ATP 3-90.99
MCTP 12-10D

DESERT OPERATIONS

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Desert Operations

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Preface

ATP 3-90.99/MCTP 12-10D, *Desert Operations*, is a dual-designated Army/Marine Corps manual that provides Soldiers/Marines with the concepts and techniques associated with conducting operations in a desert environment.

The principal audience for ATP 3-90.99/MCTP 12-10D includes Army/Marine Corps commanders, leaders, staffs, and Soldiers/Marines. Trainers and educators throughout the Army/Marine Corps will also use this manual.

Commanders, staffs, and Soldiers/Marines ensure their decisions and actions comply with applicable U.S., international, and, in some cases, host-nation laws and regulations. Commanders at all levels ensure their Soldiers/Marines operate in accordance with the law of war and the rules of engagement. See FM 6-27/MCTP 11-10C for more information on the law of land warfare.

ATP 3-90.99/MCTP 12-10D uses joint terms where applicable. Selected joint, Army, and Marine Corps terms and definitions appear in both the glossary and the text. In doctrinal publications, the normal convention for identifying terms uses italics. Since this is a dual-designated Army/Marine Corps manual, the following protocol is used to distinguish proponency (authority) of information and terms:

- Underlined terms in italics and phrasing—Marine Corps specific terms, phrasing, or concepts.
- Terms in italics and definitions in plain text—joint and Army terms with proponent publication in parentheses.

ATP 3-90.99/MCTP 12-10D implements standardization agreement (known as STANAG) ATP 3.2.1B.

ATP 3-90.99/MCTP 12-10D uses the current United States Marine Corps (USMC) doctrinal numbering schema for reference. Appendix D contains a cross reference table between the current and historical USMC doctrine numbers as many Army multi-service publications do not currently reflect the current USMC doctrine numbering schema.

ATP 3-90.99/MCTP 12-10D applies to the Active Army, the Army National Guard/Army National Guard of the United States, United States Army Reserve, United States Marine Corps, and the United States Marine Corps Reserve unless otherwise stated.

The proponent of ATP 3-90.99/MCTP 12-10D is the United States Army Combined Arms Center. The preparing agency is the Combined Arms Doctrine Directorate, United States Army Combined Arms Center. Send comments and recommendations on a DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) to Commander, U.S. Army Combined Arms Center, ATZL-MCD (ATP 3-90.99), 300 McPherson Avenue, Fort Leavenworth, KS 66027-1300; by email to usarmy.leavenworth.mccoe.mbx.cadd-org-mailbox@mail.mil; or submit an electronic DA Form 2028.

U.S. Marine Corps readers of this publication are encouraged to submit suggestions and changes to Doctrine Control Branch via e-mail: doctrine@usmc.mil.

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Acknowledgements

Photographs and vignettes come from the following sources listed in the order they appear. Photographs from the Defense Visual Information Distribution Service.

Vignette paraphrased from *Air Assault in the Gulf: An interview with MG J.H. Binford Peay, III, Commanding General, 101st Airborne Division (Air Assault)* by the Center of Military History in 1991. Available at https://history.army.mil/documents/SWA/DSIT/Peay.htm.

Vignettes paraphrased from Stephen A. Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* by the Center of Military History in 2002. Available at https://history.army.mil/html/books/070/70-73-1/index.html.

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Introduction

To understand ATP 3-90.99/MCTP 12-10D, Army leaders and Soldiers first understand the doctrinal fundamentals contained in ADP 3-0 and ADP 3-90. Army leaders and Soldiers need to understand the tactics and procedures contained in FM 3-0, FM 3-90-1, and FM 3-90-2. Army leaders and Soldiers should understand the operations process (plan, prepare, execute, and assess) and how that process relates to the military decision-making process (MDMP) and troop leading procedures described in ADP 5-0 and ADP 6-0. Marines Corps leaders and Marines first understand the doctrinal fundamentals in MCDP 1 and MCDP 1-0, as well as the Marine Corps planning process in MCWP 5-10. Both leaders and Soldiers/Marines need to understand the intelligence preparation of the battlefield/battlespace (IPB) process found in ATP 2-01.3 and MCRP 2-10B.1 (MCRP 2-3A).

The techniques contained in this publication are based on the Army's and Marine Corps' historical lessons learned in previous operations conducted in desert environments. ATP 3-90.99/MCTP 12-10D replaces the Army's FM 90-3, *Desert Operations*, and the Marine Corps' MCTP 12-10D (formerly MCWP 3-35.6). This edition of ATP 3-90.99/MCTP 12-10D updates and reorganizes the information and ensures congruence with FM 3-0, other capstone doctrine, and Marine Corps doctrinal initiatives.

The seven chapters of ATP 3-90.99/MCTP 12-10D define the desert environment; describe the foundations of desert operations; explain the application of combat power in desert regions; offer techniques for offensive, defensive, and stability operations in the desert; and provide methods for training for desert operations. The seven chapters are—

- Chapter 1 defines the various types of desert regions and explains the environmental effects the desert can have on personnel and equipment. It examines the desert environment through the framework of observation, avenues of approach, key terrain, obstacles, and cover and concealment. The chapter presents practices and procedures units can implement to protect personnel and equipment from the harsh effects of the desert environment.
- Chapter 2 describes the foundations for desert operations. It offers planning considerations for desert operations in accordance with the Army/Marine Corps' operational framework. Commanders consider the principles presented in this chapter when developing their operational approach for campaigns conducted in desert environments. These principles are based on observations and best practices from previous desert operations.
- Chapter 3 details the effects of the desert environment on combat power. The desert environment affects the various warfighting functions differently, and commanders adjust tactics, techniques, and procedures to improve operational effectiveness and reduce risk when operating in the desert.
- Chapter 4 describes desert offensive operations and the environmental impacts by warfighting function. It presents the characteristics of the offense, types of offensive operations, and forms of maneuver. The chapter explains how commanders can adapt their operations and exploit the desert's relatively unrestricted terrain to achieve surprise, concentrate forces, and maintain tempo.
- Chapter 5 presents desert defensive operations and the environmental impacts of the desert by warfighting function. It describes how commanders adjust defensive operations and the forms of defense/defensive methods to account for desert terrain. The chapter offers considerations for reducing the challenges associated with defending in the open and exposed desert environment.
- Chapter 6 examines how stability operations are affected by the desert terrain and climate. It describes how commanders adjust stability operations tasks to preserve the critical infrastructure and restore the essential services necessary to support life in this austere environment.

The techniques and considerations presented in this publication are only examples of a way to conduct operations in a desert environment. Collectively, they provide a set of tools that leaders and Soldiers/Marines employ in accordance with the unique situation and operational environment they face at any given time and location.

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Chapter 1
The Desert Environment

Chapter 1 describes the terrain, weather, and wildlife present across the various types of deserts. It also details how the desert environment can affect troops and equipment while offering techniques commanders can implement to better adapt their forces to desert operations.

DESERT CLASSIFICATIONS

1-1. Deserts are arid, barren regions of the earth. Successful desert operations require modifications to equipment and tactics as the environment can profoundly affect military operations. There are four main classifications of deserts: mountain deserts, rocky plateau deserts, polar deserts, and sandy or dune deserts. The common denominator of all four desert classifications is the lack of significant annual precipitation. Desert bedrock may have a layer of sand, ice, or gravel over it. Topsoil often has eroded or never formed due to any combination of a lack of water, heat, cold, or wind. Common land features in the desert consist of sand dunes, escarpments, dry riverbeds, and depressions. The lack of annual precipitation and topsoil leads to reduced wildlife and plant densities, often with unique and potentially hazardous adaptations, that give deserts their characteristic barren appearance. (See appendix A for additional information on desert locations and characteristics.)

1-2. Desert regions feature the greatest extremes of temperatures and weather volatility. Temperatures vary from extreme highs to extreme lows based upon the latitude and season. Temperatures can exceed 136 degrees Fahrenheit (57 degrees Celsius) in the deserts of Mexico and Libya to minus 128 degrees Fahrenheit (minus 88 degrees Celsius) in the Antarctic Polar desert. In some deserts, day-to-night temperature fluctuation exceeds 70 degrees Fahrenheit (21 degrees Celsius). Even the slightest rainfall in the desert can result in flash flooding due to lack of vegetation and the soil's inability to absorb the precipitation.

1-3. Key terrain in the desert is largely determined by the presence of water or terrain that restricts movement. The few roads available may become key terrain, especially when the desert floor cannot support wheeled vehicle traffic. Water sources are vital, especially if a force cannot sustain long-distance resupply. Where they exist, defiles play an important role. For example, in the western desert of Libya, an escarpment that parallels the coast forms a barrier to movement except through a few passes. Control of passes equates to control of key terrain. Similar escarpments exist in Saudi Arabia and Kuwait. Generally, the force that can protect its own line of communications (LOC) while interdicting those of the enemy will prevail.

MOUNTAIN DESERTS

1-4. Mountain deserts typically contain scattered ranges, areas of barren hills, or mountains, separated by dry flat basins. High ground may rise gradually or abruptly from flat areas, to a height of several thousand feet above sea level. Most of the infrequent rainfall occurs on high ground and runs off in the form of flash floods, eroding deep gullies and ravines and depositing sand and gravel around the edges of the basins. Water evaporates rapidly, leaving the land barren, although short-lived vegetation growth and flowering sometimes occurs. Shallow lakes may develop but will generally have high salt content due to high evaporation rates. The Great Salt Lake in Utah and the Dead Sea are examples of mountain desert lakes. (See figure 1-1 on page 1-2 for an example of mountain desert terrain.)

Figure 1-1. Mountain desert terrain

ROCKY PLATEAU DESERTS

1-5. Rocky plateau deserts are extensive flat areas with solid or broken rock at or near the surface. They can have wet or dry, steep-walled eroded valleys, dry riverbeds, gulches, or canyons. Narrow valleys can be extremely dangerous to personnel and equipment due to flash flooding after rains. The California National Training Center and the Syrian Golan Heights are both located in rocky plateau deserts. (See figure 1-2 for an example of a rocky plateau desert.)

Figure 1-2. Rocky plateau desert

POLAR DESERTS

1-6. The Antarctic and Arctic polar regions are the largest deserts on earth, each covering 5.5 million and 5.4 million square miles (8.8 million kilometers and 8.7 million kilometers), respectively. The Arctic region is located at the Arctic Circle (latitude 66° 32'N) and includes the northern continental fringes of North America, Iceland, coastal Greenland, and the Arctic coast of Eurasia. With long, severe winters and short, cool summers, the southern polar desert region encompasses the continent of Antarctica. In the Arctic Circle the sun never sets on the summer solstice and the sun never rises during the winter solstice (with the reverse occurring in Antarctica). The mean monthly temperature of the warmest month falls between 32 degrees and 50 degrees Fahrenheit (between 0 and 10 degrees Celsius). Annual precipitation is less than eight inches (20 centimeters), but low rates of evaporation make the climate humid. Vegetation consists of low-growing grasses, lichens, mosses, and brush with treeless plains. Soils are developed and have a permanently frozen sub-layer (permafrost) that seasonally thaws at the surface. Surface and subsurface soil drains poorly and creates muddy summertime conditions. The Arctic predominately consists of coastal plains, low-interior and high-interior plains, and lesser areas of low and high-relief mountains. Most development and infrastructure of military interest centers around ports and areas with valuable natural resources. Some prominent terrain of polar deserts consists of icecaps, glaciers, and overflow ice. (See figure 1-3 for an example of a polar desert.)

Icecaps

1-7. Icecaps include the large ice sheets such as those found in Greenland and Antarctica. Mean annual temperatures stay below freezing and little annual precipitation falls. Most of the development and infrastructure of military interest centers on ports and areas with valuable natural resources.

Glaciers

1-8. Glaciers are rivers of ice and snow that develop with the seasonal accumulation of snow in valleys where the summer temperature stays low enough to prevent complete snow melt. The accumulated snow eventually turns to ice through compression. Gravity causes the flow or movement of glaciers. Glaciers glide over a layer of meltwater between the underside of the glacier and the surface of the earth. Glaciers and polar icecaps cover ten percent of the earth's surface. Alaska contains two percent of the total glaciers on earth. Typically, glaciers occur in mountainous regions of the subarctic and some temperate areas. Glaciers function as a highway into the mountains since troops can negotiate them more safely and easily than the surrounding ridges and peaks. However, glaciers are dangerous to troops unfamiliar with the unique terrain found in this environment. Specialized training and equipment helps troops to traverse and negotiate the crevasses as well as prevent ice falls common on glaciers.

Figure 1-3. Polar desert

Overflow Ice

1-9. Overflow ice occurs when a layer of ice ruptures and the water underneath flows up to the surface. Overflow ice is difficult to detect and creates a significant obstacle when moving on frozen bodies of water. Two conditions must exist for overflow ice to occur. First, temperatures must be below freezing. As a water source freezes, it does so from the top down. Second, subsurface water must be under pressure. If the water under the layer of ice is under pressure, such as when a spring continues to bring water under the ice, the water forces its way through ice and flows on top of it. Overflow ice can occur throughout the winter despite extremely cold temperatures. Rupturing and refreezing many times, overflow ice forms numerous layers of ice.

Note. See ATP 3-90.97 for information on operations in polar deserts. The extreme cold and snow common to polar deserts make the tactics, techniques, and procedures required for operations in that environment significantly different from those tailored to operations in mountain, rocky plateau, or sandy deserts. See MCRP 12-10A.4 (MCRP 3-35.1D) for cold region operations and MCTP 12-10A [MCWP 3-35.1] for mountain warfare operations.

Sandy or Dune Deserts

1-10. Sandy or dune deserts are extensive flat areas covered with sand or gravel, the product of ancient deposits or modern wind erosion. Flat is a relative term, as some areas may contain sand dunes that are over 984 feet (300 meters) high and 9–12 miles (16–19 kilometers) long. Trafficability on this type of terrain will depend on windward or leeward gradients of the dunes and the texture of the sand. Other areas, however, may be totally flat for distances of 2 miles (three kilometers) or more. Plant life may vary from none to scrub, reaching over 6.5 feet (two meters) high. Examples of this type of desert include the ergs of the Sahara, the Empty Quarter of the Arabian Desert, areas of California and New Mexico, and the Kalahari in South Africa. (See figure 1-4 for an example of a sandy or dune desert.)

Figure 1-4. Sandy or dune desert

WEATHER

1-11. Lack of precipitation is the defining characteristic of the desert; desert environments receive less than 10 inches (25 centimeters) of sporadic rainfall annually. Desert rainfall varies from one day in the year to intermittent showers throughout the winter. Severe thunderstorms occur in the desert and bring heavy rain which can result in flash flooding. Rainstorms tend to be localized, affecting only a few square kilometers at a time.

1-12. The air stability in desert regions varies due to the extreme fluctuations between day and night temperatures. At night and early morning, the desert air is usually stable. High desert temperatures in the middle of the day decreases density and creates extremely unstable air. The three types of air stability are—

- Unstable (lapse). This condition exists when air temperature decreases with altitude. In the desert, this mostly occurs between late morning and early evening.
- Neutral. This condition exists when air temperature does not change with altitude. In the desert, this mostly occurs during early morning and early evening.
- Stable (inversion). This condition exists when the air temperature increases with altitude. In the desert, this mostly occurs between late evening and early morning.

1-13. High winds occur in certain desert seasons and can greatly affect operations due to reduced visibility. Blowing sand limits visibility. Reduced visibility can limit aviation support, inhibit the effectiveness of obscurants, cause health concerns, and increase the risk of accidents.

Note. The Army/Marine Corps obtains weather data and information from its proponent weather support agency. AR 115-10/AFI 15-157 (IP) covers Air Force weather support to the Army.

TERRAIN

1-14. Desert terrain has many variations ranging from nearly flat, with high trafficability, to impassable mountain ranges. Units preparing to deploy to specific desert regions should seek detailed information on terrain prevalent in the expected area of operations.

1-15. Desert terrain can canalize operations due to poor cross-country mobility, limited hardened roads and trails, and the lack of bridges and hardened crossing points. Some terrains inhibit cross-country mobility with soft sand, rocky areas, fractured ice sheets, glaciers, salt flats, and marshy areas. Such terrains create poor trafficability. Roads in the desert are usually scarce, poorly maintained, and primitive. Limited infrastructure reduces hardened crossing points over or through water features.

1-16. The steep slopes of dunes and rock-strewn mountains can severely restrict vehicular movement. Dry riverbeds compartmentalize terrain. The banks of these stream beds can be steep and loose which severely limits operations. Slopes covered in rocks can hinder vehicles if rocks easily dislodge.

1-17. Vast, glaciated areas present additional hazards in the polar and Antarctic deserts. Such hazards can include hidden crevasses, fractured ice, and snow avalanches. Operations in these deserts require special training and equipment.

1-18. The lack of terrain features in many deserts can make land navigation extremely difficult. In deserts without significant terrain features, Soldiers/Marines must dead reckon and verify their position with space-based precision navigation devices when available.

OBSERVATION AND FIELDS OF FIRE

1-19. Observation and fields of fire are generally excellent in most desert areas. Flat desert terrain, limited vegetation, and predominantly clear atmospheric conditions permit troops to use direct-fire weapons to their maximum range. However, at certain times of the day, visibility may be limited or distorted by heat and the atmospheric effects. Additionally, enemy forces can see friendly troops more easily in flat terrain.

1-20. Even though the landscape appears flat, it can actually contain various dead spaces. Upon closer inspection, troops can see such landscapes undulate with relatively deep dry riverbeds and depressions

creating significant dead space. Troops site direct fire weapons to provide mutual support and cover dead space. They can use indirect fires paired with sensors, or aerial fires to also cover the dead space.

1-21. Some desert terrain has so much variation that it hinders observation. When there is no usable dominant terrain exists, troops can implement long-range observation from a manned aircraft, unmanned aircraft system (UAS), or electronic sensors.

1-22. Soldiers/Marines use UASs with other unmanned and manned reconnaissance and surveillance systems. Successful UAS employment in the desert requires adequate planning for environmental factors. Depending on the platform and mission, planners and operators may have to consider the environmental factors in four separate locations: (landing and recovery sites, transit routes, satellite relay site, and anticipated target location. (See ATP 3-04.64/MCRP 3-20.6/NTTP 3-55.14/AFTTP 3-2.64 and MCRP 3-20.5 [MCWP 3-42.1] for more information on UASs.)

1-23. Troops can conduct or enhance observation using electronic devices. Electronically assisted observation includes radar, image intensifiers, and infrared devices. Troops can conduct electronic observation by surface and aerial systems.

1-24. Radars emit extremely short bursts of electromagnetic radiation, which then reflect off a target and return as an echo. Soldiers/Marines can use several radar modes in the desert, including moving target indicator and synthetic aperture radar. Radar cannot see through buildings or terrain and is degraded by rain, blowing sand, and dust. Additionally, certain threat systems can sense the radar from its active electromagnetic emissions. (See ATP 3-55.6/MCRP 2-10A.4/NTTP 3-55.13/AFTTP 3-2.2 for additional information regarding aerial radar operations.)

1-25. Image intensifiers, such as night vision devices (NVDs), work by amplifying visible light and the infrared spectrum closest to the frequencies of visible light to create a digital picture. NVDs are passive unless paired with an illuminator for active use. NVDs work well in desert environments as limited cloud cover and extended fields of view create more ambient visible light. However, atmospheric obscurants negatively impact passive NVDs.

1-26. Infrared (IR) imaging sensors work by amplifying the mid and far wavelengths of the IR band to create a digital picture representing the total IR radiation of an object against its background. IR imaging sensors are generally passive devices. IR sensors work well in desert environments in all lighting. The performance characteristics of an IR imaging sensor determine its capability to see through different densities and types of atmospheric obscurants. IR imaging sensors also work well during all environmental conditions.

Note. Thermal crossover, also called IR crossover, occurs when an object and its background are emitting IR radiation that the IR imaging sensor cannot differentiate based on the sensor's minimum resolvable temperature. Thermal crossover has the greatest effect on IR imaging sensors when it occurs simultaneously with an atmospheric phenomenon that reduces visibility.

1-27. Sensor systems operate in one of two modes:

- Active. Active sensors emit energy that reflects from targets and is recaptured by the emitting or other nearby sensor, indicating the presence of a target. Examples of active sensors include searchlights and radar.
- Passive. Passive sensors collect energy; they do not emit energy. The collected energy indicates the presence of a target. Examples of passive sensors are the human eye, NVDs, infrared imaging devices, acoustic sensors, and photographic devices.

1-28. Correction of field artillery fires, especially those of larger pieces, may be complicated by dust and sand hanging in the air following the impact of ranging rounds. Forward observers should consider placing initial rounds beyond a target rather than short of the target. Observation of fires, especially direct fires by tanks, may be difficult due to dust clouds, so wingmen may have to observe direct fires.

1-29. The movement and maneuver/maneuver of vehicles and low flying aircraft in the desert usually produce a large and enduring dust signature that can be observed from the ground and air at distances of up to 18 miles (30 kilometers). Rapid movement by vehicles and flight by rotary-wing aviation causes dramatic

dust signatures and can reveal tactical movements. In some situations, troops can slow movement to reduce dust signatures.

AVENUES OF APPROACH

1-30. Roads and trails are rare in the open desert. Complex road networks beyond simple commercial links are not needed. For centuries roads have connected centers of commerce or important religious shrines such as Mecca and Medina in Saudi Arabia. These roads are supplemented by routes connecting oil or other mineral deposits to collection outlet points. Some surfaces, such as lava beds or salt marshes, preclude any form of routine vehicular movement, but, aside from these locations, ground movement is often unrestricted. Speed of movement varies depending on the soil composition.

1-31. Vehicle travel in mountainous desert country may severely restrict troop movement. Enemy forces and certain climate conditions can easily block available routes. Heavy winter snow often blocks higher passes. Hairpin turns on the edges of precipitous mountain gorges often impede large or long vehicles.

1-32. In mountainous deserts, avenues of approach may be limited to dry riverbeds or valleys. Dry riverbeds vary from wide but barely perceptible depressions dotted with bushes to deep, steep-sided ravines. The bottoms of dry riverbeds enable frequent passage by vehicle and foot traffic. Dry riverbeds can provide cover from ground observation and camouflage from visual air reconnaissance. The threat of flash floods after heavy rains poses a significant danger to Soldiers/Marines and their equipment in a dry riverbed. Flooding can occur even if it is not raining in the immediate area. Being caught in a dry riverbed by forces on the high ground can be catastrophic. Commanders require weather forecasts and reconnaissance of proposed routes before committing major units.

1-33. Salt marshes are normally impassable, but commanders require detailed reconnaissance to assess trafficability. Salt marshes develop at points where the water in the subsoil rises to the surface and constant evaporation leaves salt deposits. Many desert areas have salt marshes either in the center of a drainage basin or near the seacoast. Old trails or paths may cross the marsh and are clearly visible during the dry season but harder to identify in the wet season. When dry, salt marshes have a hard, brittle crust. Troops can easily identify trails from the broken crust by the weight of traffic. In the wet season, troops can identify trails by standing water due to the crust being too hard or too thick for water to penetrate. However, load-carrying vehicles should avoid such routes without prior reconnaissance and marking. Vehicles may become mired so severely as to render equipment and units combat ineffective.

1-34. The ruins of earlier civilizations, scattered across the deserts of the world, are often sited along important avenues of approach and frequently dominate the only available passes in difficult terrain. Units may need to control these positions if they intend to dominate the immediate area. Currently occupied dwellings have little impact on trafficability except that they are normally located near roads and trails.

1-35. Exploration for and production of oil and other resources means wells, pipelines, refineries, quarries, and crushing plants may have strategic importance in the desert. Pipelines are often raised one meter off the ground. These pipelines will inhibit movement. Subsurface pipelines can also be an obstacle. In Southwest Asia, most maps indicate the location of subsurface pipelines. Often, a heavy vehicle traversing pipes buried at such a shallow depth can damage them. Furthermore, if a pipeline is ruptured, not only is the spill of oil a consideration, but the fumes may be hazardous as well.

1-36. Agriculture in desert areas typically has little effect on trafficability. However, irrigation canals can limit surface mobility and create choke points. Destruction of an irrigation system, which may occur during military operations, could devastate the local population and should be an important consideration in operational estimates.

1-37. The relatively few improved routes available in deserts can canalize movement. This especially occurs when there is limited off-road trafficability, such as in sandy or mountainous deserts. Logistics units require improved routes for heavy vehicles that have limited off-road capabilities.

KEY TERRAIN

1-38. Key terrain in the desert can be any man-made feature, mountain pass, source of water, or high ground. Because there are few man-made features in the desert, those that do exist can become important, perhaps

even key. Passes through steep terrain that enable vehicle passage often are key terrain due to their relative scarcity. The high ground in desert terrain is usually key terrain. The relative flatness and great distances of some deserts make even large sand dunes dominant features.

1-39. In desert regions, water sources, and the terrain that dominates access to water, are likely to be key terrain. Potable water sources, such as oases and wells, provide water resupply and tend to concentrate indigenous life. The logistics associated with water procurement and resupply can make a water source located in proximity to forces the key terrain for mission success.

1-40. The relatively few improved routes in many deserts may make them key terrain. These routes can become critical LOCs necessary for sustainment/logistics units to maintain tempo and operational reach.

OBSTACLES

1-41. Natural obstacles can hinder cross-country movement. In the desert, such obstacles consist of dry riverbeds; the steep slopes of escarpments; loose, sandy soils; mountains and hills; and dunes. Commanders require detailed reconnaissance of all natural obstacles to assess safety and trafficability.

1-42. Dry riverbeds can pose a danger to moving units, as they can appear unexpectedly, and vehicles can drive off cliffs or over the banks of the riverbeds. The walls of the riverbeds and canals can easily collapse under the weight of armored vehicles. Dry riverbeds prove particularly difficult to detect when driving with NVDs since NVDs often reduce depth perception.

1-43. Escarpments are long, steep slopes that form the wall of a plateau, rock formation, or cliff. Escarpments are most common in mountainous deserts but may also be found in areas where sandy or dune deserts transition to mountainous deserts. Mounted forces cannot traverse escarpments and only properly trained and equipped dismounted forces should attempt to climb an escarpment.

1-44. Sandy deserts are ideal for minefields. Although windstorms can reveal previously buried mines, these mines can still channel movement and deny access to certain areas. Other obstacles in sandy deserts include ditches, revetments, and barriers. Troops can create these obstacles by bulldozing sand mounds or by blasting in rocky mountainous areas to close passes.

1-45. Mountains and hills naturally hinder movement and create obstacles. Narrow mountain passes can canalize forces and increase the risk of ambush. Rock-strewn mountains hinder movement because of avalanche danger. Troops can create additional obstacles by blasting in rocky mountainous areas to close passes.

1-46. Sand dunes can stretch for miles and prevent mounted movement. Sand dunes can be more than 98 feet (30 meters) in elevation and consist of loose sand with high, steep, downwind faces that shift with the weather. Units should conduct aerial and engineer reconnaissance of sand dunes immediately before any large movement to ensure trafficability and identify potential alternate routes.

COVER AND CONCEALMENT

1-47. Depending on the desert classification, cover may be ample or nearly nonexistent. In mountainous and rocky deserts, rock formations, depressions, and ravines can provide cover for dismounted forces. In sandy deserts, cover is often limited and consists of dry riverbeds and occasional hills or dunes. Because limited natural cover exists in the desert, units often must create cover and improve their position with sandbags and defensive barriers.

1-48. Concealment is limited in most deserts. The absence of foliage makes it difficult for dismounted forces to camouflage themselves. Vehicles and larger, static equipment and facilities, such as command posts, can be concealed with desert pattern camouflage netting.

1-49. In certain areas, the desert, with its relatively level terrain and shallow compartments, contains few distinguishable terrain features to mask aviation forces. Formations of two or more aircraft can be seen up to 6 miles (10 kilometers) away as the dark airframes contrast against the desert sand. Aviation units normally deploy their aircraft along routes but, to avoid detection, may need to consider widely dispersed formations away from expected air avenues of approach.

WATER

1-50. Many deserts have a major river cut through them. The Nile River in the Sahara Desert, the Colorado River in the Colorado Plateau, the Kuiseb River in the Namib Desert, and the Tigris and Euphrates Rivers in the Syrian Desert are all prominent terrain features. These rivers are fed by heavy precipitation outside the desert and flow with enough water that the river continues in spite of the desert's high evaporation rate.

1-51. Rainwater often soaks into the ground, runs off, or evaporates too quickly to form enduring surface water features. In some cases, rain binds the sand much like a beach after the tide ebbs, forming a crust that increases trafficability. Dry riverbeds can become a torrent of dangerously rushing water with little warning from relatively minimal rainfall. Flat areas or depressions can quickly become muddy quagmires that severely restrict mobility. Rain may also change the landscape significantly as periods of heavy rain can form ravines that were previously not present. This has the potential to complicate land navigation by terrain association or attack points. When possible, Soldiers/Marines should confirm their location by using space-based precision navigation devices.

1-52. Population densities often correspond to the availability of a local water source. A Sahara Desert oasis may, for its size, be one of the most densely occupied places on earth. Subsurface water may be so far below the surface, or so limited, that wells are normally inadequate to support a large number of people. Because potable water is absolutely vital, a large natural supply may be both tactically and strategically important.

1-53. The Army Geospatial Center, a major subordinate command under the Army Corps of Engineers, collects, analyzes, and distributes water resource information for planning and management. It focuses on identifying ground, surface, and man-made water resources for the Department of Defense (DOD).

1-54. The Army Geospatial Center's Hydrologic Analysis Team maintains a water resource database that provides information on quality, quantity, and availability of water resources in areas of importance to the DOD. The data within the water resource database is attributed and categorized based on DOD water supply standards and equipment requirements. The Army Geospatial Center Water Detection Response Team is the DOD's primary organization for assisting military well drillers. Its principal function is to assist and advise well-drilling teams on the location of the best well-drilling sites and depths, and to provide information on drilling conditions for logistical planners.

VEGETATION

1-55. Vegetation and wildlife indigenous to the desert have adapted to its harsh conditions. For example, the cacti of the American desert store moisture in enlarged stems. Some plants have drought-resistant seeds that may lie dormant for years, followed by a brief, but colorful, period of growth after a rainstorm. The available vegetation is usually inadequate to provide much shade, shelter, or concealment, especially from the air.

1-56. The presence of plants and shrubs is indicative of available water. Some plants, like the desert gourd, have vines that grow to five meters in length to increase their moisture collection capacity. Others have wide lateral roots just below the surface to take advantage of rain and dew, while still others grow deep roots to tap subsurface water. Palm trees usually indicate water within 3 feet (1 meter) of the surface, salt grass within 6.5 feet (2 meters), cottonwood and willows up to 13 feet (4 meters).

1-57. Many desert plants and shrubs have toxic resins that developed as a protective defense. Other plants have sharp spines that can cause infection if they penetrate the skin. Milky sap and red beans or berries often indicate poisonous or dangerous plants. However, numerous plants and shrubs in the desert are edible and can be utilized in survival situations. (See ATP 3-50.21 for more information on edible and poisonous vegetation.)

WILDLIFE

1-58. There is great diversity but generally low density of wildlife in the desert; like plants, desert wildlife has specially adapted to their harsh environment. Desert wildlife varies significantly from region to region. Commanders consider information on local wildlife, as well as potential effects on operations and the health of Soldiers/Marines, during pre-deployment planning and training. Troops need to practice proper sanitation

and hygiene methods to control wildlife and minimize their impact on operations. (Refer to ATP 4-25.12 for more information on sanitation practices and pest control in support of operations.)

SCORPIONS AND CENTIPEDES

1-59. Scorpions and centipedes are prevalent in many desert regions. They prefer damp locations and are particularly active at night. Scorpions are easily recognizable by their crab-like appearance and by their long tail which ends in a sharp stinger. Adult scorpions vary in length from 1 to 8 inches (1 to 20 centimeters). Colors range from nearly black to light yellow and with stripes or solid shading. Centipedes have elongated bodies and numerous legs. Scorpions and centipedes hide in clothing, boots, or bedding. Soldiers/Marines should routinely shake these items before using. Although scorpion stings and centipede bites are rarely fatal, they can be extremely painful and open an avenue for further infection.

FLIES

1-60. Flies are abundant throughout desert environments and can rapidly spread diseases such as leishmaniasis. Leishmaniasis is a parasitic disease spread by the phlebotomine sand fly. Similar to other vector borne illnesses like malaria, leishmaniasis is spread when a sand fly bites a human or other mammal to feed on blood and the parasite is transmitted to the victim. The phlebotomine sand fly is only a quarter of the size of a mosquito with a transparent body and lacy wings. Sandflies exist in many deserts throughout the world and are most active during the evening and night. To prevent infection, Soldiers and Marines should cover exposed skin and apply insect repellent that contains the chemical commonly known as DEET.

FLEAS, MITES, AND LICE

1-61. Insects such as fleas, mites, and lice prevail in the desert and live on mammals and birds. Fleas, mites, and lice carry diseases such as plague and typhus. While most commonly found on native rodents or small mammals, fleas, mites, and lice may also be found in the lowland marshes common in coastal desert regions and along riverbanks.

1-62. Although very small, fleas are visible to the naked eye and typically measure between 1/16 and 1/8 of an inch (3 to 4 millimeters) long. Fleas are black or reddish-brown in color and are recognizable by their impressive jumping ability. They are most active in warm weather when temperatures exceed 90 degrees Fahrenheit (32 degrees Celsius). Fleas lay their eggs on their host; however, these eggs frequently fall to the ground and are commonly found in the host's bedding. Soldiers/Marines should avoid contact with local wildlife to prevent flea infestation.

1-63. Lice are slightly smaller than fleas and typically measure between 1/32 and 1/16 of an inch (2 to 3 millimeters). Lice may be classified as either head lice, body lice, or pubic lice. They range in color from translucent to white or tan and often lay their eggs in the seams of clothing or attached to the base of human hair. Eggs attached to hair are commonly referred to as nits and present an appearance similar to dandruff. Medical specialists can provide topical medication to kill head lice and they may be removed with a fine-tooth comb. Frequently change and wash clothes to prevent body lice infestation. If laundry facilities are unavailable, Soldiers/Marines that suspect the presence of lice can seal contaminated clothing in airtight plastic bags for two weeks to kill any lice that are present. Preventive medicine specialists may use fumigation or dusting with chemical insecticides to control or prevent a lice infestation.

1-64. Mites are smaller than both fleas and lice and are usually not visible to the naked eye. Mites are transmitted through either skin to skin contact with an infected person or through contact with an infected person's clothing or bedding. Once transmitted, the mite burrows beneath the skin where it feeds and lays eggs. This causes a pimple-like rash and intense itching, especially at night. Soldiers/Marines presenting symptoms of mite infestation should seek medical treatment. If possible, these Soldiers/Marines should be quarantined from others to prevent further infestation.

REPTILES

1-65. Lizards and snakes are prevalent in most hot deserts, and crocodiles are common in some desert rivers. Normally lizards are harmless, but some venomous species exist in North America and the Middle East.

1-66. Snakes, ranging from the totally harmless to the lethal, abound in many hot desert regions. Soldiers/Marines should avoid all snakes as even a bite from a nonvenomous snake can easily become infected. Snakes often seek shade (cool areas) under bushes, rocks, trees, and shrubs during the warmest periods of the day. These areas should be checked before sitting or resting. Soldiers/Marines should always check clothing and boots before putting them on. Vehicle operators should inspect engine compartments for snakes before conducting preventive maintenance checks and services (known as PMCS). They look for snakes in and around suspension components and engine compartments since snakes seek warm areas on recently parked vehicles to heat their bodies overnight.

MAMMALS

1-67. The most common mammals in desert regions are normally rodents. Desert rodents often scavenge in areas around Soldiers/Marines, seeking food scraps and water. If a unit remains in one location for an extended period and does not exercise effective sanitation practices, rodent populations can increase, bringing disease and attracting other potentially dangerous wildlife such as snakes, cats, and dogs.

1-68. Dogs often run in a pack. Wild dogs are often drawn to groups of Soldiers/Marines in search of food. Dogs can carry rabies, and rabies is endemic in many desert regions. Rabies is generally fatal if not properly treated. The adoption of wild dogs by Soldiers/Marines is the most common cause for dog bites. Soldiers/Marines should avoid all dogs in the desert.

ENVIRONMENTAL EFFECTS ON PERSONNEL

1-69. The harsh desert environment can rapidly fatigue unprepared troops both physically and mentally. Leaders combat this by adequately preparing their Soldiers/Marines for the conditions they will likely encounter and by maintaining a high standard of discipline. Troops with good leadership more readily accept heavy physical exertion and uncomfortable conditions. All Soldiers/Marines must clearly understand why they are fighting in such harsh conditions and should be kept informed of the operational situation.

1-70. Maintaining morale can dramatically improve performance in a harsh environment, especially for inexperienced Soldiers/Marines. There is more to welfare than the provision of mail and clean clothing. Troops must be kept healthy and physically fit. They must have adequate, palatable food, and be allowed periods of rest and sleep.

WATER

1-71. Forces trying to survive in the desert without adequate water supplies have historically met with disaster. Finding and keeping water sources may be the most crucial issue in desert conflicts. Potable drinking water is the most important requirement for Soldiers/Marines in the desert. Humans cannot perform at maximum efficiency on decreased water consumption.

1-72. Water is essential to accomplishing missions. Leaders must forecast how much water troops need and when they need it. Before missions, leaders ensure troops are properly hydrating. During the mission, leaders take steps to ensure Soldiers/Marines replace the water lost by sweating while monitoring the water supply to ensure it meets requirements. After the mission, leaders ensure that Soldiers/Marines hydrate to replace lost fluids and sustainment units replenish water to support future operations. When the water supply is limited, leaders must adjust their plans accordingly.

1-73. Leaders face challenges with water-related problems. One of the biggest water-related problems occurs when troops try to conserve water. When troops recognize how valuable water is to their survival, they may conserve it and not drink enough to sustain themselves.

1-74. A non-acclimatized Soldier/Marine requires more water than an acclimatized Soldier/Marine as they sweat more profusely. Units performing heavy activities on a sustained basis, such as a forced march or constructing fighting positions, at 80 degrees wet bulb-globe temperature (WBGT) index, require nearly a quarter gallon of water an hour. (For more information on water consumption and planning factors, refer to ATP 4-44/MCRP 3-40D.14 [MCRP 3-17.7Q].)

WARNING

Consuming over three gallons of water in a single day may put Soldiers/Marines at risk for hyponatremia, a potentially fatal medical emergency where water consumption flushes electrolytes from the body faster than they can be replenished.

1-75. While working in high desert temperatures, a Soldier/Marine at rest may lose as much as half a quart of water per hour from sweating. In very high temperatures and low humidity, sweating is not noticeable as it evaporates so fast the skin will appear dry. Whenever possible, sweat should be retained on the skin to improve the cooling process. However, the only way to do this is to avoid direct sun on the skin. For this reason, desert troops should remain fully clothed. If a Soldier/Marine is working, their water loss through sweat (and subsequent requirement for replenishment) increases in proportion to the amount of work done and the WBGT index. Soldiers/Marines may not always drink their required amount of water and will need to be encouraged to drink more than they think is necessary. This is particularly true during acclimatization. Flavored electrolyte additives can enhance the nutritional content of water and improve palatability.

1-76. The following are considerations for proper hydration during desert operations:

- Water is the key to health and survival.
- Carry as much water as possible when away from approved sources of drinking water. Humans can live longer without food than without water.
- Increase water consumption as activities and the WBGT increase.
- It is better to drink smaller quantities of water often rather than large quantities occasionally. Drinking large quantities can cause nausea and vomiting.
- Avoid alcohol, caffeine, and other diuretics as these compounds can accelerate dehydration.
- The optimum water drinking temperature is between 50–60 degrees Fahrenheit (10–15 degrees Celsius). Use evaporation (for example, a wet sock wrapped around a water bottle) to help cool water.
- Carbohydrate or electrolyte beverages are not required, but, if used, should not be the only source of fluids. Dilute carbohydrate or electrolyte beverages with water at a 1:1 ratio.
- Diseases, especially diarrheal diseases, will complicate and compound dehydration.

1-77. Healthier troops obtain drinking water only from approved sources. Approved water sources enable Soldiers/Marines to avoid disease or water that may have been deliberately poisoned or contaminated. Leaders carefully guard against pollution of water sources. If rationing is in effect, leaders issue water under the close supervision of officers and noncommissioned officers.

1-78. Table 1-1 presents guidelines for water consumption and work to rest cycles in accordance with the WBGT and level of activity. Current doctrine for planning and executing water support can be found in ATP 4-44/MCRP 3-40D.14 (MCRP 3-17.7Q).

Table 1-1. Work/rest and water consumption guide

Heat category	*WBGT index in degrees Fahrenheit*	*Easy work*		*Moderate work*		*Hard work*	
		Work/rest minutes	*Water intake (qt/hr)*	*Work/rest minutes*	*Water intake (qt/hr)*	*Work/rest minutes*	*Water intake (qt/hr)*
1	78°–81.9°	NL	½	NL	¾	40/20	¾
2 (Green)	82°–84.9°	NL	½	50/10	¾	30/30	1
3 (Yellow)	85°–87.9°	NL	¾	40/20	¾	30/30	1
4 (Red)	88°–89.9°	NL	¾	30/30	¾	20/40	1
5 (Black)	> 90°	50/10	1	20/40	1	10/50	1

Notes.

The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hours of work in the specified heat category. Individual water needs will vary ± ¼ qt/hr.

Rest means minimal physical activity (sitting or standing), accomplished in the shade if possible.

CAUTION: Hourly fluid intake should not exceed 1½ quarts. Daily fluid intake should not exceed 12 quarts.

Wearing body armor in humid climates adds 5°F to the WBGT index.

Wearing chemical, biological, radiological, and nuclear protective ensemble in humid climates adds 10°F to the WBGT index.

Legend:

°F	degrees Fahrenheit	qt/hr	quart per hour	±	plus or minus
NL	no limit to work time per hour	>	greater than	WBGT	wet bulb-globe temperature

Effects of Water Loss

1-79. Approximately 75 percent of the human body is fluid. All chemical activities in the body occur in a water solution, which helps in the removal of toxic wastes and plays a vital part in maintaining an even body temperature. A loss of two quarts (1.8 liters) of body fluid (2.5 percent of body weight) decreases efficiency by 25 percent and a loss of fluid equal to 15 percent of body weight is usually fatal. The following are some considerations when operating in a desert environment:

- Consider water as a tactical weapon. Reduce heat injuries by enforcing water consumption. Troops in armored vehicles, mission-oriented protective posture (MOPP) gear, and body armor need to increase their water intake in accordance with table 1-1. Leaders account for the effects of wearing MOPP gear by adding ten degrees Fahrenheit to the WBGT index. Leaders account for the effects of wearing body armor by adding five degrees to the WBGT index.
- When possible, drink cool water.
- Replace salt loss through meals.
- When possible, acclimatize troops by minimizing physical activity during the first days of heat exposure and gradually increase exposure and activity levels over time.
- Modify activities when conditions that increase the risk of heat injury (fatigue or loss of sleep, previous heat exhaustion, and medication use) exist.
- Adjust work/rest periods in accordance with table 1-1 and the WBGT index.
- If possible, perform heavy work in the cooler hours of the day such as early morning or late evening.

1-80. The body has a small reserve of water and can lose some without any effects. After a loss of about 2 quarts (1.8 liters) (which represents about 2.5 to 3.0 percent of body weight), effectiveness is impaired. The initial symptoms of dehydration include loss of coordination, fatigue, the inability to concentrate, and headache. Thirst will be present but not overpowering. The risk of dehydration is just as great in polar deserts as it is in other types of deserts. Soldiers/Marines can lose the same amount of fluid operating in a polar desert as they can in a sandy or mountainous desert. Leaders at all levels must monitor troops and enforce proper hydration.

