This chapter describes preparations for deployment and training for operations in a desert environment. A force sent to a desert theater will fight with the equipment it has in accordance with current doctrine. While equipment and doctrine can be modified to suit the new environment, much will depend on how well soldiers/marines and leaders have mastered their individual training. Units that have trained in Germany and the United States will have the basic technical and tactical skills that can be adapted for desert warfare. Well-trained troops and leaders can adapt quickly to the peculiar conditions of the new environment. If their individual and collective skills have been neglected, no amount of desert lore will remedy the situation.

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**Section I. Factors to be Considered When Preparing for Desert Operations**

When a unit is alerted for operations in a desert environment the commander must first answer some or all of the following questions:

- To what country is the unit going?
- What are the climatic and terrain conditions of that country?
- Will the unit be taking its own equipment overseas?
- What is the tentative timeline for departure? Will there be a period of time where the unit has time for individual training while the vehicles are in transit?
- What unit equipment is being sent overseas and what items will it require for modification (including camouflage painting)?
- What special equipment does the unit require for desert operations?
- What special maintenance is required for weapons and equipment before deployment to or arrival in a desert environment?
• Are there personnel in the unit who--
  - Have desert experience as observers or controllers?
  - Have any experience in desert conditions?
• Are all personnel physically fit?
• How many soldiers/marines are nondeployable?
• What types of operations are expected?

Once these and other questions have been answered the commander must develop a program to bring his unit to a level where it is fully capable of successfully operating in harsh desert conditions. To do this, first set a list of priorities for both individual and unit training. The training priorities listed below are shown as a guide only. They can be modified as necessary depending on the state of readiness of the unit when it is first alerted for desert employment.

Section II. Individual Training

In order to fight and survive in desert operations troops must fully understand the desert environment. The objective of individual training is to prepare the individual for operations in a desert environment. This requires both mental and physical preparation.

To the extent practicable, troops should be acclimatized before arrival in the area of operations. The requirement for acclimatization will vary slightly between individuals, but physical conditioning (fit soldiers/marines acclimatize more easily) is a part of the acclimatization process. Acclimatization should take place in climatic conditions that are similar, or slightly more strenuous, than those of the prospective area of operations.

CAMOUFLAGE AND CONCEALMENT

Camouflage and concealment training may be divided into concealment from the ground and concealment from the air. Particular attention must be paid to movement, color, shadow, and deception. Units should practice erecting and disassembling camouflage netting in order to become more efficient. Well-trained crews can save time and headaches. Camouflage and concealment are equally important for combat service support troops. Appendix E contains information about desert camouflage and concealment techniques.

DRIVER TRAINING

Because of the absence of established roads in desert areas, driving requires experience, individual skill, and physical endurance on the part of the vehicle
operator. Driver training exercises should be long and arduous to expose vehicle operators to the rigors of the desert as well as to the effects of fatigue. The need for dispersing and avoiding preceding vehicles is stressed when operating over crusted surfaces or when the trail deteriorates while operating over sand (except suspected mine areas). Training should be directed toward driver proficiency in dune areas, choice of the best ground, selection of proper gear ratios, and driver knowledge and appreciation of the exact capabilities of his vehicle. Driver skill should be developed in taking maximum advantage of momentum, gear shifting, estimating and utilizing proper speeds, and avoiding sudden driving or braking thrusts. Additional driving techniques are contained in Appendix C.

SURVIVAL, EVASION, AND ESCAPE

Convincing a soldier/marine that he is capable of surviving in the desert environment strengthens his Self-confidence, and thus his morale. FM 21-76 contains details on survival, evasion, and escape in the desert, but the following points concerning FM 21-76 should be included in desert survival, evasion, and escape training due to their importance:

- It is unlikely that wells will be poisoned. However, some wells in the North African desert have such strong concentrations of mineral salts that water taken from them may lead to intestinal irritation and subsequent illness.
- Although water is undoubtedly the most important factor in survival, a soldier/marine should not discard his personal weapon or any navigational equipment except in extreme circumstances. Mirrors of any type should be retained for signaling aircraft or other ground forces.

