficult, however, to lay down exact guidelines as they will vary much in relation to the climate, altitude, and steepness of the mountains. The use of helicopters can greatly reduce these difficulties.

d. Resources - In a usually barren environment, with little or nothing in the way of local resources, troops must be administratively self-sufficient for considerable periods of time. This applies to individuals, units and formations, and has implications for logistic systems which are discussed in Chap 9.

e. Remoteness - In counter-insurgency operations particularly, the basis of all operational planning is the collection and collation of intelligence. Because of their remoteness, mountain areas are valuable to insurgents. There is seldom a firm and stable civil administration or police force. In these conditions, security forces will find it difficult to gain the intelligence needed to come to grips with the insurgents.

SECTION 2 - DEFENSIVE OPERATIONS

General

3. Mountainous terrain favours defensive operations. The commander will normally base his plan on the positional defence concept. This is explained more fully in CFP 301(1).

4. The factors listed hereunder affect defence in the mountains:

a. Dominating ground gives the defender good observation and fields of fire which are denied to the attacker. It also provides the defender with good, mutually supporting positions.

b. The lack of mobility and the need to hold dominating ground will normally dictate the choice of positional rather than mobile defence.

c. The difficulty of digging means that more time is needed for the preparation and organization of positions.

d. It is comparatively easy to conceal troops in the mountains and to deceive the enemy about strengths and dispositions.

e. Delaying action is particularly effective because of the scarcity of routes and the ease with which they can be dominated.

Selection of Positions

5. It is essential to occupy dominating ground; the difficulty lies in deciding how much of it to hold. In general, the following guidelines will apply:

a. The high ground dominating and on either flank of the main axis must be held.

b. The approaches to this high ground must be covered by fire.

c. Any high ground which will provide the enemy with observation, dominating or overlooking the main position, should be held or neutralized.

d. Any likely outflanking routes should also be covered by fire.

e. Mutual support between positions will be difficult to obtain.

6. Flanks should be secured if possible by deep ravines, vertical cliffs or other areas difficult to penetrate. Modern climbing techniques, however, make it possible for specially trained troops to climb virtually any rock face or ice cliff, so even apparently impossible approaches must be watched. Ground surveillance radar and infra-red vision and warning devices will be useful for this purpose.

7. Advantage should also be taken of any natural obstacles to the front. These can be improved by demolitions, cratering, creating rock slides or avalanches, by nuisance minefields, booby-traps, and barbed wire. It should be remembered that obstacles must be covered by observation and at least indirect fire.

8. The ability to supply defended localities must also be considered when selecting positions. It will often be possible to supply some posts by helicopter, and combat supplies for several days may be dumped at one time. This may be particularly important if the position is liable to be cut off temporarily by enemy action of infiltration. Nevertheless, land transport routes should also be developed to the main positions wherever possible to ensure continuous supplies being maintained.

9. When the force includes tanks, their great fire power may make the effort of providing them with a route into the position well worth while.

Forward and Reverse Slopes

10. Reverse slope positions give concealment, freedom of movement and surprise, but in mountains, there may be serious disadvantages:

a. The reverse slopes are sometimes too steep and too deep to give an effective field of fire on to the crest line.

b. The vital need for observation, and the importance of holding the dominating ground may make it necessary to prevent the enemy getting any footing on the crest line. This will force the defender to hold the forward slope or at least cover it effectively by fire from defilated positions on the flanks. Alternatively, the defender may be able to tunnel through from the reverse to the forward slope and so occupy battle positions or OPs as required.

11. If the ground is sufficiently broken, it should be possible to conceal positions adequately on forward slopes. The restriction of movement by day must then be accepted.

12. In many circumstances it will be better to site positions on the summit of the ridge. Although these might appear to be too obvious, a jagged crest line will often give reasonable opportunities for camouflage and concealment. A ridge summit is difficult to hit with artillery and mortars due to the disappearance of overs and unders, and the increased observation and long fields of fire afforded should compensate for the restriction of daylight movement.

13. In any case, a commander should not automatically select the reverse slope position; the forward slope and ridge summit must be given equal consideration during the reconnaissance.

14. If the reverse slope is occupied by day, alternative night positions must be available on or forward of the crest.

15. Where the main position is.high up on a ridge, alternative positions are also necessary at a lower level, as cloud will frequently mask the upper parts of a mountain leaving the lower slopes clear.

Covering Forces

16. General - Covering forces are particularly important in mountains, where quite small forces are able to impose considerable delay. Every advantage must be taken of the numerous defensive positions afforded by the rugged terrain to wear down and delay the enemy.

17. Composition - A balanced force of armour and infantry supported by artillery, engineers, and armed helicopters will be the most suitable force.

18. Conduct of the Covering Force Operation - The armour, consisting of light armour, and if possible, tanks, operates astride the main axis and as high up the flanking hills as possible. The infantry pickets the dominating hills on either side of the axis, and the whole force leapfrogs back to previously reconnoitred and prepared positions. Helicopters may be used to position pickets, but would find it hazardous to do so in the face of direct fire or observed indirect fire. The infantry fall back along the ridge lines as fast as possible and then move to sheltered LZs to be lifted out by helicopter. The engineers are used to create obstacles, carry out route denial and lay nuisance minefields, so enabling a clean break to be made.

Conduct of the Defence

19. Due to the constant danger of being ouflanked, the defence must be organized in great depth.

20. Mountain warfare provides more opportunities than usual for aggressive defence. Fighting patrols can infiltrate and attack headquarters, supply lines and administrative areas with comparative impunity, if routes are well chosen. Patrols can also use forward temporary OPs and bring down artillery fire or close air-support on opportunity targets in rear areas. Ambushes can be easily concealed on likely lines of advance and patrol routes. This harassing action will force the enemy to deploy extra troops for protecting his line of communications, and will delay and disrupt his preparations for attack.

21. Enemy infiltration must be prevented by the accurate positioning of standing patrols, pickets, and ambushes. Ground surveillance radars can be used to good effect, but care must be taken to cover any area which is in dead ground to the radars. In the defence more time is available to study the ground and decide on the likely infiltration routes which need to be covered. Outflanking troops can themselves be cut off and surrounded provided they are discovered in time and reserves are accurately placed and effectively used.

22. Owing to the difficulties of movement, reserves must be split up and placed close behind ground of tactical importance ready for an immediate counter-attack. If possible, they should be placed on higher ground than where they are planned to be used; this is particularly important in winter. This type of counter-attack is far more effective than a delayed deliberate one, because it

should catch the enemy at the moment when he is most exhausted after an uphill assault. Large centrally placed reserves will be unable to intervene in time, unless they can be moved at once by helicopter.

23. Troops in positions which are bypassed must hold out and prevent exploitation by attacking the enemy on the flanks and rear. Plans for a break-out, probably by night, should be prepared and rehearsed, and should include casualty evacuation by helicopter.

Defence of Administrative Areas

24. A formation administrative area in the mountains is often alongside a forward air strip. Due to deployment difficulties it is likely to be concentrated in a fairly small space. It is an obvious target for enemy action in the form of air attack, hostile shelling, or raids by small enemy forces, particularly at night or in bad weather.

25. Defences must include:

a. well sited low-level air-defence artillery;

b. an infantry unit or sub-unit whose commander is specifically given the task of defence of the area;

c. a coordinated defence plan including all the units, administrative or otherwise, in the area;

d. each unit being allotted a sector of the perimeter to defend with alarm posts, wire, and properly dug defences;

e. permanent pickets posted on any high ground, dominating the area if possible with the aid of intruder alarms, ground surveillance radars and other night vision aids; and

f. aggressive patrols and ambushes used on the approaches in a counter penetration role.

Withdrawal

26. The tactics of a mountain withdrawal are the same as in normal operations, but the following points are emphasized:

a. Because of the difficulty of movement, more time is needed for reconnaissance and for preparation of new positions.

b. Every opportunity must be taken to delay the enemy and so all good hill features should be used as delaying positions. For this reason intermediate positions are likely to be closer together than usual. The delaying plan must be active.

c. Before using helicopters to extract the last troops from a position, the commander must weigh the advantages of so doing against the possible loss of the aircraft and the men they would be carrying. In any event, secure LZs are necessary and should generally be sited just below the crest in the reverse slopes of spurs and ridges. A special emphasis must be given to the withdrawal of personnel from isolated positions.

d. Once the enemy realizes a withdrawal has started, he will do all he can to infiltrate the positions, block defiles and cut off rearguards. Withdrawal routes and defiles must be picketed where necessary, and OPs and air reconnaissance used to detect any infiltration.

c. Demolitions in the narrow defiles are most effective and therefore create greater delay than most in more open country. Demolition guards are essential because of the increased threat of infiltration. These will generally be able to use vehicles and withdraw down the main axis, but where this is not possible, helicopters should be provided.

f. All non-essential supplies, ammunition, vehicles, and equipment should be evacuated early. If this cannot be completed, everything of value to the enemy must be destroyed. In the mountains, where logistics are so vital, nothing must be left for the enemy to use.

g. Scarcity of routes will dictate the need for strict control of movement. Civilians may also want to use the few routes which exist. Therefore the commander must consider this in his movement plans.

SECTION 3 - OFFENSIVE OPERATIONS

General

27. The aim of all offensive operations is the destruction of enemy forces and the imposition of the commander's will on the enemy. In mountainous country, the seizure of dominant terrain may well occupy a large place in the plan of the commander.

Considerations

28. Command and Control -

a. Terrain tends to give the mountain battlefield a piecemeal character, dividing it into more or less isolated conflicts which are difficult to control by higher commanders. To aid communications, command posts should be sited well forward.

b. Commanders must also make use of helicopters to gain a personal view of the battle and visit forward units, but flights over enemy held territory should be avoided.

c. Boundaries must be carefully planned. Heights overlooking valleys should be allotted to the formation or unit on whose area they exert most influence; this is not always easy to decide and boundaries may need to be adjusted.

29. Fire Support -

a. Because of uncertainty in the rate of advance, fire plans should not normally be on a timed basis, but on call.

b. The difficulties of ammunition supply may restrict the amount of support available, and only definite and worth while targets should be engaged.

c. Both tanks and light armour can provide accurate fire support for the attack, especially on crest lines for which their guns are more suitable than artillery and mortars. Every effort should be made to get them up into high fire positions, thus gaining surprise and making good use of their range.

d. Maximum use should also be made of close air-support and armed helicopters.

The Advance

30. General - Mountainous country restricts the normal advance on a broad front. Mobility is once again the main problem; there may be little room for mechanized movement, so the emphasis will probably be on infantry on foot with both offensive and transport air support.

31. Deployment - A formation or unit advancing will probably be limited to one route, generally up a gradually narrowing valley with a pass at the head. If it is possible to move on two axes, the commander will have more flexibility but must ensure mutual support. Separated bodies must be self-contained, both tactically and administratively. Advance and rear guards and pickets will be standard.

32. Distances - A dismounted infantry battalion moving on a ridge trail will form a column seven to ten kin (four to seven miles) in length. Pass time will be several hours and manoeuvre from the line of march could occupy two or three hours. When mounted and with pickets in place, the columns will approach six kilometres. Once movement has commenced, the rate of advance will be dictated by enemy action and the time taken to position pickets.

33. Reconnaissance -

a. Air - Preparation for the advance must include detailed air reconnaissance to determine probable and actual enemy positions, obstacles, defiles, and deployment areas. Small parties of troops in the open in broken, rocky country are difficult to spot from the air. Well concealed defensive positions are even harder to locate, except perhaps by electronic means, so it is unlikely that air. reconnaissance alone will pinpoint more than a small proportion of the enemy defences. Any obstacles on the main axis should be visible from the air and these will be an indication of nearby enemy positions.

b. Ground -

(1) With few routes and poor going cross country, light armour is likely to be of only limited value in reconnaissance. Nevertheless, it is particularly valuable as escort for transport columns moving on mountain roads.

(2) The reconnaissance platoon of a forward battle group will normally lead the advance until contact is gained.

(3) Once contact is made, or indeed from the beginning of the advance, if the commander so decides, OPs may be deployed on the high ground flanking the advance. These OPs may be lifted by helicopter to LZs on reverse slopes and can then move forward to the crest line on foot. If low cloud or hill fog prevents helicopters from operating, the only alternative is to move on foot, and progress will therefore be very slow. In any event, the OPs must be protected and this may involve the deployment of pickets. For details of the latter see Annex D.

34. Maintaining Momentum - As soon as contact is made, the normal drills should be followed. Any opposition covering the route must not be bypassed, however, because the axis must be cleared. Immediate outflanking attacks by heliborne infantry should be made by the leading battle group if possible, but if it is already fully committed a depth battle group will have to be used. Artillery support may be limited, so full use must be made of FACs and close air-support. Engineer support should be well forward so that reconnaissance of obstacles and their clearance may be effected at the earliest opportunity.

35. Outflanking Moves - Heliborne flanking moves are only possible if side valleys and ridge lines can be used to give a covered approach. This may well be possible against small enemy-delaying positions, where a determined flanking threat causes an enemy withdrawal. Once the main enemy defences are reached, however, the approaches and flanks are likely to be too well protected to allow the use of helicopters so far forward without risking heavy casualties. Further detailed reconnaissance will then probably be necessary before a deliberate attack can be launched.

The Deliberate Attack

36. Frontal attacks will be required when it is impossible or undesirable to attack from a flank. In daylight they have little chance of success against well concealed and constructed enemy defences on dominating ground involving long uphill assaults. Likely approaches are probably canalizing and are usually covered by minefields and hence, fire. The normal alternative of a flanking attack must be considered, but this may involve a long detour and take up a lot of time.

37. The other alternative is a frontal attack at night or in bad weather when low cloud restricts visibility. The latter can be dangerous if a sudden clearance exposes the assulting infantry to enemy fire, and smoke should be available on call even though the winds may be unpredictable. Any advance -it night or in had visibility must be very slow to prevent troops getting strung out in difficult country, and extra time should be allowed for unexpected obstacles. Routes must be well marked and objectives limited. The final stages of the advance should be along ridges whenever possible, with the aim of assaulting from higher ground. Perhaps the best timing is a night approach with a dawn assault, as consolidation in the dark is difficult in mountains.

38. If helicopters are used, normal procedures are followed. Extreme care must be taken when LZs are selected owing to the nature of the terrain and the lack of cover.

Infiltration

39. Mountainous country is particularly suitable for infiltration and this technique may be used in conjunction with a deliberate attack. Once again, movement will be very slow because lengthy reconnaissances are necessary; the most difficult routes will probably be the safest from enemy interference. The advantages of surprise, however, and the envelopment achieved are normally worth the time and effort involved.

40. Unexpected tactical opportunities may well present themselves to junior commanders at this stage, such as the seizure of some key position temporarily unoccupied or only lightly held by the enemy. All ranks should be encouraged to use their initiative within the commander's overall plan. Any advantage thus gained must be exploited to the fullest.

41. Helicopters can sometimes be used to assist, provided secure routes and LZs can be found, but surprise will be lost. Helicopters are perhaps better employed bringing in the urgently needed reinforcements, support weapons and combat supplies, after the infiltration has been made.

Reorganization

42. Attacking troops are often worn and exhausted at the end of an uphill assault; the enemy knows this and will probably launch an immediate counter-attack. It is therefore more necessary than ever for all commanders to be prepared for this in the reorganization phase.