1-81. As dehydration continues, the effects become more pronounced. Dehydration can compound the effects of heat and high temperatures. Some troops will experience heat cramps, while others will develop

heat exhaustion or heatstroke. Heat cramps and heat exhaustion are treatable, and the Soldier/Marine can return to duty in a few days. However, without prompt medical attention, heatstroke can be fatal. Even if the Soldiers/Marines survive, they may not be able to return to duty and could suffer permanent, debilitating injury. In any case, heat casualties require medical treatment and supervision. Preventing casualties is much easier than treating and replacing the casualties.

1-82. Chronic dehydration increases the incidence of several medical problems such as constipation, hemorrhoids, kidney stones, and urinary infections. The likelihood of these problems occurring can be reduced by enforcing appropriate water consumption.

1-83. Leaders consider the following to help prevent dehydration:

- Heat, wind, and dry air combine to produce a higher individual water requirement, primarily through the loss of fluids through sweat. Sweat rates can be high even when the skin looks and feels dry.
- Dehydration nullifies the benefits of heat acclimatization and physical fitness, it increases the susceptibility to heat injury, reduces the capacity to work, and decreases appetite and alertness. A lack of alertness can indicate early stages of dehydration.
- Thirst is not an adequate indicator of dehydration. Experience in the desert shows that troops are susceptible to dehydration even as they maintain hydration at about two percent of body weight (1.5 quarts [1.4 liters]) without any sense of thirst.

Water Storage Techniques

1-84. When water has been treated and distributed to water points, it has already been inspected for contamination by water purification specialists and medics. However, these checks do not ensure the water will not become contaminated somewhere in the unit distribution system before troops consume it.

1-85. Heat can lead to the contamination of water in the desert. Heat reduces the disinfecting power of the chlorine dissolved in the water. Even in containers, water absorbs heat from three sources: the air, the ground, and sunlight. Units cannot easily reduce ambient heat absorption, but they can minimize heat absorption from the ground and the sun by keeping water sources in the shade and off the ground. Field sanitation teams have the equipment and supplies necessary to measure and maintain safe chlorine levels in unit water containers.

1-86. Small, uninsulated water containers absorb heat more quickly than larger or insulated containers. Fortunately, troops can use the water in small containers before it becomes too warm. Water in uninsulated, 5-gallon (19-liter) cans at 60 degrees Fahrenheit (15 degrees Celsius) can heat up to unpalatable temperatures in three to four hours on a hot day in the full sun. However, when stored in the shade, the same water takes seven to eight hours to reach an unpalatable temperature. Unshaded, 55-gallon (208-liter) drums heat to unpalatable temperatures in about one day of full sun but stay drinkable for two days if shaded. Insulated, 400-gallon (1,514-liter) water trailers in or out of the sun will keep water cool for several days.

1-87. Troops store water only in clean containers intended for water. The best containers for small quantities of water are plastic water cans or coolers. Water trailers, if kept cool, keep water fresh for up to five days. If the air temperature exceeds 100 degrees Fahrenheit (37 degrees Celsius), sanitation troops must monitor the water temperature. When the water temperature exceeds 92 degrees Fahrenheit (33 degrees Celsius), Soldiers/Marines change the water since bacteria can multiply and contaminate the water. If units use ice blocks to cool water in water trailers, they must remove the ice prior to moving the trailer to prevent damage to the inner lining of the trailer. (Refer to ATP 4-25.12 and ATP 3-34.5/MCRP 3-40B.2 [MCRP 4-11B] for further information on unit water supply.)

1-88. Units carry enough water on a vehicle to last the crew until the next planned resupply. It is wise to provide a small reserve. They carry water containers in positions that—

- Prevent vibration by clamping them firmly to the vehicle body.
- Are in the shade and benefit from an air draft.
- Are protected from puncture by shell splinters.
- Are easily dismounted in case of vehicle evacuation.

They also ensure nonpotable water is never mistaken for drinking water. Water that is not fit to drink but is not otherwise dangerous may be used for other non-consumable requirements.

Water Supply Planning

1-89. Supplying water for desert operations requires deliberate planning. Water is heavy, requires specialized equipment to store and distribute, and must be transported long distances. Units require it in large quantities, it is perishable, and it is absolutely essential to both life and mission accomplishment.

1-90. The first step in water supply planning is determining water requirements. Some requirements, such as water for radiators, are reasonably constant. Some, such as water for food preparation or showers, are prescribed by the situation. Others, such as water for drinking and personal hygiene, vary heavily with conditions on the ground. Planning water requirements for centralized service support functions (shower, laundry, medical treatment, maintenance, and construction) is the responsibility of the supporting organization. The largest and most critical planning factor is drinking water. The quantity required depends on the environment and the difficulty and intensity of individual activity.

1-91. Because troops and equipment operating in the desert consume water at increased rates, frequent resupply is often required. Staffs must answer the following questions when planning the unit's water supply:

- How much water is needed?
- Where is it needed?
- When is it needed?
- How will water get to the unit?
- How does water supply affect the mission?
- How does the mission affect water requirements?
- What measures need to be taken to ensure water is properly used?

1-92. When supplies are limited, commanders must decide how to make the best use of available water. A general guide for water use is—

- Personnel (drinking only).
- Medical treatment and decontamination.
- Vehicle and equipment cooling systems.
- Food preparation.
- Personnel (uses other than drinking).
- Laundry.
- Construction.

Monitor Water Consumption

1-93. Leaders and their units can do several things to encourage water consumption. First, they make sure enough water is available for the most critical use—drinking. Furthermore, they ensure water is available where they need it. Troops working in the desert should not have to walk more than a short distance to a water source. During rest periods some troops would rather sit than walk to get water, especially if they are not thirsty. It must be easy for them to get water.

1-94. In addition to having water readily available, leaders must also make sure that troops actually drink the water they need. Since the signs of dehydration are not obvious until a Soldier/Marine is close to heat injury, leaders at the squad and platoon level must keep track of water consumed and—

- Ensure troops properly hydrate before hard work. Make sure they top off all personal hydration systems prior to beginning work.
- Keep track of how much water each Soldier/Marine drinks at the squad level; at the platoon level, monitor the consumption rate at each squad.
- Have troops take breaks in accordance with table 1-1 on page 1-13 and during breaks remind them to drink.
- Make sure water is kept as cool as possible.
- Monitor for the first signs of heat stress and reduced effectiveness, such as stumbling and slurred speech.

- Have troops monitor their urine. Reduced urination and dark-colored urine are possible signs of dehydration.
- Use the buddy system within the squad to help ensure troops are drinking enough.
- Make sure troops wear their uniform correctly. Blouses should be on with sleeves rolled down and headgear worn. The uniform should be worn as loose as possible.
- Ensure troops consume water before departing on a mission or patrol.

Water Requirements

1-95. When calculating water requirements for a whole day, leaders need to consider requirements other than drinking water, such as shaving, brushing teeth, and personal hygiene. On average, these functions require almost two gallons (eight liters) of water per Soldier/Marine per day. When rations are issued, leaders plan for one gallon (four liters) of water per meal for the mess kit, and 0.5 gallon (two liters) per meal for food preparation and kitchen cleanup. Troops can reuse the water used to heat individual combat rations for washing and shaving.

1-96. Leaders calculate water requirements for individual consumption. They plan units to use one quart of water per hour of hard work per Soldier/Marine (including rest periods) during the heat of the day. They adjust the amount to 1.5 cups (.8 liter) of water per hour of hard work during the cooler parts of the day. Experience with local conditions and the work performed may change these estimates.

1-97. How far the available water will stretch depends upon the commander's evaluation of the local situation and mission, how the commander sets priorities for water, and how careful the unit is in using its limited supply. If leaders restrict water use to only essential requirements, a unit may temporarily overcome a shortage; however, the unit's performance and capability will likely be severely restricted. Water shortages may make some daylight operations or hard work infeasible or unsupportable. Leaders and planners analyze each course of action with respect to water support requirements and the capacity of troops to sustain their efforts under extreme heat.

1-98. Like water, salt is also an essential nutrient for proper health and performance. However, the more Soldiers/Marines sweats, the more salt they lose. The issued ration has enough salt for a Soldier/Marine drinking up to four quarts (3.7 liters) of water per day. Nonacclimatized troops need additional salt during their first few days of exposure and all Soldiers/Marines need additional salt when sweating heavily. If the water demand to balance sweat loss rises, medics/corpsmen can provide extra salt under medical supervision. Salt, in excess of body requirements, may cause increased thirst and can be dangerous. Preventive medicine troops should test water for natural salinity before adding salt.

1-99. A lack of salt can cause heat cramps and too little salt with insufficient water can cause heat exhaustion. Heat exhaustion can cause a general collapse of the body's cooling mechanism. This condition is called heatstroke and is potentially fatal. To avoid these injuries, troops maintain their water and salt balance by eating regularly and drinking sufficient water. If troops expend more calories than they consume, they are more prone to heat illnesses; troops should not attempt to purposely lose weight in the desert. Because high temperatures can decrease appetite, leaders need to encourage troops to eat, with the heavier meal of the day scheduled during the cooler hours.

1-100. Water supplies are equally important to the enemy. Depriving the enemy of water sources, or denying or destroying enemy water supplies, can critically alter the enemy's options.

HEAT

1-101. Objects absorb heat from the sun and the air. In the desert, heat from these two sources is extreme; heat from the ground, the sun, and the air can easily raise temperatures above 100 degrees Fahrenheit (38 degrees Celsius). In addition to coping with these extreme temperatures, the body also produces its own heat and must find ways to shed excess heat and maintain its temperature within a narrow range. In a hot, dry desert, the primary method of heat exchange is through the evaporation of sweat from the skin. An individual's perspiration rate varies by how much heat their body needs to lose.

1-102. The body seeks to maintain its optimum temperature of 98.6 degrees Fahrenheit (37 degrees Celsius). When the air temperature is above the skin's temperature, the evaporation of sweat is the only

operative heat reduction mechanism. Following the loss of sweat, a person must drink water to replace the body's lost fluids. If the body fluid lost through sweating is not replaced, dehydration will follow. Dehydrated troops lack the body fluids to produce sweat and this inability to sweat can rapidly lead to heat injury. Additionally, when humidity rises, evaporation rates drop, and the body cannot cool itself by sweating. This further increases the risk of a heat injury.

1-103. Although the heat category provided by the WBGT index is a useful tool for leaders, the heat experienced by individual Soldiers/Marines may differ from the general heat conditions in the area. The activity level in closed vehicles will probably be less than that of troops outside, but the air temperature may be 20 to 30 degrees higher. Troops working on or near the ground may also be at an increased risk for heat injury. Ground or sand in full sun is hot, usually 30 to 45 degrees hotter than the air, and may reach 150 degrees Fahrenheit (65 degrees Celsius) when the air temperature is 120 degrees Fahrenheit (49 degrees Celsius). Cooler sand is just inches below the surface. A shaded trench can provide a cool resting spot. On the other hand, troops performing light duty in the shade are not as severely stressed and will need less water and less rest than those working in the full sun.

1-104. Keeping track of the current heat category and applying the appropriate water consumption and work/rest periods can prove challenging; however, this is a critical activity for leaders in the desert. In addition to these measures, leaders often adjust the time and duration of operations to protect troops from heat injuries. Work done in the heat of the day takes much longer and is more fatiguing than work done under relatively cooler conditions. Operations planned to take advantage of the cooler times of day—early morning, late evening, and night—not only increase productivity and reduce water use but are also easier on the troops and better for morale.

1-105. Excessive heat near the ground causes thermal bending. Such heat can produce mirages and make it extremely difficult to judge distances. Soldiers/Marines should verify estimated ranges with laser range finders when available. Troops must also use caution when using terrain association to navigate as mirages may cause confusion and disorientation.

Acclimatization

1-106. Acclimatization to heat is necessary to permit the body to reach and maintain efficiency in its cooling process. Leaders should allow approximately two weeks for acclimatization, with progressive increases in heat exposure and physical exertion. Soldiers/Marines can attain significant acclimatization in 4 to 5 days, but full acclimatization takes 7 to 14 days, with two to three hours per day of exercise in the heat. Leaders gradually increase physical activity until troops achieve full acclimatization.

1-107. Acclimatization does not reduce, and may increase, water requirements. Although acclimatization strengthens heat resistance, there is no such thing as total protection against the debilitating effects of heat. Situations may arise where troops cannot become fully acclimatized before performing heavy labor. Under these circumstances, leaders limit heavy activity to cooler hours and allow troops to rest frequently. Leaders monitor the WBGT index hourly and adjust conditions as necessary.

Climatic Stress

1-108. Climatic stress on the human body in hot deserts can be caused by any combination of air temperature, humidity, air movement, and radiant heat. Other factors adversely affect the body such as a lack of acclimatization, being overweight, dehydration, alcohol consumption, lack of sleep, old age, and poor health.

1-109. The extreme heat of the desert degrades performance and can cause heat exhaustion and heatstroke. For optimum mental and physical performance, Soldiers/Marines need to maintain their bodies within narrow limits. The body needs to minimize the excess heat it produces when performing physical activity. The amount of heat accumulation in the human body depends upon the amount of physical activity, the level of hydration, and the state of personal acclimatization. Leaders monitor their troops carefully for signs of heat stress and adjust schedules, work rates, rest, and water consumption according to table 1-1 on page 1-13.

1-110. At the first evidence of heat illness, leaders have the troops stop work, get into shade, and rehydrate. Early intervention is important.

WARNING

One heat casualty is often followed by others and is an indication that the entire unit may be at risk.

1-111. It is necessary to recognize heat stress symptoms quickly. At the first sign of heat stress, have the troops rest and drink water in the shade. Leaders may have to provide shade if no natural shade exists. Soldiers/Marines can use tarpaulins or camouflage nets to provide a shade area for troops operating in the sun in areas without natural shade. (For a complete description of the symptoms and treatment for heat injuries, refer to ATP 4-25.12.)

DANGER

Heatstroke is a medical emergency. Seek medical attention immediately.

COLD

1-112. All deserts can be dangerously cold. The polar deserts are some of the coldest places on Earth. The dry air, wind, and clear sky can combine to produce bone chilling discomfort and injury. The body's ability to maintain its temperature within a narrow range is as important in the cold as in the heat. Loss of body heat to the environment can lead to cold injuries such as frostbite and hypothermia. Because of the reduced humidity, hypothermia is the primary cold weather risk in the desert, but frostbite can also occur.

1-113. Soldiers/Marines must have enough clothing and shelter to keep warm. They will be tempted to leave clothing and equipment behind that seems unnecessary during the heat of the day. Cold-wet injuries, such as immersion syndrome (trench foot), can cause problems for dismounted troops operating in coastal marshes or arctic deserts without proper clothing or boots. Basic guidelines for cold weather operations include the following:

- Anticipate an increase in cold-wet injuries if a proposed operation will take place in lowlands or marshes. Immersion syndrome can completely debilitate Soldiers/Marines and occurs when they expose their feet to cold and wet conditions for a prolonged period.
- Monitor the weather and plan for significant temperature differences between day and night. The daytime temperature is no guide to the nighttime temperature, as 90 degree Fahrenheit (32 degree Celsius) days can turn into 30 degree Fahrenheit (-1 degree Celsius) nights.

1-114. The lack of foliage to disrupt winds can lead to severe wind chills in polar deserts. Wind chills compound the already cold temperatures and place troops at greater risk of frostbite on exposed skin. Leaders can reference table 1-2 to calculate wind chill and adjust operations as necessary. (Refer to ATP 4-25.12 for more information on preventing and treating cold weather injuries.)

Table 1-2. Wind chill chart

Wind speed (mph)	*Actual temperature (degrees Fahrenheit)*											
	50	40	30	20	10	0	–10	–20	–30	–40	–50	–60
	Equivalent chill temperature in degrees Fahrenheit											
CALM	50	40	30	20	10	0	–10	–20	–30	–40	–50	–60
5	48	37	27	16	6	–5	–15	–26	–36	–47	–57	–68
10	40	28	16	3	–9	–21	–33	–46	–58	–70	–83	–95
15	36	22	9	–5	–18	–32	–45	–58	–72	–85	–99	–112
20	32	18	4	–10	–25	–39	–53	–67	–82	–96	–110	–124
25	30	15	0	–15	–29	–44	–59	–74	–89	–104	–118	–133
30	28	13	–2	–18	–33	–48	–63	–79	–94	–109	–125	–140
35	27	11	–4	–20	–35	–51	–67	–82	–98	–113	–129	–145
40	26	10	–6	–22	–37	–53	–69	–85	–101	–117	–132	–148
	Little Danger				Increasing Danger			Great Danger				

Notes.

Little Danger	Greatest danger from false sense of security.
Increasing Danger	Exposed flesh may freeze within 1 minute.
Great Danger	Exposed flesh may freeze within 30 seconds.

Wind speed of more than 40 mph has little additional effect.

Legend:
mph miles per hour – minus

SUNLIGHT

1-115. Direct and diffused sunlight can produce eyestrain, eye fatigue, and temporarily impaired vision. When ultraviolet rays of the sun reflect from a snow-covered surface, it can result in snow blindness. To minimize the negative effects of the sunlight on the eyes, Soldiers/Marines wear dark glasses or goggles that block or reduce ultraviolet rays from the sun.

1-116. Overexposure of the skin to sunlight can cause sunburn. All personnel are susceptible to sunburn, but different skin types have varying degrees of sensitivity. Troops with fair skin, freckled skin, ruddy complexions, or red hair are more susceptible to sunburn than others. Sunburn is characterized by painful reddened skin and can result in blistering that inhibits the body's ability to sweat and transfer heat. Sunburns can increase the risk of heat injury. (Refer to ATP 4-25.12 for more information on the prevention and treatment of sunburns.)

1-117. Soldiers/Marines use sunblock to protect exposed skin. Because the risk of sunburn is significant in the desert, Soldiers/Marines should remain fully clothed in loose garments any time they operate outside.

WIND

1-118. In addition to the danger of wind chill in polar deserts, high winds in sandy deserts can prove equally detrimental. Dust and sand propelled by desert winds can make life intolerable, maintenance very difficult, and visibility restricted to a few meters. Sandstorms often occur in the spring and summer and may last for days or weeks at a time. For example, the deserts of Iran can produce wind velocities of up to 40 miles per hour (64 kilometers per hour) that have been known to last for over two months.

1-119. The wind can be as physically demanding as the heat by burning the face, arms, and any exposed skin with blown sand. Sand gets into eyes, nose, mouth, throat, lungs, ears, and hair. The combination of dry air, wind, and sand can irritate mucous membranes, chap the lips and other exposed surfaces, and cause nosebleeds. Cracked, chapped lips make eating difficult. Conjunctivitis, otherwise known as pinkeye, can occur when fine particles or other contaminants introduce microbes into the eyes. Constant wind noise and exposure to blowing sand can be exhausting, demoralizing, make communication difficult, and increase fatigue.

1-120. Desert winds normally occur during the day as the atmosphere absorbs heat. At night, wind velocities typically drop. However, sandstorms can be unrelenting and occur during both day and night. The largest sandstorms produce plumes that rise to several thousand feet and may last for several days. Leaders prepare for rapid temperature changes in the wake of a sandstorm as they may indicate a changing weather pattern. Sandstorms may also significantly alter the terrain by depositing massive amounts of sand and creating new berms or obstacles where previously none existed. Sandstorms also have the capacity to completely remove berms or terrain features. Because of their ability to alter terrain, sandstorms can complicate land navigation. Soldiers/Marines should confirm their location with space-based precision navigation devices when available.

1-121. Sandstorms reduce visibility and increase the likelihood of Soldiers/Marines becoming separated from their unit. If military operations must continue during sandstorms or other periods of limited visibility, commanders adjust their tactics, techniques, and procedures (TTP) to prevent personnel or vehicles becoming separated from their unit. During mounted patrols and convoys, commanders reduce speed, close intervals, and, depending on the enemy threat, instruct operators to turn on their vehicle lights. Dismounted patrols dramatically reduce intervals between troops and may adjust movement formations from a wedge or column to a file. In addition to adjusting their unit TTP, individuals can take steps to mitigate the impact of wind and sand by—

- Removing contact lenses.
- Applying petroleum jelly or lip balm to the lips, nose, or other exposed mucous membranes.
- Donning scarves or bandannas to protect the head and face.
- Wearing eye protection or goggles.
- Regularly washing the face, eyelids, and ears to remove sand and dust.

ENVIRONMENTAL EFFECTS ON EQUIPMENT

1-122. If not properly maintained and operated, the demanding desert climate can damage equipment. Extreme temperatures, low humidity, and windblown sand can degrade the performance of vehicles, aircraft, sensors, and weapons. The harsh environment requires careful maintenance and operators must be fully trained in maintaining their equipment. (See appendix B for techniques for operating equipment in desert environments.)

HEAT

1-123. Air and fluids expand and contract with rising and falling temperatures. For example, if tires are inflated to correct pressure during the cool of night, they may burst during operations in the heat of day. Severe heat increases pressure in closed pressurized systems such as the M2 fire burner unit. High temperatures may cause halon fire suppression systems to discharge spontaneously. Some types of equipment have thermal cutouts that open circuit breakers whenever equipment begins to overheat. Soldiers/Marines ensure that the working pressure and temperatures of all equipment stays within safety limits in accordance with the appropriate technical manual (TM).

1-124. Vehicle cooling and lubrication systems are interdependent. A malfunction by one will rapidly place the other system under severe strain. In temperature extremes, all types of engines are apt to operate above optimum temperatures, leading to excessive wear or leaky seals that can lead to engine failure. Effective leaders know which types of vehicles tend to excessively overheat and ensure crews apply extra care to their maintenance. Soldiers/Marines should refer to applicable TMs and lubrication orders for the equipment they are operating. The following best practices ensure engines do not overheat:

- Check oil levels frequently to ensure proper levels are maintained (too high may be as bad as too low), seals are not leaking, and oil consumption is not higher than normal.
- Keep radiators and air flow areas around engines clean and free of debris and other obstructions.
- Keep cooling hoses tight (a drip a second loses seven gallons [26 liters] of fluid in 24 hours).
- Leave hood side panels from engine compartments in place while the engine is running to reduce air turbulence and ineffective cooling.

1-125. Batteries do not hold their charge efficiently in intense heat. The following additional best practices ensure batteries operate in intense heat:

- Change battery-specific gravity to adjust to the desert environment (see vehicle TM for details).
- Keep batteries full, but not overfilled, and carry a reserve of distilled water.
- Keep air vents clean to prevent vapors from building up pressure and causing the battery to explode.
- Set voltage regulators as low as practical.
- Increase dry battery supplies to offset high attrition rate caused by excessive heat.

1-126. High temperatures adversely affect electronics equipment. Radios, computers, and network components tend to fail when they overheat. Failure of electronic components can cause advanced weapons, communications systems, aircraft, and vehicles to be non-mission capable. The following best practices help prevent overheating of electronic components:

- Keep electronics out of direct sunlight.
- Ensure that air can circulate freely around electronic components.
- Utilize low power settings based upon mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC)/(mission, enemy, terrain and weather, troops and support available—time available) METT-T.
- If the component requires external cooling, ensure that the external cooling unit's output is not diverted for other uses.
- Do not cover vents.

1-127. Heat causes anomalies in the electromagnetic spectrum (EMS). Radio range is shorter during the day than at night. At night, range improves but static electricity may cause interference. Very high frequency (known as VHF) communications range can be reduced by as much as 50 percent because of high temperatures. High frequency ground wave propagation over the dry sandy soil also decreases. (For more detailed information on the effects of heat on tactical radio operations, refer to ATP 6-02.53.)

1-128. Units operating in desert terrain must plan for increased consumption of tires and tracks. Sand temperatures may exceed 165 degrees Fahrenheit (74 degrees Celsius). Such high temperatures increase the wear rate of rubber components and weaken their resistance to puncture. Soldiers/Marines need to inspect rubber components exposed to wear (tires, steering components, track pads, and seals) more often for serviceability when conducting maintenance checks.

1-129. Aircraft performance is severely impacted by heat. Heat severely affects rotary- and tilt-wing aircraft performance more heavily than fixed-wing aircraft. As heat increases, operating loads and ranges decrease. Commanders and their staffs must account for the effects of heat when requesting and employing aviation assets. (For more detailed information on Army aviation operations and Army aviation capabilities, refer to FM 3-04.)

1-130. Heat distortion occurs when uneven heating of the air causes light to refract differently as it passes through pockets of air at different temperatures. Heat distortion negatively affects visibility and range estimation. As a result, items on the desert surface seem to shimmer and move slightly making positive identification more challenging and degrading depth perception. Use of a range finder helps mitigate range estimation errors induced by heat distortion.

SUNLIGHT

1-131. Sunlight can be detrimental to plastics, lubricants, pressurized gases, some chemicals, and infrared tracking and guidance systems. Soldiers/Marines need to keep items like M13 decontamination and reimpregnation kits and Stinger missiles out of constant direct sunlight. Soldiers/Marines also need to keep optics stored in their prescribed containers since sunlight can also damage them.

WIND

1-132. Desert winds, by their velocity alone, can damage materiel and equipment such as aircraft, tents, and antennas. To minimize the possibility of wind damage, Soldiers/Marines shield equipment from the wind in

accordance with the applicable TMs. Desert wind velocity can exceed operating limits of tilt-wing and rotary-wing aircraft, UASs, radar systems, and communications antennas. When the wind velocity reaches such limits, Soldiers/Marines cannot use that equipment. Leaders need to take into account forecasted wind during mission planning and execution.

DUST AND SAND

1-133. Dust and sand pose the greatest harm to vehicles and equipment in the desert. They are abrasive and unavoidable in all deserts aside from polar deserts. Dust and sand affect ground vehicles and aircraft. Engineers and mechanics work diligently to alleviate sand-related mechanical problems. Dust and sand negatively affect electronics, optics, and weapons and munitions.

1-134. Dust and sand can have severe effects on ground vehicles. Rubber components such as gaskets, tires, track components, and seals become worn more quickly. Wind driven sand can clog filters and air ducts rapidly disabling vehicles. Engine air filters require replacement or clearing more frequently in dusty and sandy conditions. Fuel and fuel filters are contaminated more quickly and must be checked and replaced often in dusty and sandy conditions. Lubricants are easily contaminated by dust and sand. Lubricants on exposed or semi-exposed moving parts must be kept to the recommended absolute minimum to reduce the possibility of contamination by abrasive dust and sand. Lubrication fittings are critical items and should be checked frequently. If they are missing, sand will enter the housing, causing bearing failure. All grease fittings should be cleaned before executing lubrication orders. Teflon bearings require constant inspection to ensure that the coating is not eroded. Sand and dirt can easily accumulate on the hulls of armored vehicles. This accumulation, combined with condensation or oil, can bind control linkages. Sand accumulation at the air-bleeder valve can inhibit heat from escaping from the transmission and result in damage to the transmission. Operator's checks and services increase in importance in this environment in accordance with the applicable TM.

1-135. Dust and sand are detrimental to aircraft. Rotating components and windshields wear more quickly and require more frequent replacement in the desert. This requires more frequent inspections than in temperate climates. Operators and maintainers must pay particular attention to wear on rotor heads, leading edges of rotor and tail rotor blades, and exposed flight controls. Over 200 pounds (90 kilos) of dirt has been known to accumulate in the fuselage of helicopters operating in desert conditions. These areas must be routinely checked and cleaned to prevent a pound-for-pound reduction in aircraft-lift capability. Protective covers should always be used when aircraft are not in operation.

1-136. Engineers can use various agents to alleviate severe dust conditions such as chloride salts, resins, petroleum products, polymers, and emulsions (the only petroleum product currently in use is asphalt salt). This is particularly critical in reducing engine wear in rotary-wing aircraft. It is also important along heavily traveled roads and in cantonment areas. Engineers also use load-stabilization techniques to increase the weight-bearing capacity for airstrips and unimproved main supply routes (MSRs).

1-137. Oil should be changed more frequently under desert conditions. Grit accumulates in the oil pan, and non-combusted low-octane fuel can seep down the cylinder walls and dilute oil in the reservoir. Diluted lubricants cool less effectively and evaporate more quickly at the higher temperatures generated during operation. Oil changes and lubrication of undercarriage points at more frequent intervals will prolong engine and vehicle life under desert conditions. Units employed in desert environments should re-evaluate their engine oil requirements and plan accordingly.

1-138. Keeping sand out of maintenance areas is critical; site selection for maintenance facilities and activities should account for sand and dust. Screens can be used to block blowing sand and provide shade for mechanics. Ground maintenance practices should be adjusted to account for dust and sand in accordance with the appropriate TM. Mechanics must keep their tools clean. Cloth or plastic sheeting can be used to protect open or disassembled components from blowing sand and dust. The same applies for disconnected water, oil, and hydraulic lines.

1-139. All petroleum, oils, and lubricants (POL) and POL dispensing tools must be stored in protected areas to prevent contamination by dust and sand. When possible, store POL in the smallest possible container to prevent contaminating large stocks. When opened, POL and tools must be protected from dust and sand by

covering and sealing with plastic bags. Use of grease cartridges in lieu of bulk grease is preferred. Refer to all applicable equipment lubrication orders for proper POL usage.

1-140. Sand and dust can severely damage and degrade electronic equipment. Most electronics have ventilating ports, channels, and fans that can get clogged with dust. These must be checked regularly and kept clean to prevent overheating and component failure. Electrical wire covers and insulation can wear quickly, and plugs and sockets can become clogged with dust and sand either preventing electrical contact or making them difficult to connect or disconnect. Sand provides poor electrical grounding, and an artificial ground may be required to protect electronic equipment.

1-141. Sand and dust can degrade performance and damage optics. Sandstorms can reduce visibility to zero in minutes as sand blocks out sunlight while flying in the air. Flying sand dust can also damage equipment. Sand and dust degrade lenses by causing small pitting and scratching. Fine dust can accumulate on lenses and may not be apparent until optical performance has severely deteriorated. Effective troops keep protective covers installed when they are not using optics.

1-142. Dust and sand adversely affect the performance of weapons and munitions. Sand and dust accumulation can cause weapons to jam, rockets to stick in their tubes, and missiles to lock on launching rails. Sand- or dust-clogged barrels can cause in-bore detonations. Soldiers/Marines give particular attention to magazines that can easily clog, interrupting the feeding of weapons. To avoid jamming caused by accumulating sand, troops avoid excessively lubricating weapons. Troops wipe off and replace lubricants contaminated with sand. They can use brushes to remove sand from weapons and optics when attempting to avoid excessive lubrication. If possible, troops use air compressors and pressurized air to remove fine sand from weapons and air filters.

HUMIDITY

1-143. Some deserts are humid. Where this occurs, humidity plus heat encourages rust on bare metal and mold in enclosed spaces such as optics. Troops keep bare metal surfaces clean and lightly lubricated. They store optics in dry conditions. When Soldiers/Marines use optics, they keep air circulating around them and purge the optics at frequent intervals. Units wash aircraft daily with a low-pressure spray, particularly if there is salt in the air.

DIURNAL AND EXTREME TEMPERATURES

1-144. The highest known ambient temperature recorded in a desert was 136 degrees Fahrenheit (58 degrees Celsius). Winter temperatures in the Arctic Polar, Antarctic, and Gobi Deserts reach minus 60 degrees Fahrenheit (minus 51 degrees Celsius). The desert's cloudless sky causes extreme heat during the day and severe cold at night. For example, the diurnal temperature variation—the difference between day and night temperatures—can be as great as 70 degrees Fahrenheit (21 degrees Celsius). Temperatures can be extremely hot during the day and then drop to below freezing at night.

1-145. Cold air holds less water vapor than hot air holds. Consequently, when deserts experience their characteristic diurnal temperature variation, condensation often forms on exposed equipment overnight. Condensation can affect optics, weapons, fuel storage facilities, and air tanks. Weapons, even if not overly lubricated, can accumulate sand and dirt from condensation. Unprotected metal can corrode from condensation in the desert.

1-146. Units adjust maintenance practices to account for temperature variations in accordance with the appropriate TM. Troops use lubricants of the correct viscosity and quantity for the temperature in which they operate the equipment. To prevent system damage, many aircraft and vehicles have specific limitations and procedures that Soldiers/Marines must follow in extreme temperatures.

THERMAL BENDING

1-147. Thermal bending is the uneven heating and cooling of a gun tube due to ambient temperature changes. It adversely affects many weapon systems. Tanks, like the Ml Abrams, are designed to compensate for these factors. The muzzle reference system allows the crew to monitor any loss of gun sight relationship and to correct for errors using the muzzle reference system updated at regular intervals. Ml-series tanks are

equipped with a thermal shroud, allowing for more even heating and cooling of the gun tube. By bore-sighting at regular intervals and constant monitoring of the fire control system, the tank crew can maximize its readiness.

REFRACTION

1-148. The apparent illusion of target displacement is commonly called refraction. Under certain light and environmental conditions, the path of light (line of sight) does not travel in a straight line. Refraction may occur in the following conditions:

- Day—Clear sky, flat terrain, winds that are less than ten miles per hour (16 kilometers per hour).
- Night—Clear sky, flat terrain, winds that are under four miles per hour (6 kilometers per hour).

1-149. Refraction makes targets appear lower during the day. The sight picture, although it may appear center of mass to the gunner, is actually below the target. This may result in a round impacting short of the intended target. At night, the effects reverse and may result in a round overshooting its intended target. Effective crews trust their laser range finders. When crews use the laser beam, the sight picture has no refraction and the round hits the desired target.

Note. Any time heat shimmer is present, refraction may also exist.

1-150. Refraction may cause problems for tank crews attempting engagements at ranges beyond 1,640 yards (1,500 meters). The most effective measure available to the crew to minimize refraction is an elevated firing position. A position at least 32 feet (10 meters) above intervening terrain generally negates any refraction effects. If this type of position is not available, a crew operating under conditions favorable to refraction, and having missed with their first round, should apply the following:

- Day—Adjust sight picture up 1/2 target form. See figure 1-5 and figure 1-6 for examples of day and night refraction.
- Night—Adjust sight picture down 1/2 target form.

Note. Crews do not need to make a correction for refraction at ranges of less than 1,640 yards (1,500 meters).

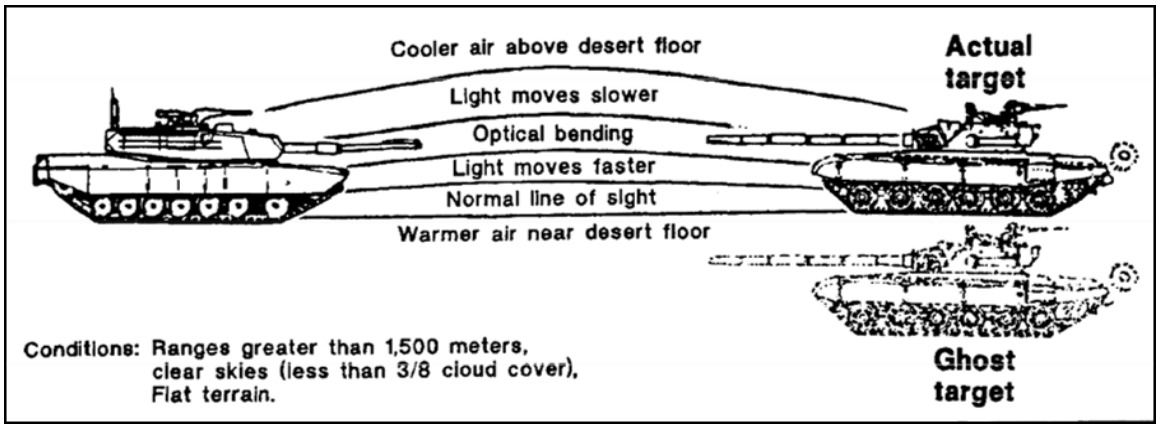

Figure 1-5. Day refraction

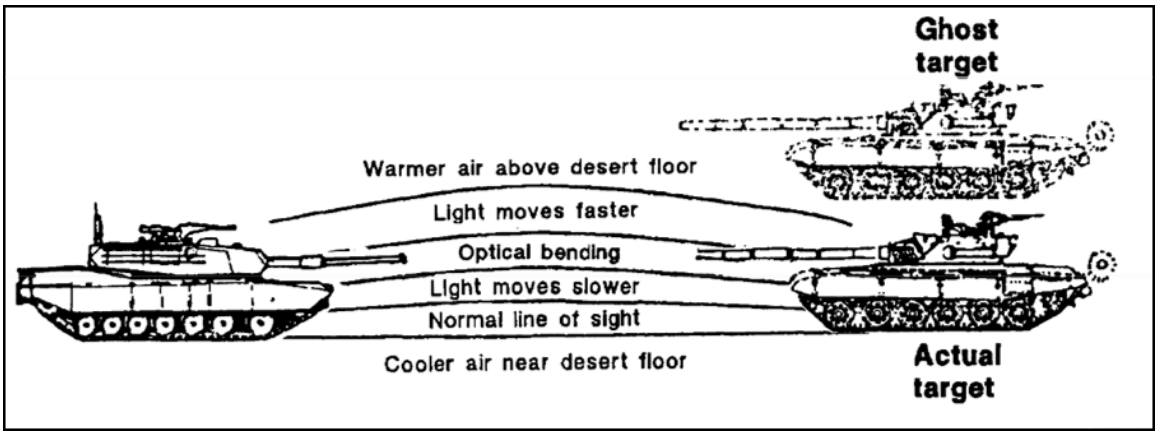

Figure 1-6. Night refraction

1-151. Tank and fighting vehicle crews boresight their weapon systems before and after firing to ensure accuracy. Boresighting establishes a definitive relationship between the axis of the bore of the gun and the sights at zero super elevation, providing a basis for all sight alignment. When the tank is boresighted at a known range, the fire control system provides system parallax correction to the gunner's primary sight and the thermal imaging system at other ranges. It is impossible to fire accurately without sight alignment; therefore, boresighting is fundamental in tank gunnery. However, boresighting does not correct refraction and crews must ensure that prepare-to-fire checks account for potential refraction.

STATIC ELECTRICITY

1-152. Static electricity is common in desert environments due to the low atmospheric humidity and poor grounding potential of the dry ground surface. It is particularly prevalent when aircraft or vehicles lack a conductor contact and are not grounded to the desert floor. Static electricity discharge occurs when objects with different electrical charges either touch or come close to each other causing a charge to transfer from one object to the other. Static electricity discharge in the presence of flammable gases or materials can result in an explosion or fire. Proper grounding techniques and procedures reduce static discharge potential.

1-153. Troops properly ground equipment by establishing a metal circuit between two pieces of equipment or the equipment and the ground. For example, they establish a metal circuit between fuel tankers and vehicles before and continuously during refueling. Troops properly ground the tankers and vehicles in accordance with the appropriate TM.

1-154. Static electricity discharge is especially hazardous when conducting sling load, rearming, and refueling operations with aircraft. Tilt-rotor and rotary-wing aircraft generate large amounts of static electricity during flight. Troops ensure proper grounding procedures and conduct checks to mitigate the risk of electrical shock.

UNIFORM AND PERSONAL PROTECTIVE EQUIPMENT

1-155. Commanders consider the threats from enemy action and the environment when modifying the uniform and protective posture. Small unit leaders supervise troops so they wear personal protective equipment (PPE) (body armor, gloves, eye protection, and helmet) correctly in accordance with the protective posture set by the command. Commanders adjust the protective posture as the threat and weather conditions change.

1-156. Commanders determine when Soldiers/Marines wear MOPP gear by considering both the chemical, biological, radiological, and nuclear (CBRN) threat and environmental factors. Wearing chemical protective garments greatly increases heat stress and the likelihood of heat injuries.

1-157. Soldiers/Marines wear uniforms to protect against sunlight and wind. Leaders consider sunglasses, eye protection, and ballistic goggles standard parts of the uniform in a desert environment. Soldiers/Marines

wear the uniform loosely. They also use sunscreen and a scarf or neck gaiter to protect the face and neck from the sun. The scarf or gaiter can also protect the face during sandstorms. Soldiers/Marines can wear wide-brim, jungle caps to reduce heat stress and protect the head and neck from sun.

HEALTH CONSIDERATIONS

1-158. Proper personal hygiene prevents disease, maintains discipline, and reinforces morale. If water is available, leaders encourage Soldiers/Marines to take every opportunity to conduct personal hygiene. If sufficient water is not available, Soldiers/Marines should clean themselves with sponge baths, wipes, a damp rag, powder baths, or a dry, clean cloth. They dispose of wastewater in approved areas to prevent insect infestation. Cleaning areas of the body that sweat heavily is especially important. Soldiers/Marines change underwear and socks frequently and use foot powder often.

DISEASES

1-159. Intestinal diseases are common in the desert. Soldiers/Marines can prevent these diseases through proper mess sanitation and proper siting and sanitation of latrines. Units position latrines well away and downwind of troop areas. Units use trench-type latrines where the soil is suitable but must be dug deeply, as shallow latrines become exposed in areas of shifting sand. Funnels dug into a sump work well as urinals. Units layer the bottom of slit trenches with lime and cover the top prior to filling them in. They ensure lime is available after each use of the latrine to deter flies. Flies are a perpetual source of irritation and carry infections; only good sanitation can keep flies to a minimum. (Refer to ATP 4-25.12 for further information on field sanitation techniques.)

1-160. Diseases common to the desert include plague, typhus, malaria, dengue fever, cholera, and typhoid. Some diseases adversely impact hydration, such as those which cause vomiting and diarrhea among their symptoms. Diseases that impact hydration compound the risk of heat injury. Infectious diseases that result in a fever can make it difficult to diagnose heat injuries. Heat injury in troops suffering from other diseases complicate recovery from both ailments.

1-161. Skin diseases can result from polluted water. Soldiers/Marines use only treated water for bathing and washing clothes to prevent these skin diseases. Units use untreated water for vehicle cooling systems or vehicle decontamination. (Refer to ATP 4-25.12 for uses for approved potable and nonpotable water.) The excessive sweating common in hot climates can cause heat rash and fungal infections of the skin. The higher the humidity, the greater the possibility of skin infections.

1-162. The following are additional health-related considerations when operating in a desert:

- Most diarrheal diseases result from ingesting water or food contaminated with feces.
- Flies, mosquitoes, and other insects carry fever-causing illnesses such as malaria, sand fly fever, dengue fever, and typhus.
- Natural or untreated water and standing water in the desert is usually contaminated and too brackish (salty) for safe consumption.
- Water supplies with insufficient chlorine residuals, native food and drink, and ice often carry disease.

PREVENTIVE MEASURES

1-163. Units can prevent both diarrheal and insect-borne diseases by breaking the chain of transmission from infected sources to susceptible troops. ATP 4-25.12 and ATP 3-34.5/MCRP 3-40B.2 (MCRP 4-11B) contain field sanitation and preventive measures that units can implement to reduce the risk of disease. Additional preventive measures include:

- Carefully store, handle, purify, and prepare water and food.
- Procure all food, water, ice, and beverages from U.S. military approved sources and inspect them routinely.
- Eat well-cooked foods hot and thoroughly washed, peeled fruits and vegetables.
- Avoid local dairy products and raw leafy vegetables.

- Consider the food in local markets hazardous. Avoid local food unless approved by veterinary food inspectors.
- If any uncertainty exists concerning the quality of drinking water, disinfect supplies using approved field-expedient methods (refer to ATP 4-25.12).
- Avoid using untreated water for washing or bathing.
- Establish hand washing facilities at both latrines and mess facilities. Pay particular attention to the cleanliness of hands and fingernails since dirty hands are the primary means of transmitting disease.
- Separate living areas from refuse areas. Since food and garbage attract animals, survey the unit area for potential animal and rodent hazards.
- Dispose of human waste and garbage as specified in ATP 4-25.12 and addressed in ATP 3-34.5/ MCRP 3-40B.2 (MCRP 4-11B).

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Chapter 2

Foundations for Desert Operations

This chapter describes the characteristics of desert operations through the operational framework and across the multi-domain extended battlefield. Drawing on the characteristics of desert operations, it outlines basic fundamentals that commanders consider when drafting their operational approach.