FIELD TRAINING

Following minimum preliminary training in garrison, desert living can only be practiced in the field, often as part of unit training. Important aspects that should be covered include:

- The effects of heat, including possible dehydration and salt loss (the need to maintain the body fluid level).
- The effects of temperature variations.
- The effects of cold weather in the desert.
- First aid for heat illnesses. Each soldier/marine should be issued a memory aid card showing symptoms and immediate treatment.
- Maintenance of morale and the ability of the individual to accept the challenge of the desert. Self discipline and common sense.
- Environmental effects such as those of sand, wind, and light.
- Water discipline.
- Hygiene and sanitation.
• Comet clothing and equipment, including how to wear and maintain clothing.
• Precautions against snakes, scorpions, insects, and disease-bearing organisms.

To the extent possible, the commander should train his unit in terrain and environmental conditions similar to what he expects to find in the operational area. It would be both shortsighted and dangerous for example, to allow water for bathing if the expected operational area is totally waterless. To further accustom the troops to hardships, contact with garrison or other urban areas should be kept to the minimum except for medical or welfare reasons. Once field training has started, necessary supplies should be brought to field locations and items that are unlikely to be available in the operational area (commercial soft drinks and foods) should not be permitted. To gain the maximum value from this training, the unit’s exposure to outside influences should be kept to a minimum.

ENEMY ORGANIZATIONS AND TACTICS

This can be taught in garrison on sand tables and map maneuvers, followed by tactical exercises without troops (TINT), and unit exercises in the field. If enemy equipment is available it should be brought to the unit so it can be studied firsthand.

DESERT NAVIGATION

Troops must be thoroughly briefed on the type of terrain and the general environment they will encounter, including—

• Water sources, if any.
• Landmarks or significant permanent terrain features.
• Friendly and enemy areas of operation.
• Prevailing winds.
• Whether or not the local populace is pro or con the US.

This information will assist navigation by reconnaissance units or individuals who become separated from their units. Although maps are the most obvious navigation aids, numerous types of equipment and techniques are available to assist soldiers/marines during desert operations.

Maps

Although maps used in field training will be those of the local area, sufficient maps of the operational area should be obtained to allow distribution for study and possible use during garrison training. This is particularly important if the
operational maps use foreign words to describe terrain, such as sebhka, summan, hidiba, and dikaka.

In addition, the grid system on some maps differs from the universal transverse mercator grid system on US maps. In many Middle East countries that were previously under British influence, for example, the Palestine grid system is used on military maps. These maps, generally last surveyed during World War II or the following decade, are widely used, not only in the area of Palestine, but also in Egypt and much of Saudi Arabia. And since they are commonly produced in either 1:100,000 or 1:50,000 scale, they do not mesh with standard US maps. In some instances, accurate maps may not be available. An alternative is to draw the grid lines on attached blank sheets of paper. This method can be highly effective when used in conjunction with navigational aids such as the GPS and LORAN.

**Latitude and Longitude Conversions**

One of the oldest systematic methods of location is based upon the geographic coordinate system. By drawing a set of east-west rings around the globe (parallel to the equator), and a set of north-south rings crossing the equator at right angles and converging at the poles, a network of reference lines is formed from which any point on the earth’s surface can be located. The distance of a point north or south of the equator is known as its latitude. The rings around the earth parallel to the equator are called parallels of latitude or simply parallels. Lines of latitude run east-west but north-south distances are measured between them. A second set of rings around the globe at right angles to the lines of latitude and passing through the poles are known as meridians of longitude or simply meridians. One meridian is designated as the prime meridian. The prime meridian of the system we use runs through Greenwich, England, and is known as the Greenwich meridian. The distance east or west of a prime meridian to a point is known as its longitude. Lines of longitude (meridians) run north-south but east-west distances are measured between them.

Geographic coordinates are expressed in angular measurement. Each circle is divided into 360 degrees, each degree into 60 minutes and each minute into 60 seconds. At any point on the earth, the ground distance covered by one degree of longitude is about 111 kilometers (69 miles); one second is equal to about 30 meters (100 feet). The ground distance covered by one degree of longitude at the equator is also about 111 kilometers, but decreases as one moves north or south, until it becomes zero at the poles. For example, one second of longitude represents about 30 meters at the equator but at the latitude of Washington, D. C., one second of longitude is approximately 24 meters.