43. The attack should never halt on a summit or on a ridge line objective, which is bound to be a registered target for enemy artillery and mortar fire. Reorganization must be carried out well forward of the crest line, perhaps even on the next reverse slope, and with rapid adjustment of positions and liaison with flanking units.

44. The importance of speed in bringing forward support weapons, especially mortars, is greater than usual. Helicopters should normally be used for this task and can also be used for casualty evacuation on the return flight.

45. The early adjustment of artillery is equally important, and all officers, and senior NCOs should be capable of doing this.

46. The evacuation of casualties is particularly difficult in mountainous country and special arrangements for the location and collection of reported casualties are often necessary.

Exploitation and Pursuit

47. Local success should be vigorously exploited by the employment of heliborne reserves to follow up, harass and cut off the retreating enemy. Every effort should be made to infiltrate small patrols by air to create obstacles and block escape routes by demolitions in defiles and other key points. Artillery and close air-support should also be used in the pursuit. Airborne FACs and OPs are especially effective at this stage.

48. Plans must be made to seal off bypassed enemy positions still holding out and protect rear echelon transport on the move forward.

49. Engineer support must be well forward with the right equipment to allow ground forces to maintain momentum through any obstacles the enemy may have prepared. Our own engineer problems may be eased if aircraft and artillery can be used to harass enemy engineers engaged in demolition and obstacle work.

SECTION 4 - OPERATIONS IN COLD MOUNTAINS

General

50. The tactics described in the previous two sections apply to all types of mountain, but they are particularly applicable to temperate wet mountain in summer when there is no snow to be seen. Cold, snow covered mountains present additional problems with regard to clothing, equipment, shelter, etc, which are dealt with in B-OG-302-005/FP-002.

Movement over Snow

51. Frozen Snow - when the snow is frozen hard, it is possible to walk on the surface without sinking in, but steep frozen snow is slippery and, when climbing or descending, steps must be picked, which is a very laborious process. Crampons, sets of steel spikes or claws strapped to the sole of the boot, will enable the wearer to climb steep frozen snow, but practice is needed in their use and they are unlikely to be issued except to special mountaineer troops. There will also be soft patches under trees or near rocks, where a man on foot may sink in up to the thigh or waist.

52. Soft Snow

a. Any movement on foot in unfrozen snow is unacceptably slow and tiring, and more often than not it is uneconomical in time and effort. Skis or snow-shoes are therefore essential, but climbing uphill on these is still a lengthy process. On very steep slopes, skis can be edged into the snow so that the climber can step up sideways or zigzag. Snowshoes are too wide to edge, however, and it may be quicker on steep sections to take them off and kick or stamp steps, as already suggested for frozen snow.

b. Going downhill, the trained skier may go fast or may zigzag down slowly, but the untrained man must stick to snow-shoes and will be as slow as ever. It follows that patrols or assaulting troops must be all on skis or all on snow-shoes. Every effort should be made to train complete sub-units to ski.

53. Avalanches - The avalanche danger must not be forgotten. In deep snow or thaw conditions extra precautions must be observed. See Chap 2 and Annex B.

Shelter

54. Some form of shelter is essential in cold mountains, and it must be available very close to the fire position. When choosing a site the avalanche and stone fall hazards must be considered. Shelters may take the form of:

a. Snow Shelters - These can be dug normally as part of the defensive post, provided there is a sufficient depth of snow. See Chap 3.

b. Natural Caves - These provide good shelter, but will not often be near enough to the defensive post. They may be suitable for headquarters, unit medical stations, or other such installations. Crevasses come into this category provided they are spacious enough, are not too deep and have an entrance/exit which can be developed.

c. Artificial Caves - These can be blasted out of the hillside. They will take some time to create, but may be worth while in a fairly static position.

d. Tents - These may be dug down into the snow but will still be difficult to conceal and should only be used if all else fails.

Morale

55. It is essential to overcome the cold by proper discipline based on sound training and the correct equipment.

56. Morale can be maintained by frequent patrols. The aim should be to deny the enemy the essentials for his existence by destroying his shelter and equipment, whilst at the same time ensuring that our own are safe and secure. An effective rotation of front line, outpost, OP, and sentry duties must be established with frequent reliefs to allow some rest and relaxation in a secure area.

SECTION 5 - OPERATIONS IN HOT BARREN MOUNTAINS

General

57. Tactics in hot barren mountains vary little from those described earlier in this chapter. The main differences are:

a. complete lack of vegetation (except in some wadis) which makes concealment more difficult;

b. sharply contrasting shadows particularly just after first light and just before last light;

c. shortage of water, which produces an added logistic problem and emphasizes the need for water discipline (see Chap 9);

d. extreme heat by day, which makes shade a necessity in a static position and visibility poor due to heat haze;

e. an increase of dust and dirt, which adversely affect engines, particularly those of helicopters. Dust from vehicles, helicopter rotors, and airstrips will also affect morale to some extent (particularly when washing is restricted) and will give away positions; and

f. the presence of flies, mosquitoes, etc, must be recognized as a health hazard, and treated accordingly.

SECTION 6 - FIGHTING PATROLS AND DEEP PENETRATION OPERATIONS

General

58. Mountains are especially suitable for these types of operations, because covered approaches, hides, and patrols bases are comparatively easy to find. There are also many good targets available in the vulnerable enemy line of communications (L of C).

Fighting Patrols

59. The type of fighting patrol refered to here is the raid. These are normally of comparatively short duration, probably lasting about one to three days, and generally with the object of sabotage. They are also used to gain information by capturing prisoners.

60. Some of the targets for sabotage likely to be found in or near mountains are:

a. dams and hydro-electric stations;

b. mines and oilfields;

c. galleried roads, tunnels, bridges, etc, in defiles that aircraft cannot easily reach;

d. hostile partisan headquarters;

e. radar stations;

f. airfields; and

g. missile sites.

Deep Penetration Groups

61. These groups will normally go much deeper into enemy territory and stay there longer. Their object is often much wider and may be:

a. to study the enemy's habits over a period of time and to collect intelligence or establish a collecting and transmitting centre;

b. to rouse the country against the enemy and support friendly partisans;

c. to disrupt the communications by forming a firm base for raiding parties against the enemy's L of C; and

d. to mislead the enemy and induce him to move his reserves away from a thrust being prepared elsewhere.

Planning

62. The following are some of the factors to be considered when planning a fighting patrol or deep penetration operation:

a. aim;

b. the objective and all that is known about it;

c. hostile forces including partisans likely to be met and how they are to be dealt with;

d. the attitude of the local inhabitants;

e. language, guides, local currency;

f. means to divert suspicion from local helpers;

g. the ground, possible approaches and exits, maps and air photographs;

h. the climate and weather, and how they can be used to help;

j. size of the force required (the smaller, the better);

k. air support;

m. maintenance including local purchase;

n. special stores and weapons;

p. method of entry and exit;

q. disposal of casualties; and

r. training.

63. Meticulous planning, preparation, thorough training, rehearsal, and a great deal of time and energy are required for these operations. The aim must therefore be worthwhile and not one that could be achieved more easily by other means.

Method of Entry

64. Methods of entry which may be used are as follows:

a. Air

(1) Helicopter - Entries should normally be carried out at last light, or after dark (preferable). To remain secure this type of entry can only be made on a hidden LZ, with the aircraft taking a roundabout route and making dummy landings at other points.

(2) Parachute - By high altitude low opening (HALO) dropping, provided a piece of flat ground about 600 metres square is available. For best results HALO dropping should be carried out at night. Commanders must consider the risks inherent in dropping into mountainous country in darkness. Perhaps the drop could be carried out at a distance and personnel could infiltrate.

b. Land

(1) Foot - If water has to be carried, a party on foot will be limited to two or three days unless helicopter resupply is possible. In snow, especially in bad weather, a party on skis will be an effective means of entry.

(2) Vehicle - This means will only be possible if there is an area through which a wide cross country sweep can be made.

(3) Lay-back - During a withdrawal, a lay-back party in a well sited hide or hides should be completely secure. Provided adequate stocks of supplies, ammunition, etc, are cached beforehand, such a party with a good knowledge of the country can last a long time and provide much useful information.

c. Water - If the target is within 24 km (15 miles) of the shore, entry by small boat is one of the best methods.

Air Support

65. Offensive air support will often be possible and effective provided communications are adequate and members of the patrol have FAC training.

66. Helicopter support will be invaluable for resupply, casualty evacuation, and lift in and out of the whole party if necessary. In sunlight, small steel mirrors are the best way of attracting a pilot's attention inconspicuously.

Method of Withdrawal

67. Just as the entry should be a surprise, the withdrawal should leave as few clues as possible, particularly with regard to local helpers. Ideally, the enemy should be left completely in the dark about how the operation was carried out, since he will then be induced to expend more effort on making certain it will not happen again. The most secure methods of withdrawal are either on foot or by helicopter from a completely hidden and remote LZ.

CHAPTER 7

THE EFFECT ON NUCLEAR OPERATIONS

SECTION 1 - NUCLEAR WEAPONS

General

1. Mountains limit some effects of nuclear weapons but accentuate others. The effects are more unpredictable than in flatter country, and may be dangerous to both friendly and enemy troops.

Blast

2. Blast will be deflected by high ridges and peaks. The primary and reflected blast waves resulting from even a low yield nuclear may cause avalanches and rock slides for distances of up to 30 km (19 miles) from ground zero. This will affect friendly troops as well as the enemy, and units operating in nuclear conditions must be particularly careful to avoid positions where they may be hit or trapped by rock or snowslides.

Nuclear Radiation

3. Nuclear radiation may be affected by steep terrain. The deposit of fall-out will be erratic and unpredictable in high winds, and may also affect friendly troops. Natural shelters such as ravines, caves, rock walls or chimneys may provide some protection from radiation and deflection of fall-out.

4. Movement from a position to avoid fall-out should not be attempted unless radiological survey information is available. Aerial radiological survey will be more difficult in rugged country and provide less accurate information due to the irregular deposit of fall-out and the difficulty of maintaining constant flight altitude above the ground.

5. Snow will provide some protection; 30 cm (1 foot) of hard packed snow or 60 cm of loose snow will reduce the dose rate by approximately 50 per cent.

Thermal Radiation

6. The clear mountain air will extend the range of.nuclear thermal effects, but high peaks and ridges will interrupt it. High altitude or cold weather clothing will give effective protection against this radiation.

7. Snow provides a good reflecting surface and will therefore increase thermal effects and a greater number will suffer from flash blindness.

Protection

8. The inability to dig trenches and underground defences except in deep snow, and the probable absence of APCs make troops more vulnerable to nuclear weapons. Sangars will be flattened by blast, and the stones from them will become lethal missiles. Again, natural shelters such as caves, rocky clefts, and high ridges will give the best protection.

Decontamination

9. This will be more difficult in mountains, because it will seldom be possible for contaminated men to be provided with baths and a change of clothing. Other expedients should be used, such as removal and vigorous shaking of all outer clothing or brushing off contamination with pine branches or heather.

Height of Burst

10. A high airburst will be the most effective means of covering the large areas of dead ground between ridges, but even then deep valleys may cause gaps to occur in the radius of damage. Accuracy will be more necessary because of the screening effect of high ridge lines.

11. Surface or sub-surface bursts can be used to block completely, or for a considerable period of time, narrow steep-sided valleys, defiles or passes. ADMs are ideally suitable in these circumstances, because they can be emplaced with pin-point accuracy and so obtain optimum results, but before using them the commander will have to consider the risk to friendly troops or civilians of any fall-out which may occur.

SECTION 2 - THE EFFECT ON NUCLEAR TACTICS

General

12. Mountains are often sparsely populated and undeveloped. This is particularly so in the cold mountains within the Arctic Circle and in the hot barren mountains of the Middle East. It could follow that nuclear weapons are more likely to be used in such terrain than elsewhere.

13. Owing to the unpredictability of the effects of nuclear detonations in mountainous country, minimum safe distances (MSD) have to be increased. This, combined with the possible lack of ground mobility of the troops involved, will limit the choice of nuclear targets.

Defensive Operations

14. Lack of mobility is likely to force a positional defence concept on commanders. To avoid providing a worth while nuclear target, emphasis must be put on concealment, camouflage, deception, and the use of alternative positions, offensive patrolling, and effective air defence to deny the enemy the information about defensive positions that he needs.

15. The need for a larger MSD coupled with lack of mobility will mean that a defending commander is unlikely to nominate nuclear killing zones (NKZ) within his own defensive system. Instead he will select KNZs covering those valleys, passes, and defiles into which the enemy may be forced by a combination of the terrain and the main defensive position. He may follow up any nuclear strike with a heliborne counter-attack force as soon as post strike analysis makes this possible.

16. ADMs may be employed to:

a. block routes by cratering narrow valleys or defiles and by causing landslides or avalanches;

b. sever communications by destroying tunnels or bridges;

c. create areas of tree blowdown and forest fires;

d. crater areas including frozen lakes which may be used by air mobile enemy forces; and

e. create water obstacles by the destruction of dams and reservoirs.

Offensive Operations

17. If the defensive measures in paras 14 to 16 are taken, an attacker may find it difficult to locate troops concentrated in the forward areas in sufficient strength to warrant a nuclear strike, however, an attacker may well decide to neutralize by nuclear strike any hill, bastion or mountain redoubt which cannot either be bypassed or captured by conventional means except at great loss, even though post strike analysis will be difficult to assess on steep gradients and subsequent follow-up action may be restricted. In such cases, support helicopters may be a valuable way of repositioning follow-up troops to enable the advance to continue as quickly as possible.

18. ADMs may be employed to create obstacles which will impede or deny the enemy movement. In particular they may be use to contribute to the security of a flank or the rear, to impede an enemy counter-attack or to assist in the bypassing, enveloping or encircling of an enemy force or position.

All Phases

19. Both attacker and defender may find that the most profitable targets for nuclear strikes in mountainous country will be:

a. passes and defiles;

b. enemy nuclear delivery units;

c. communications centres and headquarters;

d. forward air strips; and

e. administration areas, including supply or ammunition dumps.

CHAPTER 8

THE EFFECT ON COUNTER INSURGENCY OPERATIONS

SECTION 1 - PATTERN OF INSURGENT OPERATIONS

General

1. Mountains are traditionally the home of the insurgent. The French Maquis, the Yugoslav partisans in World War II, the communist terrorists of Malaya and Vietnam, the dissidents of the Radfan, and the Cuban revolutionaries have all sought refuge in the mountains. Here their fitness, staying power, and intimate knowledge of the country enabled them to nullify the normal advantages and superior fire power of regular troops, who were forced to rely on long vulnerable lines of communication, and were comparatively immobile away from their transport. The helicopter has partly swung the balance against the guerillas. No mountain hideout is now secure from a swift heliborne attack, nor is an insurgent ambush party safe from follow up by heliborne reserves.

2. Winter with snow and ice conditions militates against guerillas. Tracks in the snow give away their movements. Shelter and warmth are necessary for survival and supplies are harder to obtain. Guerillas will be on the defensive and tend to lie low in their most secure hides. This is the time to hunt them down with vigorous patrols, ambushes, and the maximum use of heliborne reserves.