UNDERSTANDING DESERT OPERATIONS

2-1. Desert operations span from military engagement to major operations and campaigns during periods of competition and conflict. Like other operations, commanders plan and execute desert operations to achieve geographic, enemy-oriented, or population-centric objectives. However, the harsh environment requires units adjust their TTP to both protect Soldiers/Marines and accomplish the mission. Army/Marine Corps leaders conducting desert operations—

- Fight for intelligence.
- Maneuver to win.
- Control the essential.
- Preserve critical infrastructure.
- Sustain the fight.
- Consolidate gains essential to retaining the initiative.

2-2. Commanders consider that the factors influencing a desert area may originate beyond the area's physical confines. For example, a major river providing reliable water to the desert may originate far outside the area of operations (AO), an ideology from another region may impact political and economic dynamics in another, or a natural resource found in the desert may fuel industry well beyond the AO. The relationship between the operational variables—political, military, economic, social, information, infrastructure, physical environment, and time (also known as PMESII-PT)—can be complex and will undoubtedly impact operations, just as operations will impact the variables. It is essential to understand the total desert environment to plan and conduct cohesive and effective desert operations.

OPERATIONAL FRAMEWORK

2-3. Commanders assign subordinates an area of operations to create freedom of action, maintain operational initiative, and efficiently apply the elements of combat power. An *area of operations* is an operational area defined by a commander for land and maritime forces that should be large enough to accomplish their missions and protect their forces (JP 3-0). Some capabilities, like cyberspace and information operations, can potentially generate effects beyond assigned AOs. As such, retaining these capabilities and the authority for their employment at higher echelons enables subordinate leaders to focus on the extremely demanding lethal and physical aspects of close combat.

2-4. Commanders designate close, deep, support, rear, and consolidation areas to describe the physical arrangement of forces in time, space, and focus; Marine Corps commanders designate close, deep, and rear areas to describe the physical arrangement of forces when using a spatial-based battlespace framework, per MCWP 3-01. The operational framework does not differ during desert operations. Commanders designate the purpose by identifying decisive, shaping, and sustaining operations for their subordinate units. Additionally, commanders designate main and supporting efforts to establish clear priorities of support and resources among subordinate units.

DEEP AREA

2-5. A *deep area* is where the commander sets conditions for future success in close combat (ADP 3-0). Operations in the deep area involve efforts to prevent uncommitted or out-of-contact enemy maneuver forces from being committed in a coherent manner, or preventing enemy enabling capabilities, such as fires and air defense, from creating effects in the close area. A commander's deep area generally extends beyond subordinate unit boundaries out to the limits of the commander's designated AO. The purpose of operations in the deep area is to set the conditions for success in the close area or to establish conditions for future operations. In doing so, deep operations can enable friendly forces to choose the time, place, and method for close operations. Operations in the deep area help locate the enemy, restrict their freedom of action, disrupt the coherence and tempo of their operations, interdict their supplies, isolate or destroy their forces, disrupt the movement of operational reserves, or prevent an enemy from employing long-range cannon, rocket, or missile fires. Planning for operations in the deep area includes considerations for information collection, airspace control, joint fires, obstacle emplacement, maneuver (air and ground), special operations, and information operations. Because of the generally permissive terrain of sandy and dune deserts, deep areas can be extremely large in the desert and commanders typically have the ability to shape operations well beyond the close area.

CLOSE AREA

2-6. The *close area* is the portion of the commander’s area of operations where the majority of subordinate maneuver forces conduct close combat (ADP 3-0). Operations in the close area are within a subordinate commander's AO. Commanders plan to conduct decisive operations using maneuver in the close area, and they position most of the maneuver force within it. Within the desert close area, one unit may conduct the decisive operation while others conduct shaping sustaining operations. A close operation requires speed and mobility to rapidly concentrate overwhelming combat power at the right time and place to exploit success. Mounted forces are best suited for movement and maneuver in open desert terrain, while dismounted forces are best suited for restricted mountainous terrain and urban operations. Each type of force presents unique sustainment challenges requiring extensive planning in a desert environment.

REAR AREA

2-7. The rear area is that area within a unit’s AO extending forward from its rear boundary to the rear boundary of the area assigned to the next lower level of command. The preponderance of forces in the rear area support and sustain forces in the close area. The rear area usually contains the support areas and may contain consolidation areas. Given the sparse population of many deserts, and the lack of key infrastructure or population centers, rear areas may be extremely large and uninhabited. Rear operations include the following:

- Security.
- Sustainment.
- Terrain management.
- Movement control.
- Protection.
- Infrastructure development.

2-8. Marine Corps formations utilize rear area operations to enhance a force’s freedom of action and extend the force’s operational reach both in time and space. Rear area operations are synonymous with sustaining actions that seek uninterrupted support to the force. The primary focus of rear area operations during the offense is to maintain momentum and prevent culminating points.

SUPPORT AREA

2-9. The *support area* is the portion of the commander's area of operations that is designated to facilitate the positioning, employment, and protection of base sustainment assets required to sustain, enable, and control operations (ADP 3-0). The support area’s purpose is to generate combat power for the close and deep areas. Most of the echelon's sustainment operations occur in this area. Within a support area, a designated

unit provides area security, terrain management, movement control, mobility support, and clearance of fires. This allows sustainment units to focus on their primary functions. Because of the open terrain and lack of cover, concealment, and infrastructure, protecting the sustainment bases and forces occupying the support area has challenges in the desert. Commanders consider the potential for air and missile threats and ensure area support or theater air and missile defense assets are available to protect the support area.

CONSOLIDATION AREA

2-10. The *consolidation area* is the portion of the land commander's area of operations that may be designated to facilitate freedom of action, consolidate gains through decisive action, and set conditions to transition the area of operations to follow-on forces or other legitimate authorities (ADP 3-0). Commanders may establish a consolidation area, particularly in the offense, to exploit tactical success while enabling freedom of action for forces operating in the other areas. Consolidation areas are established in portions of the AO where large-scale combat operations have ended, and units conduct a combination offensive, defensive, and stability operations to prevent remaining enemy forces from disrupting operations in the close or support areas. Consolidation areas in desert environments are likely to be noncontiguous population centers.

2-11. The consolidation area requires a task-organized, combined arms unit to conduct area security and stability tasks that is capable of controlling airspace and employing fires. This enables the higher echelon headquarters to focus on close operations, deep operations, and future planning. The additional combat power required to consolidate gains must be accounted for during force tailoring to ensure the successful conduct of large-scale combat operations. Typically, an additional brigade combat team is required for division operations to consolidate gains and an additional division is required for the corps. Infantry brigade combat teams and infantry divisions are most suited to consolidate gains in desert environments. Assigning an infantry brigade combat team or an infantry division to the consolidation area allows the higher echelon headquarters to capitalize on the firepower, mobility, and protection of armor and Stryker equipped units in the close area.

MAIN AND SUPPORTING EFFORTS

2-12. Commanders designate main and supporting efforts to establish clear priorities of support and resources among subordinate units. The *main effort* is a designated subordinate unit whose mission at a given point in time is most critical to overall mission success (ADP 3-0). The *main effort* is the designated subordinate unit whose mission at a given point in time is most critical to overall mission success. It is usually weighted with the preponderance of combat power and is directed against a center of gravity through a critical vulnerability (MCRP 1-10.2). Typically, commanders shift the main effort one or more times during execution. Designating a main effort temporarily prioritizes resource allocation. When commanders designate a unit as the main effort, it receives priority of support and resources to maximize combat power. Commanders establish clear priorities of support, and they shift resources and priorities to the main effort as circumstances and the commander's intent require.

2-13. Commanders may designate a unit conducting a shaping operation as the main effort until the decisive operation commences. However, the unit with primary responsibility for the decisive operation then becomes the main effort upon the execution of the decisive operation.

2-14. A *supporting effort* is a designated subordinate unit with a mission that supports the success of the main effort (ADP 3-0). A *supporting effort* is designated subordinate unit(s) whose mission is designed to directly contribute to the success of the main effort (MCRP 1-10.2). Commanders resource supporting efforts with the minimum assets necessary to accomplish the mission. Forces often realize success of the main effort through success of supporting efforts.

MULTI-DOMAIN EXTENDED DESERT BATTLEFIELD

2-15. The air, land, maritime, space, and cyberspace domains all impact desert operations. Commanders and staffs must understand friendly and enemy capabilities that reside in each domain. From this understanding, commanders can better identify windows of opportunity during operations to converge capabilities from different domains for best effects. Since many friendly capabilities are not organic to Army/Marine Corps

forces, commanders and staffs plan, coordinate, and integrate joint and other unified action partner capabilities in a multi-domain approach to operations.

SPACE DOMAIN

2-16. The *space domain* is the area above the altitude where atmospheric effects on airborne objects become negligible (JP 3-14). Space is a physical domain like land, sea, and air within which military activities are conducted. Proliferation of advanced space technology provides more widespread access to space-enabled technologies than in the past. Adversaries have developed their own systems, while commercially available systems allow almost universal access to some level of space-enabled capability. Army/Marine Corps forces must be prepared to operate in a denied, degraded, and disrupted space operational environment when conducting desert operations.

2-17. Space capabilities provide information collection; early warning; environmental monitoring; satellite-based communications; and positioning, navigation, and timing. Activities in the space domain enable freedom of action for operations in all other domains, and operations in the other domains can create effects in and through the space domain. Loss of positioning, navigation, and timing can significantly hinder operations in deserts where few landmarks can aid in navigation. (See FM 3-14 for more information on space operations.)

INFORMATION ENVIRONMENT

2-18. The *information environment* is the aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information (JP 3-13). The information environment is not separate or distinct from the desert environment but is inextricably part of it. Any activity that occurs in the information environment simultaneously occurs in and affects one or more of the physical domains.

2-19. Across the globe, information is increasingly available in near-real time. The ability to access this information, from anywhere, at any time, broadens and accelerates human interaction. Social media, in particular, enables the swift mobilization of people and resources around ideas and causes, even before they are fully understood. From a military standpoint, information enables decision making, leadership, and combat power; it is also key to seizing, gaining, and retaining the initiative, and to consolidating gains in the desert environment.

CYBERSPACE AND THE ELECTROMAGNETIC SPECTRUM

2-20. *Cyberspace* is a global domain within the information environment consisting of the interdependent networks of information technology infrastructures and resident data, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers (JP 3-12). Friendly, enemy, adversary, and host-nation networks, communications systems, computers, cellular phone systems, social media, and technical infrastructures are all part of cyberspace.

2-21. Due to ease of access, network and software complexity, and inconsistent security protocols, the cyberspace domain is vulnerable to exploitation. Access to cyberspace by an individual or group with a networked device is easy, and an individual with a single device can disable an entire network. Vulnerabilities in the systems that operate in cyberspace contribute to a continuous obligation to manage risk and protect portions of cyberspace.

2-22. The electromagnetic spectrum is the range of frequencies of electromagnetic radiation from zero to infinity. It is divided into 26 alphabetically designated bands. The EMS crosses all domains, and it provides a vital link between the space and cyberspace domains. Space operations depend on the EMS for the transport of information and the control of space assets. Space assets provide a key global connectivity capability for cyberspace operations. Conversely, cyberspace operations provide a capability to execute space operations. This interrelationship is an important consideration across cyberspace operations, and it is particularly important when conducting targeting in cyberspace. (See JP 3-85 for more information on the EMS.)

2-23. The lack of foliage and open terrain common to sandy and dune deserts make these environments conducive to cyberspace electromagnetic activities (CEMA). Without mountains, dense foliage, or masking terrain to interrupt their transmission, CEMA can be conducted at greater distances than in more restrictive

terrain. The desert's relatively stable weather patterns further support the use of CEMA as the limited number of electrical storms reduce interference and allow for accurate transmission and receipt of signals across great distances. Commanders incorporate CEMA into their operations to identify and locate enemy formations and disrupt or disable enemy command and control networks.

2-24. Figure 2-1 displays friendly, threat, and neutral (or non-attributed) networks both within an operational area and worldwide. It depicts the global nature of cyberspace and the extended battlefield.

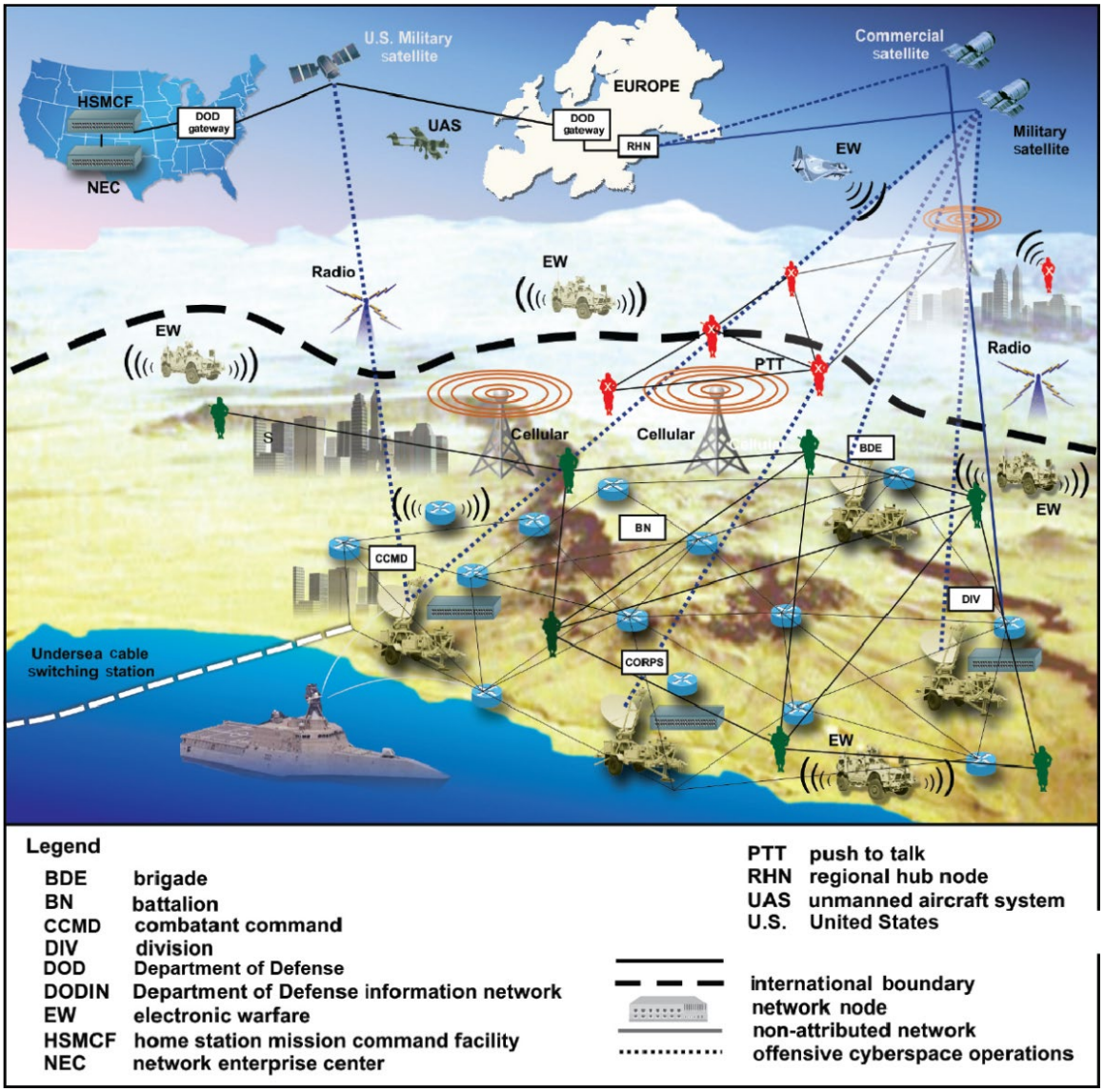

Figure 2-1. Cyberspace in the multi-domain extended desert battlefield

2-25. Advantages in cyberspace and the EMS result from effectively synchronizing Department of Defense information network (known as DODIN) operations, offensive cyberspace operations (known as OCO), defensive cyberspace operations (known as DCO), electronic attack (in joint, known as electromagnetic attack), electronic protection, electronic warfare support, and spectrum management operations. (See FM 3-12, MCIP 3-32Ei, and MCRP 3-32D.1 [MCWP 3-40.5] for more details on cyberspace effects, electronic attack, and electronic warfare.)

JOINT OPERATIONS IN A DESERT ENVIRONMENT

2-26. Desert operations require the extensive capabilities of the joint force to accomplish missions across the competition continuum that can range from routine military engagement to large-scale combat operations. A joint task force may be designated to command and synchronize the efforts of all Services and functions in a joint operations area (known as JOA). The joint force commander (JFC) designates support relations between major land units and joint functional commands. The major land units may include Army forces, Marine Corps forces, or a mixture of both in a joint forces land component command. The joint functional commands may include a special operations task force, a psychological operations task force, a civil-military operations task force, or other organizations as required by the JFC.

2-27. Many peer adversaries possess anti-access and area denial systems that—when combined with integrated air defense systems (known as IADSs), long-range rockets, and cruise missiles within an integrated fires command—challenge the joint force's ability to project into, and operate within, a theater of operation. The limited infrastructure in the desert environment makes the projection and operation of forces into an area influenced by a peer adversary employing anti-access and area denial capabilities challenging. This makes seizing and controlling key infrastructure, such as aerial and seaports, critically important to gaining access to a theater. Army/Marine Corps forces contribute to solving these problems through a multi-domain approach that includes isolating parts of the enemy's integrated fires command to enable or assist joint fires in rendering the system ineffective. (See JP 3-18 for more information on joint forcible entry.)

FUNDAMENTALS OF DESERT OPERATIONS

2-28. The harsh desert environment and its characteristics impact operations at all echelons and across the competition continuum. However, effective commanders exploit these characteristics by designing operations that possess the sustainment necessary to enable operational reach, leverage maneuver to seize and control key terrain, and gather intelligence at a rate the enemy cannot keep pace with. These fundamentals can serve as guideposts for successful operations in the desert. Although deserts may vary by geography, population density, and climate, commanders that include these guideposts in their operational design are more inclined to achieve their objectives.

FIGHT FOR INTELLIGENCE

2-29. The desert's vast spaces and lack of foliage present both a challenge and an opportunity for commanders willing to fight for intelligence. Forces operating in the desert conduct aggressive reconnaissance and intelligence operations across all domains to answer priority information requirements regarding threat forces, the populace, and the terrain. Fighting for intelligence helps forces understand their operational environment and is essential to locating and destroying enemy forces. The vast space and lack of foliage means that it is difficult for conventional threat forces to conceal their location, disposition, and intent. It also permits information collection by a plethora of platforms and means. Fighting for intelligence can be conducted by manned, unmanned, manned-unmanned teaming, or sensors.

MANEUVER TO WIN

2-30. The open spaces and unrestricted terrain prevalent in many deserts make them conducive to combined arms maneuver. Commanders realize their objectives by identifying mobility corridors and areas conducive to combined arms maneuver and rapidly exploiting them to overwhelm the enemy. As such, desert operations are characterized by rapid, mounted maneuver over wide areas, and commanders must tailor their force accordingly and plan for adequate sustainment to enable operational reach. Commanders that fail to design desert operations around combined arms maneuver cede initiative to the enemy while simultaneously exposing their troops to unnecessary risk. Static forces left exposed in the desert are not only more vulnerable to attack by the enemy but are also worn down by the harsh environment.

CONTROL THE ESSENTIAL

2-31. Most desert areas are too large to be completely occupied or even effectively controlled without an enormous force. Therefore, Army/Marine Corps forces focus their efforts on controlling only the essentials

for mission accomplishment. At a minimum, this requires control of key terrain. *Key terrain* is an identifiable characteristic whose seizure or retention affords a marked advantage to either combatant (ADP 3-90). In the desert, commanders determine key terrain based on its functional, political, economic, or social significance. Bridges, ports, water wells, and power stations may all be key desert terrain. While they may not be considered key terrain, operations may develop along the few LOCs in theater that can support military vehicles. Operations may also unfold along or around oases and other water sources. In these circumstances, the force capable of controlling the LOCs and sources of water will likely have a decided advantage.

2-32. The twelve principles of joint operations apply to desert operations. However, given the large areas characteristic of most deserts, commanders must balance the principles of mass and economy of force to ensure the right forces can concentrate at decisive points while not jeopardizing success across the wider AO or risking defeat by becoming a high-value target. Army/Marine Corps forces mass combat power at decisive points or to control requirements deemed essential for mission success. This permits conservation of combat power and prevents units from becoming easy targets for the enemy. It also implies economy of force and associated risk in those areas where Army/Marine Corps forces choose not to exercise control.

2-33. Physical control may not be possible in parts of many desert environments where Army/Marine Corps forces are employed. To achieve persistent presence, shape the operational environment, and maintain situational awareness where physical presence is not possible, units can use a virtual presence—via social media, remote observation, and digital engagements—to foster support networks among allies and partners to ensure that future forces entering the area have basic information concerning an operational environment.

PRESERVE CRITICAL INFRASTRUCTURE

2-34. Many deserts contain critical infrastructure necessary for resource extraction, refinement, processing, and transport. Pipelines, refineries, oil wells, ports, irrigation canals, dams, and power stations are all critical infrastructure found in the desert. Commanders preserve and protect these critical assets to facilitate consolidation of gains, enable stability operations, and promote a return to normalcy after hostilities end. They also recognize that damaging critical infrastructure can have disastrous effects on the environment and the local populace. Aside from simply avoiding collateral damage, Army/Marine Corps forces initiate actions to prevent an enemy or a hostile civilian group from removing or destroying critical infrastructure and assets. This may include cultural infrastructure such as religious and historical sites. In some cases, preserving the infrastructure and the society's sources of economic and cultural wealth become the stated objectives for operations.

SUSTAIN THE FIGHT

2-35. The harsh desert environment and large distances covered by maneuver forces can wreak havoc on vehicles, weapons, and equipment. Desert operations consume significantly greater amounts of Class III and Class IX items than other operations, and success often depends on proper sustainment forecasting and distribution. Commanders and staff can plan to mitigate sustainment demands by increasing common shop stock lines that are frequently required in the desert. Unit mechanics maintain excess air filters, hoses, tires, road wheels, and coolant. Soldiers/Marines train on how to identify and solve common maintenance issues such as clogged air filters.

2-36. Because of their sparse populations, lack of infrastructure, and vast areas, many desert operations occur at the end of long and tenuous supply chains. Although these chains exist to provide Soldiers/Marines with the support necessary to sustain the fight, commanders make every possible effort to conserve supplies. Commanders also consider contracting within the theater of operations for services and support they can procure locally. This will reduce demand and ensure that supply chains stretching to the continental United States are used to deliver essential items, such as munitions and end items that cannot be procured locally.

Extending Operational Reach: The 101st Airborne Division in Operation DESERT STORM

On the opening day of Operation DESERT STORM, 24 February 1991, 1st Brigade, 101st Airborne Division executed an air assault 95 miles (152 kilometers) into Iraq to establish forward operating base (FOB) COBRA, the first of two planned FOBs. The FOBs were critical to extending XVIII Airborne Corps' operational reach by providing it with the forward sustainment bases necessary to continue the attack into the Iraqi rear area and sever the Iraqi Army's lines of communications (LOCs) stretching from Baghdad south to Kuwait.

At FOB COBRA, 1st Brigade encountered stiff resistance from a dug-in Iraqi battalion; however, drawing on indirect fire, attack aviation, and close air support, 1st Brigade quickly defeated the battalion and continued securing the FOB. By that afternoon, the brigade had turned FOB COBRA into a massive forward arming and refueling point (FARP), significantly extending the division's reach. To mitigate the impact of a CBRN or ballistic missile attack, and to prevent refueling and rearming aircraft from colliding in the desert's limited visibility, the division dispersed fuel and munitions across nearly 15 miles (25 kilometers).

On the next day, 25 February, the division conducted another air assault to secure area of operations (known as AO) EAGLE and sever Highway 8, the Iraqi Army's primary LOC connecting Basra in southern Iraq with Baghdad. The second air assault brought the 101st Airborne 155 miles (250 kilometers) into Iraq and positioned its forward elements only 145 miles (233 kilometers) southeast of Baghdad. The division conducted its final air assault on February 27, when three infantry battalions pushed 95 miles (152 kilometers) further east into Iraq to establish FOB VIPER. Like FOB COBRA, VIPER became a FARP, and four Apache battalions used the FOB to launch coordinated attacks on Iraqi forces withdrawing across the Euphrates River. Although the division had planned an additional air assault for the next day, a cease-fire signaled the end of combat operations.

The 101st Airborne Division's use of air assault operations to establish FOBs and FARPs for its aviation assets extended XVIII Airborne Corps' operational reach and maintained its tempo during the opening hours of Operation DESERT STORM. Few roads existed that could support the movement of large stocks of Class III and Class V at the pace required to prevent the Iraqi Army from withdrawing to the relative safety of Baghdad. After infantry secured the FOBs, the 101st Airborne Division used heavy lift CH-47 Chinook helicopters to transport fuel bladders, pumps, and hoses and rapidly establish FARPs capable of supporting additional operations. The innovative planning and combined arms integration demonstrated by the 101st Airborne Division illustrates how commanders maintain tempo during desert operations.

CONSOLIDATE GAINS

2-37. Because desert operations are resource intensive, commanders plan to end them as quickly as possible while still accomplishing the mission. The time it takes to consolidate gains depends on the mission and operational variables. Successful consolidation of gains may take anywhere from a few days to several years depending on the scope and intensity of combat. Commanders consolidate gains to transition from offensive operations to stability operations and, ultimately, to return an area to legitimate civilian control and responsibility. Rapid transition to consolidation of gains releases Army/Marine Corps forces for combat elsewhere while improving the morale and disposition of the local populace. Units plan and resource for consolidating gains before the onset of operations and continually adjust those plans and resources as the situation develops.

Chapter 3

Combat Power in Desert Regions

Chapter 3 describes the elements of combat power and how they are affected by the desert. It provides TTP by warfighting function to adapt operations and meet the demands of this harsh environment.

ELEMENTS OF COMBAT POWER

3-1. *Combat power* is the total means of destructive and/or disruptive force that a military unit/formation can apply against the opponent at a given time (JP 3-0). The Army defines *combat power* as the total means of destructive, constructive, and information capabilities that a military unit or formation can apply at a given time (ADP 3-0). The Marine Corps stresses that combat power is the total destructive force we can bring to bear against the enemy; it is a unique product of a variety of physical, moral, and mental factors. (See MCDP 1-3 for more information on combat power.)

3-2. The Army describes combat power using eight elements: leadership, information, command and control, movement and maneuver, intelligence, fires, sustainment, and protection. Combat power is not a numerical value, but it can be estimated and is always relative to an enemy. Before an operation, combat power is unrealized potential. The Army classifies six elements of combat power as warfighting functions: command and control, movement and maneuver/maneuver, intelligence, fires, sustainment/logistics, and protection. The Marine Corps recognizes information as the seventh warfighting function. A *warfighting function* is a group of tasks and systems united by a common purpose that commanders use to accomplish missions and training objectives (ADP 3-0). (See ADP 3-0 and FM 3-0 for more information regarding the application of combat power through the warfighting functions using leadership and information to achieve unity of effort. See MCDP 1 and MCDP 1-3 for detailed information on the concentration of combat power toward the main effort and the acceptance of prudent risk.)

LEADERSHIP

3-3. Commanders apply leadership through mission command. Through leadership, the unrealized potential of combat power is transformed into action. *Leadership* is the activity of influencing people by providing purpose, direction, and motivation to accomplish the mission and improve the organization (ADP 6-22). Confident, competent, and informed leadership intensifies the effectiveness of all other elements of combat power by formulating sound operational ideas and ensuring discipline and motivation. Good leaders are the catalyst for success. Effective leadership can compensate for deficiencies in all the warfighting functions because it is the most dynamic element of combat power. The opposite also applies; poor leadership can negate advantages in warfighting capabilities. (For more detailed discussions on leadership, refer to ADP 6-22, MCDP 1, MCWP 6-10 [MCWP 6-11], and FM 6-22.)

3-4. A leader ensures Soldiers/Marines understand the purpose of operations and are employed efficiently to their fullest potential. In every operation, leaders clarify purpose and mission, direct operations, and set the example for courage and competence. They hold their Soldiers/Marines to the Army/Marine Corps Values and ensure they comply with the law of war. (See MCWP 6-10 [MCWP 6-11] for more information on the Marine Corps Values.

3-5. Several desert factors can negatively affect leadership abilities and performance. Fatigue is the most common factor that degrades performance. Performance and efficiency begin to deteriorate after 14 to 18 hours of continuous work without adequate rest and most tasks involving perceptual skills begin to degrade after 36 to 48 hours without sleep. Soldiers/Marines cease to be effective after 72 hours without sleep. A desert environment accelerates deterioration of performance and efficiency. Performance can decrease

dramatically in a chemical, biological, radiological, or nuclear contaminated environment, and sleep becomes more difficult in MOPP gear. Sleep deprivation, excessive heat, potential dehydration, and the stresses of combat can significantly affect leadership and decision-making abilities.

3-6. Commanders and leaders often regard themselves as being the least vulnerable to fatigue. However, tasks requiring quick reactions, complex reasoning, and detailed planning require leaders who are not sleep deprived and able to function at a high level. Leaders who refuse to sleep put their subordinates and the operation at risk when they cannot perform at their best. Commanders ensure that operational plans account for adequate sleep, rest, and recovery for subordinate leaders.

INFORMATION

3-7. Every engagement, battle, and major operation requires complementary information operations to both inform a global audience and to influence audiences within an operational area. Information is a weapon against enemy command and control and a means to affect enemy morale. Commanders use information to understand, visualize, describe, and direct the operations process. Soldiers/Marines use information to persuade and inform target audiences. They also depend on data and information to accurately plan and safely execute operations.

3-8. During large-scale combat operations, the JFC can create a joint military information support task force to serve as the principal organization responsible for information operations in the joint operations area. The Army's contribution to information operations during large-scale combat is the military information support group. One military information support group is assigned to the Regular Army and three military information support groups are assigned in the Reserve Components.

INFORMATION WARFIGHTING FUNCTION

3-9. The information warfighting function consists of managing and applying information and its deliberate integration with the other warfighting functions to influence relevant actor perceptions, behavior, action, or inaction, and to support human and automated decision making. The information warfighting function helps commanders and staffs understand and leverage the pervasive nature of information, its military uses, and its application across all operational phases and the range of military operations. The information warfighting function integrates, protects, and preserves friendly information while leveraging the informational effects of military activities to achieve objectives.

3-10. The foundation of effective information operations requires recognizing that actions are more powerful than words, and Marines must consider how their activities affect the information environment when they plan and assess information operations. *Information operations* is the integrated employment, during military operations, of information-related capabilities in concert with other lines of operation to influence, disrupt, corrupt, or usurp the decision-making of adversaries and potential adversaries while protecting our own (JP 3-13). The Marine Corps adds the amplification, the integration, coordination, and synchronization of actions taken to affect relevant a decision maker in order to create an operational advantage for the commander (MCRP 1-10.2). Commanders recognize that deliberate information operations often have significant constraints, restraints, and approval authority withheld at a higher echelon. Because of this, commanders and staff plan information operations in advance to ensure adequate time is available to receive the necessary approval and deliver effects in the information environment when they are needed.

3-11. The open terrain common in many sandy deserts facilitates sending, receiving, and collecting information by wireless electronic means. Commanders use information operations to shape conditions for future operations by influencing friendly, enemy, and neutral audiences. However, commanders recognize and adjust their information operations to account for adverse weather, such as sandstorms, that can degrade wireless communications and interrupt information activities. They also account for populations that may not have access to digital communications. Personal interactions, small-unit operations, and key leader engagements may be necessary to conduct effective information operations among populations who lack access to broadcast or digital communications.

3-12. While the actions of all Marines can influence the information environment, the primary organization charged with executing deliberate information operations is the Marine expeditionary force information

group (MIG). The MIG coordinates, integrates, and employs information warfare capabilities to ensure friendly force maneuver and deny the enemy freedom of action in the information environment. The MIG contains a communications battalion with a defensive cyberspace operations company and a radio battalion with an information warfare company. (For more information on information operations, see MCWP 3-32 [MCWP 3-40.4].)

COMMAND AND CONTROL WARFIGHTING FUNCTION

3-13. The *command and control warfighting function* is the related tasks and a system that enable commanders to synchronize and converge all elements of combat power (ADP 3-0). *Mission command* is the Army's approach to command and control that empowers subordinate decision making and decentralized execution appropriate to the situation. (ADP 6-0). *Command and control* is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission (JP 1). The Marine Corps amplification adds the means by which a commander recognizes what needs to be done and sees to it that appropriate actions are taken. Command and control is one of the warfighting functions (MCRP 1-10.2). Commanders exercise command and control through the operations process (plan, prepare, execute, and assess).

UNITY OF EFFORT

3-14. Although challenging, unity of effort remains essential to desert operations. The nature of the operation, the number of tasks, and the size of the AO may require that Army/Marine Corps forces operate noncontiguously. Noncontiguous operations challenge a commander's ability to unify the actions of subordinates, apply the full force of combat power, and achieve the commander's intent. Achieving unity of effort requires centralized planning, clear mission orders, and decentralized execution. Mission command allows subordinates to be innovative and operate independently in pursuit of the commander's intent and within the rules of engagement (ROE).

PROCESSES

3-15. Commanders establish and use processes and procedures to organize activities within their headquarters and throughout the force. Commanders and staff use several integrating processes to synchronize specific functions throughout the operations process. Integrating processes include the MDMP, intelligence preparation of the battlefield/battlespace (IPB), information collection, targeting, risk management, and knowledge management.

Military Decision-Making Process

3-16. The *military decision-making process* is an iterative planning methodology to understand the situation and mission, develop a course of action, and produce and operation plan or order (ADP 5-0). The MDMP consists of seven steps with inputs, a series of sub-steps, and outputs. It is a collaborative planning process conducted by the commander and their staff. (For more information on the MDMP, see FM 6-0.) The seven steps of the MDMP are—

- Step 1 – Receipt of mission.
- Step 2 – Mission analysis.
- Step 3 – Course of action (COA) development.
- Step 4 – COA analysis.
- Step 5 – COA comparison.
- Step 6 – COA approval.
- Step 7 – Orders production, dissemination, and transition.

Marine Corps Planning Process

3-17. The Marine Corps planning process (MCPP) provides commanders and staffs at all levels a means to organize and plan their activities, to transmit plans to subordinate units, and to share a common understanding of the mission and intent. The MCPP applies across the competition continuum. It applies equally to

deliberate planning and continuous planning for ongoing operations. Although listed sequentially, the six steps of the MCPP may be conducted in a different order given the demands and constraints of an operational environment. This is especially true in the desert, where the weather and logistics considerations can significantly impact operations. The six steps of the MCPP are—

- Step 1 - Problem framing.
- Step 2 - COA development.
- Step 3 - COA war game.
- Step 4 - COA comparison and decision.
- Step 5 - Orders development.
- Step 6 - Transition.

Intelligence Preparation of the Battlefield/Battlespace

3-18. *Intelligence preparation of the battlefield* is the systematic process of analyzing the mission variables of enemy, terrain, weather, and civil considerations in an area of interest to determine their effect on operations (ATP 2-01.3). Joint defines *intelligence preparation of the battlespace* as the analytical methodologies employed by the Services or joint force component commands to reduce uncertainties concerning the enemy, environment, time, and terrain (JP 2-01.3). Marine Corps amplification to the joint definition is the systematic, continuous process of analyzing the threat and environment in a specific geographic area (MCRP 1-10.2). To describe the effects of the environment on operations, commanders and staff develop a modified combined obstacle overlay, or MCOO. The *modified combined obstacle overlay* is a joint intelligence preparation of the operational environment product used to portray the militarily significant aspects of the operational environment, such as obstacles restricting military movement, key geography, and military objectives (JP 2-01.3). Commanders use the MCOO when developing and analyzing COAs and for determining the appropriate force for a given objective. The MCOO is the first step in arranging actions in both space and time to determine feasibility. When developing a MCOO for desert operations, commanders carefully consider the importance of LOCs and mobility corridors for mounted movement. Although sandy deserts may appear to possess wide areas trafficable by wheeled and tracked vehicles, without a reconnaissance to confirm the composition of the sand and ground, these largely unrestricted areas may not support mounted movement. In mountainous deserts, mobility corridors may be even more limited and force combat formations to traverse them in a column or file formation. Because desert terrain can rapidly change by sandstorms and rain, commanders and staff should use aerial and satellite imagery to support the IPB process and develop accurate MCOOs. (For more information on IPB, see ATP 2-01.3 and MCRP 2-10B.1 [MCRP 2-3A].)

Information Collection

3-19. The size and limited trafficability of the operational area can pose serious challenges to information collection in the desert. Units may require remote sensors and UASs to monitor and collect information over wide areas or specific named areas of interest. A *named area of interest* is the geospatial area or systems node or link against which information that will satisfy a specific information requirement can be collected, usually to capture indications of adversary courses of action (JP 2-01.3). Marine Corps amplification is a point or area along a particular avenue of approach through which enemy activity is expected to occur. Activity or lack of activity within a named area of interest will help to confirm or deny a particular enemy course of action (MCRP 1-10.2). Adverse weather, such as sandstorms, extreme heat, and high winds, can degrade the performance of UAS and remote sensors. Although terrain management for asset locations is a staff responsibility, commanders can mitigate some of the challenges associated with information collection in the desert through aggressive reconnaissance and surveillance operations and by delegating information collection tasks to lower echelons. When assigning information collection tasks to lower echelons, commanders ensure the tasked unit can manage the geographic areas designated for reconnaissance and surveillance. This often requires reducing the size of the zone, area, or route to be reconnoitered. (See FM 3-55 for more information on information collection.)

Targeting

3-20. Targeting during desert operations requires careful analysis and planning to ensure that forces avoid destroying critical infrastructure and use appropriate munitions. Because of the vast open areas found in many sandy deserts, units do not always need precision munitions to achieve the desired effect. Instead, commanders can conserve precision munitions for use in urban areas or on enemy forces near critical infrastructure. The fire support officer advises the operations officer on the appropriate munitions and fire support weapons systems for effective fires in the desert. The intelligence and engineer officers advise the operations officer on environmental considerations as well as help identify critical infrastructure that the commander may wish to avoid striking. Critical infrastructure in the desert can consist of water storage facilities and oil extraction, processing, or transport facilities. Damage to oil facilities can cause widespread environmental harm. Sensitive locations or infrastructure are placed on the restricted target list. (See ATP 3-60 for more information on targeting.)

Risk Management During Desert Operations

3-21. Commanders balance risk against mission requirements when developing their operational approach. Paragraphs 3-22 through 3-36 examine potential risks and offer methods for evaluating and mitigating them during desert operations.

Force Strength

3-22. When facing prospective desert operations, commanders consider if they have the necessary troops and capabilities to achieve the commander's intent within acceptable risk. Large desert areas require large formations to establish control. Major desert operations, particularly large-scale combat, require a significant number of combined arms forces. While operations may not require controlling an entire area, achieving and maintaining relative combat power is critical to successful operations. If commanders lack sufficient forces to conduct effective operations, they must temper their operations in scale, scope, and time. Commanders consider the quantity and type of forces required to shape operational environments, prevent conflict, prevail during large-scale combat, and consolidate gains to make tactical successes enduring. In addition to combat formations, commanders must ensure they have sufficient sustainment forces and enablers to maintain operational tempo and reach across vast desert AOs.

Force Tailoring/Task Organizing

3-23. Commanders mitigate risk through careful force tailoring for desert operations. *Force tailoring* is the process of determining the right mix of forces and the sequence of their deployment in support of a joint force commander (ADP 3-0). As both ready units and transportation assets are limited, commanders must recognize the trade-offs between capabilities and balance the force flow within an acceptable level of risk. For example, commanders that deploy a preponderance of combat forces into theater early in an operation take considerable risk regarding the sustainment and protection of these forces. Conversely, too many sustainment forces without adequate security forces risk defeat by the enemy. As they tailor a force for deployment, commanders assess the environment, the threat, the timeline, and the capability for the designated AO to support U.S. forces. They also examine requirements for reception, staging, and onward integration to ensure the theater can support the volume and type of forces arriving at ports of debarkation. They then identify the appropriate mix of combat forces, sustainment units, protection assets, enablers, and headquarters to meet the JFC's needs. Although there is no single solution to tailoring a force for deployment, many deserts possess limited or unimproved air and/or seaports and require theater opening and sustainment units early in the force flow to set conditions for follow-on combat units.

3-24. Force apportionment and allocation for combined arms in desert operations differ from operations in other environments. Although force apportionment and allocation should be based on an accurate METT-TC/METT-T assessment, desert operations require an increased proportion of mounted and armored capabilities and fewer dismounted capabilities than in other environments. Additionally, higher echelons of forces can conduct movement and maneuver/maneuver across large, contiguous AOs in the desert.

3-25. Because of its wide areas and often unrestricted terrain, armored and mechanized forces—cohesively integrated with aviation, fire support, and combat engineers—generally perform well in the desert and often

comprise the preponderance of forces. Light infantry units are less effective in open desert operations but are essential to clearing and holding urban centers and vital to stability operations. However, planners must account for transportation assets to provide light infantry forces with mobility. Light infantry may also prove the only ground combat forces capable of conducting operations in mountainous deserts.

3-26. When task-organizing forces for desert operations, commanders balance span of control against the risk of dissipating a unit's effectiveness by dividing it into smaller units to ensure subordinate organizations have a complete combined arms capability. This is particularly true when task-organizing enablers to maneuver forces. For example, an engineer battalion is task-organized to a brigade combat team (or a combat engineer company is task-organized to a regimental landing team) to enhance mobility. In turn, the brigade combat team/regimental landing team may task-organize this battalion into engineer companies under the control of their subordinate maneuver battalions, with combat engineer platoons attached or placed in direct support to the subordinate maneuver battalions. If this type of organization continues, maneuver companies may have an engineer platoon with maneuver platoons each assigned an engineer squad. Ultimately, the brigade combat team/regimental landing team may have lost the ability to conduct larger engineer operations by attaching its engineer assets to its lowest echelon. This can be especially disruptive to desert operations where higher echelon forces are capable of maneuvering across large areas when augmented with the appropriate enablers.

3-27. Marine Corps forces are tailored through their existing task organization to meet a combatant commander or JFC's needs. Usually organized as Marine air-ground task forces (MAGTFs), the Marine Corps provides the JFC with an appropriately scaled, integrated combined arms force that includes air, ground, and logistic units under a single commander. Differing by size and capacity for sustained operations, MAGTFs are organized as either Marine expeditionary forces, Marine expeditionary brigades, Marine expeditionary units, or special purpose MAGTFs. Figure 3-1 presents the various MAGTFs and how they are organized and augmented to support the JFC. (See MCRP 1-10.1 for more information on Marine Corps task organization.)