Geographic coordinates appear on all standard military maps, and on some they may be the only method of locating and referencing the location of a point. The four lines that enclose the body of the map (neatlines) are lines of latitude and longitude. Their values are given in degrees and minutes at each of the four
comers. In addition to the latitude and longitude given for the four corners, there are, at regular intervals along the sides of the map, small tick marks extending into the body of the map. Each of these tick marks is identified by its latitude and longitude value. Different methods exist for converting longitude/latitudes to the military grid system. Special equipment such as the global positioning systems have the capability to convert longitude and latitudes to grid coordinates, or this may be accomplished through manual means outlined in FM 21-26. For more information on map reading and land navigation techniques consult FM 21-26.

**Navigation Aids**

Navigation aids vary in sophistication and complexity and may include the following:

**Sun Compasses/Sextants**

These systems can be used on moving vehicles and require accurate timekeeping.

**Lensatic Compasses**

Individual compass error and local deviation must be known before using the lensatic compass. The lensatic compass cannot be used with any accuracy on dense steel vehicles such as tanks. A crew member should dismount to obtain an azimuth. It is unreliable near large quantities of metal, and can also be affected by underground mineral deposits. Power lines also adversely affect the lensatic compass.

**Gyro Compass**

An efficient gun azimuth stabilizer (a gyroscope) used on fairly flat ground is useful for maintaining direction.

**Fires**

Planned tracer fire assists in maintaining bearings, and field artillery and mortar concentrations, preferably smoke (or illumination at night), are useful checks on estimated locations.

**Distance Recorders**

It is essential to record distance moved, which may be done by using a vehicle odometer.
Beacons

These are particularly useful for aircraft navigation, but can also permit the enemy to locate friendly forces. It maybe necessary to place them in open desert with unit locations being marked at certain distances and bearings from them.

Radars

Provided the position of a radar is known, it can measure range and bearings and, therefore, the position of a vehicle.

Aerial Photographs

The advantage of aerial photographs, particularly to aviators, is their ability to show up-to-date views of the variations in color and texture of the desert soil.

Global Positioning Systems

The GPS is a space-based, radio-positioning navigation system that provides accurate passive position, speed, distance, and bearing of other locations to suitably equipped users. The system assists the user in performing such missions as siting, surveying, tactical reconnaissance, artillery forward observing, close air support, general navigation, maneuver, and ground-based forward air control. It can be operated in all types of weather, day or night, anywhere in the world; it may also be used during nuclear, biological, and chemical warfare. It is important to remember these types of devices are aids to navigation; therefore, users should continuously plot their positions. In the event of a GPS failure, you can revert to more traditional navigation and position determination methods.

Position and Azimuth Determining System

The PADS is a highly mobile, self-contained, passive, all-weather, survey-accurate position/navigation instrument used by field artillery and air defense artillery units for fire support missions. The system provides real-time, three-dimensional coordinates in meters, and a grid azimuth in roils. It also gives direction and altitude. The PADS can be used by the land navigator to assist in giving accurate azimuth and distance between locations. A unit requiring accurate information as to its present location can use PADS to provide this information.

Position Location Reporting System

The position location reporting system (PLRS)/joint tactical information distribution system (JTIDS), hybrid (PJH), is a computer-based system. It provides near real time, secure data communications, identification, navigation, position location, and automatic reporting to support the need of commanders for
information on the location, identification, and movement of friendly forces. The PLRS is based on synchronized radio transmissions in a network of users controlled by a master station. The major elements of a PLRS community include the airborne, surface vehicular, and man-pack users; the PLRS master station; and an alternate master station. The system can handle 370 user units in a division-size deployment per master station with a typical location accuracy at 15 meters. The man-pack unit weighs 23 pounds and includes the basic user unit, user readout, antenna, backpack, and two batteries.

**Dead Reckoning**

The simplest system of navigation is known as dead reckoning. This is a means of finding where an individual is located by a continuous plotting of where he has been. More exactly, dead reckoning consists of recording and plotting a series of courses, each measured as to the distance and direction from a known point, to provide a plot from which the position can be determined at any time. In the desert, the direction traveled is determined with a compass and the distance is measured by counting paces or reading the odometer of a vehicle. Detailed information on navigation by dead reckoning is contained in FM 21-26.

**Shadow-Tip Method**

This method provides orientation by reading the way the sun casts shadows. To use the shadow-tip method, find a fairly straight stick about 1 meter long and follow these steps:

- Step 1. Push the stick into the ground at a fairly level, brush-free spot where a distinct shadow will be cast. The stick need not be vertical; inclining it to obtain a more convenient shadow, in size or direction, does not impair the accuracy of the shadow-tip method.