3. Guerillas depend for their security on popular support, mobility, and detailed knowledge of the terrain. They endeavour not to stay in any one place for more than a few days at a time. They therefore need a large number of hiding places spread over a considerable area to be secure. Some of the essentials for a guerilla hide in the mountains are:

a. water;

b. cover from the air in the form of thick woods, scrub, jungle or caves. with concealed entrances;

c. reasonable proximity to a friendly population for food supplies; and

d. although broken rocky country is desirable, the hiding place must not be up against a line of unclimbable cliffs or precipices denying adequate escape routes.

4. Supplies, arms, and equipment will be hidden in numerous small caches buried over a wide area. In the valleys or wherever there is enough soil, caches are often found in tunnels or dug into the hillside. The entrances are always well concealed, hidden under or behind rocks, in thick scrub or under tree roots.

Tactics

5. As previously stated, mountainous country offers excellent facilities for OP work. Guerillas will use these facilities frequently and their use must never be underestimated.

6. The emphasis of guerilla tactics in mountains is on ambushes. Narrow, winding hill roads and tracks are easily ambushed. Broken rocky ground covered with scrub or bush gives good concealment and a covered line of retreat. Ambush positions are normally sited well above the road, sometimes at ranges of 200 to 300 m or more, with a fairly level escape route round a spur or ridge and then steeply down into a different valley to help a quick get away (see Figure 8-1). Ambushes are often sited in conjunction with command detonated mines or demolitions on culverts, bridges or other defiles.

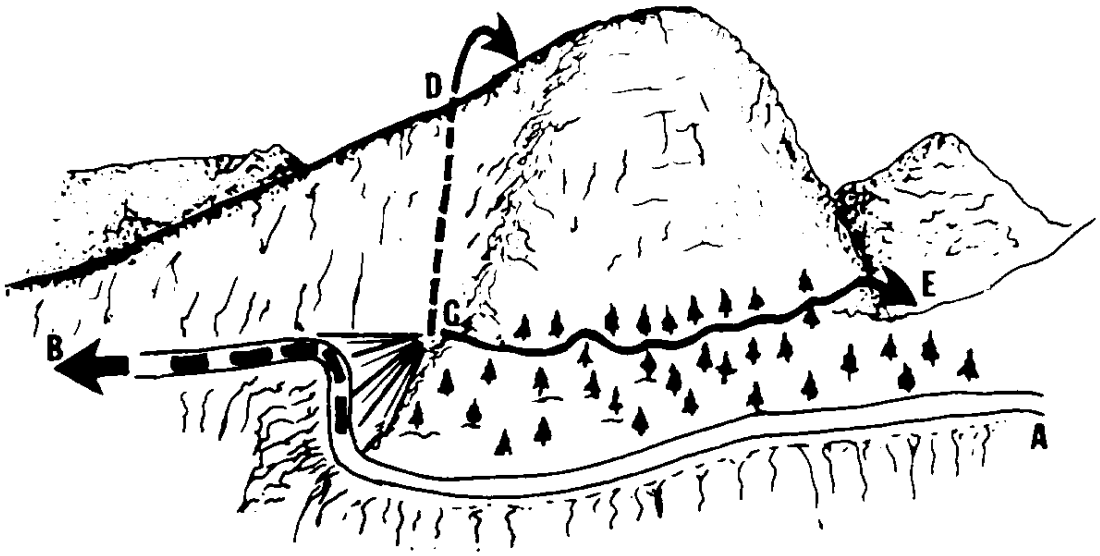

Figure 8-1 Typical Guerilla Ambush Position and Escape Route

NOTE - A guerilla ambush party at C attacks a convoy moving from A to B. CD is an unlikely escape route as the slope is too steep and lacking in cover. CE is the probable route, being level, concealed and giving access to a separate valley.

7. The other major guerilla threat to movement is nuisance mines on roads and tracks. There are laid overnight and are easily concealed in sandy, stony country. To combat this, roads and tracks must be patrolled and ambushed at night; vehicles will need a layer of sandbags on the floor. In really bad areas, roads may have to be cleared on foot every morning before use.

SECTION 2 - COUNTER-INSURGENCY OPERATIONS

General

8. CFP 302(1) describes the tactics required in situations short of war. The differences imposed by mountainous country are discussed in the following paragraphs.

Protection of Movement

9. The following problems may be encountered:

a. Crest clearance difficulties may make it impossible to provide continuous artillery support for convoys between firm bases. This may be acceptable if the enemy threat is light, if adequate armoured support is available, or if armed helicopters can be flown in support of the column. Otherwise the distance between firm bases should be reduced or artillery should be included in the column.

b. Good visibility and dominating hill features may tempt guerillas to conduct long-range ambushes with mortars, machine-guns and snipers sited on high ground several hundred metres above the road. This is difficult to attack from the road as an uphill assault will take some time and will need continuous support from the air and artillery. The best solution is to position a heliborne reserve above or behind the ambush, where the guerillas can be cut off or attacked from the rear. If there is a strong threat of this type of ambush, picketing may be necessary. Details are at Annex D.

Protection at Rest

10. Protection - The protection of any mountain base camp is expensive in troops, and in the time and effort spent in construction of defences. This can be reduced to some extent by careful siting and the use of ground surveillance radar on likely approaches. Camp sites which are closely dominated by hills must be defended by pickets on these hills with all the attendant difficulties of supply, fire support, and relief. Wherever possible, therefore, bases should be sited on high ground with a simple perimeter defence. Battalion and company size bases can often be placed on hill tops, although this will mean supply by helicopter if a road or track is not available. Formation bases require a land supply route and a bigger perimeter, which will normally include an airstrip and a water source. The base should be sited so that it is not dominated by surrounding heights and is at least outside the effective range of small arms fire if not mortar and rocket fire as well. Such sites are likely to be found only in the wider valleys, or coastal plains; the requirement for pickets will thus be kept to a minimum. To avoid aircraft being shot at on approach or take off, ground on the main flight paths to and from the air strip must be picketed.

11. Camp Pickets -

a. Camp picket positions on the hills dominating a base camp may have to be occupied for a considerable period. They therefore need careful siting with maximum observation and strong defences, as they are tempting targets for guerilla attack. Sangars or sandbag bunkers with overhead cover must be constructed if the ground is too hard for digging, and must have a protective ring of concertina wire and claymores. Mortar and artillery defensive fire tasks must be planned and available on call. Armour can also give fire support to pickets. Full use should be made of surveillance and night vision devices.

b. Permanent camp pickets will normally be manned by a section or platoon, which should be regularly relieved to ease the monotony of maintaining continuous observation.

c. Apart from securing the main base, picket posts can also be used for -

(1) artillery or general OPs,

(2) radio relay stations, and

(3) patrol bases.

12. Mobile Reserves - One of the best ways of protecting a mountain base camp is to dominate the area around it to at least 4,000 m (enemy mortar range) with OPs, patrols, and ambushes. At the same time, a mobile reserve of one or more platoons at immediate notice is maintained at base, with the necessary helicopters to transport it. One helicopter should be permanently allotted to air reconnaissance around the base area. When worth while reports of enemy sightings or contact are received, the reserve is briefed and takes off, and is at once ready to follow up and intercept the guerillas. Further orders can be passed in flight if necessary. Pre-planned drills must have been practised beforehand to deal with any contingency. A heliborne force of this type is particularly valuable in the mountains, as a force on foot would be far too slow to achieve results.

CHAPTER 9

THE EFFECT ON LOGISTIC SUPPORT

SECTION 1 - GENERAL

Principles

1. The normal principles of administration apply in the mountains just as much as in the plains, but mountainous country imposes a number of restrictions because of the difficulties of terrain and climate, probable lack of local resources, and the vulnerability of supply routes. The few and inferior routes available will only accommodate a limited amount of transport. This in turn will limit the size of the force which can be supported. The supply problem must not be underestimated as serious reverses may be suffered due to a lack of foresight.

Size and Composition

2. The size and composition of a force that can be supported in the mountains depends on the:

a. number and capacity of the roads, and the means of improving them;

b. amount of ground and cover available for deployment off the road;

c. number and type of aircraft available for air transport support;

e. availability of special transport, equipment, and supplies;

f. climate; and

g. availability of logistic units to support the force, including those required for air supply.

SECTION 2 - THE LOGISTIC PLAN

General

3. Success in mountain operations depends upon a flexible logistic plan based on a thorough appreciation of the facilities available and designed to ensure mobility.

Reconnaissance

4. Detailed reconnaissance is required of:

a. the road network to decide the type and maximum number of vehicles that can be profitably employed in the area;

b. possible deployment areas, and suitable sites for administrative areas and bases; and

c. suitable sites for short range tactical airstrips, drop zones, and helicopter landing sites.

Air Transport Support

5. Maximum use must be made of all forms of air transport, which will make an enormous difference to mobility in the mountains by saving time and effort. Air support will be limited by the weather, availability of landing sites, and the degree of enemy action both from ground and air. Where possible, helicopters should be used to bring supplies direct to units and gun positions, however the limitations mentioned will make it impossible to rely entirely on air transport.

Other Transport Support

6. Vehicle - Normal road transport should be used as far forward as possible, although unit transport must be reduced to essentials only. Units off the main axis should operate on light scales. In snow, oversnow tracked vehicles are essential for moving off the roads. Transport not required by units must be centralized and kept clear of the mountains.

Figure 9-1 Animal Transport - The Mule

7. Animal - Forward of roadhead, animal transport should be used if available (Figures 9-1 and 9-2). Formed animal transport units are unlikely to be available, but if they are the animals should be acclimatized before being used; local animals should be hired whenever possible. Pack animals can carry loads over 13 or 16 kms (8-10 miles) in remarkably difficult, rocky hill country and in weather conditions unsuitable for helicopters and road transport. Their disadvantages are:

a. the considerable weight of forage and water they require daily;

b. one man is required for each animal in forward areas;

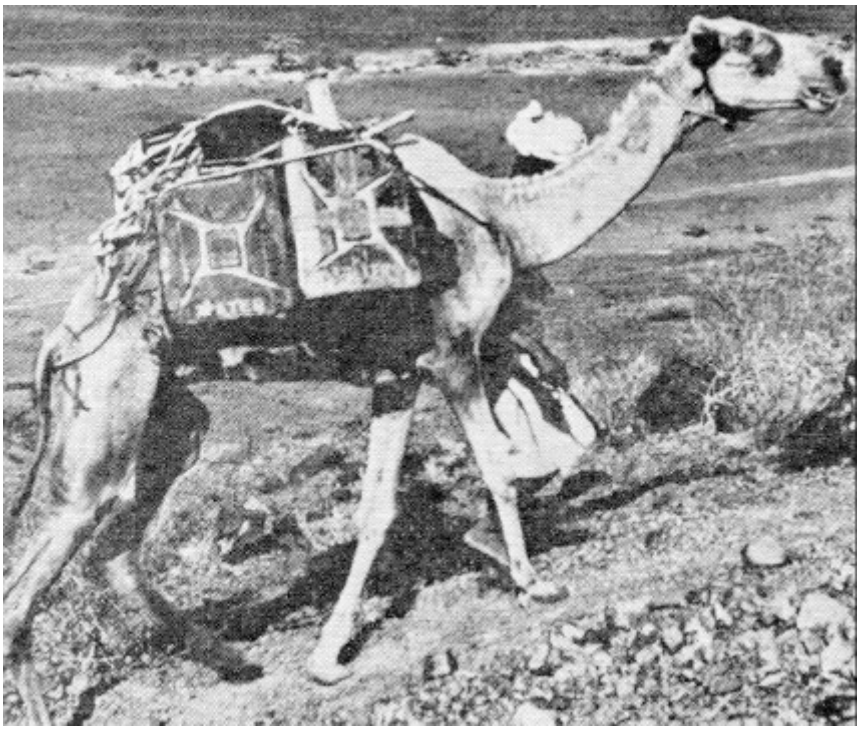

Figure 9-2 Animal Transport - The Camel

c. animals are vulnerable and conspicuous; and

d. their care and the preparation and tying on of loads takes time to learn.

More details of animal transport are at Annex E.

8. Porterage - Man-pack is the final method of transport over snow, glaciers or rock faces where nothing else will serve. Local porters should be employed if possible, but they cannot always be relied on to operate in the forward area where they are most needed, even with an escort. As a last resort, combat troops may have to be used but they will normally operate as fighting porters carrying their own arms and ammunition in addition to their loads, which will then be limited to 10 to 18 Kg (25 to 40 lb) depending on the domestic load carried. More details on porterage are at Annex F.

Other Factors

9. Traffic Control - Traffic control on the limited routes available in mountains assumes more importance than usual. The principles and methods are the same as in open country, but the following points are emphasized:

a. early location and marking of bottlenecks, deployment areas, passing places, turnrounds, and roadheads for various types of transport;

b. classification of routes as two-way, and the allotment of timings on one-way routes;

c. good communications;

d. a high standard of driving and discipline by all road users;

e. an efficient organization for clearing obstacles caused either by the elements, enemy or broken down vehicles;

f. particularly good signing is required for both day and night moves on difficult and dangerous routes; and

g. whenever possible two routes should be selected, one for vehicle traffic and the other for troops on foot, and animal transport.

10. Use of Local Labour - Pioneers are unlikely to be available to meet all demands and recourse will have to be made to local labour. Demands for local labour must be submitted by units to formation headquarters, through which it will be recruited. This labour should be used in conjunction with pioneers to ensure that there is proper supervision. When pioneers are not available and military supervision cannot be provided, the use of local labour will always involve a security problem, particularly in counterrevolutionary warfare, and should therefore be kept to a minimum.

11. Repair and Recovery - Harsh terrain conditions are likely to increase the repair load, particularly on wheeled equipment. At the same time inferior road communications will make it difficult to carry out normal recovery from forward areas to the local base. The emphasis will therefore be on forward repair; urgently needed spares must be flown forward whenever possible and there will also be a need for improvisation by individual tradesmen. With greater reliance on air communications and the consequent rise in achieved flying rates, the servicing effort on light aircraft will be increased and aircraft availability will assume greater importance.

12. Supplies - Disposition of a force in considerable depth down one overcrowded axis will likely mean longer second-line rearward journeys. Fuel consumption may increase by as much as 50 per cent compared with flat running, but this will be counter-balanced by the smaller scale of transport operating.

Water

13. Supply - It cannot be too strongly stressed that a plentiful supply of drinking water is essential for the efficient performance of men who have to undertake physical exertion in hot climates or at high altitudes. Men cannot be trained to exist on less than their actual water requirement, which is the amount needed to replace water lost through sweat, etc. In hot barren mountains such as the Radfan, the minimum requirement may be as much as nine litres (two gallons) per man per day. This ration would allow very little for washing. To maintain adequate hygiene and morale up to 23 litres (five gallons) per man per day for all purposes is desirable, but rarely possible. Water in mountainous areas is often scarce and sometimes nonexistent, so its supply and transport provides a considerable logistic problem, which must be taken into account

in all operational planning. It may even be necessary in the forward area to occupy and hold a position in which there is a water source to save transporting it, but then the protection bill must also be considered.