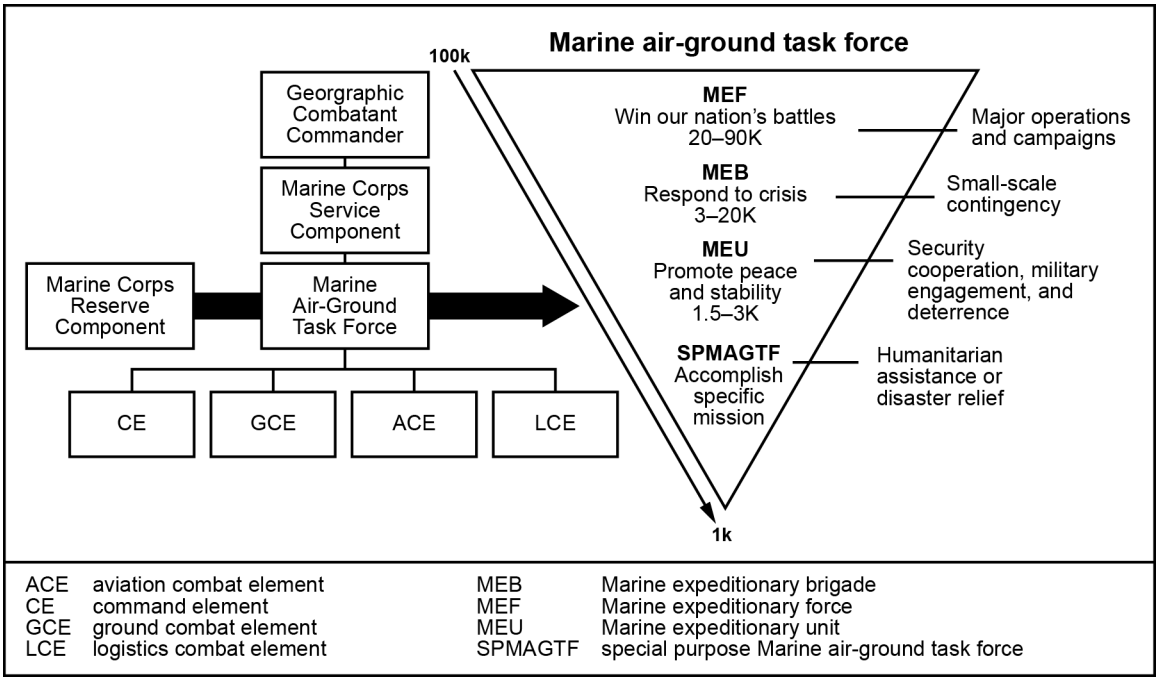

Figure 3-1. Marine air-ground task force

Casualties

3-28. Although casualties can occur during all operations and in any environment, the potential for mass casualty events increases during desert combat operations. The open terrain and lack of natural cover and

concealment make it easier for enemy surveillance to detect and locate friendly forces. The enemy can also bring indirect fire to bear from maximum range. To mitigate this, commanders make every effort to disperse forces and command posts. They also take steps to reduce or mask their electronic signature. Commanders also recognize that offensive operations generally yield higher casualties than defensive operations, especially when conducted in the open desert. To save lives and preserve combat power, commanders develop flexible and resilient casualty evacuation plans supported by standard and nonstandard assets.

3-29. Commanders conducting stability operations in the desert weigh how casualties can impact both the pursuit of operational objectives and international perception. While stability operations typically generate fewer casualties than offensive and defensive operations, a limited number of casualties has the ability to significantly impact stability operations. As in other operations, commanders assess the risk to forces and implement controls, adjust TTP, and modify objectives if the risk outweighs the benefits of the operation. They also ensure that forces do not incur undue risk in pursuit of information that may be acquired by other means.

Collateral Damage

3-30. In addition to assessing and reducing risks to forces, commanders must consider the degree to which an operation may cause harm to the local population or infrastructure. Commanders consider the second- and third-order effects that an operation will have on the local populace and implement controls to reduce the likelihood that an operation will cause unwarranted death or destruction. They also weigh the tactical advantage gained by destroying infrastructure used by enemy forces against the impact this may have on operational or strategic objectives. Often, destroying local infrastructure is at odds with the greater operational or strategic objectives.

3-31. Critical to preventing wanton collateral damage are clearly understood rules for the use of force and escalation of force procedures that enable Soldiers/Marines to positively identify threats before engaging. A clear commander's intent and an end state that is understood by all are also invaluable to helping subordinate leaders determine the right level of force to use during complex or chaotic situations. To mitigate the potential for collateral damage by indirect fire, commanders develop a robust targeting process that includes vetting by the staff judge advocate, fire support officer, and intelligence officer to ensure targets are appropriate and the correct munitions are used.

3-32. The risk of collateral damage during desert operations is less severe than in other environments. Mainly troops can more easily identify and locate enemy forces in open desert terrain. However, the risk of collateral damage increases when conducting operations in urban areas.

3-33. Collateral damage can influence international and domestic opinion of military operations and this can impact the scope, scale, and tempo of an operation. Excessive collateral damage can undermine an operation's legitimacy. It can also make post-conflict reconstruction and stability operations much more difficult. As such, commanders make every effort to limit collateral damage by adhering to the principle of restraint.

3-34. Collateral damage can seriously degrade the local population's attitude and perception towards friendly forces. This can complicate efforts to consolidate gains and stabilize an area after large-scale combat operations have ended. If collateral damage was extensive, and significant civilian casualties occurred, the population may be co-opted by the enemy and an insurgency may occur. In addition to issuing a clear commander's intent, end state, rules for the use of force, and escalation of force, commanders use information operations to shape an operational environment and limit civilian casualties. Information operations targeted at civilian populations to prepare them for pending military operations can direct them out of harm's way. In the event collateral damage occurs, commanders engage with the local population and explain the measures taken to prevent future incidents from occurring.

Fratricide

3-35. The desert's open and unrestricted terrain is conducive to rapid maneuver and engagements at maximum effective ranges. These factors increase the risk of fratricide. Commanders must take additional steps to ensure troops distinguish friendly forces from threats. Commanders also account for partners from special operations forces and foreign security forces (FSF) operating in or around their AO. Typically, the

JFC establishes a joint special operations area to deconflict conventional operations from special operations and prevent fratricide. Restrictive control measures are used to prevent uncoordinated fire and maneuver from crossing the boundary between the joint special operations area and the joint operations area. A *joint special operations area* is an area of land, sea, and airspace assigned by a joint force commander to the commander of a joint special operations force to conduct special operations activities (JP 3-0). See appendix A for more information on fratricide prevention.

Risk Reduction Control Measures

3-36. Commanders assess potential hazards and develop controls to reduce the risks to Army/Marine Corps forces. Risk reduction control measures are measures specific to an operation not included in unit standard operating procedures (SOPs). They may include MOPP level and fratricide avoidance measures. The primary means of reducing risk during desert operations involves Soldiers/Marines thoroughly understanding the desert environment and its effect on operations. Risk reduction control measures may include—

- Methods for marking vehicles to distinguish friend from foe.
- Sufficient reserves and rotation of forces.
- Appropriate physical security measures for support areas, particularly in urban areas.
- Clearly understood ROE that allows commanders to satisfactorily control operations and minimize fratricide without unreasonably restricting subordinate commanders' ability to accomplish missions.
- Clearly understood escalation of force procedures that enable Soldiers/Marines to identify and neutralize threats.
- Proper targeting procedures that include clear fire support coordination measures, positive identification of targets, and controlled clearance of fires. The goal is to achieve precise (yet rapid) effects with both lethal and nonlethal means. In close air support, positive air-to-ground communications are essential to coordinate and authenticate markings.
- Well-synchronized inform and influence activities. Commanders emphasize vigilant operations security particularly when operating closely with the media, nongovernmental organizations (NGOs), and elements of the civilian population.
- Sustainment planning considerations that account for the rapid maneuver potential of mounted forces in the desert and are capable of maintaining operational reach and tempo.
- Sufficient control measures at echelon along with standard marking and identification techniques that adequately consider limited visibility concerns for both air and ground forces. Commanders ensure that all subordinate units thoroughly disseminate any approved nonstandard reference systems.

KNOWLEDGE MANAGEMENT

3-37. *Knowledge management* is the process of enabling knowledge flow to enhance shared understanding, learning and decision making (ADP 6-0). *Knowledge management* is the integration of people and processes, enabled by technology, to facilitate the exchange of operationally relevant information and expertise to increase organizational performance (MCRP 1-10.2). Commanders implement systems and use databases, networks, and repositories to capture and share knowledge collected during operations. When knowledge management infrastructure is limited, simple procedures such as sharing information collected during debriefs over frequency modulation (known as FM) communications can effectively disseminate vital lessons and information across formations.

3-38. Effective knowledge management rests on staffs routinely conducting after action reviews and mission debriefs. Staffs collect lessons from after action reviews and debriefs and then share these lessons with higher headquarters, subordinate units, and other friendly forces in the AO. For widest dissemination, units submit their lessons learned to the Center for Army Lessons Learned at https://call2.army.mil/ or the Marine Corps Center for Lessons Learned at https://grc-usmcu.libguides.com/research-topics/main/lessons-learned. (See ATP 6-01.1 for more information on knowledge management techniques, systems, and practices.)

NETWORKS, INFORMATION, AND COMMUNICATIONS SYSTEMS

3-39. Commanders rely on networks and information systems to command and control effectively. Networks enable successful operations, and, in the unobstructed terrain of many deserts, digital communications networks allow commanders to control operations across wide areas and dispersed formations. However, units need to configure communications networks, systems, and processes to support the dynamic decision making required by the rapid pace of desert operations and not just to restrain subordinate decision making. Commanders use analog, digital, satellite, or frequency modulation communications systems to enhance situational understanding and develop a common operational picture. Used together, these communications methods build redundancy into the unit communications plan by providing options for primary, alternate, contingency, and emergency means of communications.

3-40. Maps and operational graphics often provide the details that commanders need to command and control their forces. Frequently, commanders request satellite or aerial imagery to get the most current information on the desert terrain and environment. This imagery is often critical to effective desert operations as adverse weather, such as sandstorms, and damage to infrastructure, such as oil pipelines or wells, can quickly change the terrain and navigability, making maps irrelevant. Additionally, nomadic camps, newly constructed irrigation canals, and seasonal trafficability corridors may not be mapped at all.

Radio and Satellite Communications

3-41. The effectiveness of radio communications often determines the commander's ability to quickly and clearly issue orders and provide guidance to subordinates at the pace required by desert operations. As operations unfold rapidly across wide areas and dispersed formations, commanders require reliable communications to synchronize and coordinate maneuver while staying abreast of the enemy situation. Large distances between formations, potentially adverse weather, and the vertical relief found in many mountainous deserts can degrade communications. Degraded communications obstruct a common operational picture, prevent requests for support from being received, and inhibit a commander's ability to synchronize elements of the combined arms team.

3-42. Figure 3-2 on page 3-10 offers methods for increasing communications capacity while reducing factors that can overwhelm the communications network. To mitigate the challenges associated with communicating across large formations and wide areas, commanders—

- Use retransmission and relay sites, which include UASs, to extend their reach.
- Coordinate for airborne command posts, satellite communications, high-frequency radios, and other redundant communications platforms and systems.
- Carefully position command posts and antennas to take advantage of desert terrain while protecting assets from acquisition and targeting by enemy forces.
- Conduct detailed communications analysis for movement from one AO to another.

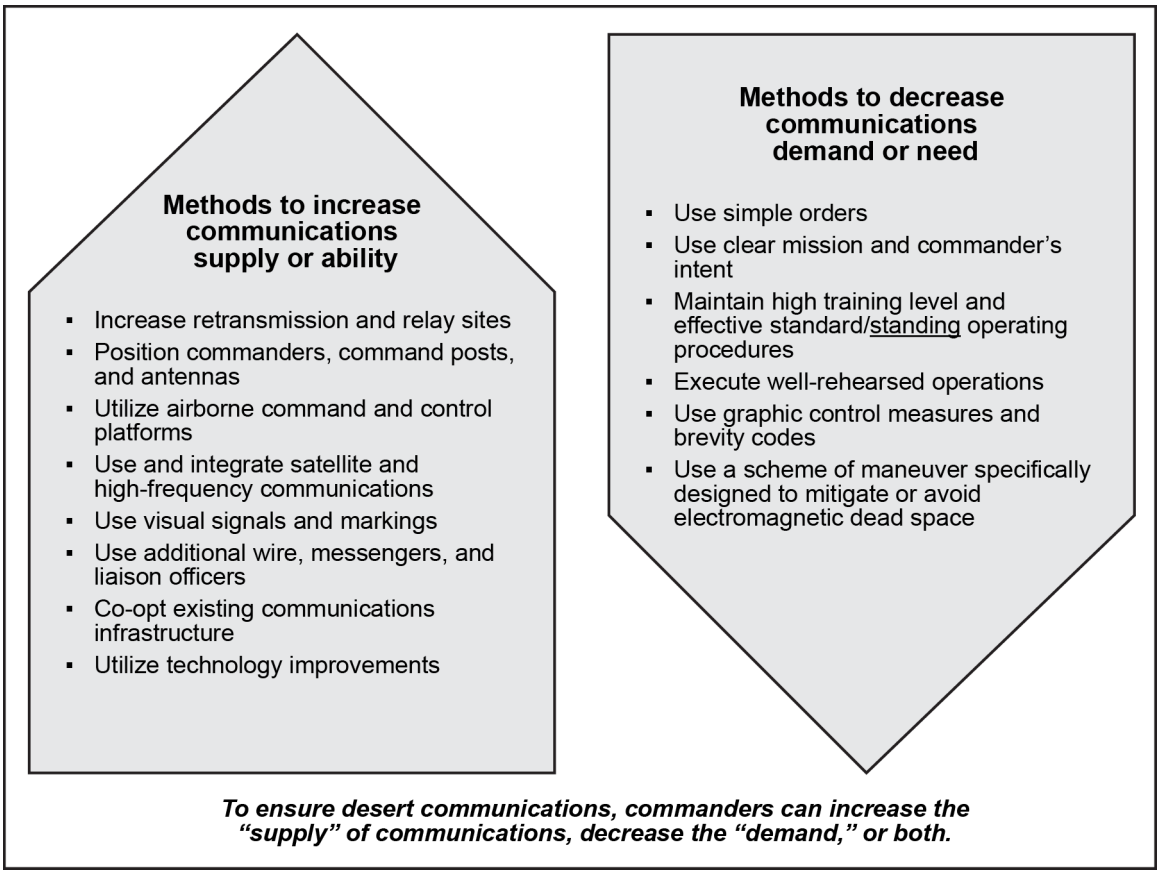

Figure 3-2. Methods to overcome desert communications challenges

3-43. Satellite communications provide an effective means of communication when units cannot maintain line of sight. However, satellite communications require a clear view of the sky at the proper azimuth and elevation to establish a signal with a communications satellite. Additionally, the large number of users and limited frequencies can negatively affect satellite-based communications availability at echelon. Commanders do not rely solely on satellite communications and, instead, build redundancy into their communications plan to enable operations in a denied or degraded space environment.

Note. For further information on tactical radios, refer to ATP 6-02.53. For further information on satellite communications refer to ATP 6-02.54. For further information on field expedient antenna techniques refer to FM 3-55.93. For further information on tactical radios, Soldiers/Marines refer to ATP 6-02.72/MCRP 3-30B.3/NTTP 6-02.2/AFTTP 3-2.18. Soldiers/Marines should refer to all applicable TMs for specific preventive maintenance procedures for tactical radio equipment.

Visual Communications and Markings

3-44. Visual markings are especially important for proper identification and fratricide prevention during desert operations. The wide areas, rapid maneuver, and large formations employed during desert operations can challenge proper identification by both friendly ground and air assets, resulting in an increased risk of fratricide. To prevent this, troops use visual markings to identify vehicles and critical locations, such as command posts, forward arming and refueling points, and casualty collection points. The unit SOP for visual markings provides methods for marking and identification during both daylight and periods of limited visibility. Potential methods for marking vehicles and locations include the use of VS-17 panels and infrared chemical lights.

Commercial Communications Infrastructure

3-45. Mobility is reduced and positions do not change as frequently during defense and stability operations. Location stability allows commanders to use military wire communications, commercial communications infrastructure, and messengers. Military wire communications, although less flexible than commercial communications infrastructure, are the most secure means of non-encrypted communication. However, absent a switchboard, military wire communications only facilitate communication between two fixed points. As such, they are primarily suitable only for local communication within defensive perimeters or for communicating with individual observation or guard posts. Soldiers/Marines using military wire to communicate with observation posts in desert environments should bury the communication wire to avoid detection by enemy patrols. Commercial communications infrastructure includes telephone distribution boxes and cellular telephone towers. However, this infrastructure is often unsecure, so troops need to establish communications security measures to prevent the enemy from infiltrating the system and collecting sensitive information. These measures are complemented by operations security (OPSEC) practices that prevent Soldiers/Marines from inadvertently betraying sensitive information over unsecure networks. Commercial communications infrastructure may be a critical and singular means to rapidly communicate with key civilian organizations, host-nation (HN) forces, and important community leaders. Consequently, a communications system incorporates both communications security and OPSEC procedures to ensure units do not compromise sensitive information when using these systems.

COMMAND POSTS

3-46. Commanders may choose to control operations using a highly mobile command group located well forward, or a command post located in the close or rear area. Because desert operations often consist of numerous engagements conducted simultaneously across wide areas, commanders select a position where they can best control the operation while not becoming overly focused on a single portion of the battlefield/battlespace. Typically, commanders use both a tactical command post and a main command post to control different aspects of an operation. Units establish a tactical command post to temporarily control a subordinate enabling operation, such as a gap crossing or passage of lines, or to control all operations when the main command post must pause its activities to displace. Commanders use a support area command post to coordinate logistics and sustainment operations throughout their AO.

3-47. Commanders balance survivability with effectiveness when selecting a location for their command post. Command posts are high-value targets for the enemy. The open terrain of many deserts makes them easily detectable and difficult to conceal. The command post's significant electronic signature also makes it vulnerable to detection and targeting by the enemy. To mitigate this, units disperse command posts and position them away from identifiable terrain, either natural or manmade, that the enemy can easily acquire, reference, and target with indirect fire. Units camouflage command posts and, when possible, protect them with air and missile defense assets. Soldiers/Marines reduce electronic signatures by only using essential communications systems and information networks or by only operating these systems at pre-arranged times to transmit and receive information. However, survivability cannot outweigh effectiveness. Troops must site and support command posts with retransmission stations to ensure commanders can command and control operations across the depth and breadth of the battlefield/battlespace. When considering the layout of their command post, commanders ensure they do not disperse individual cells and staff sections to the point that collaboration is impractical.

3-48. The rapid pace of desert operations requires command posts that can quickly displace as operations develop. This requires a well-trained staff that has rehearsed command post set-up and take-down procedures. (For more information on command post organization and responsibilities, refer to FM 6-0 or MCDP 6.)

MOVEMENT AND MANEUVER/MANEUVER WARFIGHTING FUNCTION

3-49. The *movement and maneuver/maneuver warfighting function* is the related tasks and systems that move and employ forces to achieve a position of relative advantage over the enemy and other threats (ADP 3-0). *Maneuver* is employment of forces in the operational area, through movement in combination with fires and information, to achieve a position of advantage in respect to the enemy (JP 3-0). The Marine Corps

amplification is the movement of forces for the purpose of gaining an advantage over the enemy. Maneuver is one of the warfighting functions (MCRP 1-10.2). The movement and maneuver/maneuver warfighting function includes tasks associated with force projection related to gaining a position of advantage over the enemy. Commanders maneuver to mass the effects of combat power and achieve surprise, shock, and momentum. Effective maneuver requires close coordination with fires and sustainment support.

MOBILITY

3-50. *Tactical mobility* is the ability of friendly forces to move and maneuver freely on the battlefield relative to the enemy (ADP 3-90). *Tactical mobility* is the ability to move within an engagement or battle (MCRP 1-10.2). Cross-country mobility is directly affected by the terrain, soil, and weather. While the desert's unrestricted terrain generally facilitates combined arms mobility, commanders must reconnoiter the soil composition to determine whether it can support mounted maneuver. The loose sand of some deserts, such as the Sahara, cannot support mounted maneuver. Mobility is also degraded by adverse weather, such as sandstorms, which are particularly detrimental to aviation units. Generally, combined arms units, tank-equipped forces, and Stryker/light armored vehicle-equipped units possess good tactical mobility in most deserts where the sand can support movement. Light infantry units, while capable of traversing most deserts, lack the mobility to keep pace with desert operations unless augmented with transportation support.

3-51. Tactical mobility and speed are key to successful desert operations and a form of protection for mounted forces that would otherwise be exposed in open terrain. Movement and maneuver/maneuver in the desert should be at the maximum tactical speed allowed by the mission variables. Use of natural obstacles may permit a force to establish a defensive position that theoretically cannot be turned from either flank. However, these are rare. Most desert terrain facilitates bypassing enemy positions and obstacles. Units perform detailed reconnaissance to determine if bypassing is feasible and if it will provide an advantage to friendly forces.

3-52. Although desert terrain generally supports combined arms maneuver across large areas, commanders consider several factors when planning desert operations. Tactical mobility is affected in some areas by the poor trafficability of soft sand, rocky areas, mountains, fractured ice sheets, glaciers, salt flats, and marshy areas. Roads are usually scarce, poorly maintained, and primitive. The orientation of the existing roads may not support tactical and operational movement and maneuver/maneuver further limiting their utility and increasing the importance of roads whose orientation supports movement and maneuver/maneuver. Limited infrastructure reduces hardened crossing points over or through water features. Effective staffs understand the effects of the terrain in their area of expertise and allocate the necessary resources or implement creative and innovative solutions to achieve their commander's intent.

3-53. Terrain fundamentally changes during times of precipitation in the desert. Precipitation can create rivers across routes that are otherwise trafficable for the majority of the year. Additionally, precipitation can turn normally trafficable cross-country routes into impassible quagmires. The desert is generally conducive to large formations traveling long distances relatively unimpeded by geography; however, seasonal precipitation can impact travel. Commanders address potential precipitation when planning large, combined arms operations. While the geographic effects are relatively minimal, staffs thoroughly assess them to determine the most efficient and effective mobility corridors. *Mobility corridor* is areas that are relatively free of obstacles where a force will be canalized due to terrain restrictions allowing military forces to capitalize on the principles of mass and speed (JP 2-01.3).

3-54. Engineers support mobility during desert operations much like they do during operations in temperate climates. Engineers identify routes, assess trafficability, identify and reduce existing obstacles and minefields, and construct helicopter landing zones (HLZs). Flat, open areas provide good sites to support aircraft operations (fixed and rotary wing) but may require soil stabilization or surface preparation. Desert soil generally produces extensive dust and has limited weight-bearing capacity. Wet and dry gap crossing capability may be required to reduce natural or man-made obstacles, such as rivers, dry riverbeds, crevasses, or tank ditches. Engineers support maneuver by enabling mobility, countermobility, and survivability.

3-55. The prevalence of dunes, berms, and obstacles may require numerous breaches during desert operations. Maneuver units work closely with engineers to breach obstacles and maintain operational tempo. Units conducting a breach organize into a support, a breach, and an assault force and apply the breaching

fundamentals (suppress, obscure, secure, reduce, and assault). These fundamentals assume increased importance in the desert as unobstructed observation and fields of fire expose breaching forces to accurate enemy fire from extended range. (See ATP 3-90.4/MCTP 3-34A [MCWP 3-17.8] for more information on breaching and combined arms mobility.)

3-56. Air movement, air assault, and airborne operations are inherently joint and combined arms methods of conducting vertical envelopment, crossing gaps, and seizing key terrain. These operations are best employed in situations that provide the force a calculated advantage due to surprise, terrain, threat, or mobility. They allow the commander to maneuver rapidly, accelerate the momentum of an engagement, and achieve a position of relative advantage regardless of obstacles and without dependency on ground LOCs. The lack of obstructive terrain makes these operations feasible in most deserts; however, this feature also increases the risk to aviation assets as they lose the ability to use terrain to mask their movement and approach. These operations can use any combination of rotary-wing, tiltrotor, and fixed-wing aircraft. An *air assault* is the movement of friendly assault forces by rotary-wing or tiltrotor aircraft to engage and destroy enemy forces or to seize and hold key terrain (JP 3-18). Marine Corps amplification is operations in which air assault forces (combat, combat support, and combat service support), using the firepower, mobility, and total integration of assault support assets in their ground or air roles, maneuver on the battlefield under the control of the mission commander to provide mobility and firepower of the assigned mission (MCRP 1-10.2). Air movement, air assault, and airborne operations require extensive planning, synchronization, and the application of significant combat power; they are generally high-risk missions that can be easily disrupted by adverse weather and enemy air defenses. (See FM 3-99, ATP 3-04.1, and MCWP 3-20 [MCWP 3-2] for greater detail regarding movement and maneuver/maneuver by aviation assets.)

3-57. An *amphibious operation* is a military operation launched from the sea by an amphibious force to conduct landing force operations within the littorals (JP 3-02). Amphibious operations use maneuver principles to transition ready-to-fight combat forces from the sea to a shore in order to achieve a position of advantage over the enemy. During combat operations, maneuver, in conjunction with fires (organic and supporting), is essential to gaining access where the enemy least expects it. Amphibious operations provide a position of advantage to destroy or seriously disrupt the enemy's cohesion using various rapid, focused, and unexpected actions that create a turbulent and rapidly deteriorating situation with which the enemy cannot cope. In noncombat situations, the amphibious force projects appropriate forces and resources ashore to provide the most timely and effective support. Numerous desert environments with littoral seaward and landward segments can support a commander's movement and maneuver/maneuver concept. (See JP 3-02 and ATP 4-15 for greater detail regarding amphibious operations.)

3-58. Many deserts contain important rivers and canals used by the populace to support commerce and agriculture. Some rivers and canals can be used as LOCs; however, they can also be obstacles to movement and maneuver/maneuver. Marine Corps units equipped with amphibious assault vehicles (known as AAV) or amphibious combat vehicles (known as ACV) can use these vehicles to swim across water obstacles. Light armored vehicles also have a more limited capacity to cross water features. However, units without amphibious vehicles will either have to conduct a hasty gap crossing with the equipment and means available or request engineer support to conduct a deliberate gap crossing. Mobility augmentation companies and multi-role bridging companies are organized, trained, and equipped to support deliberate wet gap crossings. (See ATP 3-90.4/MCTP 3-34A [MCWP 3-17.8] for more information on gap crossing operations.)

3-59. Staffs carefully plan and monitor the routes used by tracked vehicles. Tracked vehicles have increased cross-country mobility, relative to wheeled vehicles, but can cause significant damage to improved surfaces. Excessive travelling on improved surfaces can also quickly wear down road wheels that may require replacement. Planners consider these factors when identifying routes and mobility corridors for tracked vehicles. Sustainment planners consider requisitioning additional road wheels if tracked vehicles will routinely travel on improved surfaces.

3-60. Airspace control and airspace management are critically important to maintaining the mobility of forces operating in the desert. *Airspace control* is capabilities and procedures used to increase operational effectiveness by promoting the safe, efficient, and flexible use of airspace (JP 3-52). The Marine Corps amplifies *airspace control* as a process that coordinates, integrates, and regulates the use of an airspace of defined proportions. It does not include measures that approve, disapprove, deny, or delay air operations (MCRP 1-10.2). *Airspace management* is the coordination, integration, and regulation of the use of airspace

of defined dimensions (JP 3-52). Airspace control and airspace management can prove especially challenging during multinational operations. Multinational forces exchange SOPs and liaison officers to ensure effective and safe airspace utilization.

3-61. The extended LOCs require increased MSR regulation and enforcement to direct traffic, redirect stragglers, and prioritize movement so that throughput from the rear area to the close area is expedited. Military police can secure the roadways, enforce priority movement, and conduct detainee operations to enable freedom of action for maneuver forces. This allows commanders to concentrate their forces at decisive points or conduct economy of force operations when necessary. Typically, during large-scale combat operations, each corps has one military police brigade assigned to provide security and mobility support. During large-scale combat operations where commanders anticipate large numbers of detainees, an additional military police brigade is assigned to the theater army to provide detention support.

COUNTERMOBILITY

3-62. Commanders conduct countermobility operations to control where the enemy moves. *Countermobility operations* are the construction of obstacles and emplacement of minefields to delay, disrupt, and destroy the enemy by reinforcement of the terrain (JP 3-34). The Army defines and the Marine Corps amplifies *countermobility operations* as those combined arms activities that use or enhance the effects of natural and man-made obstacles to deny enemy freedom of movement and maneuver (ATP 3-90.8/MCTP 3-34B [MCWP 3-17.5]). Due to the mobility inherent in desert operations, units need extensive, mutually supporting, and observed obstacles covered with direct and indirect fires to restrict the enemy from bypassing or reducing isolated obstacles. When properly planned and emplaced, units incorporate obstacles with existing desert terrain to block, fix, turn, or disrupt enemy formations.

3-63. Minefields, wire obstacles, and antivehicle ditches require significant resources to emplace; however, they can work extremely well. Local materials for expedient obstacles are usually scarce. Commanders and planners must ensure that competing demands for engineering assets do not compromise survivability efforts. Because a unit cannot conceal antivehicle ditches, they must be dug so they do not outline a defensive front or flank. They are a persistent obstacle. They must be covered by fires and reinforced with other obstacles to prevent enemy infantry using them as ready-made trenches. In suitable terrain, antitank ditches should exceed the vertical step of enemy main battle tanks. However, determining digging locations in the desert often proves challenging since rocky plateaus may have a thin sandy layer covering bedrock; enemy forces can easily fill in obstacles emplaced in sandy areas.

3-64. The family of scatterable mines (FASCAM)—that includes volcano ground- and air-delivered mines, modular pack mine system, artillery-delivered mines, and air-delivered Gator munitions—are effective obstacles for most sandy desert environments. Units can emplace FASCAM remotely to preserve maneuver flexibility for friendly forces by self-destructing. FASCAM still requires considerable time to employ and may be subject to increased approval authorities in accordance with the ROE. Artillery-delivered FASCAM does not deploy well in soft sand and requires considerable indirect-fire assets and sustainment support. FASCAM is not considered a persistent obstacle.

3-65. Road craters and abatis placed on roadways are often ineffective in the desert unless they are part of a larger obstacle belt or tied into existing terrain that limits trafficability. The unobstructed terrain of most sandy deserts enables mounted forces to simply bypass obstacles placed on roadways. Destructing key bridges over rivers or canals can significantly impede enemy mobility, yet higher echelons often withhold authority for destroying bridges as this can be equally detrimental to friendly mobility. Units exercise extreme caution when bypassing obstacles, especially over roadways, since the enemy may have purposefully emplaced them to channel a unit into an enemy engagement area or minefield.

DIRECT FIRES

3-66. The unobstructed observation and fields of fire common to most sandy deserts enable direct fire engagements at maximum ranges. However, this also means that friendly forces are vulnerable to engagement at significant ranges and increases the risk of fratricide. Commanders use command and control systems and processes, such as visual markings and friend or foe identification requirements, to reduce the risk of fratricide by direct fire. Command posts, units, and indirect fire centers can also be detected at the maximum

sensing ranges of systems that use the EMS. The lack of vegetation, few urban areas, and limited cover reduce interference with electromagnetic emissions and do little to disguise the operating force's electromagnetic presence. This unobstructed positioning can also enable enemy detection and targeting by direct and indirect fire at maximum ranges. While commanders design operations to exploit engagements at maximum ranges, they also employ obscuration and other techniques to protect their forces from early detection and targeting by the enemy.

EMPLOY BATTLEFIELD OBSCURATION

3-67. To achieve surprise and protect their forces from early detection at a distance, commanders maneuver in conditions that preclude observation, such as at night, behind smoke, or during sandstorms. Tactical maneuver should take advantage of all available terrain to conceal movement. For example, a 10-foot (3-meter) sand dune can conceal a combat vehicle at significant distance, while a series of dunes can mask a rotary-wing aircraft operating map of the earth.

3-68. Commanders leverage technological advantages to execute operations during limited visibility that conceal their movement and maneuver/maneuver from enemy forces. Night vision technologies, precision navigation and timing, and resilient communications networks enable Army/Marine Corps forces to outmaneuver and defeat enemy forces who are less well equipped and adept at night operations. Night operations by aircraft reduce the risk of small arms fire and visually guided air defense systems. Operating at night has the added benefit of reducing the environmental stress caused by extreme heat during the day. However, commanders also recognize that increased heat absorption makes combat vehicles highly visible to enemy IR imaging sensors when temperatures drop at night.

3-69. When Army/Marine Corps forces cannot mask maneuver with obscuration or limited visibility operations, forces maximize speed, violence of action, joint fires, electronic warfare (EW), and military deception (MILDEC) operations to disrupt the enemy's ability to observe and target forces at distance.

INTELLIGENCE WARFIGHTING FUNCTION

3-70. The *intelligence warfighting function* is the related tasks and systems that facilitate understanding the enemy, terrain, weather, civil considerations, and other significant aspects of the operational environment (ADP 3-0). *Intelligence* is the product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations (JP 2-0). The Marine Corps amplification is knowledge about the enemy or the surrounding environment needed to support decision-making. Intelligence is one of the warfighting functions (MCRP 1-10.2). The intelligence warfighting function synchronizes information collection with the primary tactical tasks of reconnaissance, surveillance, security, and intelligence operations. Commanders drive the operations process and focus the intelligence efforts that support it. Intelligence is more than just collection. Developing intelligence is a continuous process that involves analyzing information from all sources and conducting operations to develop the situation. The warfighting function includes specific intelligence and communications structures at each echelon. (FM 2-0 describes the intelligence warfighting function in detail.)

Note. The desert's unrestricted terrain enables rapid movement by both friendly and enemy forces. It is important to quickly report and analyze information of potential intelligence value and rapidly disseminate the resulting intelligence. The relative time that information may be of value to operations can be significantly decreased compared to other environments.

3-71. The relatively open terrain, lack of urban areas, and limited communications infrastructure makes the desert exceptionally conducive to electronic intelligence (known as ELINT) and signals intelligence (known as SIGINT) collection. The lack of interference from natural or man-made obstacles makes it easy for electronic intelligence operations to identify and locate enemy formations whose electronic signature contrasts sharply against the relatively empty terrain.

PLAN AND DIRECT

3-72. Information collection planning in desert areas often focuses on targets at significantly greater distances than normal. Because of the unobstructed areas and large maneuver spaces, named areas of interest (known as NAIs) and target areas of interest (known as TAIs) often stretch well into a unit's deep area, and planners must allocate resources to observe and collect on these key areas. Additionally, desert terrain requires more mechanized collection assets than dismounted collection assets, with mounted reconnaissance formations and special operations forces performing critical roles well beyond the close area. Typically, commanders employ an armored cavalry regiment to conduct information collection and reconnaissance in the deep area.

3-73. The unrestricted terrain makes electronic intelligence, satellite, and aerial reconnaissance and surveillance highly effective in the desert. However, intelligence planners must often request these capabilities from either strategic assets or higher echelons. To access these capabilities when needed, a planner states the necessity of their use early in the planning process. Often, strategic intelligence assets such as these are only available periodically and planners must consider their use during critical phases of an operation or at decisive points.

COLLECT AND PROCESS

3-74. The intelligence staff synchronizes collection and processing to provide critical information at key times throughout the phases of an operation. Collection and processing are mutually dependent. Staffs should never allow a seam to emerge between collection and processing, even when elements conducting those functions are separated geographically. The intelligence staff continuously monitors the results not only of information collection, but also of processing to continuously assess the effectiveness of the overall information collection effort.

Environmental Considerations

3-75. Key staff considerations for information collection in a desert environment include the following:

- Immense open terrain favors the use of mechanized and armored forces.
- Surveillance ranges extend in both depth and width, allowing for maximum range engagements.
- High rates of advance can cause maneuver forces to outpace ground-based intelligence support increasing the importance of aerial collection assets.
- Ground-based and aerial collection efforts are extremely limited during dust and sandstorms; however, units can use electronic intelligence and signals intelligence to continue collection during limited visibility.
- The large areas characteristic of most desert operations requires careful planning to ensure that unattended ground-based sensors and reconnaissance assets operating in the deep area can effectively communicate information collected to intelligence planners.
- Water sources and related infrastructure can be critical to operations; staff consider establishing named areas of interest at these key locations.

3-76. Collection asset considerations in a desert environment include the following:

- Extreme heat rising from the desert floor combined with significant observation ranges can impair visual perception, distort details, and create mirages.
- Unattended ground sensors can be used to cover the wide areas associated with desert operations.
- Dust and sand, temperature variations, static electricity, and wind degrade radar.
- Heat, sand, and dust increase maintenance requirements on vehicles and electronic equipment.

3-77. Information collection plans in a desert environment maximize the use of satellite and aerial collection platforms. Ground forces are difficult to conceal in the flat, open terrain of many deserts, and these assets can identify enemy formations at great distances. Ground-based reconnaissance and surveillance assets can verify data collected by aerial and satellite intelligence to further develop the situation.

Interacting with the Population

3-78. The local populace can be a vital source of information for learning about an operational environment. Commanders rarely have enough trained human intelligence (HUMINT) collectors to satisfy the requirements of decisive action. Effective commanders cultivate and establish relationships with local civilians to support the overall information collection effort.

3-79. Commanders use liaisons to exchange information with key civilian organizations, the HN government, FSF, intergovernmental organizations (IGOs), and NGOs operating in their AO. The use of liaisons fosters trust and allows organizations to leverage each other's unique capabilities in pursuit of a common goal. During large-scale combat and stability operations, commanders establish a civil-military operations center (CMOC) to coordinate operations with the HN government, NGOs, and IGOs throughout the AO. Commanders direct unit leaders to conduct liaison with local leaders and key members of the community to answer information requests. Information collected from Soldiers/Marines and liaisons is forwarded to the intelligence staff for processing, exploitation, and dissemination.

3-80. NGOs operating in the desert can be resources for relevant information about the environment. NGOs and IGOs, by the nature of what they do, become familiar with the culture, language, sensitivities, and status of the populace, as well as the infrastructure in a region. This information is valuable to commanders and staffs who may not have access to the most current information. NGOs and IGOs may also need information and support from commanders and staffs concerning security issues. However, these organizations often hold neutrality as a fundamental principle. Many NGOs and IGOs resist being used as sources of information and hesitate to associate with the military. The discrete use of a CMOC to coordinate activities and share information may enable NGOs and IGOs to cooperate with military forces without compromising the perception of neutrality. The Department of State's United States Agency for International Development (USAID) usually has the strongest network of contacts and information on NGOs, IGOs, and local relief agencies in a country. In addition to a developed understanding of the current needs of the local populace, NGOs may also have—

- A network of influential associations.
- Historical archives.
- An extensive understanding of the desert infrastructure.
- Key knowledge of political and economic influences.
- A keen awareness of significant changes in the desert environment.
- Insight into the current security situation.
- Access to current maps and imagery.

3-81. Commanders avoid confusing productive civilian associations with HUMINT military source operations. HUMINT collection operations are separate and distinct from civil-military liaison. Only trained and certified intelligence professionals conduct HUMINT in accordance with FM 2-22.3, AR 381-100, and DODD 3115.09. Information obtained from interactions with the populace is normally incidental to other civil-military relationships. For example, as part of infrastructure repair in a stability operation, a commander may be instrumental in obtaining a generator for a local hospital. Within the context of this relationship, the commander may develop a rapport with one or more of the hospital's administrators or health practitioners. These civilians may be inclined to provide valuable information about the threat and the desert environment—often on a continuing basis. In any civil-military relationship, commanders ensure that the information civilians provide is not tied to promises of assistance or civilian loyalty.

3-82. Commanders understand that repeated interactions with any one individual can place that individual and his or her family in danger from the enemy. Before this potential danger becomes a reality, commanders refer their civilian connections to trained HUMINT personnel who can handle them more securely and effectively. In addition to civilian protection considerations, commanders turn their civilian associations over to trained HUMINT collectors anytime during the relationship if they consider the information that the contact is providing (or may provide) is credible, relevant, and—

- Provides essential information on a repetitive basis.
- Helps answer the higher-level commander's critical information requirements.

- Affects operations in another AO.
- Requires monetary compensation to obtain.

3-83. While prohibited by regulatory guidance, unofficial source operations by non-HUMINT trained and certified Soldiers/Marines risk—

- Obtaining unevaluated information that intelligence staff cannot vet.
- Creating perceptions of unequal or favored treatment while potentially limiting the effectiveness of financial recruiting tools available to HUMINT Soldiers/Marines constrained by intelligence contingency fund regulations.
- Increasing the likelihood that untrained Soldiers/Marines may fall victim to deception and misinformation.

Processing

3-84. Once intelligence personnel collect information, they process it into a format that enables analysts to extract essential information. During processing, intelligence personnel and systems convert raw data into forms of information commanders, staffs, and intelligence analysts can apply to operations.

PRODUCE

3-85. Production is the development of intelligence by analyzing collected information and existing intelligence. Analysts create intelligence products, conclusions, or projections regarding threats and relevant aspects of an operational environment to known or anticipated requirements. (See ATP 2-33.4, ATP 2-19.4, or MCWP 2-10 [MCWP 2-1] for more information on intelligence production.)

DISSEMINATE

3-86. Commanders must receive combat information and intelligence products in time and in an appropriate format to facilitate situational understanding and support decision making. While deliberate, dissemination should also be timely as it is critical to the success of desert operations.

3-87. Disseminating intelligence simultaneously to multiple recipients is one of the most effective, efficient, and timely methods and can be accomplished through various means. Typically, this is accomplished by using cyberspace or internet-based communications systems to distribute regular intelligence updates to large audiences. Commanders and the intelligence staff may also use battlefield command systems to disseminate time-sensitive intelligence to units actively conducting operations. The intelligence staff must plan for methods and techniques to disseminate information and intelligence when normal methods and techniques are unavailable. For example, if internet-based communications are degraded, the intelligence staff may use frequency modulation communications to disseminate intelligence updates by radio. However, this method should be reserved for time-sensitive intelligence updates and transmissions must be a brief as possible to avoid interfering with other operations competing for the same frequency.

BIOMETRICS

3-88. Biometric data collection is an important part of the overall intelligence, targeting, and force protection architecture. *Biometrics* is the process of recognizing an individual based on measurable anatomical, physiological, and behavioral characteristics (JP 2-0). Biometrics use unalterable physical traits to identify and, if necessary, catalog an individual in a known database. This capability can be used to identify an enemy seeking to hide among the populace during stability or counterinsurgency operations. When screened against forensic evidence, biometrics can link an individual to past aliases, locations, and events. Biometric technologies and the TTP for their employment are dynamic and rapidly changing. Commanders use biometrics in desert operations to—

- Confirm the identity of suspect individuals, including high-value individuals.
- Link persons to events through forensics, such as fingerprints.
- Restrict base access.
- Create access badges and credentials.

- Screen local hires and contractors for security threats.
- Screen applicants during security force recruitment.
- Enhance checkpoint operations by restricting the movement of threats.
- Process personnel during site exploitation.
- Control movement across borders or boundaries.
- Identify and process detainees.

3-89. Military police and intelligence forces primarily use biometrics, but Soldiers/Marines across all military occupational specialties should train to use biometric collection devices when available. Effective training includes procedures for regularly updating and synchronizing the data collected by biometric devices with their respective databases or networks. Collecting biometric data without sharing or synchronizing does little to defeat threats.

3-90. Using biometrics to verify individuals and identify threats has proven effective during stability and counterinsurgency operations in desert environments. However, commanders ensure that biometric collection does not undermine wider stability operations by upsetting the populace. Like other search procedures, biometric collection practices should respect local customs and social norms. In desert areas inhabited primarily by Muslim populations, Soldiers/Marines avoid conducting mixed gender searches and mixed gender biometric collection during routine operations. Mixed gender searches and collections can be considered offensive by local populations. (For more information of incorporating biometric collection into operations, see ATP 2-22.82 and ATP 2-22.85/MCRP 10-10F.1/NTTP 3-07.16/AFTTP 3-2.85.

FIRES WARFIGHTING FUNCTION

3-91. The *fires warfighting function* is the related tasks and systems that create and converge effects in all domains against the adversary or enemy to enable operations across the range of military operations (ADP 3-0). *Fires* is the use of weapon systems or other actions to create specific lethal or nonlethal effects on a target (JP 3-09). The Marine Corps amplification is those means used to delay, disrupt, degrade, or destroy enemy capabilities, forces, or facilities as well as affect the enemy's will to fight. Fires is one of the seven warfighting functions (MCRP 1-10.2). *Fire support* is fires that directly support land, maritime, amphibious, space, cyberspace, and special operations forces to engage enemy forces, combat formations, and facilities in pursuit of tactical and operational objectives (JP 3-09). Marine Corps amplification is assistance to elements of the Marine air-ground task force engaged with the enemy rendered by other firing units, including (but not limited to) artillery, mortars, naval surface fire support, and offensive air support (MCRP 1-10.2). Fires can be delivered by armed aircraft, land- and sea-based indirect fire systems, air and missile defense systems, and EW systems.