- Step 2. Mark the tip of the shadow with a small peg, stick, stone, twig, your finger, hole in the sand, or other means. Wait until the shadow’s tip moves a few inches (if you use a 1-meter stick, 10 to 15 minutes should be enough time).

- Step 3. Mark the new position of the shadow’s tip.

- Step 4. Draw a straight line from the first mark to the second mark and extend it about a foot past the second mark.

- Step 5. Stand with the toe of the left foot at the first mark and the toe of the right foot past the line you drew.

You are now facing true north. Find other directions by recalling their relation to north. To mark directions on the ground (to orient others), draw a line at right angles to the first line, forming a cross and mark the directions.

If you cannot remember which foot to place on the first rock (see step 5), remember this basic rule for telling east from west: the sun rises in the east and
sets in the west (but rarely due east or due west). The shadow’s tip moves just the opposite. Therefore, the first shadow-tip mark is always in the west direction and the second mark in the east direction, everywhere on earth. Figure 2-1 depicts finding your direction by using the shadow-tip method.

**Watch/Sun Method**

An ordinary analog watch (with hands) can be used to determine the approximate true north in the North and South Temperate Zones. The North Temperate Zone is north of the equator and the South Temperate Zone is south of the equator. The temperate zones extend from latitude 23-1/2 degrees to 66-1/2 degrees in both hemispheres. In the North Temperate Zone only, the hour hand is pointed toward the sun (see Figure 2-2). A north-south line can be found midway between the hour hand and 12 o’clock. This applies to standard time. For daylight savings time, the north-south line is found midway between the hour hand and 1 o’clock. If there is any doubt as to which end of the line is north, remember that the sun is in the north, and remember that the sun is in the eastern part of the sky before noon and in the western part in the afternoon.

The watch may also be used to determine direction in the South Temperate Zone (see Figure 2-2). However, it is used a bit differently. Twelve o’clock is pointed toward the sun, and the north-south line will be halfway between 12 o’clock and the hour hand. If on daylight savings time, the north-south line lies midway between the hour hand and 1 o’clock.

On cloudy days, place a stick at the center of the watch and hold it so that the shadow of the stick falls along the hour hand in the North Temperate Zone. In the South Temperate Zone, the shadow falls along a line from the center of the watch through 12 o’clock. Direction is then determined using the appropriate technique.
North of the equator, locating your direction at night can be determined by locating the North Star. To find the North Star, look for the Big Dipper. The two stars at the end of the bowl are called pointers. In a straight line out from the pointers is the North Star (at about five times the distance between the pointer stars). The Big Dipper rotates slowly around the North Star and does not always appear in the same position (see Figure 2-3).

The constellation Cassiopeia can also be used. This group of five bright stars is shaped like a lopsided M (or W when it is low in the sky). The North Star is straight out from the center star, about the same distance as from the Big Dipper. Cassiopeia also rotates slowly around the North Star and is always almost directly opposite the Big Dipper. Its position, opposite the Big Dipper, makes it a valuable aid when the Big Dipper is low in the sky, possibly out of sight because of vegetation or high terrain features.

South of the equator, the constellation Southern Cross will help you locate the general direction of the south and, from this base, any other direction. This group of four bright stars is shaped like a cross that is tilted to one side. The two stars forming the long axis, or stern, of the cross are called the pointers. From the foot of the cross, extend the stem five times its length to an imaginary point (see Figure 2-4). This point is the general direction of south. From this point, look straight down to the horizon and select a landmark.
Figure 2-3. Big Dipper.

Figure 2-4. Southern Cross.
OPERATIONAL AREA (HOST COUNTRY)

A description of the host country should cover only those facts that apply to forthcoming operations, for example:

- Geographic description.
- Climate (throughout the year).
- Religious issues and constraints.
- Cultural differences and special considerations, important customs, and the behavior expected of US military personnel. (Such as speaking to a woman in some Arab countries, which can be offensive to the local inhabitants.)
- Population density.
- Industry and agriculture.
- Language(s) (phrase books may be issued).
- Communications and transportation network.
- The armed forces (and possibly police), including organization, equipment, and rank structure.
- The situation that has led to the introduction of US forces and reasons why US forces are being introduced. No soldier/marine should have to question why he is fighting for a country other than his own, if this is the case.