14. Discipline - Because of the shortage of water the following rules as listed should be enforced in mountain operations:

a. All water must be purified before being used for drinking or washing. All water sources should be reported, positions logged at formation headquarters, and subsequently tested by medical personnel for both diseases and poisons. Troops should use individual sterilizing outfits to purify any water found locally. The purification of water at military water points is the responsibility of the engineers.

b. The issue of water must be strictly controlled. Sources which are likely to be required for drinking must not be polluted by washing, excreta or animals.

c. Drinking may have to be restricted temporarily if supplies are inadequate. The ability to tolerate such restrictions is dependant on the degree of activity and climatic conditions at the time. Some degree of restriction to normal intake can be tolerated providing the fluid balance is restored in each 24 hour period. If intake fails to balance output from respiration and sweating, progressive loss of efficiency is inevitable.

Local Resources

15. If the area is undeveloped, local resources will be very limited and the force will have to be supplied from outside. This in turn will impose a large transport commitment, so full use should be made of those local resources which are in fact available. The commander must, however, balance the advantage so gained against the possible adverse affect on the local population of depriving them of their already meagre supplies. This factor is particularly important in counter-insurgency operations when a hearts and minds policy is being pursued. Indeed this policy may necessitate bring in additional services and supplies solely for the use of the local population.

16. it follows that best use must be made of whatever is available and all ranks should be actively encouraged to improvise whenever possible.

Protection

17. Protection of the L of C, administrative units, and B echelons will be important in the mountains, where the narrow supply routes will always be vulnerable to enemy raids and infiltration. Light armour may be employed on these tasks.

SECTION 3 - SUPPLY

General

18. Support for operations in mountainous terrain will be provided by the service battalion with additional support as necessary from higher formation units. The resupply of material to formation units will as far as possible follow the normal maintenance system.

System of Supply

19. The service battalion will support the units with the normal range of technical, transport and general stores, and a reserve of clothing. In situations where road transport cannot be used, the battalion will operate without vehicles, with stores off-loaded on the ground. Replenishment of service battalion stocks will be effected by whatever transport agency is available, probably from a higher formation stores holdings unit.

20. Where resupply to units is primarily by air, second line combat supplies will be held as grounded stocks by the service battalion.

21. There is likely to be an increased demand for certain items; wear and tear on clothing and equipment is usually severe. For example, the following figures were used by the British Army in assessing life of clothing in the Radfan:

Boots 3 to 4 weeks
Pants 7 to 10 days
Shirts 7 to 10 days

Small arms, radios, vehicle tires, suspensions, and trailer connections are easily damaged and will also need replacing. In hot barren mountains, large quantities of water containers of all types will be needed.

Storage of Material

22. The climatic conditions likely to be found in mountainous country will tend to shorten the storage life of material; the limitation on storage facilities and the lack of space will aggravate the situation.

23. The main climatic problems are extremes of temperature and high relative humidity; it is unlikely that special packaging will be available to overcome these climatic problems, and storage methods must therefore minimize these effects. Stock levels in the forward areas should be kept to the minimum necessary to meet the operational requirement; reserve stocks should be held at as low an altitude as possible.

24. Material will normally be stacked in the open. Maximum use must be made of natural cover to protect stacks from the prevailing weather, and stacks should be kept clear of wet ground by the use of dunnage or pallets.

25. Stacking methods should ensure that those stores most vulnerable to frost damage are placed centrally in the stacks.

26. If necessary, stocks should be guarded to prevent pilfering.

CHAPTER 10

TRAINING

SECTION 1 - INDIVIDUAL AND COLLECTIVE TRAINING

General

1. The following special training or increased emphasis on certain normal training subjects is required to prepare troops for operations in mountainous country.

Individual Training

2. Physical Fitness - It cannot be too strongly emphasized that a high standard of physical fitness linked with correct techniques is probably the greatest single factor for success in mountain operations. Fit soldiers will be able to stand extremes of temperature and the effects of altitude, whilst the unfit will give in or impose unacceptable delays on the remainder. Mountain fitness can only be achieved by living in the mountains and undertaking progressive hill walking and climbing with loads for increasing distances and periods. To achieve maximum efficiency the correct techniques outlined in Chap 2, para 15 must also be mastered; once this is done the carriage of heavy loads and rapid movement up and down steep slopes can be carried out.

3. Map Reading and Orienteering - Map reading in mountains is more difficult and therefore needs practice, especially in bad weather or at night. Orienteering can be used to introduce competition and so arouse enthusiasm. See Chap 3, paras 17 and 18 and CFP 318(8), Manual of Map Reading.

4. Route Selection - The problem of route selection should be studied and should include the relative merits of detours against loss of height. See Chap 3, paras 11 to 16.

5. Elementary Rock Climbing - Mastery of this skill gives the individual great self confidence, but the training needs careful supervision and organization by qualified mountaineering instructors if casualties are to be avoided.

6. Silent Night Movement - This is more difficult in mountains than elsewhere, particularly when moving over scree.

7. Skill at Arms

a. All ranks must realize that there may be a difference in the performance of their weapons at high altitudes, since the weapons tend to fire high. In addition, special oil and lubricants will be required at subzero temperatures.

b. The individual should be practised in firing accurately at longer ranges with the rifle and other weapons.

c. There is a need for special training in firing up hill and down hill.

d. "Crack and thump" training must be carried out, because the acoustics in mountains are different to acoustics in other types of country.

e. Night firing must also be practised.

f. After preliminary training all these points can best be combined in a mountain field firing area. In the later stages of training this field firing should be included at the end of a long cross mountain march.

8. First Aid and Counter Exposure Training - This may be vital to the survival of the individual casualty and must be known to all ranks.

9. NBC Training - Progressive training involving all these skills should be carried out wearing NBC protective clothing to accustom all ranks to its use.

10. Other - Water and hygiene discipline must be practised by all.

Section and Sub-Unit Training

11. Observation Training - The manning of OPs and observation at long ranges, including judging distances, are skilled techniques which need considerable practice in real mountainous country.

12. Fire Positions - The selection of good fire positions requires practice if the problem of dead ground is to be overcome, and the position is not to be overlooked.

13. Picketing - Movement into picket positions both by helicopter and on foot must be practised; this can be combined with the selection of picket positions, and the construction of section sangars and general picket defences.

14. Patrolling - This is the basis of all tactics and is more important than ever in mountains, where long range patrols are particularly effective. The siting of ambushes and anti-ambush drills must be mastered.

Unit Training

15. Mobile Reserve Training - This must include deplaning from helicopters under difficult conditions and roping down. It must also include drills to cover all contingencies after rapid deplaning to unreconnoitred country, ie, immediate attack, immediate ambush, hasty defence, and quick cordoning.

16. Air Training - In addition to helicopters, all ranks must be able to operate with short- and medium-range tactical transport aircraft, including the selection and marking of Dzs and Lzs, helicopter marshalling, and air drop procedures.

17. FAC Training - Units earmarked to operate in mountainous country should ensure they have the full scale of trained FACs on their strength.

18. Armour, Artillery, and Mortar Target Indication - It is equally important that all ranks down to and including section commanders should be trained in these techniques.

19. Driving - Driving any type of vehicle on hill roads and tracks, especially at night, needs practice and experience, which can only be gained by training in mountainous country.

20. Radar and Night Vision Aids - The siting and use of these devices needs practice in the mountains, particular. attention being paid to the many areas of dead ground.

21. Night Operations - As operations in the mountains will be conducted at night more often than not, training for all phases of war must be carried out in the dark over really rough going.

22. Snipers - Up to 10 per cent of the men in infantry rifle companies should be trained as snipers. Part of this training should be carried out in high mountains if possible, as the thinness of the atmosphere at altitude may affect sniper rifles at long ranges.

23. Concealment and Camouflage - A high standard of training in these skills is essential, particularly if there is a nuclear threat.

ANNEX A

NOTES AND GENERAL WEATHER HINTS APPLICABLE TO THE NORTHERN HEMISPHERE

Clouds (See Figure A-1)

1. The hints listed hereunder should be borne in mind when one is examining clouds:

a. The character and direction of the upper strata decide the eventual direction of the wind and the more permanent character of the weather. The lower strata affect only the immediate future.

b. High travelling cirrus, increasing from the south or west, with a halo round the sun or moon giving way gradually to lower clouds of the altostratus type with a corona, indicate the approach of a warm front and rain.

c. High cirrus of the "mare-tails" type portray wind and predict rain according to their direction.

d. Stratus at any height means bad weather and the tendency of cirrus or cumulus to stratify is ominous.

e. Cumulus clouds are signals of a change for the worse, when they tower rapidly and more especially when they topple over or show a tendency to do so.

f. Heap clouds - cumulus and cumulonimbus - may be three- or four-miles thick vertically. Precipitation is generally of short duration but heavy.

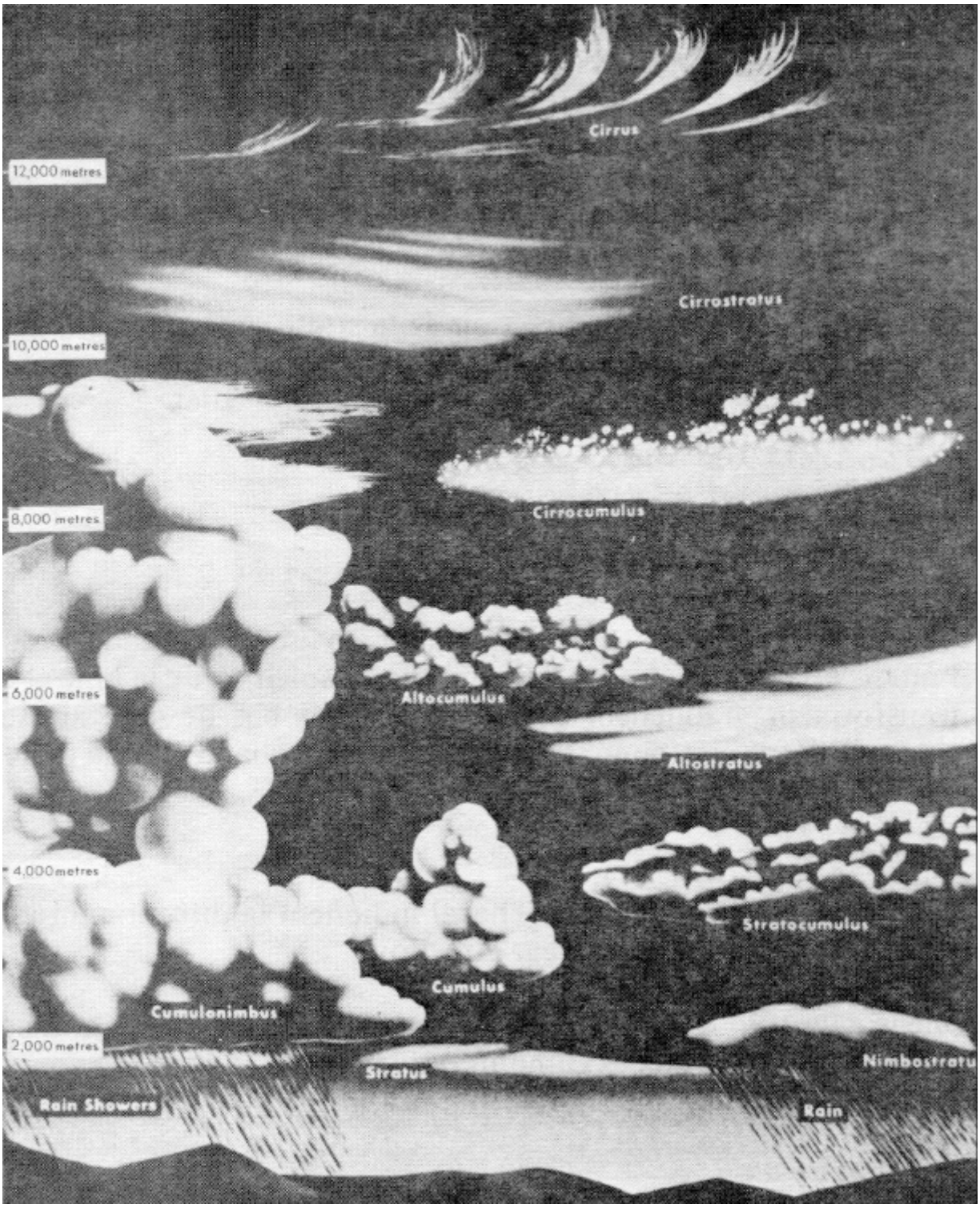

Figure A-1 Cloud Types

g. Layer clouds are level, relatively shallow sheets, often covering a wide area. They give less changeable weather than heap clouds, but any rain or snow from them is liable to last a long time.

h. Cloud building up around a peak in the early morning is probably a bad sign.

j. Black wisps of cloud before sunrise, especially in a clear sky, mean early rain.

k. Fish clouds, or long, thin, elongated lens-shaped types, if they point east and west, usually mean foul weather; pointing north and south fair. They invariably indicate high winds.

m. A snow cloud may be light in tone - often with a yellowish orange tinge.

n. Ascending mists on hillsides are bad omens.

p. Good signs are mists in the valleys and hollows at evenings; clouds lifting at sunset; and hilltops smoking their pipe of evening peace.

Wind

2. Notwithstanding (or possible in addition to) certain popular conceptions of wind omens, the following have proven to be generally correct:

a. The north wind is usually for the good.

b. The south wind is generally bad. It brings a succession of storms but leaves fine intervals.

c. The south-west wind means rain to follow.

d. The west wind, if continous, means continuance of unsettled weather.

e. The east wind is infrequent and rarely long continued. It is generally favourable, but may be cold.

f. A wind backing against the sun (eg, changing from north-west to west or from west to south-west) means a change for the worse.

g. A wind veering with the sun (eg, changing from south-west to northwest) means a change for the better.

h. A rising wind with a drop in temperature or gusty and round-the-compass winds are of ill omen.

j. A wind blowing uphill at night means unstable conditions and the possibility of a change.

General Hints

3. In addition to the cloud and wind hints, the following general observations are valid:

a. Weather systems move from west to east.

b. Changes for the worse usually come from the west or south-west, so look west or, at least, to windward.

c. To find where the area of low pressure is, stand with your back to the wind and the low pressure will be on your left or left rear.

d. A red sunrise is bad; a red sunset is good.

e. Over-gaudy colours at sunrise or sunset, and all hard outlines foretell rain and wind. Delicate colours, well-blended tones, and filmy cloud edges are fine weather prophets.

f. Sunset on a pale yellow sky means a rainy day - on a bright yellow sky, a windy day.

g. Heavy dews and the wind falling off at sunset, or the wind becoming a downhill one are all good signs, but on clear cold nights they may cause fog to form.

h. The clearness and nearness of distant hills, except just after rain, are bad signs.

j. Early rain rarely lasts. ("Rain before seven, clear before eleven".) The longer the period of settled weather the more definite will be the signs of a real change.

k. When there is precipitation and the sky cannot be seen, very small snowflakes or drizzles indicate that the clouds above are thin and there is fair weather at high altitudes. A steady fall of snow or rain indicates that precipitation has begun at high levels and that bad weather is likely on ridges and peaks.

m. There is a danger of lightning on high exposed ridges.

NOTE - The dominant feature of weather in the mountains is its simple unpredictability.

ANNEX B

HINTS ON AVALANCHES

Safety Measures

1. It is dangerous to move on steep newly fallen snow which is more than 30 cm (1 foot) deep. The greater the depth of new snow, the greater the danger of an avalanche. Even at the freezing point or a few degrees below, deep new snow is liable to avalanche on slopes steeper than 22 degrees or 40 per cent (or sometimes even less), for up to two or three days after a fall.