THE TARGETING PROCESS

3-92. *Targeting* is the process of selecting and prioritizing targets and matching the appropriate response to them, considering operational requirements and capabilities (JP 3-0). Units may use the Army targeting process and the joint targeting cycle to integrate and synchronize fires into operations, creating the desired effects in time and space. Using targeting, fires cells recommend targeting guidance to the commander, develop targets, select targets for attack, and coordinate, integrate, and assign allocated joint, interagency, and multinational fires to specific targets and target systems. There are two types of targeting: deliberate targeting and dynamic targeting.

3-93. The joint targeting cycle consists of six phases:

- Phase 1. End state and commander's objectives.
- Phase 2. Target development and prioritization.
- Phase 3. Capabilities analysis.
- Phase 4. Commander's decision and force assignment.
- Phase 5. Mission planning and force execution.
- Phase 6. Assessment.

3-94. Dynamic targeting consists of six steps:

- Find. Detect and classify targets for prosecution.
- Fix. Determine the location of the potential target.
- Track. Observe and monitor the target's activity and movement.
- Target. Decide whether to engage the target and select and coordinate the means to create the desired effects.
- Engage. Take action against the target.
- Assess. Focus on the results of the target engagement. Battle damage assessment (known as BDA) is critical to determine if an immediate reattack is required.

Dynamic targeting is not separate from the joint targeting cycle. All potential targets nominated for attack continually change in importance due to the changing nature of the battlefield. When the target poses a danger to friendly forces or it presents a lucrative, fleeting opportunity to attack, the JFC may designate it as requiring an immediate response. Commanders may plan and anticipate such targets as deliberate actions in the joint targeting process. However, if the nature of these targets precludes detailed advanced planning, such as a mobile ballistic missile threat, the staff may initially identify them during the deliberate planning phases of the joint targeting process and, once detected, may prosecute them by dynamic targeting.

DESERT EFFECTS ON FIRE SUPPORT

3-95. The desert's unrestricted terrain and lack of inhabitants presents ample opportunities for indirect fire to support maneuver. However, like other environments, certain constraints, such as protected infrastructure and urban areas, remain. The desert environment can also affect—

- Acquisition and engagement ranges.
- Positioning.
- Mix of munitions.

Acquisition and Engagement Ranges

3-96. Acquiring targeting information and tracking targets throughout the depth of the desert is demanding. The large maneuver areas and relatively high rates of movement and maneuver/maneuver allow for shorter exposure times and require firing systems to act rapidly on targeting data to engage targets at the maximum effective range. Targeting enemy indirect fire assets with acquisition radar works well in the desert due to the lack of masking terrain and long flight times. However, battle damage assessment can be difficult as the extended ranges and large areas may prevent detailed observation and assessment. Poor weather, smoke from burning oil infrastructure, and excessive dust or sand can complicate target identification, laser designation, and terminal guidance.

3-97. Commanders meet target acquisition challenges by innovatively integrating and layering reconnaissance capabilities and systems. These capabilities include special operations forces, manned aircraft systems, UASs, EW, and reconnaissance assets. Staffs carefully plan for the placement and security of forward observers, joint fires observers, and joint terminal attack in support of targeting priorities. Staffs consider using more artillery systems to ensure the responsiveness (rather than the weight) of fires. Positioning numerous artillery systems reduces dead space and permits units to establish more direct sensor-to-shooter links.

3-98. Identification of friend or foe is difficult in the desert due to the potential for observation at extremely long ranges, the large size of many maneuver elements, and the lack of easily identifiable terrain features for control measures. While some automated digital systems assist with identification of fixed-, rotary-, and tilt-rotor aircraft, those systems are usually only available to specialized air and missile defense systems. Additionally, multinational operations increase the likelihood that friendly forces may field the same or similar vehicles and weapon systems as enemy forces. To prevent fratricide, commanders ensure Soldiers/Marines conduct friend or foe vehicle recognition training. They may also use unique markings, such as VS-17 panels or chemical lights, to help Soldiers/Marines recognize friendly vehicles. Commanders use battlefield command systems to clear fires and implement restrictive control measures to prevent cross boundary fires in areas that lack easily identifiable terrain features. (See appendix C for more details on fratricide prevention in the desert environment.)

Positioning

3-99. Commanders position artillery and rocket assets in the close area in range of enemy air defense or fires assets throughout the substantial deep areas common to most desert operations. This entails risk, and artillery assets must fire and displace quickly due to enemy counterfire capabilities. Target acquisition radars cannot radiate constantly without risking destruction by enemy long-range systems.

3-100. When armor and infantry units move, the artillery must move with them. Due to the rapid pace of desert operations and the potential for enemy observation, close and continuous field artillery support is necessary. Field artillery units should be at least as mobile as the force they are supporting.

3-101. Naval gunfire can result in significant range probability errors as the dispersion pattern of the naval gun is roughly elliptical with the long axis in the direction of fire. Hence, coverage of targets such as roads and airfields is most effective when the gun-target line coincides with the long axis of the target. Very close supporting fire can be delivered when the gun-target line is parallel to the front line of troops. However, a gun-target line perpendicular to the front-line trace can endanger friendly forces.

3-102. The combat radius and payload of rotary-wing aircraft is reduced by high temperatures and altitude. Therefore, the commander must position attack aviation platforms and their support assets within supporting range of ground maneuver forces. Commanders must also coordinate the positioning of indirect fire assets in a manner that minimizes airspace clearance requirements and ensures responsive joint fires. This is often accomplished by establishing purple kill boxes with floors and ceilings that prohibit munitions from crossing coordinating altitudes. Kill boxes deconflict ground-based and air-launched fires, prevent fratricide, and maximize the targeting of enemy forces. (For more information on kill box planning and employment, see ATP 3-09.34/MCRP 3-31.4/NTTP 3-09.2.1/AFTTP 3-2.59.)

Mix of Munitions

3-103. The type and quantity of munitions used in the desert differs from that used in other environments as the requirements for precision-guided munitions is generally lower. Low population density and longer observation ranges lead to fewer concerns of collateral damage and fewer restrictions on the use of unguided munitions and munitions with larger effects. When required by METT-TC/METT-T, units can still use precision-guided munitions to mitigate collateral damage, provide close fire support, target moving vehicles, and destroy high-value targets. However, reduced visibility caused by dust and sand can significantly degrade laser-guided munitions. Global Positioning System (known as GPS)-guided munitions are subject to electromagnetic jamming and spoofing but can function with a high degree of accuracy during limited visibility conditions.

3-104. When employing submunitions with high dud rates, commanders must balance the military necessity, potential for collateral damage, immediate effects on the battlefield, and effects on future movement and maneuver/maneuver. Some submunitions have increased dud rates caused by the surface composition and do not function in loose, sandy deserts.

SUSTAINMENT/LOGISTICS WARFIGHTING FUNCTION

3-105. *Logistics* is planning and executing the movement and support of forces (JP 4-0). The Marine Corps amplification is all activities required to move and sustain military forces. Logistics is one of the warfighting functions (MCRP 1-10.2). The *sustainment warfighting function* is the related tasks and systems that provide support and services to ensure freedom of action, extend operational reach, and prolong endurance (ADP 3-0). Commanders conducting sustainment/logistics in support of unified land operations must understand the diverse requirements of the supported formations and the environmental challenges associated with desert operations.

3-106. The Army identifies four elements of the sustainment warfighting function: logistics, financial management, personnel services, and health service support. The Marine Corps classifies logistics elements into six functional areas: supply, maintenance, transportation, general engineering, health services, and other services which include legal, exchange, food, disbursing, postal, billeting, religious, mortuary, and morale and recreation services.

3-107. U.S. forces in the desert operate at the end of a long, complicated, and potentially tenuous LOC. Inherent to the success of any tactical operation is continuous sustainment/logistics planning and responsive support. The desert environment challenges every category of sustainment/logistics. A unit's effectiveness in the desert often depends on its sustainment/logistics; however, the large formations and rapid movement associated with desert operations can stretch LOCs and expose them to attack. Commanders carefully consider tempo when developing their scheme of maneuver and concept of sustainment, ensuring maneuver forces do not outdistance their support and that available forces can secure sustainment assets.

3-108. Limited resources and the demanding environment can challenge sustainment operations in the desert. The lack of locally available water places increased demands on water transportation and storage assets. The harsh environment requires increased maintenance and servicing to maintain equipment readiness. The heavy use of limited infrastructure by mechanized forces can quickly damage roads and bridges requiring regular repair.

MAINTENANCE, REPAIR, RECOVERY, AND BATTLE DAMAGE ASSESSMENT AND REPAIR

3-109. Maintenance involves all action, including inspection, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation, taken to retain materiel in a serviceable condition or to restore it to serviceability. For the Marine Corps, maintenance includes inspection, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation. It also includes all supply and repair action taken to keep a force in condition to carry out its mission. The Army's two levels of maintenance are field maintenance and sustainment maintenance. The Marine Corps uses three categories of maintenance: organizational, intermediate, and depot. (For more information on maintenance, see ATP 4-33 and MCTP 3-40E.)

3-110. The desert's harsh environment and the mechanized nature of operations create unique maintenance considerations:

- Dust and sand increase the consumption rate of filters, oils, and lubricants. (See paragraphs 1-133 through 1-143 for more on dust and sand.)
- Increased levels of Class III and Class IX are required on hand.
- Class III and Class IX items must be properly stored to prevent damage by sand and dust.

3-111. To maintain operational readiness rates, Soldiers/Marines need to repair disabled equipment as close to the site of damage as the tactical situation and available resources permit. Evacuation should be limited whenever possible. However, due to the large AOs common to desert operations, field maintenance personnel and contact teams may not be available to support recovery and repair. Leaders train crews to perform basic maintenance and like recovery. Under extreme circumstances, crews repair only what is necessary to make the vehicle or equipment combat effective. If unable to make these repairs, recovery teams recover and evacuate the vehicle to the nearest secure site where field maintenance personnel are available.

3-112. SOPs for recovery and repair should include—

- Guidelines for crew-level recovery and battle damage assessment and repair (BDAR).
- Recovery by forward maintenance teams.
- Recovery by field maintenance personnel.
- Priorities for recovery by vehicle type.
- Limitations on field expedients. For example, the distance or time over which one tank is allowed to tow another tank considering the heat buildup in the transmission in a hot desert environment.
- Recovery of classified equipment, to include communications equipment.
- Security and guides for recovery teams.

3-113. Troops use BDAR to rapidly return disabled equipment to the commander by field-expedient repair. BDAR restores the minimum-essential combat capabilities necessary to support a specific combat mission or to enable the equipment to self-recover. Soldiers/Marines accomplish BDAR by bypassing components or safety devices, cannibalizing parts from like or lower priority equipment, fabricating repair parts, taking shortcuts to standard maintenance, and using substitute fluids, materials, or components to meet the immediate needs of combat. Depending on the repairs required and the time available, repairs may or may not return the vehicle to a fully mission-capable status. Operators and crew, maintenance teams, or recovery

teams may perform BDAR. (See ATP 4-31/MCRP 3-40E.1 [MCRP 4-11.4A] for more information on recovery and BDAR.)

DISTRIBUTION

3-114. The desert environment, terrain, and the character of operations can challenge distribution support. Units often disperse maneuver formations across wide areas conducting rapid movements. This creates long LOCs that can prove vulnerable to enemy attack. Additionally, sustainment and distribution units may be restricted to improved routes as the sandy terrain may only be passable to cross-country capable vehicles with a reduced payload. The lack of terrain features and routes can challenge navigation, and sustainment units can easily become separated from the main body.

3-115. MSRs are often considerably longer in the desert than in temperate climates. Commanders secure MSRs that link the rear area to the close area to protect logistics convoys from attack by bypassed enemy forces. MSRs require frequent patrolling and regulation to ensure security and the flow of supplies. Military police are trained, organized, and equipped to conduct LOC security and MSR regulation and enforcement. Within the security and mobility support discipline, military police perform convoy security, temporary route signing, straggler movement control, response force operations, and checkpoint operations to protect the force and preserve the commander's freedom of action. Using military police in this capacity enables maneuver and security forces to focus on combat in the close area.

3-116. Planners adjust TTP for convoy operations to account for the unrestricted terrain, extended MSRs, and large AOs common to the desert. Within individual convoys, Soldiers/Marines increase intervals between vehicles to limit the number of vehicles caught in a potential ambush. Sustainment planners consider varying routes and times between logistics packages so to avoid setting a pattern that the enemy can exploit. They also coordinate with the protection cell and provost marshal to clearly identify areas of responsibility for response operations and security along extended MSRs that cross multiple units' AOs.

3-117. Sustainment/logistics operations should be given priority for the use of hard-surface routes. However, if hard-surface roads are not present, engineers can increase the trafficability and weight-bearing capacity of unimproved routes. In austere environments or during the initial phase of an operation, engineers may have to use local materials to improve the weight-bearing capacity of unimproved routes; salt-marsh mud applied over the top of sand can temporarily improve trafficability until the appropriate construction materials arrive.

SUSTAINMENT/LOGISTICS PLANNING

3-118. Planners consider each element of the sustainment warfighting function when they develop the concept of support. Support requirements are identified by assessing the size and composition of the force and the mission variables. Planners then project support requirements over the duration of the operation and throughout its various phases. Sustainment planners and operators anticipate the tempo of operations and maintain the flexibility to support branches and sequels as they develop. Sustainment plans should be as detailed as planning time permits.

3-119. After analyzing the concept of operations, sustainment commanders and planners must be able to accurately predict support requirements. They must determine—

- Type of support required.
- Quantities of support required.
- Operational commander's priorities by type and unit.

3-120. Based on this information, the staff must then develop a concept of support/concept of logistic support that applies resources against requirements in a manner that results in the most responsive support possible. Staffs establish and maintain communications links among the various support echelons in theater and the operational force. Continuous follow-up ensures units perform tasks as planned or adjust systems and processes to provide responsive support.

3-121. Sustainment planners must know priorities for support. This helps ensure that units with the highest tactical priority receive required support first. Commanders and their staff provide mission directives, determine sustainment requirements, and establish priorities within the unit.

3-122. A key to successfully extending operational reach in the desert is the ability to anticipate the requirement to push sustainment support forward specifically ammunition, fuel, replacements, and water. Sustainment commanders must act, rather than react, to support requirements. The existence of habitual support relationships facilitates this ability to anticipate.

Logbase ECHO: VII Corps Sustainment Planning During Operation DESERT STORM

Third Army's scheme of maneuver during Operation DESERT STORM required VII Corps to reposition the bulk of its combat forces—including the 1st Armoured Division (United Kingdom), the 1st Infantry Division, the 1st Armored Division, the 3rd Armored Division, and the 2nd Armored Cavalry Regiment—to forward assembly areas 150 miles west of the tactical assembly areas (TAAs) it occupied during Operation DESERT SHIELD. Relocating from the established TAAs to forward assembly areas enabled VII Corps to attack from an unexpected direction and avoid the Iraqi army's prepared defensive positions. However, this movement had to be accomplished before VII Corps could attack into Iraq. VII Corps planners recognized that such a significant move would exhaust their subordinate divisions' supplies and require the corps be extensively resupplied before it initiated offensive operations.

To fully replenish its combat forces in their forward assembly areas, VII Corps established Logbase ECHO in the northwestern desert of Saudi Arabia. The logistics base was located between the subordinate divisions' forward assembly areas and, in the month preceding the corps' movement, was stocked with Class I, Class III, and Class V to support the pending offensive operation. To protect the base from observation and destruction by Iraqi forces, the 1st Infantry Division tasked 1st Squadron, 5th Cavalry Regiment and 3rd Battalion, 37th Armored Regiment with establishing a security area north of the logistics base along the Iraqi border. The two units then established a screen line that prevented Iraqi forces from encroaching on the area. To further enhance operations security and protect noncombatants, the 14th Military Police Brigade worked with the Saudi government to relocate Bedouin camps in the area. Once established, the logistics base provided over 130 million gallons of water (492 liters), 60 million gallons of fuel (227 liters), and approximately 6,000 tons of ammunition to sustain VII Corps' assault into Iraq.

FORECASTING

3-123. Due to extended LOCs, consumption forecasts are very important in desert operations. Planners must adjust time and distance calculations and consumption rates to the conditions on the ground since they may differ significantly from estimates conducted during training or operations in other environments. The absence of roads in forward areas, increased fuel consumption during cross-country movement, navigation problems, vulnerability of trains and supply locations, sandstorms, and wide dispersion all require tailored planning factors when forecasting resupply requirements and operations.

PERSONNEL SERVICES

3-124. Personnel services include postal operations, health services, and casualty operations. Unit staff and theater sustainment planners use accountability and strength reporting to address human resource requirements, identify shortages, and request necessary augmentation through the JFC. This includes casualty forecasts necessary to inform commanders and staffs. The staff judge advocate and personnel service battalion provide legal services. (See FM 1-0 or MCTP 3-40B for additional information on human resources support/tactical logistics.)

Health Services

3-125. The vast distances, increased lethality, and rapid pace of desert operations can burden medical resources and complicate casualty treatment and evacuation procedures. The potential for large numbers of casualties increases as formations maneuver across wide areas and exchange indirect fire without natural cover and concealment to protect forces. These mass casualty situations can exceed the capabilities of organic and direct support medical assets without careful planning and coordination. Casualty evacuation must occur concurrently with operations. Units that cease aggressive maneuver to evacuate casualties while in enemy contact often suffer additional casualties. See FM 4-02 or MCTP 3-40B for additional information on Army health system/tactical logistics.

3-126. Evacuating casualties by ground across extended LOCs consumes valuable time and resources. When possible, planners establish HLZs forward to facilitate air evacuation of casualties and limit the burden on maneuver units. This enables freedom of action and supports the tempo and pace inherent to successful desert operations. It also prevents congesting LOCs with excessive two-way traffic and allows them to primarily be used to push heavy logistics packages forward that units could not move by air. When units do not have air evacuation available, commanders mitigate the excessive ground evacuation times by distributing adequate medics/corpsmen throughout their formation and ensuring Soldiers/Marines have trained to provide tactical casualty care at the point of injury.

3-127. Effectively managing large numbers of casualties requires clearly understood SOPs, rehearsals, adequate resources, rapid triage, and detailed patient tracking procedures. When developing the unit's health service support plan, medical planners—

- Identify external sources of medical support and augmentation, such as medical evacuation support, forward resuscitative and surgical teams, combat support and field hospitals, and Class VIII resupply procedures.
- Designate ambulance exchange points and HLZs to support air evacuation.
- Develop procedures for rapidly evacuating and triaging casualties to the appropriate role of care.

Mortuary Affairs

3-128. The extended LOCs typical of desert operations can affect the evacuation of the deceased and must be a planning consideration. Units transport remains in palletized transfer cases when the tactical and logistical situation permits. In the desert, units may need additional refrigeration equipment or facilities to properly store the deceased.

3-129. When the situation prohibits immediate evacuation, troops may need to temporarily inter remains within the theater. Temporary interment must be authorized by the combatant commander and is usually planned and executed by echelons above corps. Units can use HN support to dig and fill temporary interment sites. However, HN support laborers do not handle or process the remains or personal effects of U.S. personnel. Soldiers/Marines bury the deceased with their personal effects to aid with identification when remains are disinterred. The mortuary affairs company commander is responsible for the survey, layout, and records concerning the cemetery.

CAPTURED MATERIEL AND EQUIPMENT

3-130. Given the sparse resources available in the desert, commanders can authorize the use of certain classes of captured materiel and equipment. Units can use captured equipment to maintain momentum by decreasing reliance on extended LOCs. The most common classes of supply that units can use to support operations are Class III and Class IV stocks. However, staffs need to test and inspect Class III before troops use it in friendly vehicles or equipment. Cautious Soldiers/Marines consider that the enemy may have purposefully contaminated or sabotaged equipment and materiel left behind. Troops carefully examine weapons, munitions, and supply caches before disturbing them to ensure they are not booby trapped. Soldiers/Marines avoid consuming captured Class I and only use captured Class VIII to treat enemy wounded.

ENVIRONMENTAL CONSIDERATIONS BY CLASSES OF SUPPLY

3-131. Desert operations place unique demands on certain classes of supply. Commanders carefully assess how the desert environment affects Class I, Class III, Class IV, Class V, and Class IX supplies and subsequently operations.

Class I - Subsistence

3-132. A force's ability to transport and store water is key to successful desert operations. The theater army typically plans, forecasts, and distributes bulk Class I to units in theater. However, many units lack the means to transport or store the amount of water required to support desert operations. Sustainment planners often have to coordinate for alternatives. Possible solutions include converting fuel tankers to water tankers, using blivets, and purchasing water storage tanks from local vendors.

3-133. Commanders establish priorities for water use through orders or unit SOPs. (Soldiers/Marines see ATP 4-44/MCRP 3-40D.14 [MCRP 3-17.7Q] for planning and executing water support doctrine.)

Class III - Petroleum, Oils, and Lubricants

3-134. Class III includes bulk and packaged fuels and lubricants. Mechanized forces operating across vast AOs consume large amounts of POL. Bulk Class III is planned and distributed by the theater army; however, sustainment planners at echelons below corps must forecast and coordinate for the additional POL required to support desert operations.

3-135. Sustainment planners requisition and distribute additional fuel cans, bladders, and auxiliary tanks to extend the range and reach of maneuver forces. They also establish forward arming and refueling points (FARPs) and plan to conduct refuel on the move to maintain momentum. If conducted off-road, both refuel on the move sites and the location of FARPs must be carefully reconnoitered to ensure the surface conditions can support the weight of fuel tankers, infantry fighting vehicles, tanks, and aircraft. These sites are often in the close area and should be considered a high-value target. As such, commanders allocate security and protection assets, such as air and missile defense, to refuel on the move sites and FARPs. FARPs and refuel on the move sites are temporary and, to avoid targeting by the enemy, units relocate them frequently. (See FM 4-0 for more information on refuel on the move and FARP operations.)

Class IV - Construction Material

3-136. Class IV includes construction materials, installed equipment, and all fortification and barrier materials. Because little natural cover exists in many deserts, units can require significantly more Class IV than in other theaters, and consume more of some items, such as sandbags and defensive barriers. Engineers generally employ larger and more extensive preplanned obstacle belts in desert regions due to the lack of natural obstacles. They use as many local materials as possible. Engineers conduct reconnaissance operations to determine what Class IV stores are available in theater and what to requisition. The construction of airstrips, routes, and minor port facilities, and the rehabilitation of major port facilities and railways, constitute engineer missions of particular importance in desert regions.

Class V - Ammunition

3-137. Class V consists of ammunition of all types, including bombs, explosives, mines, fuses, detonators, pyrotechnics, missiles, and rockets. Due to the unobstructed fields of fire, sparse population, and extended ranges common to most desert engagements, large caliber ammunition consumption rates are high. However, units demand fewer precision munitions than they demand for operations conducted in environments with greater population densities and infrastructure. Battalion trains should contain a one-day supply of ammunition and missiles for all vehicles in the force. Staffs divide ammunition between combat and field trains when trains are echeloned. To protect ammunition from the desert's harsh environment, units store it as packaged until they can upload it on combat vehicles or distribute it for use.

3-138. Preplanned obstacle belts are generally larger and more extensive in deserts and require considerable quantities of mines to support. However, the ROE may prohibit the use of certain types of mines. Commanders ensure they receive the appropriate approval before employing mines.

Class IX - Repair Parts and Components

3-139. Class IX includes repair parts and components required for the maintenance of all equipment. The extreme conditions and large distances covered by mechanized forces during desert operations increases the consumption and demand for Class IX items. Otherwise nonessential items, such as speedometers and odometers, may prove essential to conducting land navigation in an environment lacking recognizable terrain features. Units hold small repair parts with high usage rates as far forward as possible and sometimes distribute them to individual vehicles and crews. Commanders seek authorization to increase the quantity of shop stock lines maintained on hand. Typical high consumption items include—

- Tires.
- Water pumps, gaskets, fan belts, water hoses, and clamps.
- Ignition systems.
- Wheel and sprocket nuts.
- Wedge bolts.
- Gauges (including speedometers and odometers).
- Filters.
- Rotor and tail blades.
- Road wheels for tracked vehicles.
- Windshields.

PROTECTION/FORCE PROTECTION WARFIGHTING FUNCTION

3-140. *Protection* is the preservation of the effectiveness and survivability of mission-related military and nonmilitary personnel, equipment, facilities, information, and infrastructure deployed or located within or outside the boundaries of a given operational area (JP 3-0). The *protection warfighting function* is the related tasks and systems that preserve the force so the commander can apply maximum combat power to accomplish the mission (ADP 3-0). *Force protection* is preventive measures taken to mitigate hostile actions against Department of Defense personnel (to include family members), resources, facilities, and critical information (JP 3-0). The Marine Corps amplification to *force protection* is actions or efforts used to safeguard own centers of gravity while protecting, concealing, reducing, or eliminating friendly critical vulnerabilities. Force protection is one of the warfighting functions (MCRP 1-10.2). The components of protection/force protection are survivability, air and missile defense, area security, and CBRN operations.

3-141. Protection/force protection requires that Soldiers/Marines, leaders, and organizations identify, prevent, and mitigate threats and hazards. Large-scale combat in the desert can be extremely lethal since the environment lacks natural cover and concealment and is characterized by engagements at maximum ranges. This lethality requires the synchronization, integration, and organization of capabilities and resources to preserve combat power through continuous protection/force protection.

SURVIVABILITY

3-142. *Survivability* is all aspects of protecting personnel, weapons, and supplies while simultaneously deceiving the enemy (JP 3-34). The Marine Corps amplification adds the degree to which a system is able to avoid or withstand a man-made hostile environment without suffering an abortive impairment of its ability to accomplish its designated mission (MCRP 1-10.2). The Army defines *survivability* as a quality or capability of military forces which permits them to avoid or withstand hostile actions or environmental conditions while retaining the ability to fulfill their primary mission (ATP 3-37.34/MCTP 3-34C). Survivability, as a quality, applies to personnel, equipment, vehicles, and facilities. For example, body armor and PPE enhance an individual's survivability, while placing sandbags over windows can enhance a building's survivability.

3-143. Survivability has two components: avoidance and withstanding. Avoidance seeks to prevent an attack or to prevent accurate targeting. Susceptibility is the degree to which a unit, location, facility, or site is vulnerable to attack. The capability to withstand seeks to prevent degradation as a result of having been subjected to an attack. Normally in a military operation, a force with greater vulnerability has less capability to withstand degradation as a result of an attack.

3-144. To avoid detection and increase survivability, commanders reduce the visual and electromagnetic signatures of their forces. They integrate active and passive protection measures such as camouflage, light discipline, rapid repositioning, and dispersion to frustrate the enemy's ability to effectively locate and target friendly forces. Commanders prevent units from concentrating at key logistics centers or command posts. They limit the use of non-mission-essential electronics or communications to reduce their command post's electromagnetic signature. They operate with the smallest, most mobile command posts possible to enable rapid repositioning.

3-145. Three categories of threats to survivability exist: hostile actions, nonhostile activities, and environmental conditions. Although all three categories of threats can cause damage, destruction, death, or injury to personnel and physical assets, survivability focuses on avoiding or withstanding threats posed by two of those categories: hostile actions and environmental conditions.

Note. Hostile actions and environmental conditions can sometimes overlap, making it difficult to distinguish between them. Hostile actions can affect environmental conditions and their effects sometimes linger for significant periods, such as with CBRN weapons. In addition, threat forces and elements may, as a hostile action, create hazardous environmental conditions. For example, they may destroy a dam to cause flooding. Regardless of whether a particular threat qualifies as a hostile action, an environmental condition, or both, the capability to avoid or withstand such a threat is critical to the survivability of military forces.

3-146. Commanders increase survivability by ensuring all Soldiers/Marines have, and properly use, the appropriate protective equipment. Commanders ensure that Soldiers/Marines have standard equipment—helmets, gloves, body armor, and chemical protective over garments. Commanders ensure availability of other PPE and materials such as—

- Goggles or ballistic eye protection.
- Knee and elbow protectors.
- Barrier materiel, including pre-formed concrete barriers, wire, and sandbags.
- Fire extinguishers and other firefighting equipment.
- Immunizations.

SURVIVABILITY OPERATIONS

3-147. Personnel, equipment, facilities, and physical assets have inherent survivability qualities or capabilities that can be enhanced through survivability operations. *Survivability operations* are those protection activities that alter the physical environment by providing or improving cover, camouflage, and concealment (ATP 3-37.34/MCTP 3-34C). By providing or improving cover, camouflage, and concealment, survivability operations help military forces avoid or withstand hostile actions.

Engineer Role in Survivability Operations

3-148. Although all units conduct survivability operations within the limits of their capabilities, the Army/Marine Corps has a broad range of diverse engineer capabilities that can enhance survivability. Engineering tasks in support of survivability operations include building, repairing, or maintaining fighting and protective positions as well as hardening, concealing, or camouflaging roads, bridges, airfields, and other structures and facilities. These tasks tend to be equipment intensive. Units may need to complete tasks on a prioritized basis to optimize use of low-density equipment. The commander determines the priority of engineering support based upon the mission variables.

Desert Survivability Positions

3-149. Survivability operations enhance the ability to avoid or withstand hostile actions by altering the physical environment. They accomplish this by providing or improving cover, camouflage, and concealment in four areas. The first three areas address fighting positions, protective positions, and hardened facilities, focusing on providing cover (although not excluding camouflage and concealment). The fourth area addresses camouflage and concealment and focuses on providing protection from observation and

surveillance. All four areas have the added benefit of providing some degree of shelter from the elements. The four areas of survivability operations are often addressed in combination. Fighting positions and protective positions, for example, usually also require camouflage and concealment. Camouflage and concealment activities often accompany activities to harden facilities.

Fighting Positions

3-150. A fighting position allows Soldiers/Marines and their weapon systems to engage and destroy enemy forces while avoiding or withstanding hostile actions. Such positions include individual, crew-served, and combat vehicle positions, as well as bunkers and towers. Fighting positions provide cover and concealment and, to be effective, they are integrated into the unit's defensive plan. Fighting positions are sited in accordance with the scheme of maneuver and scheme of fires to support a defensive plan that allows flexibility and the relocation of forces while bringing maximum fire on the enemy.

Protective Positions

3-151. Protective positions protect personnel, vehicles, and equipment occupying the position, allowing them to avoid or withstand hostile actions. As with fighting positions, protective positions provide cover, camouflage, or concealment. Unlike fighting positions, protective positions do not focus on providing a position from which to engage the enemy.

Fighting and Protective Position Considerations

3-152. Site selection for fighting positions and protective positions is critical to ensuring the Soldiers/Marines occupying them will have adequate protection. When selecting sites, troops incorporate the position into the existing terrain and vegetation. This reduces the need for man-made camouflage while also making the position harder to detect. Deserts often lack the thick vegetation required to conceal a fighting position; however, units can use terrain, such as dry riverbeds, to cover and conceal vehicles and personnel. Commanders ensure positions are not sited on ridgelines or the crest of hills or dunes to avoid silhouetting vehicles, equipment, and personnel. Positions must also account for the height of antennas, ensuring these obvious structures do not stand out above the top of the position and betray its location to the enemy.

3-153. Shadows, particularly in the morning and evening, are easily observable at great distances in the desert. Units must place equipment in total shadow, which is rare, or with its maximum vertical surface facing the sun so that minimal shadow falls on the ground. Maximum vertical area is the tallest significant portion of a vehicle. For example, the maximum vertical area of a 5-ton truck is the rear canopy, while the maximum vertical area of an M88 recovery vehicle is the front of the vehicle. Troops can break up the shadow by siting equipment next to scrub or broken surfaces, such as rocks or crevasses. Troops avoid siting equipment broadside to the sun and usually reposition vehicles and equipment as the sun moves. Digging in reduces the length of shadows by reducing the height of the vehicle exposed to the sun.

3-154. Vehicles passing over pebbles, gravel, or crushed rock can press these into the sand, creating prominent track marks when viewed from the air. Planners note and have vehicles avoid such areas if possible since tracks will easily betray the location of even a well-concealed position. Units use existing trails and blend new trails into old ones.

3-155. Commanders and staff consider reconnoitering and assessing soil composition when selecting sites to dig fighting or protective positions in the desert. Extremely loose sand is not conducive to constructing fighting positions and does not provide as much cover as dense or rocky soil. Once troops dig positions, commanders ensure troops cover the positions when unoccupied to prevent the shadows formed within them from betraying the position from the air.

3-156. Troops ensure dug-in generators have adequate air space for cooling and ventilation. Units set radios and antenna systems as far out as possible and in different directions to reduce the overall electromagnetic signature and not betray the command post’s location.

3-157. Engineer activity often precedes operations, which makes it important that engineers conceal such work from enemy surveillance. Engineers can conceal their activity by—

- Employing the fewest personnel and smallest amount of equipment required to complete the task.
- Dispersing, concealing, and storing vehicles and other equipment away from the construction site when not in use.
- Completing all possible preparations well away from the site.
- Constructing survivability positions and countermobility obstacles in accordance with the terrain's natural contour.

3-158. Sometime engineers need to improvise construction of a survivability position by using materials commonly found on hand. (See TC 3-21.75 for more information on constructing fighting positions.) Some examples of field-expedient materiel for constructing survivability positions include:

- Wall revetments (digging down) using—
  - Sheet metal.
  - Corrugated sheet metal.
  - Plastic sheeting.
  - Plywood.
  - Air load pallets (463L pallets).
  - Sandbags.
- Wall construction (building up) using—
  - Defensive barriers.
  - 55-gallon drums filled with sand.
  - Expended artillery shells filled with sand.
  - Shipping boxes or packing material.
  - Prefabricated concrete traffic barriers.
  - Sandbags.
- Overhead cover stringers using—
  - Single pickets.
  - Double pickets.
  - Railroad rails.
  - "T" beams.
  - Diameter pipe 2 inches (5 centimeters) or larger.
  - Timbers 2 inch x 4 inch, or 4 inch x 4 inch (5 centimeter x 10 centimeter, or 10 centimeter x 10 centimeter) or larger.
  - Reinforced concrete beams.
  - 55-gallon drums cut in half longitudinally.
  - Large diameter pipe or culvert cut in half.
  - Precast concrete panels, 6 to 8 inches (15 to 20 centimeters) thick. Airfield panels.
  - Air load pallets (463L pallets).
  - Shipping pallets.
- Stand-alone positions using—
  - Connexes or shipping containers buried in the sand.
  - Large diameter pipe or culvert.
  - Steel water tanks buried in the sand (cleaned and ventilated).
  - Other storage tanks buried in the sand (cleaned and ventilated).

3-159. Once constructed, troops inspect survivability positions for—

- Low profile.
- Structurally sound materials.

- Excavation-walls that slope outwards.
- The setback for overhead at a minimum of 1 foot (30 centimeters) or 1/4 the depth of cut.
- Stringers—
  - Set firmly on a structural support.
  - With lateral bracing emplaced along supports.
  - That are 2 inch x 4 inch or 4 inch x 4 inch (5 centimeter x 10 centimeter, or 10 centimeter x 10 centimeter) used on the edge; the strength is on the depth of the lumber.
- Supports that extend past the excavation by 1/2 the depth of cut.
- Revetments with pickets that—
  - Support sheeting.
  - Are tied back.
- Overhead cover:
  - Quality of structural layer is inspected.
  - Dust layer-plywood or panels are in place.

Hardened Facilities

3-160. Units can harden existing structures and facilities to improve their survivability. Hardening helps to withstand hostile actions. Troops can use barriers, walls, sandbags shields, berms, or other physical security improvements.

3-161. Hardening of facilities also includes the use of bridge protective devices such as anti-mine booms, impact booms, and anti-swimmer nets. These devices typically protect bridges or crossing sites from waterborne demolition teams, floating mines, or floating debris (See ATP 3-90.4/MCTP 3-34A [MCWP 3-17.8] for more information on hardening bridges and dams.)

CAMOUFLAGE AND CONCEALMENT

3-162. Camouflage consists of materials and techniques used to hide, blend, disguise, or disrupt the appearance of military targets to prevent visual and electronic detection of friendly forces. In the desert, the lack of foliage and unobstructed observation makes camouflaging difficult, and properly concealing troops, facilities, and equipment requires discipline, ingenuity, and improvisation. Poorly executed camouflage on just one vehicle can compromise an entire task force. In addition to using dedicated camouflage systems, such as the lightweight camouflage screen system (LCSS), Soldiers/Marines can improvise camouflage from both the natural environment and other materials on hand. They can use twine or wire with local vegetation interwoven as an alternative when LCSS is unavailable.

3-163. The desert version of LCSS provides concealment against visual, near infrared, and radar acquisition or surveillance devices. To prevent shadows and imitate the ground, LCSS completely covers the vehicles or equipment it is concealing. Alternatives to the LCSS, in order of effectiveness, include—

- An appropriately colored open-weave cloth stitched to an ordinary wide-mesh net. This provides both color and texture and can augmented with local vegetation.
- A standard net threaded in long straight strips colored to match the terrain.

3-164. The number of nets required depends on the size of the equipment covered. As a whole, the nets should allow a gradual slope of not more than 15 degrees from the top of the equipment to the ground. Standard issue for companies operating in the desert includes a spray gun and various tints of paint to provide for temporary variations in net color to match the terrain.

3-165. When using nets for stationary equipment—

- Do not allow nets to touch sensitive items such as helicopter rotor heads and radio antennas, which may cause a net to catch fire or damage the equipment.
- Do not pull nets so tight that each supporting pole stands out.
- Ensure the net does not prevent the equipment from fulfilling its primary task.
- Avoid straight-edged patterns on the ground, which can compromise the position.

- Use burlap spray-painted in a nondescript desert color to cover reflective surfaces.
- Cut desert scrub in the immediate area.
- Use poles, natural or man-made, to raise the nets from the equipment, thereby hiding its shape. Natural substitutes for supporting poles are very difficult to find in the desert due to the lack of trees.
- Hook and hold a camouflage net to the ground away from the vehicle by using wooden pegs or long steel pins, depending on soil consistency.

3-166. Concealment consists of avoidance techniques used to prevent an enemy from detecting or identifying friendly troops' equipment, activities, or installations. Soldiers/Marines should site equipment, facilities, and vehicles to best exploit the terrain features for concealment, such as behind berms or dunes. They must also widely disperse and avoid siting equipment, facilities, and vehicles in easily recognizable geometric patterns.

3-167. Soldiers/Marines can modify vehicles to improve concealment. The enemy can easily see the shine from optics and matte paint polished by continual wear from long distances. Troops need to cover these vehicles to prevent reflecting sunlight. Troops should also cover running gears on tracks polished by wear with burlap when stationary. Soldiers/Marines can remove or lower windscreens and windows on certain vehicles to prevent reflection. They can also modify vehicle silhouettes by removing the cabs and tops of various nomenclatures.

3-168. Soldiers/Marines need to take action to conceal the movement of vehicles. Large formations and convoys produce excessive amounts of dust, sand, and exhaust. When operating off-road they also produce distinctive track and tire marks in soft sand. When operating off-road, company trains and sustainment convoys should travel in a column and follow the preceding vehicle's tracks. This frustrates the enemy's ability to assess the tracks and determine the size and composition of friendly forces. This also reduces the risk of multiple vehicles encountering mines or improvised explosive devices (known as IEDs). Commanders also balance the need for speed with concealment to determine the optimum rate of march. While speed may provide a form of protection or be necessary to maintain tempo, it also produces large clouds of dust, sand, and exhaust, which the enemy can use to locate friendly forces. Drivers must avoid the harsh use of accelerators to prevent creating easily identifiable exhaust plumes.

3-169. Soldiers/Marines ensure all vehicles look alike by disguising critical vehicles, such as water tankers and fuel trucks, by placing canopies over their tanks. Troops cover vehicles with mesh netting supported by brackets along with local vegetation attached to further disrupt the silhouette. This hinders the enemy in identifying and targeting key assets while also reducing the amount of heat absorbed by the fuel tank and reducing fuel lost to evaporation. Soldiers/Marines avoid positioning vehicles at a halt in an easily recognizable geometric pattern. This makes Soldiers/Marines easier to identify and target with indirect fire.

3-170. After dismounting local security, camouflage is typically the next priority at halts. Soldiers/Marines take the following actions:

- Site in vegetation or shadow, if available.
- Cover shiny surfaces with burlap screens.
- Drape the net.
- Add any available vegetation to the net.
- Obscure or sweep away vehicle tracks for 164 feet (50 meters) behind vehicles.

3-171. Stationary aircraft take a relatively long time to conceal as they are fragile in comparison with other equipment, have a considerable heat signature, and must also be readily accessible for maintenance. Additionally, the more troops conceal aircraft, the greater their response time. Some aircraft cannot conduct operations while carrying their supporting camouflage equipment and will require supporting ground assets. When camouflaging aircraft—

- Ensure air avenues of approach support site access.
- Exploit the terrain to mask aircraft from enemy surveillance.
- Avoid extended ground operations at the site prior to occupation.
- Once on the ground, move aircraft into shadow if possible.

- Cover all reflective surfaces.
- If possible, shift the main rotor until it is at a 45-degree angle with the fuselage and drape a net over the rotor and fuselage.
- Conceal the remainder of the aircraft.

Command Posts

3-172. Command posts can be difficult to conceal in the desert. When Soldiers/Marines lack natural terrain features and foliage, they can use LCSS to conceal command posts and other locations so long as it is a similar color as the surrounding environment. Units prohibit vehicles and aircraft from approaching closer than absolutely necessary. During defense or stability operations, units can dig in stationary command posts that will remain in position for more than 72 hours for additional protection. Engineers can also construct berms around command posts to protect from shrapnel, enable access control, and break up the silhouette.

Supply Points

3-173. Supply points are considered high-value targets and must be concealed to prevent enemy detection. Often, the volume of traffic near supply points can challenge efforts to conceal their location in the desert. However, units can implement measures to both improve their ability to withstand an attack and avoid detection. Commanders consider the following when establishing supply points:

- Locate supply points near existing roads and trails as the construction or use of new trails may betray the supply point's location.
- Avoid creating an easily recognizable geometric pattern by spacing stocks irregularly, both in length and depth. If possible, the supply point should follow the shape and contour of the surrounding terrain.
- Stack stocks as low as possible and dig them in preferably.
- Camouflage stocks with LCSS, sand, gravel, burlap, netting, or other materials that match the local terrain.
- Mix the contents of each supply point so that the destruction of one supply point will not cause critical shortage of one particular commodity.

AIR AND MISSILE DEFENSE

3-174. Air and missile defense units protect the force from missile attack, air attack, and aerial surveillance by ballistic missiles, cruise missiles, conventional fixed- and rotary-wing aircraft, and UASs. These units prevent the enemy from interdicting friendly forces while enabling freedom of movement. All members of the combined arms team perform air defense tasks; however, ground-based air defense artillery units execute most Army air and missile defense operations. Air and missile defense elements coordinate and synchronize defensive fires to protect installations and personnel from over-the-horizon strikes. Army air and missile defense capabilities are an integral part of the theater air defense framework and support the area air defense commander.

3-175. All units must include a scheme for countering air attacks in their battle plans using both active and passive measures. Passive air defense measures to reduce a unit's vulnerability or minimize damage from an air attack include camouflage and concealment, positioning and dispersion, hardening of positions and facilities, and recovery and reconstitution plans. Active air defense is direct action taken to destroy enemy aerial platforms or reduce their effectiveness with all available weapons. (See ATP 3-01.8 for additional information on techniques for combined arms for air defense.) A well-integrated air and missile defense plan is critical to desert operations as the lack of masking terrain leaves units exposed to attack by enemy air and missiles.

3-176. Commanders and staff carefully plan to ensure that dispersion of forces does not create gaps in air defense coverage. The relatively long LOCs and the ability to maneuver over large areas increases requirements for dedicated air and missile defense units. Tactical-level active and passive air defense measures can be effective but are not a substitute for the capabilities provided by air defense units.