Treatment of these subjects will vary in degree according to category. Personnel who may require additional information such as the country’s history, can find it in the appropriate DA 550-series pamphlet.

DESERT MANEUVER

Chapter 3 describes the influence of the desert environment on tactical operations. This subject should first be taught to a limited number of leaders and commanders as a theoretical subject, down to platoon level. Leaders should then train their units during unit training. The emphasis should be on small unit tactics, including combined arms operations. Additional subject matter that should be covered includes--

- Terrain in the operational area, emphasizing differences and similarities with the training areas the units will use.
- Application of concealment, using terrain and artificial means such as smoke, and the application of maneuver techniques.
- Mobility in the desert.
- Command and control techniques for desert operations.
• Navigation.
• Conduct of fire in desert operations.
• Resupply during desert operations.
• Special equipment techniques.

GENERAL TRAINING

Nearly all equipment will be affected in one way or another by the environment as described in Chapter 1. The purpose of this training is to train operators. Training should include--

• Likely effects on the equipment they operate.
• Efficient operations of the equipment within the limits imposed by the environment, including tactical limitations of the equipment, for example, helicopters may have difficulties flying NOE; and radios will normally be operated on reduced output due to the environment and enemy ECM.
• Preventive maintenance-employing any special techniques required by the desert environment. The appropriate equipment technical manual or lubrication order provides specific information concerning hot climate operations and maintenance.
• Basic desert recovery and repair techniques, including defensive measures, and camouflage required during recovery and repair operations.

Instruction must be oriented toward the expected operational area. For example, it is possible to keep radios cool by using ice packs, but if ice packs are not going to be available in the area of operations, then do not teach troops this technique as it will not be practiced.

SPECIAL MAINTENANCE AND SUPPLY TECHNIQUES FOR STAFF AND LEADERS

Special maintenance techniques that need to be addressed are the same as those taught to specialists, however, they only need to emphasize aspects that ordinarily require control or supervision, or affect the employment of equipment in desert terrain. This training should include any special handling techniques required in the operational area. The importance and difficulties of supply in desert operations are described in Chapter 4. Training should be modified according to--

• Modified tables of organization and equipment (MTOE) and mission of the unit.
• Supply situation expected in the area of operations.
• Capabilities of logistic units likely to support unit operations with special attention given to units not normally found in conventional operations, for example, well-drilling teams, refrigeration assets available in the theater, and transportation cargo carrier companies.

NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) TRAINING

Wearing protective clothing, flak vests and masks in the desert environment will make a person extremely uncomfortable. Troops should not participate in strenuous activity while wearing protective clothing until they are acclimatized. Training in MOPP gear should become progressively more strenuous. Physical training sessions in field protective masks progressing to foot marches in MOPP 4 is a recommendation. Use of protective clothing in severe desert heat is described in Chapter 1 and Appendix D. Points that should be emphasized during training are—

• The value of being uncomfortable rather than dead.
• The need to avoid heat illness by—
  - Reducing the labor rate to the minimum, and delaying work until cooler hours.
  - Maintaining proper body water and salt levels, particularly during a time of chemical threat.
  - Detecting the first symptoms of heat illness in others by constant vigilance.
  - Increasing the time factor of an operation as troops will move slowly when wearing protective clothing.

DESERT TERRAIN APPRECIATION

When training soldiers/marines to appreciate desert terrain, leaders should focus on the effects of the different types of desert terrain on the capabilities and limitations of unit equipment. Highlight the impact of the terrain on vehicular trafficability, fields of fire, and observation in the likely operational area. When possible, crews and small unit leaders should learn to appreciate desert terrain from practical experience in terrain as nearly similar as possible to that in the likely combat zone.

MEDICAL TRAINING CONSIDERATIONS

The unit surgeon can provide valuable information on the medical implications of operations in the desert environment. He can advise the unit commanders on measures to take to ensure training includes preventive medicine concepts essential to keeping nonbattle injuries to a minimum. Burn casualties should also be a medical training consideration as these will be the most likely casualties in a mechanized environment. Hydration and mouth-to-mouth resuscitation of
injured personnel in a field protective mask should also be a training consideration. Nonbattle casualties, due to a lack of consideration of preventive medicine concepts, can far outnumber combat casualties.