2. During rain or other warm weather, even slopes of such moderate gradient as 15 to 20 degrees (27 to 36 per cent) are liable to wet snow avalanches. If the snow becomes sticky, the approach to thaw conditions should be suspected. The temperature may rise several degrees in half an hour. During thaws, avalanches occur more frequently in the afternoon than in the morning.

3. After snowfalls accompanied by wind, all lee (protected) slopes should be regarded with suspicion, since it is upon these slopes that thick accumulations of soft powdery snow form and are most liable to avalanche.

4. Slopes, often lee ones, where the snow has been hardened by wind (as opposed to sun and frost) should be suspected for "wind slab", the most insidious type of avalanche, as the wind hardened surface of the snow cannot easily be distinguished from safe frozen crust. The characteristic of these avalanches is that they break up onto large blocks which may cause injury even though they do not travel far or fast.

5. A dangerous slope should not be traversed. If it is impossible to turn back, it is best to go straight down or straight up. Should a traverse be essential the slope should be crossed as high up as possible, and with an interval of between 100 to 200 m between each member of a party. All must be roped together.

6. Cornices are found on ridges and are built up when the wind blows snow over the ridge and it adheres to the leeward side of the crest. Big cornices may project in an overhang of many feet. See Figures B-1 and B-2.

7. When there is any doubt, it is advisable to keep to ridges. Avoid routes where there is a possibility of troops being swept over precipices or on to other dangerous ground.

8. If caught in an avalanche try by a swimming motion to keep on top. When the avalanche slows down, cover the face with the arms to clear a space for breathing round the head and shoulders.

9. If wearing skis, they should be removed if possible before the avalanche hits, as they tend to drag one down deeper into the snow. For the same reason ski poles should be discarded at once.

10. Never try to run away from an avalanche; it moves far too quickly and will engulf one when least expected. If a crevasse is near and provided it is not too deep, jump into it. Should all else fail and there is no cover around, sit with back to the avalanche putting the rucksack behind you and wait for it. When the avalanche arrives, act as in para 8 above.

Avalanche Rescue

11. Men have been known to survive 48 hours in an avalanche, so every effort must be made to dig victims out as soon as possible and to keep on searching until they are found. Rescue is made easier if it is known:

a. where the victim was first caught by the avalanche; and

b. where he disappeared from view.

The first search should then be concentrated in the lower part of the avalanche along the extension of the line from these two points (see Figure B-3);

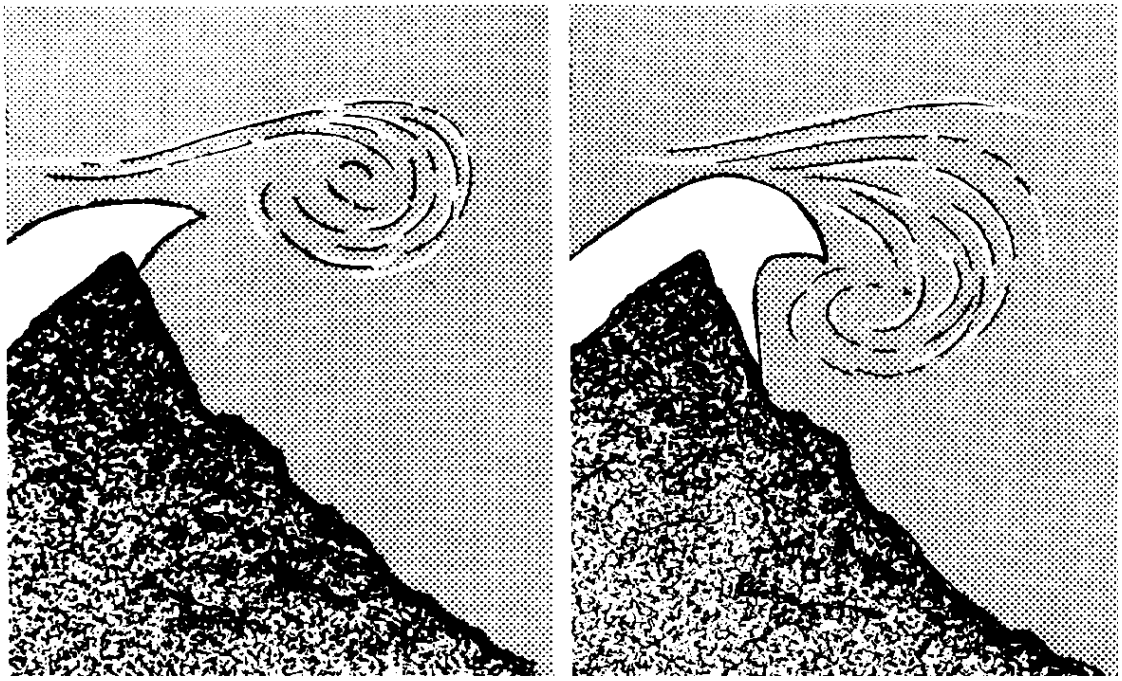

Figure B-1 Formation of Cornices

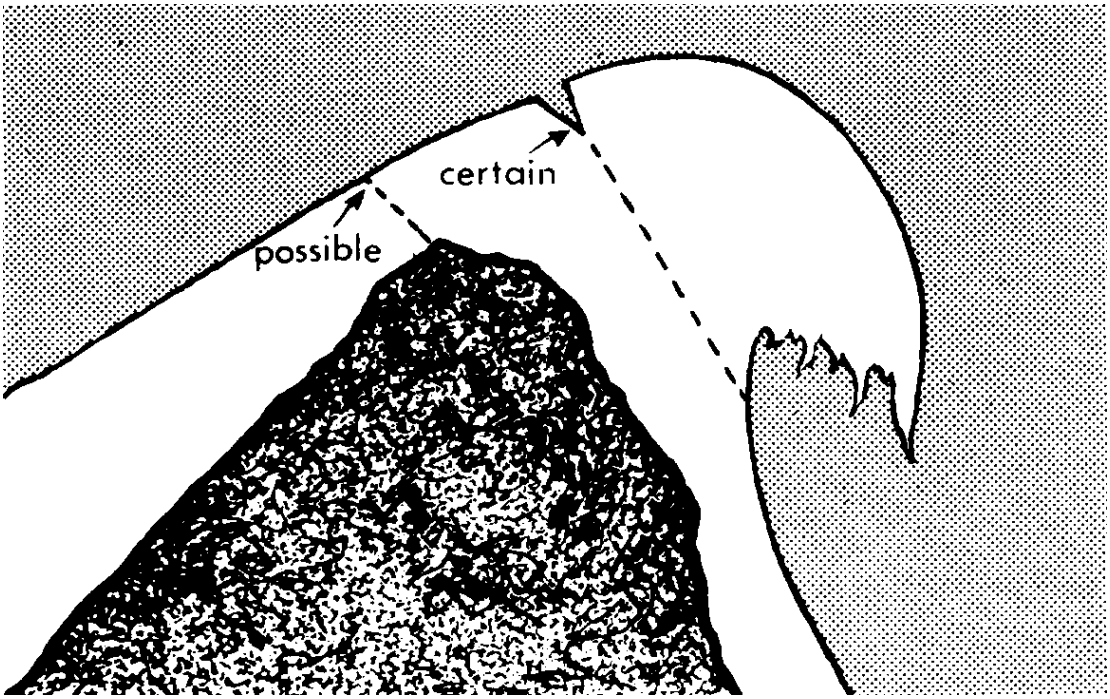

Figure B-2 Lines of Rupture

12. If this initial search is not successful, searchers should spread out about four feet apart in a line across the bottom of the avalanche and search systematically upwards, probing with sticks as they go. As soon as the victim is found, clear his mouth and nose of snow and, if he is unconscious, start artificial respiration at once. Then get him shelter and give him hot drinks and warm clothing if possible. When warmed, evacuate him to proper medical care.

(1) - Point of First Catch

(2) - Point at Which Last Seen.

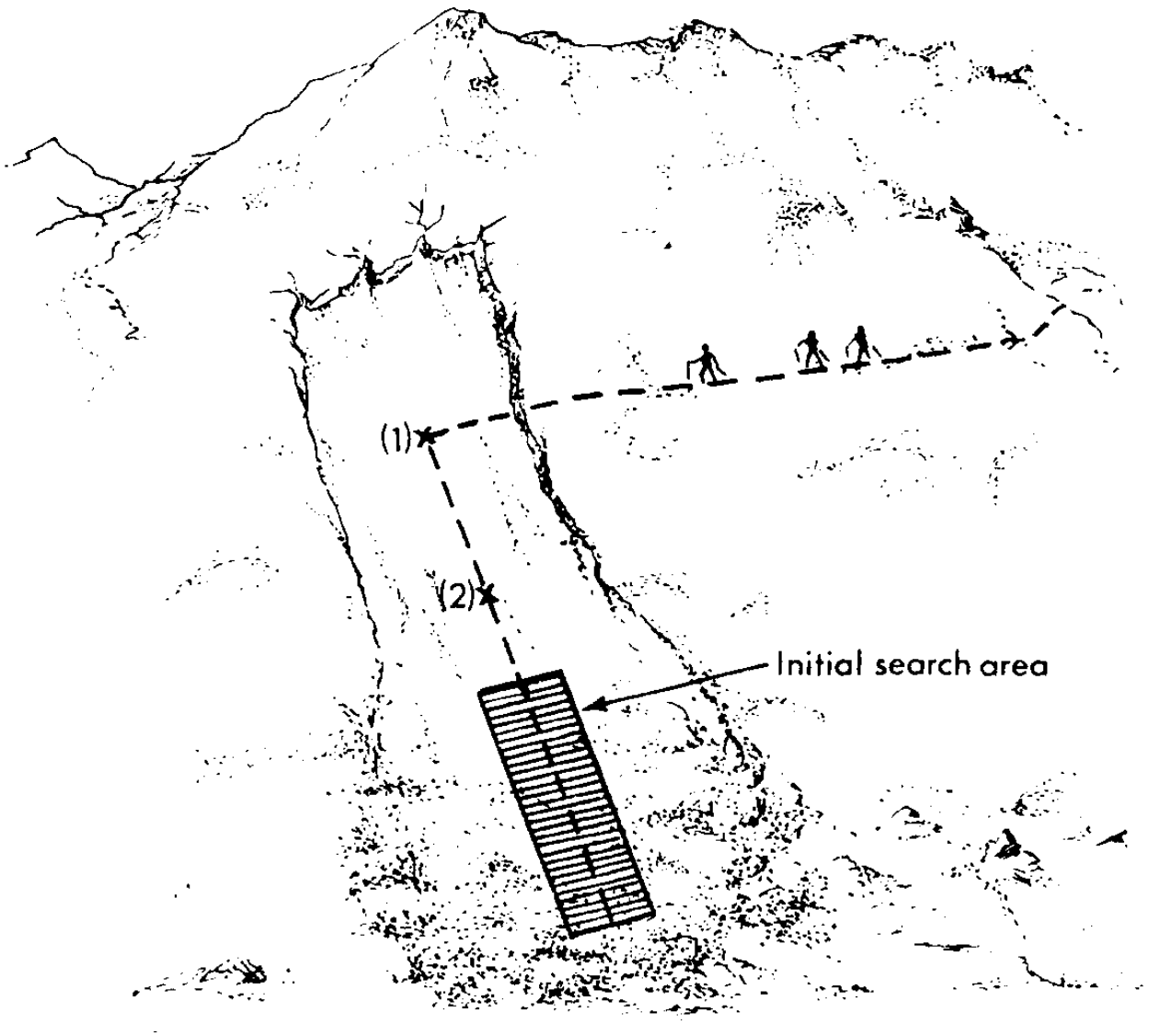

Figure B-3 Avalanche Rescue

ANNEX C

ROUTE SKETCH EXAMPLE

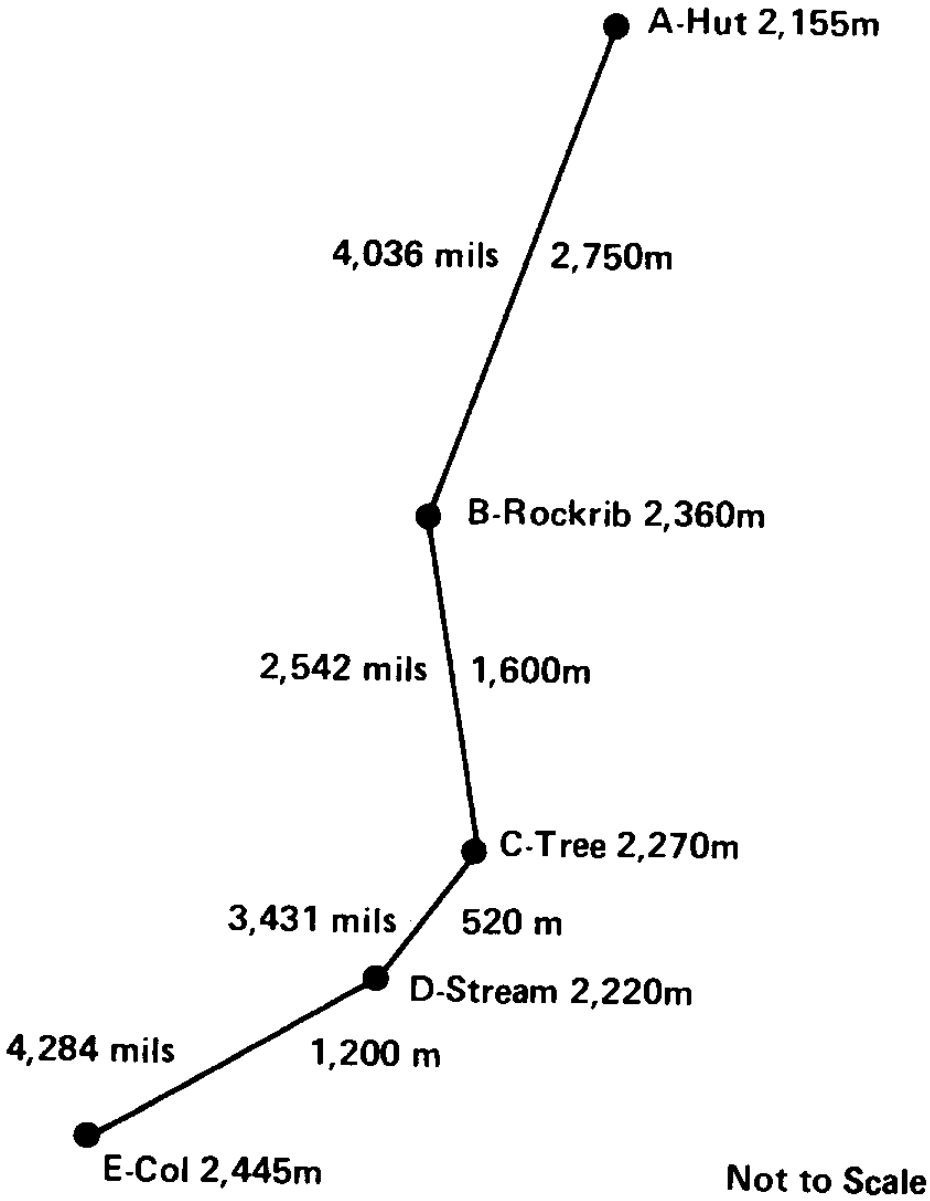

Figure C-1 Rough Route Sketch

1. Figure C-1 indicates a route from Hut A at 2,155 m to Col E at 2,445 m, with measurements of distances bearings and heights taken from a map.