3-177. Commanders and staff use a critical asset list (CAL) and a defended asset list (DAL) to develop an air defense plan that protects key assets in theater. A *critical asset list* is a prioritized list of assets or areas, normally identified by phase of the operation and approved by the joint force commander, that should be defended against air and missile threats (JP 3-01). A *defended asset list* is a listing of those assets from the critical asset list prioritized by the joint force commander to be defended with the resources available (JP 3-01). During desert operations, defended assets may include petroleum or water infrastructure, such as pipelines, derricks, wells, and storage tanks.

AREA SECURITY

3-178. Military police perform area security tasks to protect forces, assets, and infrastructure in a theater of operations. They also assess and implement physical security measures and antiterrorism measures at critical sites, facilities, and bases. During desert operations, commanders can use military police to secure extended LOCs and vital infrastructure, such as petroleum pipelines, water storage facilities, and pumping stations. Protection of these critical items demands both active and passive measures, including overflight by returning aircraft or overwatch by convoy movements. The storage sites for water, food, ammunition, and POL have historically been high-value targets and must be protected.

CBRN OPERATIONS

3-179. Military forces use CBRN weapons to produce casualties, induce psychological shock, and disrupt or slow operations. Although chemical weapons use is prohibited under the Chemical Weapons Convention, threat forces may employ CBRN weapons in coordination with conventional weapons. (For a more information on CBRN operations, refer to FM 3-11. For a more information on obscurants, refer to ATP 3-11.50.)

Weather

3-180. The effectiveness of CBRN weapons and obscurants is directly proportional to air stability. Air stability is a result of temperature variations at different altitudes. Desert temperatures vary greatly between day and night. At night and early morning, desert air is very stable. This may be the best time for CBRN and obscurant employment because of extensive downwind drift and area coverage. Desert air is very unstable during the late morning through afternoon. This may be the worst time for CBRN and obscurant employment because of quick and irregular dissipation. Unstable air may lead to ineffective target area coverage and possible danger to unintended populations. Commanders and CBRN officers consider the differences in air stability presented in paragraph 1-12 when assessing the dissipation pattern of CBRN agents and obscurants in desert environments.

3-181. Some chemical agents that come in contact with the skin work more effectively when employed in high temperatures. Bodies react to and absorb chemical agents more quickly due to open pores and increased perspiration.

3-182. High winds are common in certain desert seasons and have the greatest effect on the dissemination of biological, chemical, obscurant, and radioactive clouds. In general, the optimal wind speed for effective dispersion of biological, chemical, obscurant, and radioactive clouds is between 5 and 10 knots. Below 5 knots, the clouds remain stagnant and do not spread optimally. Above 10 knots, the clouds tend to disperse, thereby reducing effectiveness and potentially spreading the cloud in an unpredicted manner.

3-183. The lack of humidity in most deserts reduces the effectiveness of obscurants. Obscurant particles grow when they absorb moisture from the air. The lack of humidity in desert air decreases the particle size and density of the obscurant making it less effective.

Terrain

3-184. Open desert terrain facilitates the spread of CBRN agents evenly and steadily in all directions. Nuclear-induced radiation is greater in sandy soil due to the high silica content. Desert soil below the surface crust is a fine powder, so the blast and suction effects of a nuclear detonation will cause considerable dust clouds.

Chemical Weapons in the Desert

3-185. Chemical weapons use is prohibited under the Chemical Weapons Convention. However, many nations continue to produce chemical weapons and the definition of chemical hazards has been expanded to account for the prevalence of toxic industrial chemicals that may be encountered on the battlefield. A *chemical hazard* is any chemical manufactured, used, transported, or stored that can cause death or other harm through toxic properties of those materials, including chemical agents and chemical weapons prohibited under the Chemical Weapons Convention as well as toxic industrial chemicals (JP 3-11).

3-186. Chemical agents are used to create casualties, degrade performance, slow maneuver, restrict or deny the use of terrain, and disrupt logistics support. High explosives can be mixed with a chemical agent to conceal the use of chemicals and compound their effects and dispersion area. Persistent chemical agents are often used to create contaminated areas that inhibit or block maneuver, while nonpersistent agents are generally used in areas through which the enemy plans to maneuver.

3-187. The desert environment can significantly affect the employment of chemical weapons. High daytime temperatures increase the incapacitating effect of liquid agents but also cause liquid agents to evaporate more quickly and decrease their duration. Strong winds also increase the evaporation rate of liquid agents but cause chemical clouds to drift downwind in irregular patterns and concentrations that tend to disperse target area coverage. If a liquid chemical agent soaks into the desert sand, it can increase the time of hazard. Air instability (late morning and early afternoon) usually causes quick, vertical, and irregular dissipation of chemical agents reducing concentration and target area coverage. Desert air stability (early morning and evening) generally results in effective concentration and target area coverage.

3-188. Supply points and logistics centers are high-value targets for chemical attacks. Contaminating supplies and equipment can significantly disrupt operations by delaying sustainment support, reducing critical supply stores, and dramatically increasing the consumption of decontamination supplies. Commanders should provide air and missile defense assets to protect key supply points from enemy attack by ballistic missiles armed with chemical weapons.

Biological Weapons in the Desert

3-189. The United States is a signatory to the Biological Weapons Convention and therefore renounces the development, production, acquisition, transfer, retention, stockpiling, and use of biological and toxin weapons; however, many potential threats continue to maintain or develop biological weapons and the potential for their use remains a concern. A *biological agent* is a microorganism (or a toxin derived from it) that causes disease in personnel, plants, or animals or causes deterioration of materiel (JP 3-11). Biological agents may be disseminated as a liquid or vapor using rockets, bombs, or aerosol generators.

3-190. Biological agents can produce lethal effects in anywhere from 1 to 24 days from the time of exposure. However, high temperatures (120 degrees Fahrenheit [49 degrees Celsius] and higher) and sunlight can destroy many biological agents left exposed on surfaces. Rapid evaporation rates and low humidity can also deprive biological agents of the necessary moisture particulates required to circulate in the air. Cooler nighttime temperatures and the lack of sunlight provide biological agents a chance to linger and infect personnel. High winds disperse biological agents in a manner that decreases their effectiveness. Stable desert air conditions (night or early morning) provide the greatest agent concentration and area coverage. Unstable desert air conditions (late morning and afternoon) promote atmospheric mixing and lower agent concentration, reducing effective target coverage.

3-191. There are several measures units can take to reduce the risk of exposure to biological agents. Units test water and food sources frequently for potential contamination. Sanitation, personal hygiene, and immunizations are important measures for protecting individual troops.

3-192. Toxins are extracted from biological sources or synthetically manufactured. Toxins can be a liquid, vapor, or powder, and delivered by aerosol generators, artillery, rockets, or bombs. Depending upon the toxin, the lethal effects produced can last anywhere from one minute to 12 hours from the time of exposure.

Nuclear Weapons in the Desert

3-193. Several adversaries maintain nuclear capabilities while others actively seek to develop or acquire them. Forces can deliver nuclear weapons by missiles or bombs to detonate in the air, on the ground, or below the ground. Depending upon the radiation dosage received, lethality could be immediate or delayed for days.

3-194. Nuclear weapons are not just strategic weapons and can have a significant impact on operations. Through radioactive contamination, forces can use nuclear weapons to block, deny, or prevent the use of key terrain and mobility corridors. This has the potential to significantly inhibit movement and maneuver by making otherwise unobstructed desert areas impassable. Nuclear weapons used in this manner canalize and compartmentalize forces, subjecting them to further targeting by conventional indirect fire. Forces can also use tactical nuclear weapons to target troop and equipment concentrations and large command posts. Commanders disperse their forces and establish redundant command posts to mitigate the potential effects of nuclear weapons.

3-195. Nuclear weapons are used to physically separate forces by echelon and mission. In the defense, they can be used to block follow-and-support or follow-and-assume forces from supporting operations in the close area. In the offense, nuclear weapons are used to prevent a counterattacking force from striking at flanks or other vulnerable areas.

3-196. Nuclear weapons release energy in three forms: blast, nuclear radiation, and thermal radiation (heat and light). Each of these forms of energy can significantly affect unprepared or exposed Soldiers/Marines.

Blast

3-197. High desert temperatures in the middle of the day result in decreased air density, so nuclear blast waves move faster. Nuclear blasts, whether air burst or ground detonated, raise considerable amounts of desert sand and dirt that can inhibit observation and maneuver for extended periods. The lower desert air density causes less of a drop in static overpressure, but a more rapidly expanding shock wave. This increases the danger to aircraft and helicopters flying in the area. Nuclear blasts degrade desert trafficability in the immediate area of the strike, especially for wheeled vehicles, due to the destruction of hardened surfaces.

Nuclear Radiation

3-198. Immediate nuclear radiation is a function of weapon yield and changes little with the environment. Residual radiation is high in the case of low air burst or ground burst weapons. The time of day and the wind affects residual radiation in the desert. At night with no wind, residual radiation evenly distributes around the point of burst. At night with a steady wind, residual radiation drifts downwind for many miles. In the late afternoon, residual radiation may drift in a totally irregular pattern and direction due to air instability. In flat, sandy deserts the absence of significant terrain features allows radiation to disperse unobstructed in multiple directions, thereby increasing the risk of exposure. Desert sand can absorb significant amounts of radiation due to the high level of silica in the soil. Staffs constantly monitor and recon for radiation to prevent troops from maneuvering into contaminated areas.

Thermal Radiation

3-199. The range that thermal radiation (heat and light) can spread increases in the desert where little masking terrain exists. This increased range increases the risk that thermal radiation can burn or blind troops. Thermal radiation can extend up to 31 miles (50 kilometers) from the point of detonation. A unit needs to warn troops within this radius to take cover and protect themselves when it detects a pending detonation.

Mission-Oriented Protective Posture

3-200. The threat of a chemical, biological, or nuclear attack requires commanders to consider the MOPP gear of their forces. MOPP includes the use of protective masks and clothing as well as vehicle configuration and operation. While MOPP gear protects Soldiers/Marines from the effects of chemical, biological, and nuclear weapons, it can also degrade performance by increasing physical stress, obstructing vision, and complicating movement. Troops in protective gear fire weapons less accurately, move more slowly, and must rest more often. This degradation is compounded by the extreme heat common to most deserts. Changing the

MOPP level during operations requires Soldiers/Marines to stop their actions and adjust their equipment appropriately. Commanders consider METT-TC/METT-T in addition to the weather when deciding on an appropriate MOPP level for their forces.

3-201. Leaders recognize that heat stress and fatigue increase significantly when performing strenuous activity in MOPP gear and they adjust the work/rest cycle to account for this additional strain. MOPP gear adds ten degrees to the WBGT index and, when performing strenuous activity in heat category five, troops require 50 minutes of rest for every ten minutes of work. Leaders must carefully monitor water consumption. Soldiers/Marines working in these conditions should consume a quart of water every hour. Leaders also consider conducting hard work during cooler parts of the day or at night to reduce the risk of heat casualties when troops must wear MOPP gear. See table 1-1 on page 1-13 for more information on the work/rest cycle and recommended water consumption rates.

Decontamination

3-202. Decontamination operations are challenged by the lack of natural water sources in most deserts. Although decontamination takes place as far forward as possible, the lack of water may make this infeasible and deliberate decontamination efforts may have to occur further to the rear where infrastructure exists to support it. Sea water may be used as a substitute for fresh water during normal decontamination operations, but equipment should be rinsed with fresh water to prevent corrosion. For more information on decontamination operations and CBRN passive defense see ATP 3-11.32/MCRP 10-10E.8/NTTP 3-11.37.

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Chapter 4
Desert Offensive Operations

This chapter describes characteristics of the offense and types of offensive operations. It reviews the forms of maneuver and describes how the desert environment impacts them. It briefly examines the warfighting functions and implications for them during offensive operations in the desert. The chapter concludes by describing how commanders consolidate gains as they transition from offensive operations.

OFFENSIVE OPERATIONS

4-1. An *offensive operation* is an operation to defeat or destroy enemy forces and gain control of terrain, resources, and population centers (ADP 3-0). They impose the commander's will on the enemy. A commander may also conduct offensive actions to deprive the enemy of resources, seize decisive terrain, deceive or divert the enemy, develop intelligence, or hold an enemy in position. Units can destroy the enemy by concentrating friendly forces at a weak point in the enemy's defense and destroying enemy combat units, or by driving deep into the enemy's rear to destroy its sustainment elements and cut the enemy's LOCs. No force can survive in the desert for long without sustainment.

4-2. An attacking force conducts aggressive reconnaissance to the front, flanks, and rear, not only to locate and identify enemy obstacles, units, weak points, and flanks, but also to give early warning of threats to their flanks and sustainment elements. Aggressive reconnaissance is even more important in the desert given the lack of masking terrain and concealment. Therefore, commanders need to push reconnaissance units as far out from the main body as possible to allow early warning and to deny the enemy observation.

4-3. Leaders at all levels assess and exploit the terrain to gain an advantage over the enemy. However, due to the scarcity of key terrain in some desert environments, the only limitations placed upon a maneuvering force may be its ability to maintain responsive sustainment and to protect its sustainment elements from enemy attack. The longer the LOCs become, the more susceptible they are to attack.

4-4. In most deserts, the scarcity of large areas of defensible terrain means that a defending force has at least one flank open to attack. The attacking force must seek this flank and attempt to maneuver around it into the defender's rear before the defender can react and block the envelopment with mobile reserves.

4-5. Successful desert offensive operations depend on rapid, responsive, and violent maneuver, seeking a vulnerable enemy flank while exposing none to the enemy. The enemy, realizing the danger of remaining stationary in this terrain, may choose to conduct spoiling attacks or to counterattack. The resulting engagement between the two attacking forces often consists of a series of flanking actions and reactions with success going to the force that can find the other's unguarded flank first.

4-6. Given the vast maneuver spaces and large AOs typical of desert operations, commanders carefully consider how their subordinate forces can support each other without becoming over extended. Commanders develop their scheme of maneuver and concept of operations to ensure main and supporting efforts can synchronize their actions at decisive points in spite of the vast distances that may separate them. *Mutual support* is that support which units render each other against an enemy, because of their assigned tasks, their position relative to each other and to the enemy, and their inherent capabilities (JP 3-31). In Army doctrine, mutual support is a planning consideration related to force disposition, not a command relationship. Mutual support has two aspects: supporting range and supporting distance. *Supporting range* is the distance one unit may be geographically separated from a second unit yet remain within the maximum range of the second unit's weapons systems (ADP 3-0, and MCWP 3-01 and MCRP 1-10.2). *Supporting distance* is the distance between two units that can be traveled in time for one to come to the aid of the other and prevent its defeat by an enemy or ensure it regains control of a civil situation (ADP 3-0). *Supporting distance* is the distance

between two units that can be traveled in time for one to come to the aid of the other (MCWP 3-01 and MCRP 1-10.2). Due to the large maneuver distances in the desert, mutual support does not mean that one unit is always in position to fire against an enemy threatening another unit. However, units must be capable of maneuvering in support of one another as the situation develops. This often depends on a robust command and control framework, a resilient communications network, and responsive sustainment that provide commanders the flexibility necessary to adjust their plan in real time.

CHARACTERISTICS OF THE OFFENSE

4-7. Characteristics of the offense include audacity, concentration, surprise, and tempo. Effective offensive operations capitalize on accurate and timely intelligence to maneuver forces to positions of relative advantage before contact. Contact with enemy forces before the decisive operation is deliberate and designed to shape the optimum situation for the decisive operation. The decisive operation relies on subordinate initiative and shared understanding to exploit friendly advantages and present the enemy with multiple dilemmas.

AUDACITY

4-8. Audacity is a willingness to take bold risks. Commanders demonstrate audacity by balancing risk with potential gains as they execute their plans. In the desert, commanders that know the terrain and its impact on maneuver forces are better positioned to incorporate audacity into their plan without placing their forces at undue risk. Units also achieve audacity by using special operations forces to conduct shaping operations throughout the depth of the battlefield/battlespace. Combining special operations forces actions with conventional attacks can unhinge an enemy's defensive plan.

CONCENTRATION

4-9. Concentration is massing the effects of combat power in time and space at the decisive point to achieve a single purpose. Concentration requires the coordination of unified action partner capabilities in multiple domains to create opportunities that enable offensive land operations. Information systems provide relevant information that helps commanders determine when to concentrate their forces. By massing combat power rapidly along converging axes and synchronizing the effects of supporting assets in multiple domains, attackers overwhelm enemy forces.

4-10. In desert operations, the attacking force creates a major advantage by concentrating the effects of combat power at the point and time of its choosing. However, in a well-prepared defense, the defender often has the advantage of interior lines. The defender reinforces or repositions forces more quickly using routes that are shorter than those that the attacking force must use to reach the same location. Successful desert operations require converging air and ground maneuver with overwhelming all-domain fires at decisive points. To achieve proper synchronization and precise effects, commanders consider the unique time and distance relationships set by the environment.

4-11. Concentrating forces during desert operations requires careful coordination and planning to reduce risk. The open terrain and unobstructed fields of fire make it easy for the enemy to detect and target concentrations of forces. Because of this, commanders typically disperse forces for increased protection. Units must be able to rapidly concentrate at a given time and place and then disperse just as rapidly to avoid being targeted by the enemy. Commanders also consider that concentration does not necessarily require vehicles and troops mass in a single area, but that units have the ability to place an overwhelming concentration of fires and effects across all domains on the enemy.

4-12. Concentration may require economy of force operations in other portions of the battlefield/battlespace. Commanders use MILDEC operations to mislead the enemy and conceal the strength and disposition of forces in both the decisive operation and economy of force operations. MILDEC operations play a key role in allowing commanders to concentrate forces when masking terrain and concealment is unavailable.

SURPRISE

4-13. Commanders surprise enemy forces by attacking at a time or place or in a manner for which enemy forces did not prepare or expect. Commanders achieve surprise by showing enemy forces what they expect

to see while actually doing something different. Surprise delays enemy reactions, overloads and confuses enemy command and control systems, induces psychological shock, and reduces the coherence of the enemy's defense. Accurately assessing the enemy's intent and appropriate timing and synchronization are necessary to achieve surprise.

4-14. Because the desert terrain is not conducive to achieving surprise, Army/Marine Corps forces achieve surprise by attacking across various domains using innovative methods. For example, commanders plan airborne or air assault operations to vertically envelop the enemy, Marine Corps forces conduct an amphibious assault on an unexpected flank, or mechanized forces attack deep into the enemy's rear. Commanders arrange these operations either sequentially or simultaneously to achieve surprise and to deny the enemy the advantages inherent in the defense.

TEMPO

4-15. *Tempo* is the relative speed and rhythm of military operations over time with respect to the enemy. (ADP 3-0, and MCWP 3-01 and MCRP 1-10.2). A high tempo allows Army/Marine Corps forces to achieve surprise and quickly gain positions of advantage. Controlling operational tempo and not allowing the different tempos of dissimilar formations to adversely affect synchronization is a challenge that commanders must overcome. However, controlling tempo ensures the enemy remains off-balance and cannot adequately prepare a successful defense. Maintaining a higher tempo than the enemy requires a combined arms force that is better led, trained, prepared, and resourced.

4-16. The tempo of most desert operations is relatively high. The unobstructed terrain permits rapid maneuver, and forces exploit this characteristic to maintain momentum. However, commanders and staff carefully balance the tempo of an operation with their ability to sustain it. Commanders take innovative steps to overcome sustainment challenges, maintain tempo, and extend operational reach. For example, air assault or airborne forces can be used to establish a forward logistics element or FARP in the deep area to maintain the tempo of mechanized forces as they progress across the battlefield/battlespace.

4-17. Key to maintaining tempo is the use of a sizeable operational reserve. A reserve enables commanders to execute follow-and-assume or follow-and-support missions when the main effort nears its culminating point or requires reconstitution. Commanders can also use a reserve to enable continuous operations by permitting some forces to rest and refit while operations continue.

4-18. Commanders cannot achieve the demanding tempo of desert operations without the careful synchronization and integration of combined arms. Commanders leverage their attack aviation, air support, and mechanized forces to advance across open desert at a faster rate than the enemy. They use permissive control measures to allow field artillery and other fires to engage the enemy at maximum range. They converge EW, cyberspace, information, and fires at decisive points to create confusion and frustrate enemy command and control. Subordinate initiative drives movement and maneuver as forces exploit these opportunities to outflank or penetrate an overextended enemy in disarray.

TYPES OF OFFENSIVE OPERATIONS

4-19. Offensive operations consist of movement to contact, attack, exploitation, and pursuit. Each of these types of operations are possible in the desert; however, the exploitation and pursuit are often extremely successful given the open terrain and ease of movement/maneuver.

MOVEMENT TO CONTACT

4-20. *Movement to contact* is a type of offensive operation designed to develop the situation and establish or regain contact (ADP 3-90). The goal of a movement to contact is to make initial contact with a small element while retaining enough combat power to develop the situation and mitigate the associated risk. A movement to contact creates favorable conditions for subsequent tactical actions. Commanders conduct a movement to contact when the enemy situation is vague or not specific enough to conduct an attack. During a movement to contact, once an enemy force makes contact, the commander has five options: attack, defend, bypass, delay, or withdraw. Subordinate variations of a movement to contact include search and attack and cordon and search operations.

4-21. Although movements to contact involve using the smallest force necessary to make contact with the enemy, given the vast areas and large formations prevalent during desert operations, commanders plan and organize their security formations to execute movements to contact. A security force performing a guard or cover should stay prepared to conduct a movement to contact if they locate the enemy. In organizing their security force for a movement to contact in the desert, commanders exploit the open terrain by maneuvering their cavalry formations abreast with a tank unit trailing in reserve. When the unit makes contact, the tank company can either assist the cavalry troops with breaking contact or attack to destroy the identified enemy formation. This provides the commander with tactical flexibility and positions the unit to quickly adapt to the situation on the ground.

The Battle of 73 Easting

On 26 February 1991, Colonel Leonard D. Holder's 2nd Armored Cavalry Regiment (ACR) was maneuvering east across the Iraqi desert as the covering force for the 1st Infantry Division. As VII Corps' lead security formation, 2nd ACR was tasked with conducting a movement to contact to locate the elite Iraqi Republican Guard Tawakalna Division. Lieutenant General Frederick Franks, the VII Corps commander, ordered Colonel Holder to "gain and maintain contact, determine [the] size, disposition, [and] strength [of the Tawakalna Division]," but, "Do not become decisively engaged." After fixing the enemy armored division, the 2nd ACR would pass the fight to the 1st Infantry Division at 70 Easting, which would then attack to destroy the Tawakalna Division, significantly degrading the Iraqi center of gravity.

Colonel Holder, unable to use his aviation units because of a sandstorm, organized his three cavalry squadrons on line and initiated the advance east. In the north, 2nd Squadron began receiving airburst indirect fire at approximately 1540 and quickly encountered several enemy fighting vehicles and tanks in hasty defensive positions. Destroying three enemy tanks, 2nd Squadron continued to advance with E and G Troops in the lead, followed by F Troop and H Company (tanks) in the rear. With the sandstorm limiting visibility, E Troop, commanded by Captain H.R. McMaster, ran into an enemy strong point located at a small village where several trails intersected. Captain McMaster reacted quickly and ordered his two lead tank platoons to attack the enemy battalion. Although outnumbered, the tank platoons dispatched the enemy armor while the scout platoons provided suppressive fire to protect the tanks from attack by dismounted infantry. Soon, Captain McMaster had occupied the only high ground in the area and positioned his forces to effectively defeat a subsequent counterattack. Although E Troop attacked beyond the planned limit of advance, and finally halted at 73 Easting, the armored cavalry troop destroyed well over half of an enemy battalion occupying prepared defensive positions.

Fighting immediately south of 2nd Squadron, 3rd Squadron also encountered elements of the Tawakalna Division and defeated several counterattacks. Later that evening, G Troop met stiff resistance from dismounted infantry and T-72 tanks attempting to use the limited visibility to attack through G Troop and flank E Troop from the south. Unfortunately for the Iraqis, the tube-launched, optically tracked, wire-guided (commonly known as TOW) anti-tank missiles and M1A1 Abrams main gun sites could see through the darkness and target both enemy tanks and infantry fighting vehicles. After the smoke cleared, it became evident that G Troop destroyed two Iraqi tank companies and killed hundreds of enemy soldiers during the reckless counterattack. Further south, 1st Squadron destroyed the final remaining battalion of the Iraqi 50th Brigade and, by 1700, was on line with the rest of the 2nd ACR.

Heeding Lieutenant General Franks' order to "not become decisively engaged," Colonel Holder ordered 2nd ACR to halt at 73 Easting and prepare to pass the 1st Infantry Division. The 2nd ACR had successfully executed its movement to contact and had fixed the Tawakalna Division. Outnumbered and facing an enemy in prepared defensive positions, the regiment's well-trained combined arms teams relied on speed and audacity to overwhelm and destroy two armored battalions, setting conditions for VII Corps' continued attack on the Iraqi center of gravity.

ATTACK

4-22. An *attack* is a type of offensive operation that destroys or defeats enemy forces, seizes and secures terrain, or both (ADP 3-90). An *attack* is an offensive action characterized by coordinated movement, supported by fire, conducted to defeat, destroy, or capture the enemy or seize and/or secure key terrain (MCWP 3-01 and MCRP 1-10.2). Attacks incorporate coordinated movement supported by fires. They may be part of either decisive or shaping operations. A commander may describe an attack as hasty or deliberate, depending on the time available for assessing the situation, planning, and preparing. A commander may decide to conduct an attack using only fires, based on an analysis of the mission variables. An attack differs from a movement to contact because in an attack the commander knows at least part of an enemy's disposition. This knowledge enables commanders to better synchronize and employ combat power.

4-23. The synchronized employment of combined arms is crucial to a successful attack in the desert. Although uniquely suited for desert operations, commanders avoid attacking with only armored or mechanized forces without their supporting infantry. Commanders use infantry to protect armored forces from enemy infantry and to clear and hold urban desert terrain.

4-24. Several subordinate forms of the attack, particularly the ambush and raid, are less common in the desert due to the lack of natural cover and concealment. However, depending on the mission variables, commanders may execute a raid by using air assault forces to rapidly infiltrate and exfiltrate an objective. The desert's open terrain is conducive to establishing numerous HLZs that air assault raiding forces can use. Having multiple subordinate forms integrates both flexibility and redundancy into the raid, enabling the raiding force and supporting aviation assets to adjust to conditions as they unfold and choose from several different HLZs to infiltrate and exfiltrate forces.

4-25. Field artillery raids also work effectively in the desert. During a field artillery raid, typically self-propelled field artillery units exploit the desert's open terrain to push beyond the forward line of own troops (known as FLOT) and execute a fire mission within enemy territory. This enhances the range of the artillery units that are typically positioned in the close or rear area. Field artillery raids can induce shock and surprise in an enemy that does not expect to be within indirect fire range. When organizing forces for a field artillery raid, commanders ensure the field artillery is highly mobile and supported by a security force.

4-26. A demonstration, another subordinate form of the attack, also works well in the desert. In military deception, a *demonstration* is a show of force similar to a feint without actual contact with the adversary, in an area where a decision is not sought that is made to deceive an adversary (JP 3-13.4). The Marine Corps amplification adds operation designed to divert enemy attention, allowing the forces of a Marine air-ground task force to execute decisive action elsewhere. It is a show of force that threatens an attack at another location but does not make contact with the enemy (MCWP 3-01 and MCRP 1-10.2). Demonstrations are often effective in the desert because the open terrain permits numerous potential avenues of approach and a defending commander is often eager for information concerning the most likely friendly COA or scheme of maneuver. The lack of natural cover or masking terrain also makes it easy for the enemy to observe friendly movements and the massing of combat power. After observing friendly actions, the enemy may construct its defense around the information collected from the demonstration. However, having deceived the enemy, friendly forces can attack along an axis of advance or from a direction of attack unexpected by the enemy. As such, well-planned demonstrations can be important components of MILDEC operations.

EXPLOITATION

4-27. Exploitations seek to disintegrate enemy forces to the point where they have no alternative but to surrender or retreat. An *exploitation* is a type of offensive operation that usually follows a successful attack and is designed to disorganize the enemy in depth (ADP 3-90). An *exploitation* is an offensive operation that usually follows a successful attack and is designed to disorganize the enemy in depth (JP 2-01.3). Marine Corps amplification of the joint definition is an offensive operation following a successful attack that is designed to disorganize the enemy in depth. It extends the initial success of the attack by preventing the enemy from disengaging, withdrawing, and reestablishing an effective defense (MCWP 3-01 and MCRP 1-10.2). Exploitations take advantage of tactical opportunities. Division and higher echelon headquarters normally plan exploitations as branches or sequels.

4-28. Exploitations can be particularly effective in the desert as the lack of reinforcing terrain makes it difficult for an enemy to prepare a thorough defense in depth. After breaking through the enemy's main defensive line, commanders anticipate continuing the attack by rapidly moving through the open terrain to target the enemy's rear area. A *breakthrough* is a rupturing of the enemy's forward defenses that occurs as a result of a penetration. A breakthrough permits the passage of an exploitation force (FM 3-90-1). Commanders prepare for an exploitation by weighting the assault force or other follow-on forces with highly mobile armored units.

PURSUIT

4-29. A *pursuit* is a type of offensive operation designed to catch or cut off a hostile force attempting to escape, with the aim of destroying it (ADP 3-90). A *pursuit* is an offensive operation designed to catch or cut off a hostile force attempting to escape, with the aim of destroying it (MCWP 3-01 and MCRP 1-10.2). A pursuit normally follows a successful exploitation. However, if enemy resistance breaks down and enemy forces flee the battlefield, any type of offensive operation can transition into a pursuit. Pursuits entail rapid movement and decentralized control. Bold action and calculated initiative are required in the conduct of a pursuit.

4-30. There are two variations of the pursuit: frontal and combination. In a frontal pursuit, the commander employs only a single force to maintain direct pressure on the retrograding enemy by conducting operations along the same retrograde routes used by that enemy. A combination pursuit employs a direct pressure force and an encircling force to cut off the enemy's escape. A *direct pressure force* is a force employed in a pursuit operation that orients on the enemy main body to prevent enemy disengagement or defensive reconstitution prior to envelopment by the encircling force. It normally conducts a series of attacks to slow the enemy's retirement by forcing the enemy to stand and fight (FM 3-90-1). In pursuit operations, an *encircling force* is the force which maneuvers to the rear or flank of the enemy to block the enemy's escape so that the enemy can be destroyed between the direct pressure force and encircling force. This force advances or flies along routes parallel to the enemy's line of retreat. If the encircling force cannot outdistance the enemy to cut the enemy off, the encircling force may also attack the flank of a retreating enemy (FM 3-90-1). In pursuit operations, an *encircling force* is the force that maneuvers to the rear or flank of the enemy to block its escape so that it can be destroyed between the direct pressure force and encircling force. This force advances or flies along routes parallel to the enemy's line of retreat. If the encircling force cannot outdistance and cut off the enemy, the encircling force may also attack the flank of a retreating enemy (MCWP 3-01).

4-31. Like exploitations, the desert's open terrain and the associated rapid maneuver make pursuits highly effective in the desert. Commanders may use air assault forces as an encircling force in a combination pursuit. The numerous potential HLZs for an air assault force provides the commander with flexibility and allows the unit to insert and reposition the air assault force rapidly at various key points along the enemy's line of retreat. While capable of serving as the encircling force in other environments, the desert's unpredictable weather and high winds make airborne forces unsuitable for most desert operations.

FORMS OF MANEUVER

4-32. Maneuver is the dynamic element of combat; the means of concentrating forces at decisive points to achieve surprise, psychological shock, and momentum to overwhelm a larger force or a prepared defender. Through maneuver, commanders exploit the full potential of their fires, avoid undesirable terrain, bypass

enemy defensive positions, and compel the enemy to fight on terrain of their choosing. Commanders use the forms of maneuver in various combinations to gain and maintain a position of advantage over the enemy. Army/Marine Corps forces maneuver before and during an attack. The forms of maneuver include envelopment, frontal assault, infiltration, penetration, and turning movement. The desert's unrestricted terrain makes it conducive to most forms of maneuver with the exception of infiltration.

ENVELOPMENT

4-33. *Envelopment* is a form of maneuver in which an attacking force seeks to avoid the principal enemy defenses by seizing objectives behind those defenses that allow the targeted enemy force to be destroyed in their current positions (FM 3-90-1). *Envelopment* is an offensive maneuver in which the main attacking force passes around or over the enemy's principal defensive positions to secure objectives to the enemy's rear (MCWP 3-01 and MCRP 1-10.2). At the tactical level, envelopments focus on seizing terrain, destroying specific enemy forces, and interdicting enemy withdrawal routes. The commander's decisive operation focuses on attacking an assailable flank. It avoids the enemy's strength—the enemy's front—where the effects of enemy fires and obstacles are the greatest. Generally, a commander prefers to conduct envelopment instead of a penetration or a frontal attack because the attacking force tends to suffer fewer casualties while having the most opportunities to destroy the enemy. Envelopment can also produce great psychological shock to the enemy. If no assailable flank is available, the attacking force creates one through the conduct of a penetration. The four varieties of envelopment are the single envelopment, double envelopment, encirclement, and vertical envelopment. A single envelopment results from maneuvering around one assailable flank of a designated enemy force. A double envelopment results from simultaneous maneuvering around both flanks of a designated enemy forces. *Encirclement* operations are operations where one force loses its freedom of maneuver because an opposing force is able to isolate it by controlling all ground lines of communications and reinforcement (ADP 3-90). Vertical envelopments are tactical maneuvers in which troops, either airborne or air assault, attack the rear and flanks of a force, in effect cutting off or encircling the force.

4-34. Commanders use clear, restrictive control measures when conducting double envelopments, encirclements, and vertical envelopments in the desert. Because these operations involve separate units in contact maneuvering towards each other, the risk for fratricide is significant. The extended engagement ranges typical during desert operations compounds this risk. Often, forces are capable of engaging before they can properly identify a target as friend or foe. Control measures used to mitigate the risk of fratricide during an envelopment can include phase lines, limits of advance, contact points, restrictive fire lines, restrictive fire areas, no-fire areas, and clearly identifiable boundaries between converging units.

4-35. Executing an envelopment in the desert often proves more challenging than in other environments because the open terrain permits the enemy to retreat in various directions, unconstrained by terrain. In other environments, or in mountainous deserts, a commander conducting an envelopment can use natural terrain obstacles, such as a ridge, as one of the enveloping arms. When conducting an envelopment in open, sandy desert, the enveloping force must possess greater mobility than the enemy.

FRONTAL ATTACK

4-36. A *frontal attack* is a form of maneuver in which an attacking force seeks to destroy a weaker enemy force or fix a larger enemy force in place over a broad front (FM 3-90-1). A *frontal attack* is an offensive maneuver in which the main action is directed against the front of the enemy forces (MCWP 3-01 and MCRP 1-10.2). An attacking force can use a frontal attack to rapidly overrun a weak enemy force. Commanders commonly use a frontal attack as a shaping operation in conjunction with other forms of maneuver. A commander normally employs a frontal attack to—

- Clear enemy security forces.
- Overwhelm a shattered enemy during an exploitation or pursuit.
- Fix enemy forces in place as part of a shaping operation.
- Conduct a reconnaissance in force.

4-37. Because the desert is so conducive to rapid movements by large formations, frontal attacks are commonly used to fix an enemy force capable of maneuvering away from the desired engagement area.

However, commanders recognize that frontal attacks can also produce significant casualties. This risk is increased in the desert as a defending enemy is capable of engaging the attacking force at extended ranges and the attacker is often forced to maneuver without natural cover or concealment. Commanders carefully integrate and synchronize the use of combined arms to mitigate the risks associated with a frontal attack. Preparatory fire is used to suppress and neutralize enemy indirect fire and cover the attacking force. Close air support and attack aviation destroy enemy armor and enable the attacking force's freedom of movement.

INFILTRATION

4-38. An *infiltration* is a form of maneuver in which an attacking force conducts undetected movement through or into an area occupied by enemy forces to occupy a position of advantage behind those enemy positions while exposing only small elements to enemy defensive fires (FM 3-90-1). An *infiltration* is the movement through or into an area or territory occupied by either friendly or enemy troops or organizations. The movement is made, either by small groups or by individuals at extended or irregular intervals. When used in connection with the enemy, it implies that contact is avoided (MCWP 3-01 and MCRP 1-10.2). The lack of cover and concealment makes infiltrations difficult in many desert environments. Special operations forces or light infantry may infiltrate by air assault to avoid enemy detection. These forces can be used to conduct reconnaissance and to assist with targeting in the deep area.

PENETRATION

4-39. A *penetration* is a form of maneuver in which an attacking force seeks to rupture enemy defenses on a narrow front to disrupt the defensive system (FM 3-90-1, MCWP 3-01, and MCRP 1-10.2). Destroying the continuity of that defense allows the enemy's subsequent isolation and defeat in detail by exploiting friendly forces. The penetration extends from the enemy's security area through the main defensive positions into the enemy support area. A commander conducts a penetration when there is no assailable flank, enemy defenses are overextended and contain weak spots, or time pressures do not permit envelopment.

4-40. A penetration requires the attacking force to concentrate overwhelming combat power at the point of penetration. During the decisive operation, often a breach, the attacker possesses a nine to one combat power advantage over the defender. Commanders organize their forces into a breach, support, and assault force with a sizeable reserve capable of defeating an enemy counterattack. Using the reserve in this manner allows the assault force to focus on seizing the objective or destroying the remaining defensive position. Commanders also use their reserve to exploit the penetration's success by tasking them to follow-and-support or follow-and-assume the assault force.

4-41. The concentration necessary to execute a successful penetration in the desert can expose units to targeting by enemy indirect fire and aircraft without the protection of natural cover and concealment. To mitigate this, commanders allocate air and missile defense and field artillery units capable of conducting counterfire to protect forces in the area selected for penetration. The commander also considers methods to isolate the area of penetration from support or reinforcement by enemy forces. Often, a leader uses shaping operations to fix enemy reserves and long-range fires in their current locations to prevent them from attacking the decisive operation.

TURNING MOVEMENT

4-42. A *turning movement* is a form of maneuver in which the attacking force seeks to avoid the enemy's principle defensive positions by seizing objectives behind the enemy's current positions thereby causing the enemy force to move out of their current positions or divert major forces to meet the threat (FM 3-90-1). A turning movement is a form of offensive maneuver in which the attacking force passes around or over the enemy's principal defensive positions to secure objectives deep in the enemy's rear. A commander uses this form of offensive maneuver to seize vital areas in the enemy's rear area before the main enemy force can withdraw or receive support or reinforcements (MCWP 3-01). A commander can also affect a turning movement by using air assault forces to vertically envelop the enemy. Waterborne or amphibious forces can execute a turning movement by landing in the enemy's rear. A commander conducts a turning movement to seize vital areas in the enemy's support area before the main enemy force can withdraw or receive reinforcements. A turning movement differs from an envelopment in that the commander conducting a turning movement seeks to make the enemy force displace from its current location while the commander

conducting an envelopment intends to engage the enemy force in its current location from multiple or unexpected directions.

4-43. The unrestricted mobility and open terrain make turning movements effective forms of maneuver in the desert. Friendly forces can utilize the desert's large mobility corridors to attack from unanticipated directions and draw the enemy into open terrain. Once exposed, the enemy is more vulnerable to defeat in detail. As such, commanders conducting a turning movement often plan for a subsequent exploitation or pursuit.

Turning Movement: Third Army in Operation DESERT STORM

On 2 August 1990, Iraq forces invaded and quickly occupied its southern neighbor Kuwait. The unprovoked attack shocked the international community and soon a U.S. led coalition was preparing to respond. To prevent Iraq from driving further south and threatening the vital Saudi oil fields, elements of the XVIII Airborne Corps rapidly deployed to Saudi Arabia as part of Operation DESERT SHIELD. Later, VII Corps joined XVIII Airborne Corps; Third Army, the theater army, now had the combat power it needed to deter further aggression. After six months of planning and rehearsing in the Arabian desert, and with Saddam Hussein unwilling to withdraw his forces, Operation DESERT SHIELD became Operation DESERT STORM and Third Army initiated combat operations to liberate Kuwait.

To eject Iraqi forces from Kuwait, Third Army conducted a turning movement to draw the Iraqi forces out of their defensive positions in Kuwait and then destroy their most capable force, the Republican Guard, in the open deserts of northwestern Kuwait. To execute the maneuver, the highly mobile XVIII Airborne Corps, positioned on Third Army's western flank, used its air assault and mechanized forces to attack north approximately 260 kilometers into Iraq and to secure a portion of the Euphrates River Valley. The XVIII Airborne Corps would then turn east and threaten the Iraqi rear area. This deep attack would not only draw Iraqi forces from their prepared positions, but it also severed their supply lines running from Baghdad to Kuwait and prevented reinforcements from joining the fight.

As the XVIII Airborne Corps launched its attack into Iraq, VII Corps, operating further east, breached a weakly held portion of the Iraqi border and then turned east to strike at the retreating Iraqi forces. General Frederick Franks, the VII Corps commander, tasked the 1st Infantry Division with conducting the breach and then passing the 1st Armoured Division (United Kingdom) to attack the Iraqi 52nd Division. Simultaneously, the U.S. 1st and 3rd Armored Divisions, with the 2nd Armored Cavalry Regiment as a covering force, penetrated an uncontested portion of the border and began enveloping Iraqi forces from the west. Once the Republican Guard was turned from its defensive positions by the XVIII Airborne Corps attack, VII Corps was in position to attack directly into its flank.

Third Army's concept of operations during DESERT STORM embodied all the characteristics of effective maneuver. It incorporated several forms of maneuver to overwhelm and surprise the defending Iraqi forces. The 1st Infantry Division and 1st Armoured Division conducted a penetration to fix and destroy elements of the Iraqi VII Corps holding the enemy's western flank. The 1st and 3rd Armored Divisions executed a single envelopment to attack the Republican Guard from an unanticipated direction. Together, XVIII Airborne Corps and VII Corps turned the Iraqi defenders and achieved a position of advantage that enabled them to fight on terrain of their choosing and defeat the Republican Guard in just four days.

WARFIGHTING FUNCTION CONSIDERATIONS

4-44. Each battle or engagement has unique characteristics, such as types of weapons, degree of tactical mobility, and influence of various effects across multiple domains. The commanders most likely to enjoy

tactical success can visualize the battlefield, understand the implications of existing friendly and enemy dispositions, and take effective action first. Commanders maintain this momentum by following up attacks quickly to deny enemy forces any opportunity to adjust or adapt to a new situation. The tempo of friendly operations must be fast enough to prevent effective enemy counterattacks. Commanders maintain pressure by adjusting combinations of friendly capabilities to exploit initial gains and create further dilemmas for an enemy commander. In preparing for offensive operations in the desert, commanders consider implications by warfighting function.

INFORMATION

4-45. The information warfighting function supports offensive operations by deceiving the enemy, damaging enemy morale, and providing noncombatants with methods for avoiding areas where combat is likely. MILDEC and military information support operations (MISO) constitute the primary types of information operations conducted during the offense. MISO teams conduct information operations in the offense to encourage adversary forces to defect, desert, flee, or take any other action beneficial to friendly forces. Additionally, MISO teams conduct information operations to degrade enemy command and control. Methods for MISO include face-to-face engagements, broadcasts on loudspeakers, distributed leaflets, radio and television broadcasts, and postings on internet-supported communications including social media.

4-46. There are various methods for disseminating information in desert environments. Commanders determine the most appropriate method for disseminating information by assessing the condition of the information infrastructure in the AO, the population's access to information technology, and the traditional methods of information exchange. Many desert populations use internet, cellular phone, and satellite-based technologies to exchange information. Commanders can leverage these same technologies to communicate with populations via social media or internet-based news services. However, in more traditional societies, or in areas where the information infrastructure has been either damaged or destroyed, commanders may need to rely on more rudimentary methods for disseminating information. In these environments, Marines conduct information operations by distributing leaflets, broadcasting programs on shortwave radio, or hosting face-to-face meetings and engagements. Often, commanders may have to meet in-person with tribal or local leaders and community members to conduct information operations effectively.