Section III. Unit Training

When determining unit training requirements, the commander must first consider the training level of his unit when alerted for deployment. When time does not permit a comprehensive training program, the commander must concentrate on those areas where his unit is least proficient, considering the priorities previously described. In order to operate in the desert environment, the unit must, above all, be physically fit, so physical conditioning is of paramount importance.

COMBINED ARMS AND SERVICES TEAM

The greatest combat power results when leaders synchronize combat, combat support, and combat service support systems to complement and reinforce one another. The slice concept refers to CS and CSS units task organized to support a particular maneuver or combined arms unit. Leaders should routinely practice habitual relationship and cross attachment of units. Training as combined arms teams is critical to successful desert operations.

PHYSICAL CONDITIONING AND ACCLIMATIZATION

To the extent possible, physical conditioning and acclimatization should take place simultaneously. When a unit is training in a hot environment, begin physical training at night or during the cooler part of the day and work up to rigorous training, such as foot marches in open sand terrain at midday. Emphasis on mounted operations in desert warfare does not imply that foot marching can be totally disregarded. Physical conditioning must be continued after arrival in the area of operations.

Medical advice should always be available during periods of physical training in hot weather. Training several days prior to deployment to combat the effects of jet lag works well, if performed as a command directive. Avoiding coffee and alcohol, and drinking plenty of water will also assist in overcoming the effects of jet lag. Planning for the change in time zones and developing a sleep plan are recommended and will facilitate readiness.

WEAPONS TRAINING

Soldiers/marines must train to proficiency at all ranges but accuracy at maximum effective range both in daytime and nighttime must be emphasized. Firing should also be practiced during the heat of day to condition troops to heat haze.
and mirages. Emphasis must also be placed on maintenance of individual weapons in view of sandy desert conditions.

**NBC TRAINING**

The purpose of unit NBC training is to train individual soldiers/marines to become proficient as a team while wearing protective clothing and masks, and when in combat vehicles—while buttoned up. This training should be conducted both in daytime and nighttime, until the unit can operate effectively under these conditions. Additional information and guidance on the effects of the environment on NBC weapons are contained in Appendix D.

**MARCH DISCIPLINE**

Although of particular importance to combat support and combat service support units, all units should be trained in tactical road marches. Training should emphasize—

- Off-road movement over open terrain.
- Irregular spacing when moving in convoy.
- The need to maintain sufficient distances between vehicles to preclude “dust blindness.”
- Actions to be taken when stuck in sand, and when a vehicle breaks down.
- Vehicle camouflage.
- Removal of tracks which would reveal friendly locations.
- The need for dispersion when halted.
- Air defense drills.
- Practicing incoming artillery drills.

**OBSTACLES AND BARRIERS**

In some desert areas, natural obstacles such as wadis or other terrain features can be found. Often, however, it will be necessary to use artificial obstacles if enemy movement must be slowed. A minefield, to be of any tactical value in the desert, must usually cover a relatively large area, so mechanical means and engineer support are required. Since there are often too many avenues of approach to be covered with mines, it is usually best to employ mines to cover any gaps between units, especially at night. Minefields are most effective when they can be covered by observation or fire. During unit training, soldiers/marines should be trained to lay mines wearing gloves, since human scent attracts desert animals who may attempt to dig them up. Emphasis should be on antitank minefield since combat vehicles are the most dangerous threat.
SCOUTING, SURVEILLANCE, AND PATROLLING

Effects of the environment on scouting, observation, and surveillance techniques are described in Chapter 3. Effects of the environment on surveillance, target acquisition, and night observation devices are described in Chapter 1.

ADJUSTMENT AND CONDUCT OF FIRE

The principles for adjustment and conduct of fire in the desert are the same as for operations in more temperate climates. However, the following considerations, somewhat peculiar to desert operations, should be kept in mind:

- Obscuration from sand, dust, smoke, or a combination of these, can affect direct-fire adjustment.
- There may be major inaccuracies of initial rounds from indirect-fire weapons due to misjudgment of target location.
- The target may be concealed by sand or dust if rounds land short, on, or near the observer target line.
- Heat haze and mirages can mislead gunners and observers as to target location. This condition can particularly affect antitank guided missile gunners.