2. The following card for the same route is a useful way of making a time and distance plan:

Legs	Magnetic Bearing	Height at end of leg (Metres)	Height Difference (Metres)	Distance (Metres)	Time (Mins)
A-B	4036	2,360	Up 205	2,750	80
B-C	2542	2,270	Down 90	1,600	34
C-D	3431	2,220	Down 50	520	12
D-E	4284	2,445	Up 225	1,200	63

NOTE - The time is based on an average speed of 4 km per hour plus one hour for every 300 metres of ascent or 600 metres of descent.

ANNEX D

PICKETING ON THE MOVE

General

1. Protection on the move is usually necessary in mountain warfare, and almost certainly in the advance to contact. Advance- and rear-guards may not be sufficient and it may be necessary to occupy the ground overlooking the route with troops from the column; this is called picketing. The column then moves inside a protected area formed by advance- and rear-guards and by pickets established on the dominating ground flanking the route.

2. Moving under picket protection slows down the column, and to attain maximum speed a comprehensive picket drill is essential. Picketing headquarters must be directly behind the advance guard, and picket positions must be selected quickly. Previous study of maps and air photographs assist in this. As pickets are posted, the next troops for picketing must take their place in readiness. Pickets may vary in size from a section to a company in exceptional circumstances where a large feature overlooks a considerable portion of the route. They are withdrawn by their commander on orders from the rear-guard commander.

3. The distance from the route to be picketed is governed solely by the range of weapons being used by the enemy. If the enemy are only equipped with rifles, any feature over 600 m from the route can be ignored, but if more sophisticated weapons such as mortars are used, pickets must be established where they can observe out to the required range. The selection of picket sites is never easy, for a likely looking site may itself be dominated by a possibly enemy held peak a short distance beyond it. The main principle is that ground must be picketed if the enemy, from that ground, can interfere with the movement of the column. By moving along one side of a wide wadi it may be necessary to picket only one side of the route, but this will be rare.

4. Another method of picketing, known as a flying picket, is possible in certain types of terrain. In this method, a picketing force remains on the hill tops, changing picket locations along the crest-line on foot instead of returning each time to the valley floor.

5. Formations and units operating in mountainous country must have SOPs to cover picketing drills and be trained in them. They should cover posting of pickets and the use of picketing logs, orders to picket commanders, action of a picket on arrival in its position, the procedure for withdrawing pickets, and orders governing the wearing of fluorescent panels on the backs of soldiers to identify their location in pickets. The identification of picket locations is not easy and is a key problem; apart from fluorescent screens, the use of coloured smoke and even heliographs are common practice.

6. A possible diagrammatic layout of a column on the move, using pickets is shown at Figure D-1. With the exception of scout cars, the locations of supporting arms have not been included. Clearly, both guns and mortars must be moved along the route so that every. picket is within range; this inevitably means that they must leap-frog forward, the deployment of both weapons being coordinated by the senior artillery officer present with the column. OP parties will be deployed to important pickets that dominate much of the route, similarly a FAC will be well forward, possibly in a helicopter, to coordinate air support in the defensive fire plan.

7. The placing and withdrawal of pickets on foot is both time consuming and physically exhausting; the use of helicopters is a fast and convenient alternative. There are, however, important limitations on their use and it should be considered as normal to deploy pickets on foot initially.

Subsequent support, and possibly withdrawal, can then be done by support helicopters. Mountainous routes are such that it is seldom easy to be certain which features dominate the route, without themselves being dominated from elsewhere. In these circumstances it will be unwise, unless the enemy threat is very weak, to deploy pickets by helicopter. During the approach and at the moment of deployment the helicopter will be very vulnerable to small arms and mortar fire, both from the objective and neighbouring features. Furthermore, on many features it will not be possible to land a helicopter and thus troops must rappel at a most vulnerable time. The use of armed helicopters and observed fire onto the picket objective will do much to reduce the risk but, certainly in counter-insurgency operations, it may be unwise and dangerous to do this in an area which may be occupied by civilians. These factors must be carefully weighed before pickets are deployed by helicopter. Infantry must continue to expect to deploy by foot, and train accordingly.

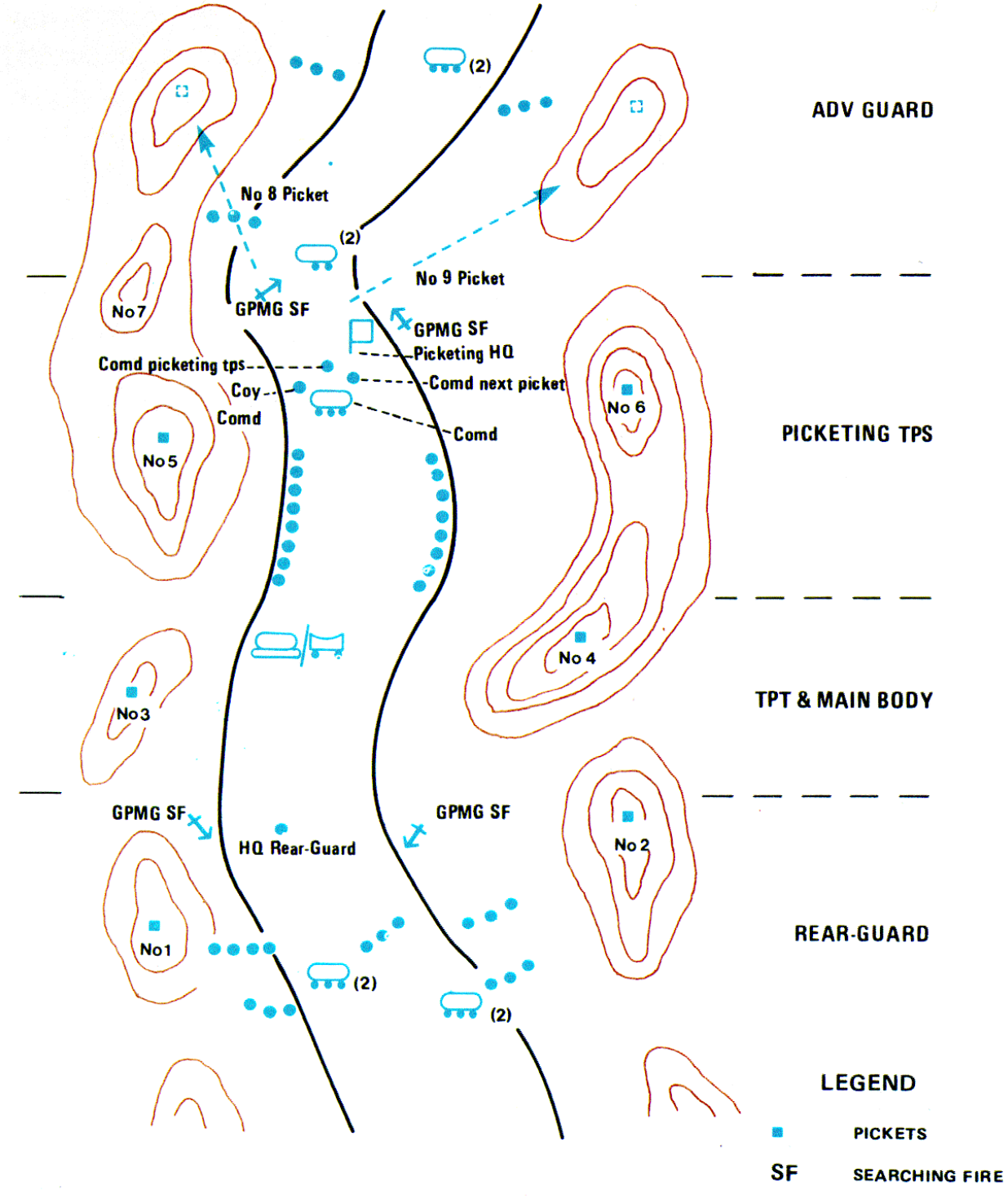

Figure D-1 Picketing on the Move

8. An expert knowledge by all ranks of the drills involved is essential. This is a subject which should receive extensive coverage in SOPs at all levels.

ANNEX E

ANIMAL TRANSPORT DATA

General

1. The key to mountain operations is often the degree of mobility which can be achieved. Animal transport is extremely valuable as heavy loads may be carried, thus relieving soldiers of burdens. Personnel are thus better able to fight at the end of a march. However, all must be aware of the limitations of this form of transportation.

Limitations

2. Animal transport is an uneconomical form of maintenance because the load that can be carried is often out of proportion to the energy expended; it is best used for relatively short journeys. The longer the journey the more the animal's load carrying capacity is used in carrying its own fodder, unless supplies are available en route. A stage can be reached where there is no payload available, because all task animals are engaged in carrying their own rations. The range of animal transport is further limited by the slow pace, the availability of water supplies, and by the fatigue of both animals and drivers.

Types of Animal Transport

3. The type of animal transport available varies in different parts of the world and includes the following:

	Animal	**Load capability (kg)**
a.	Elephant	375 (800 lb)
b.	Camel	110- 160 (250-3 50 lb)
c.	Mule (mountain artillery)	120-150 (260-340 lb)
d.	Pony, yak, bullock, water buffalo	70-90 (160-200 lb)
e.	Mule (general service)	70 (160 lb)
f.	Donkey	45 (100 lb)

Veterinary experts must always be consulted on the selection of suitable animals and measures to control contagious diseases.

4. As the mule has proven to be the best pack animal suitable for both jungle and mountain warfare, the remainder of this annex will deal with mule transport.

Employment of Mules

5. Mules may be used for first and second line tasks and can move with their loads over most any type of country except up steep rock faces or through very deep snow. A useful yardstick for assessing gradients is that a loaded mule can climb any slope a man can negotiate without using his hands.

6. Over average mountainous country a mule can be expected to cover up to 25 km (16 miles) a day, of which not more than half should be under load. At night over a very rough track the range under load may be reduced to about six kms (4 miles). In jungle, a mule will go as far as his driver can in any one day; but the mule's route is more restricted because of its size and awkwardness of its load.

7. Mules can work unshod in sandy dry going, but require shoeing for wet or stony ground, which wears their hooves quickly.

8. Pack mules receive a daily ration of up to 11 kg (25 lb) of forage. Their daily water consumption is approximately 45 litres (10 gallons) of clean water each; they are normally watered three times a day.

9. Expert saddle fitting and the frequent adjustment of saddlery is important if mules are to be kept fit for work. Mule saddles are not transferable between mules, except in emergency, and then a reduced carrying capacity must be expected. Loads must be properly balanced and secured.

10. When it is clear that the unit will have to rely on animal transport for a considerable period, mules may be allotted permanently to a first line unit in place of vehicles. In this case the unit will have to train personnel in mule management and loading. For limited operations, it is more economical for mules with drivers to be allotted from the animal transport squadron of the higher formation supporting the operation. Allowance should be made for the non-availability for load carrying, from time to time, of a small proportion of the allotted mules because of temporary lameness or galls.

11. For F and A echelon work it is usual to have one driver to each mule; for B echelon and second line work one man can handle two mules.

Load Carrying Capacity of Mules

12. The payload of a general service mule is 70 kg (160 lb), but experience has shown that, in addition, the mule can carry its own domestic load as follows:

a.	Local mule driver's kit	2 kg (5 lb)
b.	Local mule driver's ration (2 days)	4.5 kg (10 lb)
c.	Mule's reserve ration (2 days)	4.5 kg (10 lb)

This additional 11 kg (25 lb) means that the mule is over-loaded at the start of a march, but the load is reduced en route.

ANNEX F

PORTERAGE

General

1. The equipment of a unit may be carried by the following:

a. unit personnel;

b. soldiers of other units, attached purely for the porterage of unit equipment;

c. local porters; or

d. a combination of any of the above.

Unit Personnel

2. A small-scale operation against light opposition can often be carried out by a unit or sub-unit carrying its own requirements. This entails the fighting men of the unit sharing out among themselves the essential fighting loads.

3. Clearly a unit can undertake only very limited operations, if it must rely on its own manpower. In a larger scale operation of longer duration, it will need some assistance.

Attached Personnel Used as Porters

4. These are soldiers temporarily attached to a unit or sub-unit for a particular operation, to help that unit or sub-unit to carry its fighting equipment and stores. They must be armed to protect themselves but, as their primary task is to act as porters, their arms will probably be restricted to light weapons such as SMGS, pistols, and grenades.

Local Porters

5. Local porters will normally be friendly, indigenous inhabitants or specially enlisted local troops, usually unarmed, who cannot be used without adequate escort.

6. Local porters normally take the place of second line transport and will usually be employed to carry forward daily maintenance requirements, plus reserves of important items, to forward unit A echelons only. Units themselves must then carry the loads to forward positions.

Organization

7. The organization of a unit on a porter basis requires careful planning within the unit to ensure that only essentials are carried.

8. Attached soldiers used as porters must operate on their normal units and sub-units under their own commanders.

9. No establishment exists for local porter units, and formation authority is required before local porters are engaged. When authority has been received, porters may be recruited through local chiefs or headmen. Payment will normally be made from unit imprest, but at times it may be wholly or partly in kind, eg, rations.

10. To get the best results out of any porters, the following must be considered:

a. an echelon system which enables the porters to return to a well protected base after each journey;

b. escorts and protection;

c. sound administration, including the provision of any special clothing or equipment, medical cover, and instructions in portering duties. With local porters the provision of suitable rations is essential; and

d. firm friendly handling and supervision of local porters by officers and NCOs who understand the local language and customs are important. If necessary, civilian interpreters may have to be used.

Load Carrying Capacities

11. The following figures of man-pack carrying capacity are a guide only and will vary according to the type of men, the climate and nature of the country and scale of operations:

a. Own Unit Soldier Porters - The total weight on the man should not exceed 18 to 22.5 kg (40 to 50 lb).

b. Attached Soldier Porters - 11 to 13 kg (25 to 30 lb) payload plus 9 kg (20 lb) domestic load, ie, two days rations, water bottle and weapon; but this combination can be varied according to circumstances.

c. Local Porters - 15 kg (35 lb payload plus 6.5 kg (15 lb) domestic load of rations and water; but payload may be increased by 2 kg (5 lb) if porters are carrying only one day's ration. This is a minimum. Hill men will often carry up to a 27 or 30 kg (60 or 70 lb) payload.

Planning Data

12. When planning the number of porters required for a particular operation, the following factors must be taken into account:

a. the length of carry;

b. the type of country, including height above sea level;

c. the type of porter available;

d. availability of water;

e. the weight of domestic load to be carried;

f. the size and shape of the load to be carried;

g. the location of an area suitable for off-loading stores, if necessary; and

h. the need for protection if local porters are used.

13. The method of calculating the number of porters required is as follows:

a. Calculate the lift, ie, load carriers' potential, of a unit or sub-unit.

b. Determine the load the unit or sub-unit must carry in excess of the domestic load, if any, ie, rations in excess of two days and any share of the unit's B echelon.

c. By subtracting b from a the payload of the unit or sub-unit will be found.

d. Calculate the total load to be lifted.

e. The difference between c and d is the load for which additional porterage is needed. Thereafter, it is a simple matter to determine the number of porters required according to the type available.