4-47. Commanders use MILDEC to deceive the enemy and protect the main effort. MILDEC is used to—

- Achieve surprise.
- Preserve friendly forces, equipment, and installations from destruction.
- Minimize an enemy's advantage.
- Gain time.
- Cause an adversary to deploy forces or capabilities prematurely or in a manner or location advantageous to friendly forces.
- Cause an adversary to waste combat power with delayed or inappropriate actions; thereby ceding initiative to friendly forces.
- Influence the adversary's intelligence collection focus.
- Condition the adversary to particular patterns of friendly behavior that friendly forces can exploit later.

COMMAND AND CONTROL

4-48. The large AOs typical of desert operations may require additional signal support—such as retransmission teams, joint network node signal assets, and access to satellite communications—to facilitate command and control across large, separated formations.

4-49. Units conducting offensive operations should expect to operate in a degraded communications environment. Degradation may occur from environmental circumstances, such as sandstorms, or enemy action directed against friendly communications and information systems. Units use mission orders and a clear commander's intent to remain effective in a degraded communications environment, regardless of the source of the degradation.

MOVEMENT AND MANEUVER/MANEUVER

4-50. Mobility is essential for effective offensive operations in the desert. In the desert, commanders must be able to move, exploit, and pursue an enemy across a wide front. When attacking, commanders concentrate the effects of combat power at selected locations. This may require engineer support to improve or construct combat trails through areas where routes do not exist. The surprise achieved by attacking through an area believed impassable may justify the effort expended in constructing these trails. Whenever possible, forces bypass existing obstacles and minefields instead of breaching them. The inherent trafficability of many desert environments supports mobility, but extensive route reconnaissance is required to ensure the movement and maneuver/maneuver scheme is feasible for armored forces.

4-51. Rivers and other gaps remain major obstacles during military operations. Deliberate gap crossings are among the most critical, complex, and risky combined arms operations. Forces conduct hasty crossings as a continuation of the attack whenever possible because the time needed to prepare for a gap crossing allows enemy forces more time to strengthen their defense. The size of a gap, as well as the enemy and friendly situations, dictates the specific TTP used in conducting a crossing. Although counterintuitive, commanders prepare their forces for both hasty and deliberate gap crossings prior to conducting desert operations. Many deserts host large rivers, and most are dotted with irrigation canals to enable agriculture. Training and preparation for gap crossings is a high-payoff task as the procedure for conducting a gap crossing is very similar to conducting a breach. Breaches are common during desert operations as the lack of natural terrain features require the enemy to use obstacles and mines to disrupt friendly movement and block avenues of approach. (For more information on gap crossing and breaching, see ATP 3-90.4/MCTP 3-34A [MCWP 3-17.8].)

4-52. The ability to fight at night, under limited-visibility conditions, or while employing obscuration is an important prerequisite to effective maneuver. The performance of tasks and the conduct of operations under these conditions reduce the risk of detection and enemy targeting in deserts that lack masking terrain. Offensive tasks performed in these conditions can achieve surprise and make enemy visual target acquisition more difficult.

4-53. As a general rule, a force attacking in daylight should try to attack when the sun is comparatively low and positioned behind the force as it advances. This enables friendly forces to plainly see enemy targets without their shadows while the defenders—who face the sun—are handicapped by glare, mirages, and haze from the sun. However, it is not always possible, nor essential, for the sun to be directly behind the attackers. The commander of a maneuver force should attempt to keep the sun somewhere on a 3,200-mil arc to the flanks or rear of the unit, allotting significant discretion for an angle of attack.

4-54. Dust and blowing sand create observational hazards to a maneuvering force. Elements should move in echelon with overwatching elements on the upwind side. Conducting ground and aviation operations in areas with fine dust or snow significantly increases accidental and operational risk. Since it is impossible to disguise dust clouds created by vehicles conducting movement and maneuver/maneuver during daylight, attacks should occur as rapidly as possible to minimize enemy reaction time.

4-55. The decision to conduct movement or maneuver/maneuver through a sandstorm or blizzard depends on mission variables and the direction and intensity of the storm. If the advancing unit is caught in a storm blowing from the enemy's direction, the safest alternative is to halt until it abates, although this may not always be possible. In some situations, it may be possible for platoons to form close columns and continue movement. When the storm blows toward the threat, it is possible, and often extremely effective, to conduct an attack immediately behind the storm. However, sandstorms may prevent aviation support and observed fires.

4-56. Operations conducted under limited visibility conditions require additional planning and preparation to mitigate risk and prevent fratricide. They frequently require additional restrictive control measures. Land navigation, already challenged by the lack of easily identifiable terrain features, proves even more challenging during inclement weather or limited visibility. Leaders ensure that night-vision and navigation systems required to maneuver under these conditions are available and functional. Leaders rehearse these operations before execution to ensure complete integration and synchronization of their plan.

INTELLIGENCE

4-57. IPB is critical to supporting desert maneuver. During IPB, the intelligence staff works closely with the other staff sections to develop the MCOO. Among other things, the intelligence staff uses the MCOO to depict mobility corridors suitable for use by armored forces. The MCOO can also include line of sight overlays to assist the commander in identifying mobility corridors and avenues of approach that will conceal friendly movement from the enemy. Line of sight overlays identify slopes in terrain that, although gradual, can conceal movement at distance. These overlays are particularly important in deserts where few natural terrain features exist to mask friendly movement.

4-58. During desert operations, staffs use situation templates. The tempo and scope of offensive operations in the desert make it especially challenging for the development and distribution of real-time intelligence products to inform the commander and staff. Situation templates prove invaluable when commanders do not have real-time intelligence products to support offensive operations. A *situation template* is a depiction of assumed adversary dispositions, based on that adversary's preferred method of operations and the impact of the operational environment if the adversary should adopt a particular course of action (JP 2-01.3). Marine Corps amplification is a series of projections that portray, based on enemy doctrine, the most probable disposition and location of enemy forces within constraints imposed by weather and terrain (MCRP 1-10.2). When used with the MCOO, situation templates address terrain, mobility corridors, artillery range fans, movement times between enemy reserve assembly area locations and advancing friendly forces, and other related intelligence variables.

FIRES

4-59. As an attacking force moves forward, preparation fires sequentially neutralize, suppress, or destroy enemy positions. Preparation fires are normally high-volume fires delivered over a short period to maximize surprise and shock. Preparation fires are particularly important during desert operations since the lack of masking terrain can expose an attacking force to enemy direct and indirect fire at significant ranges. Commanders assess the probable effects of preparation fires against losing a degree of surprise or increasing their vulnerability to counterfires when determining whether to fire an artillery preparation. Commanders may also decide to employ precision munitions against selected high-payoff targets to negate the requirement for long duration preparation fires using standard munitions.

4-60. Preparation fires include the conduct of EW and offensive cyberspace operations. Because they do not carry the same risk of fratricide as conventional fires, EW and cyberspace operations can continue while ground maneuver forces remain engaged in close combat. In this capacity, EW and cyberspace operations can continue to disrupt enemy command and control and prevent a coordinated response or counterattack.

4-61. Artillery raids also work as an effective technique in the desert since the open terrain can permit a mobile artillery force to operate in the close or deep area for short engagements. Units can use artillery raids to target the enemy's rear area or other high-payoff targets that the enemy believes are beyond the range of conventional field artillery. During an artillery raid, an artillery unit, accompanied by a security force, establishes hasty position areas for artillery (PAAs) well forward of its standard positions, fires predetermined targets, and then rapidly displaces back to its PAAs in the close or rear area. When planning an artillery raid, commanders establish hasty PAAs in a location or from a direction that the enemy will least expect. This can frustrate or delay counterfire operations allowing the artillery unit time to displace before receiving return fire. Units can also use artillery raids to deceive the enemy as to the true location and disposition of friendly forces.

4-62. A defending enemy possessing artillery, rocket, and CEMA capabilities seeks to use any advantage to disrupt friendly command and control, fire support, information collection, and sustainment activities. Methods that an attacking force could employ when faced with a defending enemy force enjoying superior fire support capabilities include—

- Target selected enemy forces to enable the forward displacement of friendly fire support systems.
- Disperse attacking troops, systems, and supplies as much as is possible.
- Protect attacking troops, systems, and supplies by only moving them into attack positions at the last possible moment.

- Counter enemy target acquisition efforts by effectively using military deception, cover, and concealment.
- Target enemy command and control nodes.
- Rapidly penetrate the enemy's security area to neutralize its long-range fires by closing the distance between enemy and friendly forces.

4-63. Short-range air defense assets in support of an offensive operation are generally weighted toward the unit's decisive operation. These assets establish a protective corridor over the terrain traversed by the main effort. Short-range air defense assets are critical to effective offensive operations in the desert as the lack of foliage and masking terrain exposes maneuver forces to observation and attack by enemy aircraft.

SUSTAINMENT/LOGISTICS

4-64. Sustainment/logistics maintains the momentum of an attack by delivering supplies as far forward as possible. Sustainment/logistics commanders must act, rather than react, to support requirements. The existence of habitual support relationships facilitates the ability to anticipate requirements.

4-65. Commanders can use throughput distribution and preconfigured packages of essential items to help maintain offensive momentum and tempo in the desert. Logistics units and materiel remain close to a maneuver force to ensure a short turnaround time for supplies and services. This includes uploading as much critical materiel—such as POL and ammunition—as possible. Commanders conceal logistics preparations for an attack to deny enemy forces indications of their unit's tactical plans.

4-66. The availability of adequate supplies and transportation to sustain an operation becomes more critical as the operation progresses and the LOCs lengthen, the quantity of POL required to move supplies increases, and the requirements for repair and replacement of weapons systems increase. Sustainment units in direct support of maneuver units must be as mobile as the forces they support.

4-67. In preparing for an offensive operation, commanders may pre-position sustainment caches at tactical assembly areas or attack positions to provide maneuver forces a full complement of Class I, Class III, and Class V before attacking. However, commanders must take precautions to secure these logistics bases and ensure they do not compromise the friendly forces' anticipated scheme of maneuver.

4-68. The burden on medical resources increases due to the intensity and lethality of offensive operations in the desert and the increased distances over which units require support as a force advances. Medical units must anticipate large numbers of casualties over a large geographic area. If either force employs weapons of mass destruction, greatly increased casualties can exceed the capabilities of organic and direct support medical assets. Units should plan and rehearse nonstandard casualty evacuation procedures.

PROTECTION/FORCE PROTECTION

4-69. Commanders maximize offensive operations at night to conceal movement and maneuver and protect forces from detection. Night operations exploit Army/Marine Corps technical advantages while avoiding the extreme heat common during the day. Operating at night can increase effectiveness while reducing requirements for potable water. Observation varies according to the amount of ambient light and the type of sensors Soldiers/Marines use. During nights when the moon is full or almost full, the clear desert sky and ample ambient light allow good observation, both with the naked eye and with passive image intensifiers, or NVDs. However, units must exercise strict light discipline since the terrain does not conceal artificial light. Even against peer threats, the advantages of Army/Marine Corps technical and tactical night fighting capabilities can be decisive.

CONSOLIDATE GAINS

4-70. Because they occur in portions of the AO where large-scale combat operations have ended, commanders consolidate gains as a means of transitioning from offensive operations to stability operations. *Consolidate gains* are activities to make enduring any temporary operational success and to set the conditions for a sustainable security environment, allowing for a transition of control to other legitimate authorities (ADP 3-0). Consolidation of gains in not a synonym for stability, counterinsurgency, or nation building. It

describes activities designed to make the achievement of the military objective enduring. As such, it encompasses a broad array of tasks combined in variable ways over time specifically addressing the desert context. Offensive, defensive, and stability tasks all contribute to the consolidation of gains and are not tied to a specific timeline or phase. It is about exploiting tactical success by establishing security and stability in a manner decisive enough to achieve national strategic aims.

4-71. To consolidate gains effectively and efficiently requires a commander who clearly understands both the purpose of the operation and all potential enemy capabilities to resist. The critical assumption for planning is that enemy forces will use all means at their disposal to protract a conflict. Consolidating gains requires commanders to exploit their existing combat power advantage by pursuing the enemy's remaining means of resistance and denying it the ability to prolong conflict after the enemy's original forces in the field are defeated. This exploitation and pursuit can involve several simultaneous lines of effort or operations including—

- Defeating or reducing bypassed enemy forces.
- Securing critical infrastructure and equipment such as weapons caches, munition depots, fuel storage areas, server farms, and radio and television stations.
- Securing military installations and police stations.
- Ensuring the continuity of essential services such as water, sewer, trash, and electric.
- Controlling and accounting for captured or surrendered enemy forces.
- Establishing security and order in accordance with the ROE and the law of land warfare.
- Influencing public opinion and discrediting the enemy's narrative.

4-72. The temporal window for consolidating gains can be relatively limited. Commanders must rapidly account for bypassed or defeated enemy forces before these elements transition to irregular warfare or criminal enterprises. The enemy may also attempt to incite civil unrest and ultimately resist consolidation of gains by perpetuating the conflict or preying on the population.

4-73. While consolidating gains requires a combination of both security and stability tasks, commanders may transition stability tasks to other forces, the HN, or a unified action partner if the security situation permits. This enables Army/Marine Corps forces to consolidate gains elsewhere or to contribute to ongoing offensive operations. For example, there may be sufficient HN civilian or military governance in place to ensure that the population has adequate food and medical care. Because large portions of the desert are uninhabited, Army/Marine Corps forces may focus primarily on security tasks in most areas while stability operations occur in key urban areas.

4-74. Activities to consolidate gains may occur over a significant period and involve transitions in both focus and partners. Emphasis will shift from actions to ensure the defeat of remaining threat forces to measures that address the needs of the population. That emphasis eventually shifts to the transfer of responsibility from Army/Marine Corps forces to a HN government, interagency partners, or other organizations.

4-75. Forces establish credibility and legitimacy with a local population in the way they conduct operations. The civilian population's perception of legitimacy will influence how it reacts to military forces. Adversaries often seek legitimacy by assuming roles that gain favor with the population, such as resolving disputes, influencing key leaders, providing essential services, or protecting the population from criminal elements. Consolidating gains may ultimately decide who possesses the ability to compel, control, influence, and gather support from a population. Therefore, throughout desert operations, Army/Marine Corps leaders have legal and moral responsibilities to establish area security and restore services while combatting the efforts of threat forces working against friendly objectives. (See JP 3-07, ADP 3-07, and MCWP 3-03 for further information on legitimacy and other stability considerations.)

CONSOLIDATION AREA FRAMEWORK

4-76. During large-scale combat operations, a consolidation area refers to the portion of the commander's AO that may be designated to facilitate freedom of action, consolidate gains through decisive action, and set conditions to transition the AO to follow-on forces or other legitimate authorities. In the consolidation area, forces establish a level of control that allows for the performance of tasks to consolidate gains. The consolidation area may or may not contain support areas that focus on support to forward deployed units.

Assigning a consolidation area to a subordinate headquarters allows the higher echelon headquarters to adequately focus resources on close operations and allows a subordinate headquarters to make progress towards consolidating gains and achieving desired objectives. It is the first step towards the transition from offensive operations to stability operations.

4-77. Commanders assign forces to consolidation areas as soon as possible to maintain tempo and allow forces in the close area to focus on offensive operations. Planning to assume responsibility for a consolidation area should begin early. Thorough planning covers considerations for modifying ROE or escalation of force procedures, requesting IGO or NGO support, establishing liaisons with unified action partners or the HN, and coordinating with civil affairs units in the AO. By planning to transition consolidation areas to follow-on forces as close areas are secured, the commander enables close combat forces to maintain the initiative and maneuver without loss of momentum.

Note. A consolidation area requires additional combat power and is not intended to draw forces from the close or deep area. Units in the close area do not typically conduct consolidation of gains activities.

ACTIVITIES TO CONSOLIDATE GAINS

4-78. Activities to consolidate gains consist of security and stability tasks and will likely involve combat operations against bypassed enemy forces and remnants of defeated units. Normally, most of a unit's efforts focus on the performance of area security/rear area security at the onset of operations to consolidate gains. Area security includes activities to protect friendly forces, installations, and routes within a specific area. The weight of effort will shift toward the performance of stability tasks as the security environment improves. (See Chapter 6 for more information on stability operations.)

4-79. *Area security* is a type of security operation conducted to protect friendly forces, lines of communications, and activities within a specific area (ADP 3-90). During activities to consolidate gains, the security force may also protect the civilian population, institutions, or infrastructure. Key infrastructure includes water treatment plants, electric power stations, government facilities, and cultural sites. During desert operations, oil and gas pipelines and their associated storage facilities are considered key infrastructure that units should protect to facilitate post-conflict stability and prevent damage to the environment. Commanders use a combination of fixed checkpoints, mobile patrols, and UAS to monitor and secure extended oil and gas pipelines in the desert.

4-80. The Marine Corps conducts rear area security. This type of security includes measures taken prior to, during, or after an enemy airborne attack, sabotage, infiltration, guerrilla action, or initiation of psychological or propaganda warfare to minimize its effects. The Marine air-ground task force rear area is described as that area extending rearward from the rear boundary of the ground combat element and the Marine air-ground task force rear boundary.

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Chapter 5
Desert Defensive Operations

This chapter outlines the purpose and characteristics of desert defensive operations. It describes the types of defensive operations, the forms of the defense, and the desert's impact on defensive operations by warfighting function. Lastly, this chapter discusses transitions to offense and retrograde.

DEFENSIVE OPERATIONS

5-1. A *defensive operation* is an operation to defeat an enemy attack, gain time, economize forces, and develop conditions favorable for offensive or stability operations (ADP 3-0). *Defensive operations* are operations conducted to defeat an enemy attack, gain time, economize forces, and develop conditions favorable to offensive and stability operations. The three types of defensive operations are area, mobile, and retrograde (MCWP 3-01 and MCRP 1-10.2). Normally, the defense cannot achieve a decisive victory. However, it sets conditions for a counteroffensive or counterattack that enables forces to regain the initiative. Purposes for performing defensive operations include—

- Deterring or defeating an enemy offensive.
- Gaining time.
- Achieving economy of force.
- Retaining key terrain.
- Protecting the population, critical assets, and infrastructure.
- Refining intelligence.

5-2. The defense is what provides time for a commander to build combat power and establish conditions to transition to the offense. Initially, a defending commander is likely to be at a relative disadvantage against an attacking force, since the enemy can choose when and where to strike. This is often compounded in desert environments where unrestricted or open terrain provides the attacker with numerous options for their scheme of maneuver. The defender is at a further disadvantage in sandy or dune deserts where the lack of easily defensible terrain requires significant countermobility and survivability operations to improve defensive positions. However, the terrain in mountainous or rocky plateau deserts often provides the defender with multiple options for canalizing enemy maneuver forces and counterattacking from natural strongpoints or battle positions. The attacker often possesses a significant combat power advantage with defending forces lacking sufficient fires, air and missile defense, and aviation assets early in the campaign. Units may not have enough joint fires, and the enemy may have dominance in one or more of the domains that limits joint capabilities.

5-3. Commanders have several considerations when planning a defense. The keys to a successful defense include—

- Timely detection of the enemy's course of action.
- Concentrating effects at the decisive time and place.
- Depth.
- Security (forward, flank, and area security/rear area security in support areas).
- The ability to shape and exploit terrain.
- Flexibility.
- Designation, composition, location, and employment of the reserve.
- Timely resumption of the offense.

5-4. Much like they do during offensive operations, commanders conduct shaping operations in the defense. Shaping operations consist of aggressive reconnaissance and counterreconnaissance to determine the enemy's scheme of maneuver while concealing the disposition and composition of friendly forces. Commanders also conduct spoiling attacks to disrupt enemy preparations, gain additional time to prepare the defense, or destroy key assets the enemy requires for a successful attack. These shaping actions help to set the conditions for decisive action, such as the defeat of the enemy's main effort by a counterattack that could allow the friendly force to transition to the offense.

5-5. Defensive operations may be conducted during all phases of an operation. Certain terrain may require defense throughout an operation, such as—

- Deep water ports, key logistics installations, railyards, water pumping stations, airfields, bulk fuel storage sites, ammunition depots, and oil wells.
- Key terrain features, such as mountain passes.

CHARACTERISTICS OF THE DEFENSE

5-6. Characteristics of the defense include disruption, flexibility, maneuver, mass and concentration, operations in depth, preparation, and security. Effective defensive operations rely on accurate and timely intelligence and other relevant information regarding enemy forces, weather, and terrain. A defender deliberately seeks opportunities to disrupt and attrit an attacker throughout the depth of their formation to set conditions for the transition to the offense.

DISRUPTION

5-7. Defenders disrupt attacks through aggressive counterreconnaissance operations and spoiling attacks. They counterattack to deny the enemy the ability to exploit its initial tactical gains. Defenders conduct EW and offensive cyberspace operations to disrupt enemy command and control systems and isolate forward echelons from their higher headquarters. Commanders conduct countermobility operations to disrupt enemy maneuver forces attacking through open desert terrain. In areas where the terrain does not inhibit enemy maneuver, engineers emplace mines and obstacles to block, disrupt, or canalize enemy forces into engagement areas where they can be destroyed.

FLEXIBILITY

5-8. The defense requires flexible plans that anticipate enemy actions but allow for adjustments as the situation develops. Commanders develop plans that exploit the advantages of using interior lines to rapidly reposition forces and they do not hesitate to shift the main effort once the enemy's scheme of maneuver is revealed. They constitute a reserve and position it where it can quickly respond to enemy penetrations or counterattack as necessary. They designate primary, alternate, and supplementary battle positions in depth and ensure units have rehearsed transitioning between each of their assigned positions.

MANEUVER

5-9. Both offensive and defensive desert operations are characterized by combined arms maneuver. Ideally a defending force retains the ability to maneuver against an attacking enemy during all types of defensive operations. The mobile defense requires a striking force to maneuver against the enemy in a decisive counterattack. Retrograde operations also require maneuver as the delaying force or security force attrits the enemy without becoming decisively engaged. Generally, a defending force becomes highly vulnerable to defeat in detail when it loses the ability to maneuver or cannot outpace the attacking force. Commanders rely heavily on aviation and mechanized forces to maneuver across the large areas typical of desert operations.

MASS AND CONCENTRATION

5-10. Defenders seek to mass and concentrate the effects of overwhelming combat power against the enemy's decisive operation. Defenders may surrender ground or conduct economy of force operations in some areas to concentrate forces at decisive points in support of the main effort. They avoid dispersing their forces in defensive positions across wide desert areas and instead leverage intelligence to identify the enemy's

decisive operation and concentrate forces against it. The open terrain of sandy or dune deserts enables the rapid repositioning of forces at decisive points once the enemy's scheme of maneuver is determined. The reserve may also be used to concentrate combat power, preserve the integrity of the defense in threatened sectors, or prevent culmination. Once committed, the commander reconstitutes a reserve from remaining forces available. Commanders conduct deception operations to conceal potential weak points in their defense where they have assumed risk to concentrate forces elsewhere.

Military Deception: 1st Cavalry Division in Operation DESERT STORM

On 17 January 1991, U.S. Central Command (USCENTCOM) transitioned from Operation DESERT SHIELD, a defensive operation, to Operation DESERT STORM, an offensive operation, by launching an air campaign designed to disrupt Iraqi command and control, destroy their integrated air defense system, and establish air superiority. However, transitioning on the ground required a careful military deception (MILDEC) operation to protect the coalition's main effort and conceal the true direction of attack.

During Operation DESERT SHIELD, most coalition ground combat units were stationed in northeastern Saudi Arabia along the Kuwaiti border. As a defensive operation this positioning made sense. The primary purpose of Operation DESERT SHIELD was to defend against an Iraqi attack into Saudi Arabia while building combat power for potential response options. As such, the preponderance of VII Corps' forces were positioned east of a dry riverbed known as Wadi al Batin directly south of the Iraqi Army's positions in Kuwait. However, Operation DESERT STORM called for VII Corps to attack from the west of Wadi al Batin into the weaker flank of the Iraqi Army. To do this, Lieutenant General Frederick Franks needed to move the bulk of his corps 150 miles west without raising Iraqi suspicions.

To conceal VII Corps' direction of attack, the 1st Cavalry Division was charged with executing an MILDEC operation along the heavily defended border east of Wadi al Batin in order for the rest of VII Corps to occupy its attack positions west of the wadi. On 21 January 1991, the 1st Cavalry Division replaced the Syrian 9th Armored Division along the section of the border opposite the Iraqi defenses. Over the next month, the 1st Cavalry Division's mission was to convince Iraqi intelligence that the U.S. attack would occur near Wadi al Batin and that the 1st Cavalry Division would lead the charge. To execute a believable MILDEC operation, Brigadier General Tilelli, the 1st Cavalry Division commander, knew that he had to engage the Iraqi defenders in combat without becoming decisively engaged. To do this, the 1st Cavalry Division established a security zone along their front and began conducting aggressive reconnaissance and counterreconnaissance operations. The division actively patrolled the border with both aviation and ground units. These operations led to several skirmishes with Iraqi reconnaissance forces. On 5 February, an attack helicopter from 1st Cavalry Division took fire from an Iraqi observation post. In response, on 7 February, 1st Battalion, 82nd Field Artillery destroyed the observation post and an accompanying attack helicopter targeted the fleeing Iraqis with a wire-guided missile.

Further reinforcing the deception operation, the division tasked its engineers with blasting holes in the ten-foot-tall berm that separated Iraq from Saudi Arabia. The gaps were designed to convince the Iraqi defenders that the U.S. main effort would indeed attack where they expected it. However, the most significant phase of the deception operation came on 19 and 20 February, when 2nd Brigade conducted Operation NIGHT STRIKE, a reconnaissance-in-force mission to determine the Iraqi defender's composition, disposition, and intent. The operation was led by 1st Squadron, 5th Cavalry, which attacked 6 miles (10 kilometers) into Iraq where it first made contact. Leaders of 1st Squadron, 5th Cavalry believed they were attacking hastily dug-in reconnaissance forces that they could easily defeat or capture. However, the unit had advanced into the middle of the Iraqi 25th Infantry Division's security zone and was soon engaged by well-sited and camouflaged enemy armor and recoilless rifles. After five hours of combat, 1st Squadron, 5th Cavalry withdrew back across the border, but not without losing three vehicles, five killed in action, and nine wounded.
1st Cavalry Division's MILDEC operation enabled VII Corps to transition the bulk of its forces west of Wadi al Batin into their attack positions without betraying VII Corps' intentions. 1st Cavalry Division was a natural choice to execute the operation; Iraqi intelligence could be easily convinced that the division was the covering force for the VII Corps' main body that would surely advance up the wadi. The division's aggressive patrolling, engineer operations, and reconnaissance-in-force were audacious and made the operation believable.

OPERATIONS IN DEPTH

5-11. *Operations in depth* is the simultaneous application of combat power throughout an area of operations (ADP 3-90). Commanders plan their operations in depth to facilitate subordinate operations. They set conditions by destroying or disrupting enemy long-range fires, air and missile defense, sustainment/logistics, and command and control. Operations in depth can damage, confuse, and even paralyze an enemy force. Operations in depth prevent the enemy from maintaining its tempo. Generally, within the close area, the commander establishes a security area and the main battle area (MBA) with its associated forward edge of the battle area (known as FEBA). When possible, commanders tie their operations in depth to naturally reinforcing terrain. This is particularly effective in mountainous or rocky plateau deserts where terrain features, such as ridges, can function as strongpoints for larger defensive zones. In sandy or dune deserts they consider the effect that rivers or canals will have on attacking forces when identifying locations for primary, alternate, supplementary, and successive positions.

PREPARATION

5-12. Defenders arrive in their AOs before the attacker and use the available time to prepare. Defenders study the terrain and the enemy and prepare engagement areas. They combine natural and man-made obstacles to canalize attacking forces into those engagement areas. They place information collection assets throughout their AOs to provide information and early warning of enemy actions. They integrate fires into the defense and establish PAAs in depth to support the movement of artillery assets. Defenders improve survivability by constructing field fortifications, using camouflage, and dispersing. Defending forces conduct rehearsals and preparations to ensure all units are familiar with their various battle positions and the routes between them. Significant engineer support is often required to prepare defensive positions in desert environments. The lack of natural cover and concealment require engineers to construct survivability positions and obstacles, such as anti-tank ditches and minefields. Preparations may also include route signing as the lack of easily identifiable terrain features in sandy or dune deserts can make retrograde operations under pressure extremely difficult.

SECURITY

5-13. Commanders secure their forces by performing area security, protection, OPSEC, and CEMA tasks. They also protect their forces with air and missile defenses. Security tasks prevent enemy intelligence, surveillance, and reconnaissance from determining the location, disposition, and composition of friendly forces. They also conceal friendly preparations, engagement areas, and the MBA. These measures also provide early warning and continuously disrupt enemy attacks. Protection efforts preserve combat power. Commanders use MILDEC and CEMA to inaccurately portray friendly forces and mislead the enemy about their size, disposition, and composition. Security may include the provision of area security for civilians, infrastructure, and LOCs in the rear area.

5-14. Security areas in desert environments are deeper than in other environments as the lack of masking terrain and natural foliage increases the risk that enemy forces will observe or attack friendly forces at extended ranges. Commanders add depth to the security area by assigning smaller frontages to security forces and using aviation units to provide early warning of enemy reconnaissance forces. Security forces conduct counterreconnaissance operations in the security area to prevent the enemy from observing friendly forces and defensive preparations.

TYPES OF DEFENSIVE OPERATIONS

5-15. There are three types of defensive operations: the area defense, the mobile defense, and the retrograde. All three contain both static and mobile elements. Mobility is crucial to effective defensive operations in the desert as the unobstructed terrain makes static defenders vulnerable to attack by a mobile enemy. Mobile defenses may employ static positions to help control the depth and breadth of enemy penetration and ensure retention of ground from which to launch counterattacks. In area defenses, commanders may employ patrols, intelligence units, and reserve forces to cover the gaps among defensive positions, reinforcing as necessary and counterattacking from defensive positions as directed. In retrogrades, commanders use mobile forces to draw an adversary into a position of disadvantage and then target the enemy from static battle positions. Defending commanders may combine all three patterns, using static elements to delay, canalize, and halt the attacker, while using mobile elements, such as spoiling attacks and counterattacks, to strike and destroy enemy forces. The balance of these patterns depends on the enemy, mission, force composition, mobility, relative combat power, and the nature of the conflict.

5-16. The open and unrestricted terrain common to most deserts presents additional challenges for the defender. Generally, commanders incorporate the terrain into their defensive plan to canalize the enemy, direct them along natural lines of drift and avenues of approach into engagement areas, and prevent them from deploying the brunt of their combat power simultaneously. However, in the desert, commanders must use a combination of defensive activities and countermobility operations to compensate for the lack of restrictive terrain. (For more information on defensive operations, see FM 3-90-1.)

AREA DEFENSE

5-17. The *area defense* is a type of defensive operation that concentrates on denying enemy forces access to designated terrain for a specific time rather than destroying the enemy outright (ADP 3-90). The *area defense* is a type of defense in which the bulk of the defending force is disposed in selected tactical localities where the decisive battle is to be fought. Principal reliance is placed on the ability of the forces in the defended localities to maintain their positions and to control the terrain between them. The reserve is used to add depth, to block, or restore the battle position by counterattack (MCWP 3-01 and MCRP 1-10.2). The focus of an area defense is on retaining terrain where the bulk of a defending force positions itself in mutually supporting, prepared positions. Units maintain their positions and control the terrain between the position of enemy forces and the terrain they desire. The decisive operation focuses fires into engagement areas, possibly supplemented by a counterattack. Commanders use their reserve to reinforce fires, add depth, block, or restore a position by counterattack; to seize the initiative; and to destroy enemy forces.

5-18. The area defense is extremely difficult in the desert as the lack of reinforcing terrain leaves battle positions exposed to enemy fire. This sparse terrain precludes the use of strong points to anchor an area defense. A *strong point* is a heavily fortified battle position tied to a natural or reinforcing obstacle to create an anchor for the defense or to deny the enemy decisive or key terrain (ADP 3-90). A *strong point* is a key

point in a defensive position, usually strongly fortified and heavily armed with automatic weapons, around which other positions are grouped for its protection (MCWP 3-01 and MCRP 1-10.2). To account for the lack of reinforcing terrain, commanders conduct extensive countermobility operations and use engineer support to fortify their planned battle positions. They use obstacles to canalize and then fix enemy forces in engagement areas. In the desert, units often construct anti-tank ditches as effective obstacles they can integrate into an area defense.

5-19. Commanders conducting an area defense in the desert must identify a counterattack force and prepare to counterattack as soon as the enemy reaches its culminating point. The area defense succeeds once friendly forces have regained the initiative and transitioned to the offense.

MOBILE DEFENSE

5-20. The *mobile defense* is a type of defensive operation that concentrates on the destruction or defeat of the enemy through a decisive attack by a striking force (ADP 3-90). The *mobile defense* is defense of an area or position in which maneuver is used with organization of fire and utilization of terrain to seize the initiative from the enemy (MCWP 3-01 and MCRP 1-10.2). The mobile defense focuses on defeating or destroying enemy forces by allowing them to advance to a point where they are exposed to a decisive counterattack by a striking force. The *striking force* is a dedicated counterattack force in a mobile defense constituted with the bulk of available combat power (ADP 3-90). A *fixing force* is a force designated to supplement the striking force by preventing the enemy from moving from a specific area for a specific time (ADP 3-90). A fixing force supplements a striking force by holding attacking enemy forces in position, by canalizing attacking enemy forces into engagement areas, and by retaining areas from which to launch the striking force.

5-21. The mobile defense is the preferred type of defensive operation in the desert as the open terrain permits rapid maneuver from multiple avenues by a mechanized striking force. In this unrestricted terrain, the striking force and fixing force may conduct an envelopment to encircle an attacking enemy. The unobstructed fields of fire enable both the striking force and the fixing force to engage the enemy at maximum range.

RETROGRADE

5-22. The *retrograde* is a type of defensive operation that involves organized movement away from the enemy (ADP 3-90). *Retrograde* is the process for the movement of non-unit equipment and materiel from a forward location to a reset (replenishment, repair, or recapitalization) program or to another directed area of operations to replenish unit stocks, or to satisfy stock requirements (JP 4-09). Marine Corps amplifies the joint definition with this: any movement or maneuver of a command to the rear, or away from the enemy (MCWP 3-01 and MCRP 1-10.2). An enemy may force a retrograde, or a commander may execute one voluntarily. As a transitional operation, units do not conduct a retrograde in isolation but as part of a larger scheme of maneuver designed to regain the initiative and defeat the enemy. Each form of retrograde has its unique planning considerations, but considerations common to all retrogrades are risk, the need for synchronization, and security. Retrograde operations require numerous enablers, such as military police and engineers, to facilitate the rearward passage of lines as forces withdraw across AOs. During a retrograde, units use obstacles to disrupt and slow enemy formations so that friendly forces can maintain a higher rate of withdraw than the enemy's rate of advance.

5-23. The three forms of the retrograde are—

- Delay.
- Withdraw.
- Retirement.

Delay

5-24. A *delay* is when a force under pressure trades space for time by slowing down the enemy's momentum and inflicting maximum damage on enemy forces without becoming decisively engaged (ADP 3-90). A *delay* is a form of retrograde in which a force under pressure trades space for time by slowing the enemy's momentum and inflicting maximum damage on the enemy without, in principle, becoming decisively engaged (MCWP 3-01 and MCRP 1-10.2). In delays, units yield ground to gain time while retaining flexibility and freedom of action to inflict the maximum damage on an enemy.

5-25. The delay is one of the most demanding ground combat operations. A delay wears down the enemy so that friendly forces can regain the initiative through offensive action, buy time to establish an effective defense, or determine enemy intentions as part of the performance of echelon security tasks. The delaying force—normally organized into a main body, security force, and a reserve—accomplishes its mission by delaying on successive positions, by delaying on alternate positions, or by a combination of the two. It also attacks, defends, feints, or demonstrates. Normally in a delay, inflicting casualties on the enemy is secondary to gaining time. Except when directed to prevent enemy penetration of a phase line for a specific duration, a force conducting a delay normally does not become decisively engaged. The fixing force in a mobile defense might also conduct a delay to maneuver the attacking enemy force into a location where the striking force can make a decisive attack on enemy force elements to defeat that enemy force in detail.

5-26. Delays require numerous control measures, such as trigger lines and disengagement lines, to control fires and movement throughout the operation. The lack of identifiable terrain features in the desert can make it difficult for maneuver units to recognize control measures during close combat. Soldiers/Marines may have to rely on technology, such as battlefield command systems, to incorporate and visualize the necessary graphic control measures into the operation. Where few natural terrain features exist, commanders tie control measures to roads and trails to aid Soldiers/Marines in determining when to engage and disengage during a delay.

5-27. Commanders conduct countermobility operations and incorporate obstacles into their defensive plan to both canalize enemy forces into engagement areas and then slow their progress out of the engagement area. This enables friendly forces to rapidly displace to subsequent battle positions faster than the advancing enemy. Obstacles are used to turn, fix, disrupt, or block enemy formations. However, friendly forces must overwatch obstacles, and obstacle groups are integrated into the scheme of fires to ensure the enemy does not successfully breach and reduce obstacles.

Withdraw

5-28. *Withdraw* is to disengage from an enemy force and move in a direction away from the enemy (ADP 3-90). A withdrawal is a planned method of retrograde in which a force in contact disengages from an enemy force and moves in a direction away from the enemy (MCWP 3-01). Withdrawing units, whether all or part of a committed force, voluntarily disengage from contact to preserve the force or release it for a new mission. Withdrawals are challenging as the attacking force is often stronger than the defender. Commanders conduct a withdrawal when—

- They are at risk of being defeated.
- They joined battle on unfavorable conditions or terrain.
- Opportunity exists to draw the enemy into unfavorable terrain or a position of relative disadvantage.
- Forces must be redeployed or repositioned elsewhere.

5-29. Commanders typically organize a withdrawing unit into a security force, a main body, and a reserve. Commanders also organize a detachment left in contact and stay-behind forces if the scheme of maneuver requires them. The heavier the previous fighting and the closer the contact with the enemy, the more difficult the withdrawal.

5-30. A unit usually conducts its rearward movement at times and under conditions when the advancing enemy cannot observe friendly activity. However, concealment is difficult in the open confines of the desert. In addition to withdrawing under periods of limited visibility, commanders use EW, CEMA, and cyberspace operations to mask troop movement. They may also incorporate a MILDEC plan into the withdrawal to prevent the enemy from recognizing that they are disengaging.

5-31. Enablers, such as military police and engineers, are critical to facilitating a withdrawal. Enablers guide withdrawing units through gaps and lanes and around obstacles as the force moves to the rear. This maintains the withdrawing unit's tempo and ensures it outpaces the advancing enemy. The use of guides proves especially important when withdrawing during limited visibility as mechanized forces using NVDs may not be capable of seeing anti-tank ditches and other obstacles designed to slow the advancing enemy.

Retirement

5-32. A *retirement* is when a force out of contact moves away from the enemy (ADP 3-90). *Retirement* is an operation in which a force out of contact moves away from the enemy (MCWP 3-01 and MCRP 1-10.2). Retirement operations are administrative in nature. Commanders usually conduct retirement operations to reposition forces for future operations or to accommodate an updated concept of operations or scheme of maneuver.

5-33. The desert's open terrain and the ability for mechanized forces to conduct rapid maneuver increase the risk that a force conducting retirement may be attacked by the enemy. Although they are not in contact, commanders organize a retiring force for combat and consider security throughout the planning process. Retiring units employ advance, flank, and rear security. Typically, another unit's security force provides security for a retiring unit; however, commanders must plan for enemy contact and organize their unit for self-defense.

FORMS OF THE DEFENSE/DEFENSIVE METHODS

5-34. There are three forms of the defense—perimeter, linear, and reverse slope. The Marine Corps considers these defensive methods rather than forms, and identifies three additional methods: battle position, strong point, and sector (MCWP 3-01). They are the basic dispositions that a commander may employ to array forces in a defense relative to the terrain and enemy.

PERIMETER

5-35. The perimeter defense is most commonly conducted as part of an area defense when a unit must retain key terrain, such as a strong point, or when it must defend itself in areas where the defense is not tied in with adjacent units. Units also conduct the perimeter defense when a force must secure a critical site such as a base, PAA, or forward logistics element. A perimeter defense orients in all directions and requires aggressive patrolling and security operations beyond the perimeter to identify and defeat the enemy's attack. Advantages of the perimeter defense include the following:

- 360-degree security.
- Centralized control.
- Quick emplacement and simplicity.
- Easily adjusted and reinforced frontage where necessary.
- Interior lines that provide flexibility and allow the commander to shift forces rapidly where needed.

5-36. Disadvantages of the perimeter defense include the following:

- Enemy penetration creates problems with enfilade, masking, and cross fires.
- The perimeter's often circular shape makes it difficult to execute effective final protective fires.
- The circular shape of a perimeter defense exposes maximum personnel to the bursting radius of indirect fire landing within the perimeter.

5-37. The open terrain and numerous avenues of approach common to many deserts make conducting a perimeter defense extremely difficult. Commanders use obstacles and countermobility operations to limit the enemy's options for attacking the perimeter. Engineers support survivability operations by digging-in critical equipment and constructing improved fighting positions for both personnel and vehicles. Finally, commanders incorporate aggressive patrolling and reconnaissance operations to identify the enemy's scheme of maneuver and focus the maximum available firepower into designated engagement areas.

DEFENSE OF A LINEAR OBSTACLE

5-38. Units can conduct a defense of a linear obstacle as part of either an area defense or a mobile defense. Rivers, canals, or other linear obstacles generally require a forward defense as the defending commander seeks to prevent the enemy from crossing the obstacle and establishing a bridgehead or lodgment. Local defending units immediately and violently counterattack any enemy bridgeheads to destroy enemy forces located within the bridgehead, while higher echelons attempt to isolate enemy bridgeheads from

reinforcement. If the enemy seizes a bridgehead and strikes out rapidly, it could quickly penetrate the defending force. This requires the commander to conduct either a delay or a withdrawal.

5-39. When incorporating the defense of a linear obstacle into a mobile defense, commanders allow the enemy to cross the linear obstacle with a portion of its force before isolating and engaging that portion with the striking force. Commanders use the fixing force to drive the enemy to cross at a desired location to best accommodate the striking force's scheme of maneuver. Once the enemy has partially crossed the obstacle and divided its force, the commander conducts shaping operations to isolate the enemy bridgehead. The defending commander then launches a decisive attack with the striking force to destroy the isolated enemy bridgehead.

REVERSE SLOPE DEFENSE

5-40. The commander organizes a reverse slope defense on the portion of a terrain feature or slope with a topographical crest that masks the main defensive positions from enemy observation and direct fire. All or part of the defending force may employ this technique. It is generally useful at lower tactical levels, such as battalion and below.

5-41. The reverse slope defense is particularly effective in the desert as it leverages the seemingly flat terrain to both conceal friendly forces and maximize direct fire on the enemy. Although they may appear flat, many deserts consist of rolling hills and dunes that planners can incorporate into a reverse slope defense when other concealment is unavailable. A reverse slope defense denies the enemy direct observation of friendly positions until they are within range of the defenders' direct-fire weapons. This feature provides the defender with the element of surprise, a trait normally associated with the offense.

5-42. An effective reverse slope defense requires thoroughly developing an engagement area and establishing clear engagement criteria, sectors of fire, and disengagement criteria. Once commanders identify engagement areas, units construct fighting positions for both individuals and vehicles. Improved fighting positions provides the defender with a decided advantage over the attacker and prevents the engagement from becoming a reverse slope attack by the enemy. The defending forces must also be capable of disengaging and moving out of their battle positions should the enemy attack through the engagement area. This can be difficult in sandy deserts and units should reconnoiter and, if the time is available, establish clearly marked lanes to use when breaking contact. Figure 5-1, on page 5-10 depicts a reverse slope defense.