Direct-fire gunners may have to depend on flank observers, who may be any individual on the battlefield equipped with a radio. If observation is lost, subsequent corrections are very unlikely to cause a second round hit. The following considerations can help to overcome the obscuration or sending problem:

- An observer requesting indirect fires needs to ensure that initial rounds land beyond the target to preclude short rounds obscuring the target, and then adjust accordingly.
- By remembering the greatest impact of heat haze (which varies throughout the day) is on ATGM gunners-when both gunner and target are within 2-3 feet of the desert surface.

AIR DEFENSE

In desert operations any type of unit, be it tank, infantry, trains, tactical operations centers, or supply points, can expect to be a target for air attack. Air attacks may be from fighter bomber aircraft using cannons, missiles, bombs, napalm, and machine guns, or from attack helicopters using machine guns, rockets, or missiles.

Enemy air superiority should be assumed during all field training and simulated fighter bomber attacks and attack helicopter missions should be flown against the unit whenever possible. When practical, aerial photographs of positions should be taken, and pilots interviewed to assist in the critique of air defense, both
passive and active. Points that should be emphasized during training are mentioned in the following paragraphs.

Passive air defense measures should be taken routinely. When stopped for any period of time, take every advantage of whatever cover and concealment are available. As previously described, natural cover and concealment will be difficult to find in many desert areas. Nevertheless, vehicles, particularly unarmored vehicles, should be irregularly dispersed and dug-in, or revetments provided. When appropriate, air guards, trained in aircraft recognition, should be posted, with clear instructions on actions to be taken when aircraft are sighted. Units not being attacked by aircraft, but in close proximity to the attack, may desire to remain stationary in order to avoid detection. Reducing infrared signatures is also a passive anti-air consideration. Artificial camouflage can be used as described in Appendix E.

Active air defense techniques used in desert operations are the same as those described in other doctrinal manuals, appropriate to the level of command. However, at small unit level, additional emphasis should be given to air defense using small arms. When combat vehicles on the move are engaged by enemy aircraft, their immediate action will depend on whether or not they are maneuvering in contact with the enemy. If they are in contact they should continue to maneuver, relying on overwatch elements and air defense artillery to engage attacking aircraft.

Vehicles about to be engaged by enemy aircraft in open desert where cover is not available, should move perpendicular to the attacking aircraft to evade rocket or machine gun fire. Engage the aircraft with small arms fires, if possible. Meanwhile, the remainder of the unit should mass small arms fire to the aircraft’s front. Sudden variations in course may also distract the pilot.

COMMUNICATIONS

Good communications in desert terrain will often depend on the state of mind of the operators. They must be enthusiastic, persistent, and determined to make and maintain contact. Unit training should concentrate on ECCM techniques. When conducting field training, higher headquarters can provide assistance in the form of small teams to jam unit nets. Practice actions to be taken when radio contact is lost due to heat (described in Appendix C).

FRATRICIDE CONSIDERATIONS

The following are fratricide considerations when operating in a desert environment and may be topics for fratricide awareness training:

- Because of the absence of easily identifiable terrain features in the desert, knowing your exact location can be especially important. Be in the right place at the right time. Use position location/navigation (GPS) devices; know your location and locations of adjacent units (left, right, leading and follow on). Synchronize tactical movement.
- Ensure positive target identification. Review vehicle/weapons ID cards; know at what ranges and under what conditions positive ID of friendly vehicles/weapons is possible. This is especially important in the desert due to the likelihood of weapons being able to fire at their maximum ranges.

- Maintain situational awareness—be aware of current intelligence, unit locations/dispositions, denial areas (minefields/FASCAM), contaminated areas (e.g., ICM and NBC), SITREPs, and METT-T. This can be more difficult in desert environments because navigation is more difficult.

- Conduct individual and collective (unit) fratricide awareness training. This includes target identification/recognition; fire discipline; and leader training.

- Use common language/vocabulary. Use doctrinally correct, standard terminology and control measures (e.g., fire support coordination line (FSCL), zone of engagement, and restrictive fire line (RFL)).

- Consider the effects of key elements of terrain analysis on fratricide. These include observation and fields of fires, cover and concealment, obstacles and movement, key terrain, and avenues of approach.

- Gun tube orientation can also assist in avoiding/preventing fratricide.