ANNEX G

ALTITUDE ILLNESS

General

1. The contents of this annex are based on an article in "The Lancet" of 18 Oct 75 which was the work of Drs Charles S Houston and John Dickinson.

2. People who ascend to high altitude rapidly without allowing time for acclimatization are susceptible to altitude illness. Those who return to low altitude early in the disease seem to fare well. The article surveyed twelve cases of illness. Of these, two were fatal and in each of these instances, evacuation had been delayed. The most effective protection lies in slow ascent.

Case Histories

3. These reports are presented as examples only.

4. Case 1 - A 39-year-old female flew from 1,500 to 2,750 m, and in the next two days climbed to 3,500 m where she developed a severe headache. On the 4th day after leaving low altitude she began to vomit while walking to 3,800 m, and on day 5 while walking to 3,960 m she needed assistance because ot dyspnoea, weakness, and vomiting. On the afternoon of day 6 she lost consciousness and was carried down to 3,350 m. She was examined and treated. On day 8 her general condition was no better. She was flown to hospital at 1,500 m. Lumbar puncture showed an opening pressure of 270 mm, and clear colourless fluid which contained no cells, normal sugar and protein. During the next two weeks she improved slowly. On the 17th hospital day she began to speak, but was emotionally unstable. On the 31st day after leaving low altitude she was returned home and subsequently regained normal mental function.

5. Case 2 - A 41-year-old male was dead on arrival at hospital. He had flown from 1,500 to 2,750 m, and during the next few days climbed to 4,270 m where he rapidly lost consciousness, dying five days after leaving 1,500 m. The pathologist wrote: "The enlarged heart is evidence of some cardiovascular disease of uncertain etiology, but just what that might have had to do with the final lethal outcome is uncertain. It is possible that the cardiac condition added to the changes brought on by altitude and had a detrimental effect once the latter train of changes was initiated".

6. Case 3 - A 28-year-old military officer was flown from 770 to 5,300 m in one hour without premedication. He developed a severe headache, and within 20 hours of arrival was drowsy and inactive. He improved slightly with oxygen and morphine, but 26 hours after leaving low altitude his condition deteriorated and he was evacuated to 770 m. There his vital signs were normal, and his lungs were clear. Although he reacted to painful stimuli, he was deeply unconscious, but with normal reflexes. No laboratory studies were possible. He was treated and regained full consciousness in 10 hours. He recovered fully within 5 days.

7. Case 4 - A 36-year-old teacher drove from sea level to 2,590 m nonstop in 48 hours, and during the next four days climbed on cross-country skis to 3,200 m, through deep snow. He was very fit, and had little difficulty at first. The party covered an average of six km each day, taking 3 - 7 hours to do so with 23 kg packs. On day 2 the patient complained of a severe headache, and later noted cough and weakness, but reached 3,200 m by day 5, though in poor condition. On day 6 he became semiconscious, and when evacuated by helicopter on day 7 was in a deep coma. He was admitted to hospital and treated. 60 hours after admission he was quiet, more coherent, but euphoric, and 12 hours later he ate well. He was discharged 4-1/2 days after admission, 11 days after starting his trip, and six days after coma had begun. He had been very sick at 3,960 m on two climbing trips in the proceeding 10 years, but on two other trips to 4,720 m he had been symptom-free. His general health was excellent and he always kept in training. Six months after this episode he felt that he had fully recovered,

8. Case 5 - A 25-year-old healthy male walked in 13 days to 3,500 m and during the next four days to 5,300 m, where he had abdominal pain, fatigue, vomiting, and diarrhoea. On day 5 above 3,500 m he became less responsive and had difficulty with balance. On day 6 he could not walk and slept most of the day, becoming unconscious on day 7 when he was carried down to 4,890 m. That night, bubbling breath sounds and bloody foamy sputum developed. Next day, after being carried down to 4,270 m, he improved slightly after treatment, and on the following day he was flown unconscious to hospital at 1,500 m. 48 hours later he was able to follow movements with his eyes, and in a week could feed himself. On the 10th day after admission (15 days after onset) he was oriented and abled to move his legs. Two days later he was discharged but the attending physician wrote: "I believe he may suffer residual brain damage and I am not sure he will be able to walk again".

Prevention

9. For 50 years various methods of preventing the signs and symptoms of altitude illness have been recommended. However, the mainstay of prevention is slow ascent permitting adequate acclimatization. It used to be thought safe to allow one day per 300 m ascent from 3,000 to 4,270 m, and two days per 300 m thereafter. However, illness has developed despite i his rate of ascent, and it now seems more prudent to allow one day per 150 m of ascent from 2,750 m upwards, interrupted by a day of partial rest at 4,270 and 5,500 m. Although even this rate of ascent cannot promise protection it will be considered too slow by Himalayan trekkers! The following advice has been prepared by a physician who has seen a good deal of altitude illness, and may be more acceptable to the inpatient:

a. Plan your trek with care. The idea of 'snatching a quick holiday' may be all right for the seaside, but it does not give the respect due to the Himalayas. Take informed advice about a reasonable time to reach your objective, and on no account try to 'beat the record' for the trek.

b. Allow two 'rest days' on the way up to your highest point, say at about 3,350 and 4,575 metres. This does not mean that you cannot explore, but be sure to sleep at the same altitude as the night before.

c. If you are using an aeroplane to fly to a high-altitude air-strip, do not plan to go much higher on the day of the flight.

d. If you develop symptoms of mountain sickness, stay where you are until you have recovered, and then go on.

e. If you have symptoms of cerebral oedema, or have any other alarming symptoms, GO DOWN AT ONCE even if it means being carried or travelling by, night. (Consider the terrain, moonlight, etc.)

f. Beware of the 'do or die' attitude in the Himalayas - all too often it has meant more 'die' than 'do'.

10. A very high fluid intake seems to be beneficial. The mechanism is believed to be the stimulation of a water diuresis. Females, during their premenstrual phase are advised to take even longer for ascent, and perhaps take prophylactic diuretics or acetozolamide, if their previous experience shows excessive water retention at this time. For similar reasons, it is prudent to avoid the use of contraceptives, sometimes used to postpone menstruation during a mountain trip.

ANNEX H

THE EMPLOYMENT OF ARTILLERY IN MOUNTAIN OPERATIONS

General

1. Artillery operating in mountainous terrain has specific problem areas to resolve in addition to those of the other arms. Basic tactical principles, however, remain valid, subject to terrain and weather conditions.

2. Tactical problems to be solved by the ground forces depend to a very high degree on mobility. However, in mountain operations the search for this mobility is limited by the impenetrability of the mountain mass. Roads are scarce; most trails are usable only by pack-animals; and the terrain is broken into numerous isolated compartments by rivers, streams, ridges, and valleys. The meterological conditions are subject to many changes, with and without snow, so that the mountain cannot be analyzed from one point of view but from many, according to the practicability of the communications means and the evolution of the season.

3. This restraining influence of the terrain and the difficulty in mastering it, limit the speed and efficiency of the operations. The coordination of action is often difficult, and the execution of command is seriously hindered by the difficulty of displacing command posts. Since it is impossible for the commander to guide his subordinates at each moment, he is obliged to leave to them a high degree of initiative. Logistical problems must also be solved in the mountains. To carry to the front the necessary supplies and to evacuate casualties and materials along poor and vulnerable routes is not easy. Any lack of agreement between tactical needs and logistical possibilities makes the situation particularly difficult. Nevertheless, the introduction of airmobile facilities has eased these constraints somewhat.

Deployment

4. Good gun areas are usually few in number, and due to the shape of the ground they must be very carefully planned. Most artillery equipment can only accept very limited slopes on which to deploy. Good gun areas are generally found in the valleys or foot hills. They must be selected with cover and accessibility to roads in mind. Often batteries must be split into sections to make proper use of good areas for deployment. Detailed map reconnaissance for gun areas is required when planning deployments. Consideration for crest clearance must be carried out in detail to give an indication of the coverage available from firing positions.

5. The ability to concentrate more than one fire unit may be limited, and artillery staffs must carefully plan deployment so that the weight of fire may be placed on the most important approaches or known targets.

6. Regardless of the type of operation, positions must be selected in depth to provide continuous fire support. In many cases, movement to alternate positions is required to bring maximum weight of fire to bear.

7. Very often, it will be necessary to use helicopters to bring the guns into position and thus to eliminate the major part of the difficulties. However, certain limitations of the helicopter - decreased lifting capability in high altitude and vulnerability to ground fire - and rapidly changing meteorological conditions in the mountains must be considered.

8. For all these reasons, it will be necessary in most cases to position only one battery in a definite sector. Sometimes a section may be adequate if the action is limited in time or space. In fact, the possibility of emplacing a complete regiment in one position area will be the exception. Therefore, the organization and equipment of these regiments must provide for sufficient decentralization of firing means so that subordinate elements can operate independently.

Communications

9. Because of the nature of the country, communications by radio will often be difficult and, where feasible, radio may have to be supplemented by line. Often a remote, high communications station will be necessary at battery or regimental level for communication with observers and line laid from it to the fire units which will generally be in lower areas which may have poor communications.

Observation

10. In clear weather visual observation can be magnificent. However, periods of clear weather may be infrequent. This first impression of good visibility is frequently misleading. Summits and ridges following one after another appear to merge and create the impression of a continuous field of observation. A visibility diagram of this field will produce unexpected surprises. From a certain observation post one may be able to see no more than 30 to 40 per cent of the actual terrain before him. Observations posts should not, therefore, all be at the same altitude or perspective, nor too far above the terrain to be observed. Clouds, fog, and haze can accumulate very quickly and deny observation.

11. Forward observation parties will normally travel with the supported arms but at times may have to be deployed on an observation plan devised by a coordinating artillery HQ. In order that forward observers may quickly reach the best points for observation, helicopters may be employed when flying conditions are suitable.

12. Because of the difficulty in observing the target area, extra observer parties may be necessary and must be found from within battery resources. In addition, when forward observation parties are operating on foot for extended periods of time, additional personnel may be required to assist in carrying the necessary equipment, including batteries, night observation devices, and laser range finders. In this case all OP parties will take with them only the bare necessities for performing their task under the anticipated conditions

13. Air OP should be employed whenever possible as an adjunct to ground observation parties.

Adjustment of Artillery Fire

14. All arms must be capable of adjusting artillery fire in mountainous country because of the poor inter-visibility which may exist among artillery OPs. Normal target grid correction procedure is used, but mountainous country adds another major problem in the correction of artillery fire: this problem is the effect of the slope of the ground.

15. The effect of slope combined with the zone of the weapon system in use and the angular relationship with the observer, gun, and target (angle T, see Figure H-1) produces a variety of effects. At times these effects counteract one another, in other cases they accumulate an produce extraordinary results from seemingly normal target grid corrections. It is important to note that the adjustment of artillery fire is done in such a manner that corrections are ordered on a horizontal plane passing through the last round fired. This presents no appreciable problem in level or rolling terrain, but mountainous conditions produce effect which are briefly outlined in Figures H-2 to H-6:

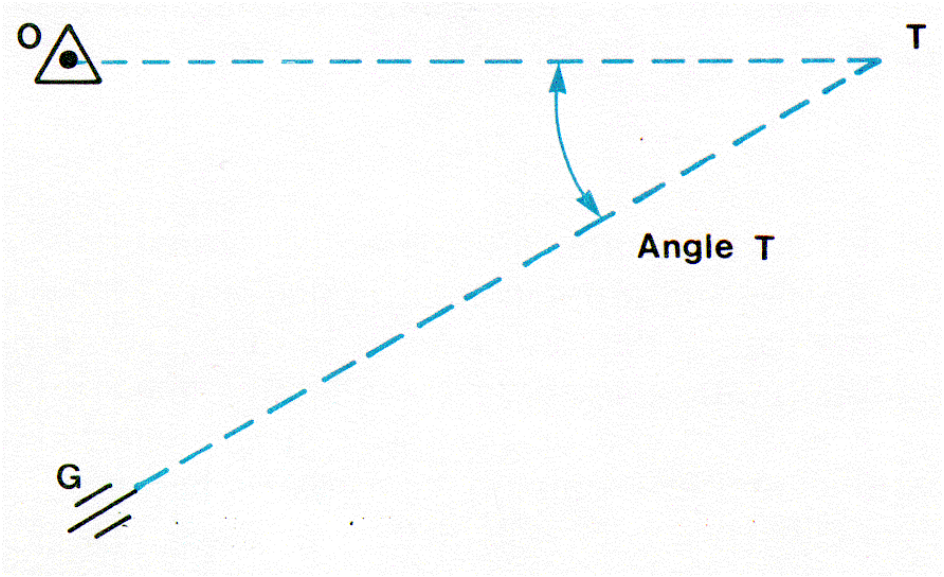

Figure H-1 Depiction of Angle T as formed by lines OT and GT

a. Guns Firing Toward and Over the Observer (Figures H-2 and H-3) Assume that the first round is seen at SI and DROP 400 is then ordered. Because the correction is applied in the horizontal plane the round is directed at B1 instead of B and will therefore fall at S2 and not at B. In this case the Angle T is zero and the effect of zone is not depicted.

b. Combined Effect of Angle T, Slope, and Zone (Figures H-4 and H-5) - Assume that the round has landed at S1, a RIGHT 200 is ordered to correct onto the Observer Target Line (OT) but due to the slope lands at S2. A further RIGHT 100 is ordered to try and bring the round onto the OT line. However, zone and the correction ordered combine to carry the round over the slope. After an indication such as depicted by S3 an add correction should be given with a view to ordering a small line correction later as the effect of zone becomes more apparent.

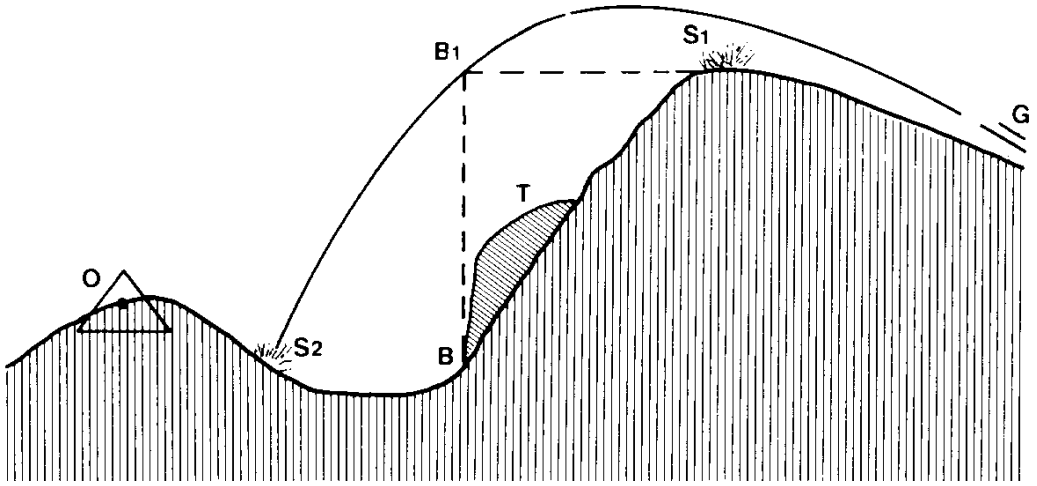

Figure H-2 Guns Firing Toward the Observer (Range Correction)

c. Ground Sloping Across the Bearing of Fire (Figure H-6) - Assume that from a projectile impacting at SI a correction of RIGHT 200 is ordered. However, due to the slope the round will pass through BI instead of B and fall on the reverse slope out of sight from the observer. No effect of zone is depicted.

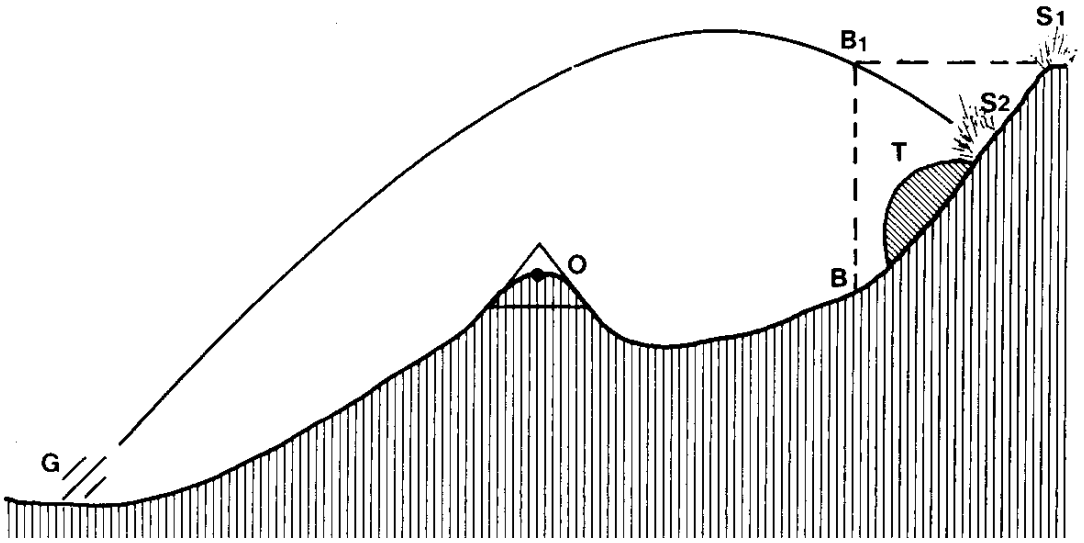

Figure H-3 Guns Firing Over the Observer (Range Correction)

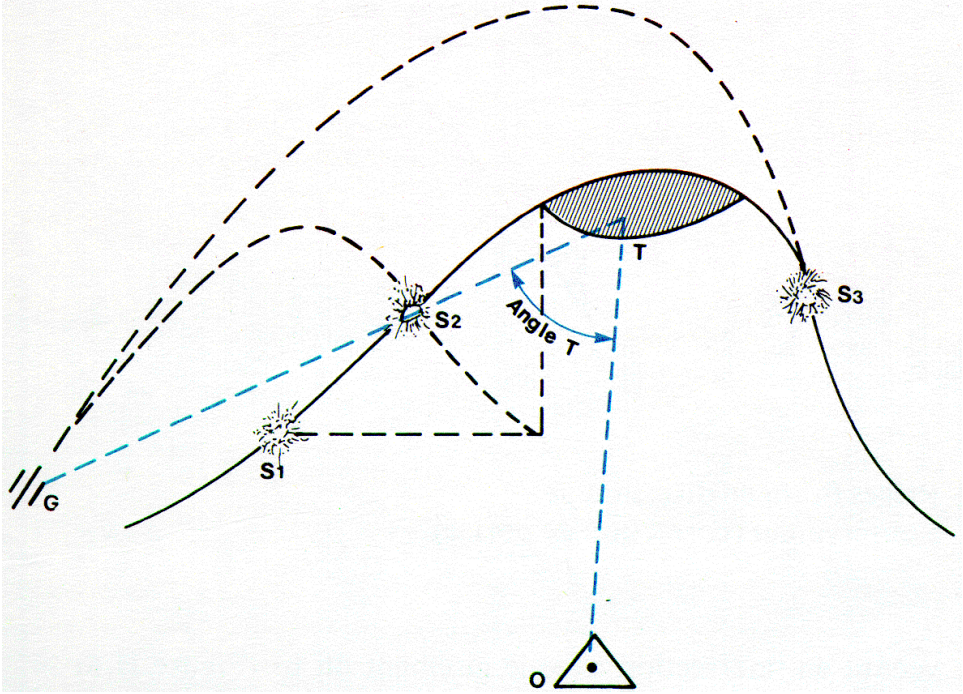

Figure H-4 Ground Sloping Toward the Observer - Depicting Correction For Line (as seen by the Observer)

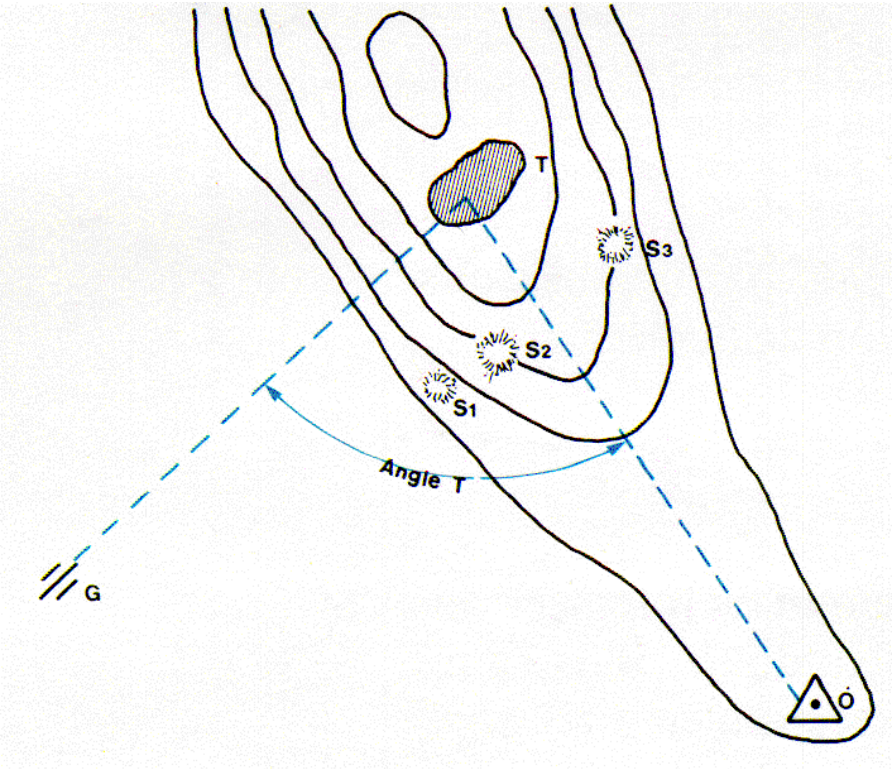

Figure H-5 Ground Sloping Toward the Observer - Depicting Correction For Line (seen from above)

16. When firing a target on a slope of 800 (45') or greater, these rough guides may be adopted:

a. When a correction is required that will result in a downhill movement of the next round, the correction ordered is half the observed measurement. For uphill corrections the measurement is doubled.

b. If possible, the first correction should be an Add or Drop in order to determine the "fall line" of the slope.

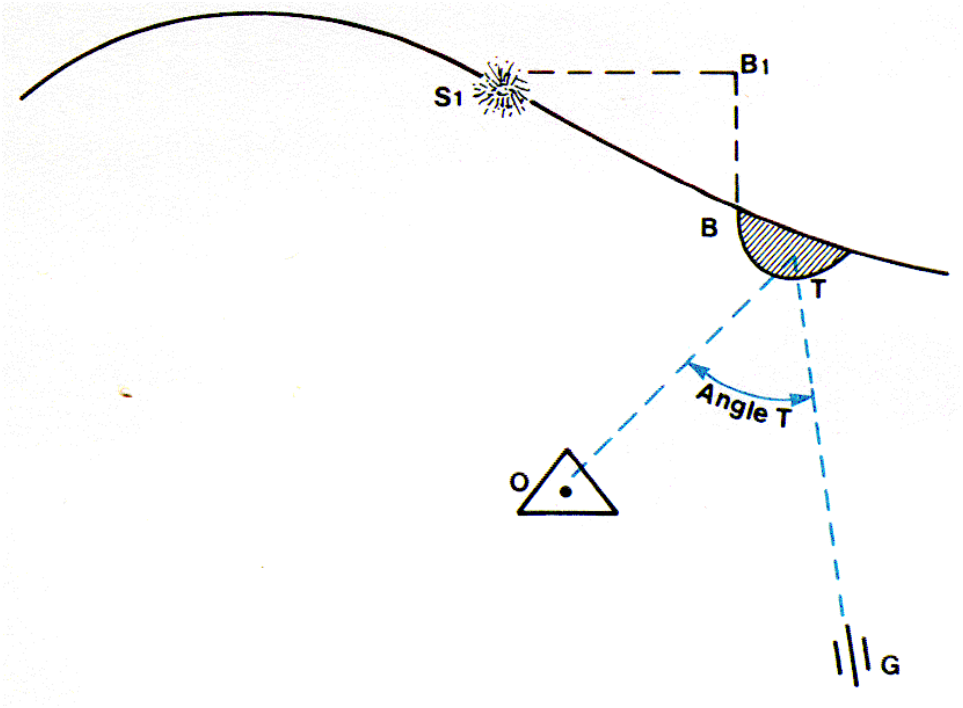

Figure H-6 Ground Sloping Across the Bearing of Fire - Depicting Correction For Line

c. With slopes of less than 800 (450) the same principle is applied with success in relation to the degree of slope.

17. The effects of different natures of ammunition are sometimes unusual in mountain operations. Some problems are outlined below:

a. HE - High explosive with delay fuses often will not penetrate cover, and may cause avalanches or rock slides which may or may not be to the advantage of friendly forces. The effectiveness of HE may be increased because of rock splinters produced when the round explodes.

b. ICM - Improved conventional munitions may be very effective in mountains although the increased length of range zone may mean the friendly forces cannot approach supporting fire as closely as on level terrain.

c. Smoke - Smoke is difficult to employ effectively. Base ejection canisters may bounce erratically or roll down hills. Due to weather, crests, up drafts, and the base of the cloud, screens are apt not to be effective. Concentrations of smoke are generally better. Test rounds should always be fired and it may be necessary to adjust individual guns onto portions of the desired area, with a resultant delay in completing an effective screen.

d. Illumination - Due to clouds and fog, illumination may immediately be masked. However, when the rounds descend the light is enhanced by reflection from the clouds, rock faces and snow. Positioning the flare in the correct location may be very difficult and expensive in time and ammunition.

e. CVT - Due to crests and arming times, controlled variable time (CVT) fuse engagements must be very carefully planned. In many instances it may not be possible to employ CVT in low-angle fire.

f. Time Fuses - Due to steep angles of descent and slopes, time fuses may be often wasted attempting to produce the most efficient height of burst and therefore may be wasteful in ammunition.

Accuracy of Fire

18. In mountains, meteorological conditions change rapidly and may vary from valley to peak to the next valley. In addition, maps may not be accurate and map using can be difficult. Artillery units must carry out the highest degree of survey possible in order to assure the most accurate fire possible.

19. When possible, fire should be adjusted and observed. Danger Close procedure is often necessary when adjusting for targets, even some targets of opportunity. This is due to inconsistencies in meteorological conditions, and to the effects of ground slope in the target area and crests, all of which may combine to produce trajectories which could endanger our own troops.

20. In order to assist in the provision of up-to-date meteorological information, meteorological sections are necessary at, at least, regimental level.

Target Acquisition

21. Because of ammunition supply difficulties, the selection of targets and the allotment of ammunition are of great importance. Care must be taken to avoid wasting ammunition on unprofitable targets. Because of the decentralized nature of mountain operations, targets warranting great masses of artillery fire may be fewer than in other environments.

22. One type of target which will be especially profitable is a narrow defile which is being used as a supply route by the enemy and on which heavy concentrations can be placed. Another effective target found in the more precipitous mountains is a large mass of snow or loose rocks above an enemy position.

23. Target acquisition devices are much less effective in the mountains; radar is adversely affected by ground clutter and sound ranging is very difficult because of echoes and widely varying meteorological conditions across the base. Drone flight paths are influenced by crests and effective flights may be impossible because the drone is generally programmed to fly to one altitude during a mission. In addition clouds and fog may obscure the target area.

24. Direct observation by ground and aerial observers is the most reliable manner of locating targets in the mountains, although ground observation is usually limited to the next hill mass.,Much reliance is placed on shelling reports from troops in contact. Maps and air photographs should be studied carefully to detect likely enemy positions as their choice is also limited.

Air Defence

25. Air defence artillery missions in mountainous areas are the same as those in other terrain, subject to modification of techniques caused by climate, terrain, and nature of the operation. Lack of roads may reduce mobility and make resupply operations more difficult. Extremely cold weather causes longer warm-up times for electronic equipment and as a result the use of special heating devices may be required.

LIST OF TERMS AND DEFINITIONS

balance climbing

The basic technique of mountain movement generally requiring only use of hands for balance. Mainly refers to rock climbing without the use of the climbing rope or other specialized aids.

chimney

A vertical fissure in rock large enough to accommodate the body of a climber.

chute

A sloping or vertical channel in rock or terrain caused by erosive action, generally wider than a chimney.

cliff

A high, steep rock face.

commando crawl

A method of crawling on top of a rope by laying on the chest with one leg and foot hooked over the rope and, letting the other leg hang down, pulling with the hands.

crack

A fissure in rock or ice, varying in size, accommodating a piton, hand, foot, or leg.

exposed climb

A climb from which a fall would be severe or fatal.

face of rock

The sheer, unbroken front of a cliff or rock.

fissure

A crack in rock or ice.

free climbing

Climbing without a rope or other aids.

gully

A shallow, narrow ravine caused by erosion.

hold

A rock or man-made support in ice or snow used by a climber in progressing from one position to another. Method of using such support.

karabiner

An oval-shaped steel link with a spring clip in one side.

mountaineering

The art of mountain climbing.

piton

A medal wedge driven in rock or ice used to provide support.

rappelling

The process whereby a climber lowers himself by sliding down a climbing rope.

rock fall

The fall of any quantity of rock on a mountain.

sangar

Stone breastwork - "build up instead of digging down".

scree

Small unconsolidated rocks and gravel (fist size or smaller) located mostly below rock ridges and cliffs.

scree slope

Slope covered with scree.

slab

A relatively smooth portion of rock laying at an angle.

sound rock

Firm rock which holds together well. The opposite of rotten rock.

standing part

Anchored portion of rope.

talus

Accumulated rock debris, fallen from a dominant rock ridge or face, larger than scree or large blocks, unconsolidated in nature.

talus slope

Slope covered with talus.

traversing

Ascending or descending diagonally instead of straight up or down.

tyrolean traverse

A method used in mountaineering to make a lateral movement by the use of a rope bridge and rappel seat, pulling with the hands.

wall

A vertical or near vertical portion of a mountain, rock or ice cliff.