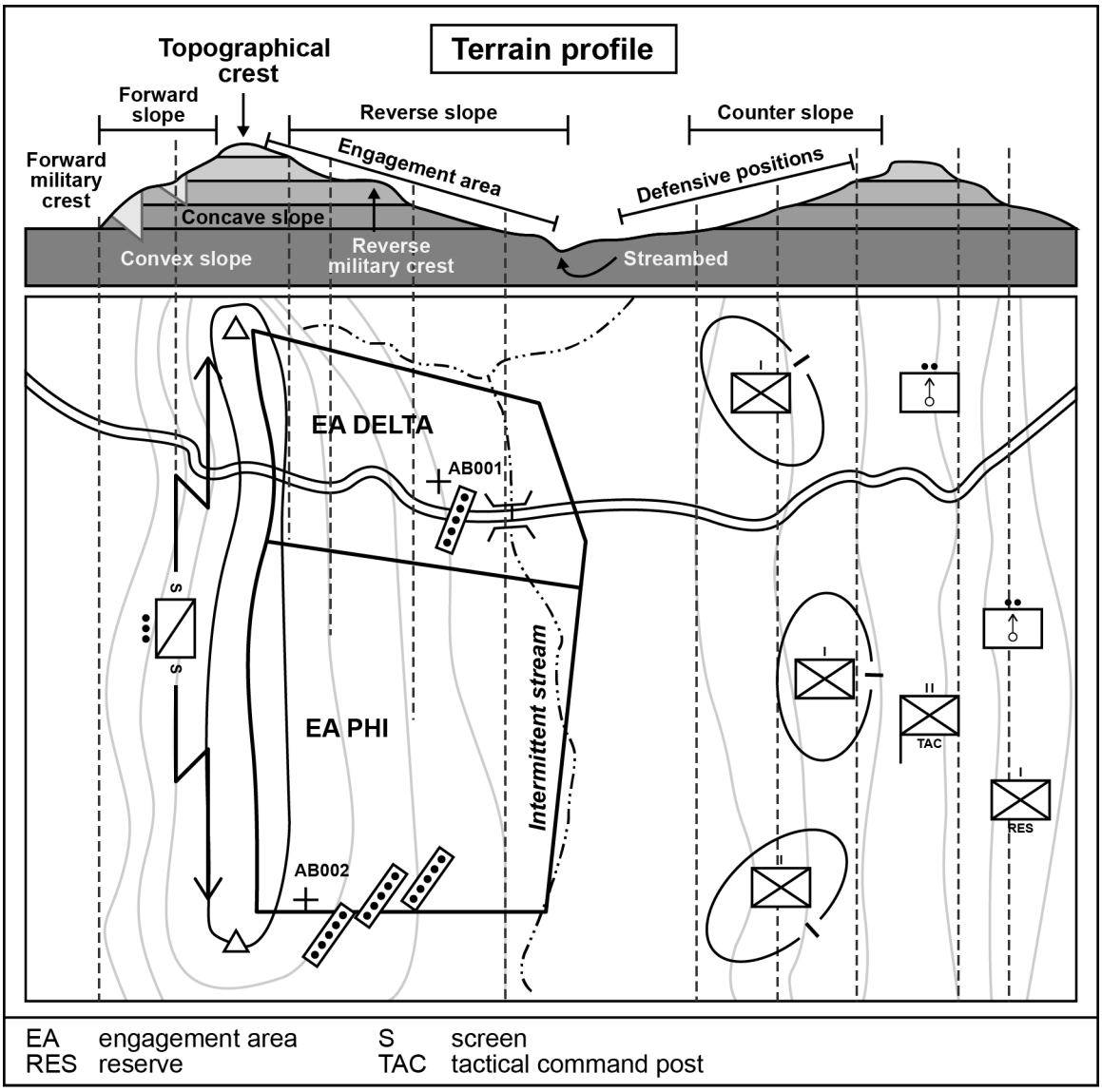

Figure 5-1. Reverse slope defense

BATTLE POSITIONS

5-43. In ground operations, a *battle position* is a defensive location oriented on an enemy avenue of approach from which a unit may defend (MCWP 3-01 and MCRP 1-10.2). Units use a battle position to deny or delay the enemy the use of certain terrain or an avenue of approach. The size of a battle position can vary with the size of the unit assigned. For ground combat units, battle positions are usually hastily occupied, but units continuously improve them.

STRONG POINT

5-44. Usually heavily fortified and armed with automatic weapons, a strong point is a key point in a defensive position around which other positions are grouped to protect it. The design of a strong point denies the enemy certain terrain and the use of an avenue of approach. It differs from a battle position in that it is designed to be occupied for an extended period. Established on critical terrain, units must hold a strong point for the defense to succeed. A strong point requires all-around defense and sufficient supplies and ammunition to

continue to fight even if surrounded or cut off from resupply. Strong points often require considerable time and engineer resources to develop. (See also paragraph 5-18 for more on strong points.) (See MCWP 3-01 for more on strong points.)

SECTOR

5-45. A higher commander may assign subordinate commanders a defensive sector to provide them maximum latitude to accomplish assigned tasks. The extent of the assigned sector assigned depends on METT-T. As a general rule, a sector should be no larger than that unit can influence. (See MCWP 3-01 for more on sector.)

WARFIGHTING FUNCTION CONSIDERATIONS

5-46. The defense is more effective when adequate time exists to prepare battle positions and engagement areas. When units have limited time, commanders increase the size of their reserve to act as a response force in areas where they lack defensive preparations. If an enemy attack does not take place at the predicted time, commanders use the additional time to improve their defensive positions, increase the effectiveness of the security area, establish additional alternate and supplementary positions, refine the defensive plan (including branches and sequels), and conduct rehearsals. They use the warfighting function framework to synchronize operations and ensure all elements of combat power are leveraged towards an effective defense.

INFORMATION

5-47. Information operations in the defense consist of MILDEC and OPSEC measures used to protect friendly forces. Units can employ MILDEC to conceal weak points in the defense due to economy of force operations or the need to concentrate forces elsewhere. Units can use OPSEC to deny the enemy knowledge about the size, capabilities, location, disposition, and intent of friendly forces. Commanders use the OPSEC process to protect the commander's concept of operations and prevent the enemy from identifying potential vulnerabilities.

COMMAND AND CONTROL

5-48. The defense carefully employs control measures to prevent fratricide and ensure units in contact with the enemy remain capable of movement and maneuver. Commanders identify and plan engagement areas, battle positions, engagement criteria, trigger lines, and disengagement criteria for defending forces. They integrate indirect and direct fires to defeat, disrupt, or deny enemy forces access to key terrain. They synchronize and control movement through a combination of preplanned criteria and direct control of subordinate forces.

5-49. The lack of identifiable terrain features in many deserts requires commanders use innovative methods for identifying AOs and other graphic control measures for the defending force. These control measures are necessary to coordinate movement and provide a reference to troops on the ground for when they should engage, disengage, and move to subsequent positions. In addition to using Global Positioning System-enabled information systems, commanders may have to use less visible roads and trails to identify control measures on the ground. When no features exist as often occurs in a desert, commanders may use signs to mark routes, passage points, lanes, and battle positions for defending forces to reference.

5-50. Commanders use the operations process to command and control their forces. Although they are in the defense, they create branches and sequels that build flexibility into their plan. They prepare for a transition to the offense or a retrograde.

5-51. Because an enemy force has the initiative, the defending commander may have to frequently shift main and supporting efforts to contain the enemy's attack until the defending force can seize the initiative. This may require the commander to adjust subordinate unit AOs, repeatedly commit and reconstitute the reserve, and modify the original plan.

5-52. As desert operations are characterized by rapid maneuver, command posts should remain relatively mobile and capable of reacting to developments during the battle. Commanders can utilize their tactical command post to control the numerous enabling tasks, such as rearward passage of lines, common to

retrograde operations. This enables the main command post to control the battle while subordinate forces move through each other's AOs.

MOVEMENT AND MANEUVER/MANEUVER

5-53. Defending commanders exploit the advantages of occupying the terrain where an engagement will occur. Defending commanders select terrain that allows the massing of friendly fires. Defensive positions in the MBA make use of existing and reinforcing obstacles that impede enemy movement, forcing the enemy to commit forces piecemeal into friendly engagement areas. Using obstacles this way exposes portions of an enemy force for destruction without giving up the advantage of fighting from protected positions. Examples of key terrain include areas that permit major obstacle systems covered by fires, important road junctions, and choke points.

5-54. Whether conducting an area defense, a mobile defense, or a retrograde, commanders must maintain the ability to conduct movement and maneuver during desert operations. A static force, or a force that cannot outpace the enemy, becomes vulnerable to encirclement and defeat in detail. Commanders retain the ability to reposition forces throughout the MBA, including the reserve, and to withdraw forces if the defense becomes untenable.

5-55. The large maneuver areas characteristic of desert operations mean that gaps often exist between defending units. Commanders cover gaps with security forces that screen to protect the main defensive positions and identify enemy forces attempting to penetrate these gaps. Commanders ensure that the reserve is positioned to respond and defeat enemy forces in these gaps. Despite the likelihood of gaps between forces, commanders attempt to site battle positions within mutual range of each other so that friendly forces can engage the enemy from two positions at all times. This creates multiple dilemmas for the enemy while reducing the likelihood of defeat in detail.

5-56. It is important that a defending unit prevent the uncoordinated movement of dislocated civilians through its AO. Such uncoordinated movements can hamper the execution of a unit's defense by hindering the repositioning of defending forces, disrupting sustainment operations, and delaying the evacuation of casualties. A defending unit must meet its legal obligations to the civilians in its AO. Commanders use military police to clear routes and control dislocated civilians in their AO, ensuring both the humane treatment of noncombatants and the mobility required to mount an effective defense.

Mobility

5-57. During a defense, mobility tasks include maintaining routes, coordinating gaps between obstacles to enable friendly movement, and supporting counterattacks. Commanders establish the priority of mobility support based on the mission variables. This support consists mainly of reducing obstacles and improving or constructing combat roads and trails to ensure the defending force can rapidly reposition as the battle develops. During a counterattack, engineer breaching systems open closed lanes or breach hasty minefields placed by a retrograding enemy. Commanders coordinate to ensure that units leave lanes or gaps in their obstacles that allow for the repositioning of main body units and the commitment of the counterattacking or striking force. CBRN reconnaissance systems also contribute to a force's mobility in a contaminated environment.

Countermobility

5-58. During a defense, units conduct countermobility operations to reduce the mobility of the enemy through obstacle zones, belts, barriers, and groups. When planning obstacles, commanders and staffs consider not only current operations but also the transition to the offense. They ensure that obstacle placement does not prevent friendly forces from counterattacking. Soldiers/Marines clearly mark and report minefields to prevent fratricide if friendly forces later maneuver over the area.

5-59. Obstacles can provide additional protection from enemy attacks by forcing an enemy force to spend time and resources to breach or bypass them. Effective obstacles block, turn, fix, disrupt, or force an enemy to attempt to breach or bypass them. A commander integrates reinforcing obstacles with existing terrain to halt or slow enemy movement, canalize the enemy into engagement areas, and protect friendly positions. Troops must integrate obstacles with fires to be effective. Obstacles that are not covered by fire generally

disrupt only the leading elements of an attacking force for a short time. When possible, units conceal obstacles from enemy observation. They coordinate obstacle plans with adjacent units and conform to the obstacle zone or belts of superior echelons. It is difficult to conceal obstacles from observation in the desert environment; however, the desert's open terrain requires extensive use of obstacles for an effective defense.

Obscurants

5-60. Commanders use obscurants to disrupt an enemy's assault or movement formations and deny an enemy force the use of target acquisition optics, visual navigation aids, air avenues of approach, landing zones, and drop zones. Obscurants create gaps in enemy formations, mark targets, and screen and obscure friendly positions to deny the enemy information about the size, location, and composition of friendly defensive positions. Modern bispectral obscurants protect troops from thermal as well as visual spectrum viewing devices. Commanders must carefully employ obscurants after considering enemy systems and friendly capabilities. Improper use can create an advantage for an enemy. The effectiveness of obscurants depends on weather conditions and the rate and quantity of obscurants employed. Using obscurants can also enhance MILDEC operations and cover friendly movements. However, the desert's low humidity and often windy conditions can reduce the effectiveness and duration of obscurants.

5-61. To defeat the enemy's use of obscurants, or when conducting operations during periods of limited visibility, defending forces may have to move closer to avenues of approach they are guarding while also relying on remote sensors to identify approaching enemy forces. They also rely on NVDs to identify and target the enemy. NVDs are extremely effective during static operations; however, the lack of depth perception makes them difficult to use during mobile operations or counterattacks. Commanders employ tighter vehicle formations when conducting maneuver under limited visibility conditions.

5-62. An attacking enemy force can be expected to create or take advantage of limited visibility conditions. Normally, a defending commander can expect an attacker taking advantage of these conditions to—

- Conduct reconnaissance to locate a defender's weapons, obstacles, and positions.
- Breach or reduce defensive obstacles.
- Infiltrate through gaps in a defender's security area.

5-63. The enemy may use sandstorms to conceal an offensive operation. This generally occurs when the sandstorm blows from the enemy's direction of attack. In this case, units should immediately occupy their battle positions before the storm arrives. Units should remain there—ready to fire and maneuver against the attacker—until after the storm abates. If vehicle patrolling is possible, a scout platoon or similar unit should screen gaps between units and along the enemy's most likely avenue of approach. When patrolling during limited visibility conditions, such as a sandstorm, the patrol should operate in a column formation to prevent individual vehicles from becoming separated or lost.

INTELLIGENCE

5-64. During planning, commanders use intelligence products to identify probable enemy objectives and schemes of maneuver. From those probable objectives and approaches, staffs can develop named areas of interest and target areas of interest. In a defense, staffs can use the IPB process to determine an enemy force's strength, likely COAs, and the location of enemy follow-on forces. IPB products identify cyberspace activities, cross-domain capabilities, patterns of enemy operations. IPB products also identify the enemy force's vulnerabilities to counterattack, interdiction, EW, air attack, and canalization. Commanders study an enemy force's capability to conduct air attacks against friendly forces, insert forces behind friendly units, employ CBRN and explosive weapons or devices, and conduct asymmetric or unconventional warfare. The intelligence staff also evaluates how soon the enemy can commit its follow-on forces. Defending commanders can then decide where to arrange their forces to defend and shape the battlefield.

FIRES

5-65. The targeting process ensures the collective and coordinated use of indirect and joint fires to gain and maintain fire superiority throughout defensive operations. In the defense, commanders use fires to neutralize, suppress, or destroy enemy forces. They also employ fires to delay or disrupt an enemy's ability to execute a given COA and to enhance the effects of massed direct fires and obstacles.

5-66. Commanders employ fires to support their security forces during desert operations, to destroy enemy reconnaissance elements, and against other high-payoff targets. Commanders support security forces by planning the delivery of fires at appropriate times and places to slow and canalize an enemy force as it approaches and moves through the friendly security area. Employing fires allows their security forces to engage enemy forces on more favorable terms. Finally, commanders use indirect fire to support the withdrawal of security forces when troops complete their shaping efforts and when a defending unit must break contact to reposition to a subsequent battle position. Organic and joint fires continue to engage enemy follow-on forces before the enemy can commit them to the MBA. Fire support assets engage enemy command and control facilities and logistics sites in depth to isolate an attacking enemy.

SUSTAINMENT/LOGISTICS

5-67. Commanders address several unique sustainment considerations in their defensive plan. Priorities for replenishment are normally ammunition and materiel to construct obstacles and defensive positions. Usually units have a reduced need for bulk fuel. Some units have an increased demand for decontaminants, CBRN collective equipment, and PPE. Commanders consider stockpiling or caching ammunition and limited amounts of petroleum products in centrally located positions within the MBA. However, units must destroy or evacuate these stocks in the event the friendly position is in jeopardy of being overrun by the enemy. Requisitioning and distributing Class IV material requires extensive transportation support and materiel handling capabilities. The size and weight of Class IV items may also make them difficult to efficiently transport throughout the theater of operations. Commanders plan and request Class IV items early and ensure they coordinate for engineer support to assist in deploying obstacles and other barrier materials.

5-68. Sustainment planners use preconfigured loads to ensure supported units receive reliable and appropriate resupply. Preconfigured combat loads are typically packages of potable and non-potable water, CBRN defense supplies, barrier materials, ammunition, POL, medical supplies, and repair parts tailored to a specific unit. The use of preconfigured loads works especially well when sustainment units have a habitual relationship with the supported unit and are familiar with its consumption rates and supply needs. Regularly pushing preconfigured loads forward eliminates the need to request supplies and reduces the chance that a lapse in communications will interrupt the supply flow and jeopardize the integrity of a defense. Commanders use information systems to accurately tailor combat-configured push packages to the demands of supported unit.

PROTECTION/FORCE PROTECTION

5-69. In the defense, commanders protect forces and critical assets by synchronizing, integrating, and organizing protection capabilities and resources. Commanders incorporate protection throughout the operation as they understand, visualize, and assess threats and hazards against the protection assets available. Commanders then apply the elements of combat power to prevent or mitigate these threats or hazards from impacting friendly operations. Commanders use decision support tools and analysis to develop both the CAL and the DAL. Protection consists of air and missile defense, survivability, CBRN operations, and area security.

Air and Missile Defense

5-70. Ground commanders mitigate the risk of air and missile attack through both passive and active methods. Passive methods include survivability operations, deception, dispersion, redundancy, and detection and warning. These activities improve unit survivability by reducing the likelihood of detection and targeting from the air and by mitigating the potential effects of air surveillance and attack. They include detecting air and missile launches, predicting impact points, and providing threat identification and disseminating early warning. Commanders also take steps to reduce their unit's electromagnetic signature by reducing the number and duration of high-emitting devices. Enemy aircraft can use a unit's electromagnetic signature to identify and attack high-payoff targets such as command posts.

5-71. Commanders use active air defense measures, such as short-range air defense units, to identify and destroy enemy aircraft and missiles. While long-range air defense systems are generally under the control of the theater air and missile defense commander and used to protect assets on the DAL, short-range air defense units can be attached to maneuver units and integrated into the defensive plan. Commanders should employ

short-range air defense units along anticipated enemy air avenues of approach to intercept enemy aircraft and protect maneuver forces. Commanders can also use them to protect key infrastructure, such as bridges or dams, in the unit's AO. Finally, commanders ensure that air and missile defense units protect critical sites, such as command posts.

Survivability Operations

5-72. Commanders use survivability operations to mitigate the attacker's initiative by forcing them to fight at a disadvantage. Survivability operations in the defense focus on enabling the defending forces to withstand an enemy attack while remaining combat effective. Units construct primary, alternate, and supplementary battle positions to build flexibility into the defense and ensure maneuver forces are protected while engaging the enemy with direct fire. While the focus of protection during defensive operations aims to ensure units can withstand an enemy attack, commanders continue to use concealment, MILDEC, decoy or dummy positions, and dispersion to confuse the enemy and frustrate their ability to effectively target friendly positions.

5-73. Survivability operations in the defense include constructing positions for command posts, PAAs, air and missile defense assets, and supply caches. They also include preparing individual and crew-served fighting positions and defilade fighting positions for combat vehicles. Commanders balance countermobility operations with survivability operations as both will likely require engineer support and compete for limited quantities of Class IV. Because of this, it is critical that commanders provide clear guidance on resourcing and priorities of effort.

5-74. Because of the limited concealment available in the desert, units avoid occupying their primary battle positions until the last possible moment. This reduces the likelihood the enemy will identify and target friendly positions. Combat vehicles occupy fighting positions at hull and turret defilade to help conceal the vehicle and protect it from direct and indirect fire while still enabling it to engage the enemy at maximum range. Troops can easily construct hull and turret defilade positions in most sandy deserts. Fighting positions should be dispersed and, after engaging the enemy, vehicles displace and occupy their alternate or supplementary positions to avoid being targeted. The desert's unobstructed terrain facilitates frequent movements between positions; troops need to reconnoiter and mark routes to enable rapid displacement. Units can use smoke to conceal movement between positions; however, commanders recognize that the use of smoke may also indicate to the enemy that friendly forces are repositioning. (See ATP 3-37.34/MCTP 3-34C for more information regarding survivability operations.)

Chemical, Biological, Radiological, and Nuclear Defense

5-75. Defending units in fixed positions have a higher risk of being attacked with CBRN weapons. Commanders mitigate this threat by assessing the CBRN risk, prescribing the necessary MOPP measures, and establishing priorities for CBRN detection and decontamination.

5-76. CBRN units conduct surveillance and decontamination operations to detect and mitigate the effects of a CBRN attack. During relatively static defensive operations, CBRN planners identify decontamination sites for personnel and equipment, procure ample decontaminants, identify a reliable water source, and develop an evacuation plan for equipment and personnel that cannot be decontaminated on site. Planning decontamination operations in desert environments is complicated by the lack of natural water sources available. Commanders may use water from irrigation canals to decontaminate equipment, but they will have to plan for an appropriate water source to decontaminate personnel.

Area Security

5-77. In addition to the threat of conventional attack, defending units in stationary positions have a higher risk of attack by enemy special purpose forces, paramilitary units, and guerrillas. These forces typically avoid targeting combat units and instead attack more vulnerable targets such as command posts and support areas. These attacks can be part of a larger enemy offensive operation but may be designed to appear as individual terrorist attacks or the uncoordinated actions of an insurgent group. The enemy may also employ airborne or air assault forces to attack sustainment bases or other key infrastructure in the support area. The prevalence of oil and gas infrastructure in many deserts presents a lucrative target for enemy special purpose forces. Damaging or destroying oil and gas infrastructure can result in an environmental catastrophe that can disrupt

defensive operations and cause chaos in the rear area. Enemy special purpose forces may also target civilian population centers to incite disorder and increase the number of civilians on the battlefield.

5-78. Commanders conduct area security throughout the rear area to detect and defeat enemy special purpose attacks. Security forces protect command posts, communications infrastructure, support areas, supply caches, LOCs, and key civilian infrastructure. During the initial phases of an operation these forces perform critical area security tasks at air and seaports to ensure friendly forces can enter the theater. Military police perform area security tasks to protect forces, assets, and infrastructure in theater. They are trained and equipped to defeat level I and level II threats. Using military police in this capacity ensures that combat units can remain focused on defensive operations in the MBA.

TRANSITIONS

5-79. As the defense is rarely the decisive form of war, commanders anticipate transitioning from the defense to either offensive or retrograde operations. The earlier a commander can identify when the transition will occur, the greater the likelihood of success for the follow-on operation. Identifying transition points early provides friendly forces with the time to plan and prepare the various sustainment, mobility, and fires requirements necessary for the pending operation. Such planning addresses the need to control the tempo of operations by maintaining contact with enemy forces and preventing them from consolidating their gains or reconstituting their forces.

TRANSITION TO THE OFFENSE

5-80. The defending commander begins the transition to offensive operations by anticipating when and where an enemy force will reach its culminating point or require an operational pause before it can continue. The *culminating point* is the point at which a force no longer has the capability to continue its form of operations, offense or defense (JP 5-0). At those moments, the combat power ratios most favor the defending force. The enemy will do everything it can to keep friendly forces from knowing when it is overextended. Indicators that an enemy force is approaching its culminating point include the following:

- Enemy forces begin to transition to the defense whether in or out of contact with friendly forces.
- Enemy forces suffer heavy losses.
- Enemy forces start to deploy before encountering friendly forces.
- Enemy forces are committed piecemeal in continued attacks.
- The enemy reserve is identified among attacking forces.
- Examination of captured or killed enemy soldiers and captured or destroyed enemy equipment and supplies reveals that the enemy cannot adequately sustain itself.
- The enemy's tempo slows.
- Local counterattacks meet with unexpected success.

5-81. Commanders take care not to fall victim to enemy MILDEC or information operations designed to entice friendly forces to prematurely transition to offensive operations. Transitioning before the enemy reaches its culminating point risks abandoning the strength of the defense and exposing the transitioning force to a full-strength enemy on the attack. In a mobile defense, transitioning to an offense generally follows a striking force's attack. In an area defense, commanders designate a portion of their force to conduct the counterattack, selecting units based on the concept of operations.

5-82. Commanders should not wait too long to transition from the defense to the offense as an enemy force approaches its culminating point. Enemy forces will be dispersed, extended in depth, and weakened. At that time, any enemy defensive preparations will be hasty, and enemy forces will not be adequately prepared for the defense. Additionally, the psychological shock on enemy soldiers will be greater if they suddenly find themselves desperately defending on new and often unfavorable terms.

TRANSITION TO THE RETROGRADE

5-83. A retrograde usually involves a combination of delay, withdrawal, and retirement operations. These operations may occur simultaneously or sequentially. As in other operations, the commander's concept of

operations and intent drive planning. Each form of retrograde has its unique planning considerations, but considerations common to all retrogrades are the need for synchronization and increased security operations. However, several considerations receive special emphasis during the transition from the defense to the retrograde. For example, commanders consider conducting a MILDEC operation to conceal the retrograde and protect forces as they move away from the enemy. Conversely, they may use the retrograde to lure the enemy into an area where it is vulnerable to counterattack. Commanders must also recognize the need to establish defensive positions elsewhere for the retrograding force.

5-84. Maintaining morale during a retrograde often proves challenging since Soldiers/Marines may see the operation as a defeat. Commanders must be well forward and visible, displaying an offensive spirit. Commanders ensure their Soldiers/Marines understand the purpose and intent of the retrograde as well as their role in accomplishing the mission. Thorough planning, effective control, and aggressive leadership can reduce the psychological impact of a retrograde and enhance the probability of regaining the initiative elsewhere.

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Chapter 6
Desert Stability Operations

This chapter outlines the purpose and characteristics of stability operations in the desert. It reviews the Army/Marine Corps stability operations tasks and offers TTP for tailoring them to the desert environment.

STABILITY OPERATIONS

6-1. A *stability operation* is an operation conducted outside of the United States in coordination with other instruments of national power to establish or maintain a secure environment and provide essential government services, emergency infrastructure reconstruction, and humanitarian relief (ADP 3-0). A stability operation occurs as part of decisive action in a joint operation or as an activity (often in peacetime). Stability operations tasks are those tasks executed by a JFC to successfully accomplish stability operations. These tasks may be the operation's primary mission, be performed as tasks (specified or implied) during large-scale combat operations, be performed as activities during periods of peace, or be part of larger operations to consolidate gains.

6-2. Stability operations in the desert may be performed in both urban centers and in sparsely populated desert regions. In urban centers, stability operations focus on providing security, establishing law and order, and restoring essential government services. In rural desert regions, stability operations may aim to repair or secure key infrastructure, such as oil and gas wells, assist with agricultural projects, such as the construction of irrigation canals, and improve or secure key roadways that connect urban centers.

STABILITY OPERATIONS TASKS

6-3. Stability operations tasks seek to stabilize the environment for the host nation to begin to resolve the root causes of conflict and state failure. Ultimately, stability operations tasks aim to establish conditions that support the AO's transition to legitimate authorities.

6-4. Stability operations involve both coercive and cooperative actions. Units conduct these operations in situations in which a legitimate civil authority cannot provide requisite security and services to the desert inhabitants as a result of—

- Decisive action during a joint operation.
- Internal strife or civil war.
- Natural or man-made disaster.
- Foreign subversion, lawlessness, insurgency, or terrorism.

6-5. Initially, stability operations focus on the minimum-essential stability tasks of providing security, food, water, shelter, and medical treatment. Once conditions allow, these tasks are a legal responsibility of Army/Marine Corps forces. However, commanders may not need Army/Marine Corps forces to conduct all these essential tasks since civilian organizations, such as NGOs or IGOs, may be available to perform them. As conditions and time allow, the effort will transition to a more deliberate execution of the six stability tasks. (See JP 3-07, ADP 3-07, and MCWP 3-03 for additional information on stability tasks.)

6-6. The Army and Marine Corps utilize different, yet compatible, stability tasks. See table 6-1 on page 6-2 for a comparison.

Table 6-1. Joint, Army, and Marine Corps stability tasks

Joint Stability Tasks	*Army Stability Tasks*	*Marine Corps Stability Tasks*
Security	Establish civil security	Establish civil security
Foreign humanitarian assistance	Restore essential services	Provide humanitarian assistance
Economic stabilization and infrastructure	Support to economic and infrastructure development	Support economic and infrastructure development
Rule of law	Support to civil control	Support establishment of civil control
Governance and participation	Support to governance	Support to governance
	Conduct security cooperation	Support and/or provide restoration of essential services

Establish Civil Security

6-7. Civil security is the provision of security for state entities and the population, including protection from internal and external threats. Establishing a safe, secure, and stable environment is crucial to obtaining local support for military operations. During the initial phase of a stability operation, Army/Marine Corps forces may need to perform all civil security tasks if the HN police and military cannot or does not exist. However, while Army/Marine Corps forces establish civil security, leaders may use security force assistance units to train the HN police and military. As soon as HN security forces can perform this task, Army/Marine Corps forces transition civil security responsibilities to them. Within the security sector, transformation tasks focus on developing legitimate, sustainable, and stable security institutions. Civil security establishes the conditions for enduring stability and peace.

6-8. Establishing security often requires the conduct of offensive operations to identify and neutralize enemy forces, guerillas, or insurgents fomenting violence. The primary offensive operations used during stability operations are the cordon and search and the search and attack. However, commanders balance the benefit of offensive operations against the risk that they may alienate the populace and further destabilize the area. As the security environment improves, commanders execute fewer offensive operations and transition their focus to other stability operations tasks. After eliminating a guerilla or insurgent force, commanders may no longer have to execute aggressive offensive operations and can instead transition to simple presence patrols and community engagement operations. (See FM 3-24/MCWP 3-02 [MCWP 3-33.5] for more information on counterinsurgency operations.)

6-9. Many desert regions are sparsely populated and primarily inhabited by nomadic tribes, herders, and small agricultural communities near rivers, canals, or oases. These communities may police themselves and require fewer resources to establish civil security. Instead, commanders secure these areas by conducting border security operations to regulate cross-border traffic and prevent weapons smuggling and infiltration by foreign fighters. They may also secure these areas by patrolling key LOCs to ensure they are not used to traffic weapons or arms to more populated areas in theater.

6-10. Commanders assess local customs and norms regarding the role of police and security forces as they work with the host nation to establish civil security. Different cultures view the role of security forces differently and, to be sustainable, the security framework developed by Army/Marine Corps forces must be acceptable to the local populace. Some nations in the Middle East rely more on a tribal structure to enforce local order, while others are more accustomed to a centralized national police force. Some cultures may view proactive policing as unnecessary government interference or oppression. Regardless of how the local culture views the role of its security forces, commanders recognize that a western policing model may not be acceptable, and they cooperate with the host nation to develop a security framework to meet the needs of the local populace.

Provide Humanitarian Assistance

6-11. Conflict, especially extended conflict, results in human suffering caused by acute shortage of water, food, shelter, clothing, bedding, and medical care. Marine Corps forces are often the first response force on the scene and support HN efforts to provide humanitarian assistance with logistics, distribution, communications, and other relief capabilities and supplies. Most often, Marine Corps operating forces work

in support of other U.S. governments departments and agencies, the host nation, or others. Depending on the situation, providing humanitarian assistance may include three subtasks, providing local security, distributing relief supplies, and supporting dislocated civilians. (See MCWP 3-03 and ATP 3-57.20/MCRP 3-03A.2 [MCRP 3-33.1C] for additional information regarding humanitarian assistance.)

Support to Civil Control/Support Establishment of Civil Control

6-12. Civil control is the ability for the sanctioned local leadership to manage the disputes and conflicts within the population effectively and foster the rule of law. The rule of law means that all persons, institutions, and entities—public and private, including the state—are accountable to laws that are publicly promulgated, equally enforced, independently adjudicated, and consistent with international human rights principles. To strengthen civil control and the rule of law, Army/Marine Corps units seek to improve the capability, capacity, and legitimacy of HN judicial and corrections systems by providing training and support to law enforcement and judicial personnel. Army/Marine Corps units focus on implementing temporary or interim capabilities to lay the foundation for HN or inter-organizational development of judicial systems when conducting stability operations in desert environments.

6-13. Similar to establishing civil security, supporting civil control requires Army/Marine Corps forces to assist in developing sustainable institutions that meet the needs of the populace. Although they may perform the same functions as institutions in the west, judicial institutions in a desert may utilize less sophisticated technology and procedures to investigate and adjudicate cases. Individual and witness testimony, confessions, and reenactments may be more credible in these cultures than forensic evidence. Commanders recognize these differences and do not attempt to force foreign practices onto nascent judicial systems as this will likely prove unsustainable and quickly abandoned once Army/Marine Corps forces leave the theater.

Restore Essential Services/Support and/or Provide Restoration of Essential Services

6-14. Restoring essential services to desert inhabitants allows them to return to their daily activities and sets conditions for economic development. Ideally, the HN government and civilian relief agencies should restore and develop essential services. These agencies, along with the HN government, often possess critical knowledge regarding what services are required, where they are best delivered, and what delivery method is most suitable to the local environment. However, when partner organizations are not well established or lack capacity, Army/Marine Corps forces can accomplish these tasks until relieved by other organizations. Often, Army/Marine Corps forces enable the host nation, NGOs, and IGOs to restore essential services by providing logistics support and security.

6-15. Essential services are often grouped under the acronym SWEAT-MSO, which stands for sewage, water, electricity, academics, trash, medical, safety, other considerations. Leaders use this acronym and the associated criteria to both assess the status of essential services and then build lines of effort to restore these services.

6-16. Access to sufficient potable water and reliable electricity are critical to effective stability operations in the desert. Without these essential services, the desert's harsh environment and extreme heat can make life unbearable and the local populace will quickly become frustrated and unsupportive. In addition to establishing civil security, commanders make restoring water services and electricity their top priority. Figure 6-1 on page 6-4 demonstrates how units can use the SWEAT-MSO framework to build lines of effort for stability operations.

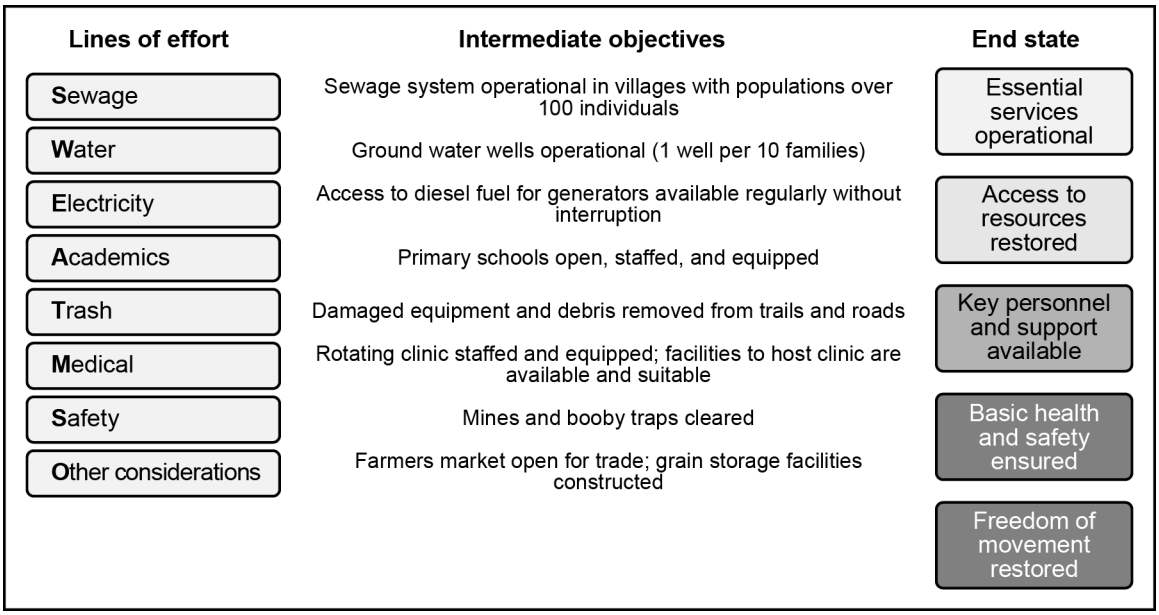

Figure 6-1. Sample desert SWEAT-MSO lines of effort

Support to Governance

6-17. Governance is the set of activities conducted by a government or community organization to maintain social order, define and enforce rights and obligations, and fairly allocate goods and services. Effective, legitimate governance ensures these activities are transparent, accountable, and involve public participation. If a HN government or community organizations cannot provide governance, units may need to provide some degree of military support. In extreme cases where civil government or community organizations are dysfunctional or absent, international law requires military forces to provide basic civil administration.

6-18. Although elections often become an end state condition in planning, commanders should not rush to hold elections before the environment is stable and the populace is ready. In societies divided along ethnic, tribal, or religious lines, as is common in many deserts, elections may further polarize factions. While representative institutions based on universal suffrage often offer the best means of fostering governance, this may not be the case in all cultures. Instead, commanders recognize that cultures unaccustomed to the liberties associated with democracy may take longer to stabilize before holding elections. In these situations, commanders prepare for extended periods of martial law and military governance. By establishing civil security, restoring essential services, and supporting economic development, commanders can stabilize conditions enough for fair and peaceful elections to occur.

Support Economic and Infrastructure Development

6-19. Long-term peace and stability in the desert requires sustainable economic and infrastructure development. In post-conflict and fragile states, HN actors—not interagency partners, civilian relief organizations, or NGOs—often have the best qualifications to lead efforts to build economic capacity. However, if security considerations or other factors restrict their ability to intervene, Army/Marine Corps units assist HN entities in fostering sustainable economic and infrastructure development. Preserving assets such as factories, universities, and markets dramatically reduces the time required to reestablish a sustainable level of economic activity.

6-20. When conducting reconstruction and infrastructure repair, commanders consider using these activities to improve the local economy and provide legitimacy to the HN authorities. Local contracts offer a tool for commanders to restore essential services, rebuild key infrastructure, aid economic development, and reduce dependency on U.S. forces and resources. Through contracting officers, commanders award construction or service contracts to local businesses. These contracts then stimulate the local economy by increasing available

currency and improving employment. This has the added benefit of reducing the number of unemployed civilians vulnerable to exploitation by guerrillas or insurgents. Local construction contracts can also imbue the community with a sense of pride in the restoration of their town or city and foster buy-in. When done in concert with the HN or local government, reconstruction projects enhance legitimacy and credibility. However, awarding local contracts for short-term projects does not replace the need for long-term economic planning and the development of stable jobs.

6-21. Commanders consider using operational contract support to benefit both the joint force and the local populace. Operational contract support is the process of planning for and obtaining supplies, services, and construction from commercial sources in support of joint operations. Operational contract support can stimulate the local economy by providing a reliable, yet temporary, injection of capital to local companies that provide services to the joint force. (See ATP 4-10/MCRP 3-40B.6 [MCRP 4-11H]/NTTP 4-09.1/ AFMAN 10-409-O for more information on operational contract support.)

6-22. Supporting economic and infrastructure development in the desert often requires a multi-directional approach. While commanders may coordinate with civil affairs to stimulate local economic development, senior leaders often have to work at the national level to facilitate infrastructure projects. Infrastructure development may only be feasible when the HN government can manage and supervise large-scale projects without unacceptable levels of corruption upsetting investment. This will likely require a top-down approach by Army/Marine Corps leaders alongside unified action partners to assist with the structural reforms and oversight required to increase the HN government's ability to manage large infrastructure projects. Large infrastructure projects also require significant investment from unified action partners, such as the Department of State, and this may be beyond the purview of Army/Marine Corps leaders. Commanders leverage the CMOC to ensure unity of effort and coordinate infrastructure development alongside unified action partners.

6-23. Many deserts contain valuable natural resources and associated infrastructure that units must protect to hasten a return to normalcy. Commanders consider oil and gas refineries, pumping stations, pipelines, and wells as key terrain they must secure as soon as possible after the cessation of large-scale combat or disaster recovery operations. Resource sites and infrastructure are vital to fueling the country's economy and facilitating its long-term stability and recovery. Commanders protect these sites from looting or exploitation by the local populace and third-party actors, such as neighboring states, until the legitimate authority entitled to the properties and their contents can properly administer them. Commanders also secure key transportation infrastructure, such as railyards, ports, and warehouses, to ensure the logistics network can support commerce and trade.

Conduct Security Cooperation

6-24. *Security cooperation* is all Department of Defense interactions with foreign security establishments to build security relationships that promote specific United States security interests, develop allied and partner nation military and security capabilities for self-defense and multinational operations, and provide United States forces with peacetime and contingency access to allied and partner nations (JP 3-20). Security cooperation is composed of multiple activities, programs, and missions, and it is functionally and conceptually related to security force assistance, foreign internal defense, and security sector reform. Security cooperation primarily focuses on interoperability programs with both core partners and the fledgling security forces of a failed or failing state. These programs aim to develop security force doctrine and organizations, establish formalized training and exchange programs, assist with leader development, aid in equipping HN forces, and support HN forces with specialized capabilities. The security force assistance brigade is manned, trained, and equipped to conduct security cooperation and can be used to allow other forces to focus on additional stability tasks. (See JP 3-20, FM 3-22, and MCIP 3-03Di [MCIP 3-33.03] for more information on security cooperation activities.)

6-25. When no formal HN security force exists, such as in the aftermath of large-scale combat operations, commanders can leverage local militias or paramilitary forces as the foundation for a local police force or army. However, intelligence professionals need to screen and vet these forces to ensure they do not present a security risk to either the local populace or U.S. forces.

6-26. Commanders explore all options when determining where and how to train a HN security force. If local facilities are unavailable, or the security environment is not stable, commanders may coordinate with a

neighboring state to host the training. The neighboring state may possess better training facilities than those present in the failed or failing state. Removing recruits from an unstable environment also allows them to focus solely on training without the distractions caused by ongoing violence in their homeland. This practice may also reduce desertion rates by preventing recruits from easily returning home.

WARFIGHTING FUNCTION CONSIDERATIONS

6-27. An element of decisive action, stability operations are often executed alongside offensive and defensive operations occurring across the joint operations area. As a result, many of the warfighting function considerations previously addressed in chapters 3, 4, and 5 apply to stability operations in the desert environment. The following considerations, organized by warfighting function, address the desert's environmental impact on units conducting stability operations.

INFORMATION

6-28. Information operations are a critical component of effective stability operations. The success of stability operations often rests on the local population's perception of Marines' actions in the area. As such, commanders use information operations to communicate progress, communicate intent, and garner understanding with affected audiences. An understanding populace, in turn, increases the pace of stabilization and decreases requirements for security forces, thereby enhancing overall efficiency. Commanders also use information operations during stability to deny insurgents or irregular forces the ability to exploit a potentially sympathetic population while the AO remains unstable. These operations are most effective when closely integrated with the intelligence warfighting function to identify how the enemy is using cultural, religious, ethnographic, political, economic, and criminal considerations to its advantage.

COMMAND AND CONTROL

6-29. Stability operations challenge command and control by requiring units to execute a wide range of tasks with various forces across a single AO. During stability operations, tasks can range from area security/rear area security to infrastructure development; simultaneously accomplishing such disparate tasks often requires unique task organizations. Units without previous command relationships or experience working together must develop complementary systems and processes that achieve unity of effort. To achieve unity of effort among unified action partners conducting stability operations, commanders establish a CMOC and ensure appropriate liaisons are exchanged across the command. The CMOC and liaisons ensure security operations and stability tasks do not work at cross purposes, and operations to further secure the populace or defeat remaining threats do not undermine economic, infrastructure, or governance initiatives.

Political and Military Objectives

6-30. Stability operations use assessment frameworks that contain qualitative and quantitative criterion by which to measure progress towards objectives and the effects necessary to meet those objectives. Quantifiable criteria must be measurable and link cause with effect. Qualitative criteria provide context and inform the commander's ability to understand an operational environment. Often, quantitative criteria are used to inform and develop qualitative assessments of an operation's progress towards identified political objectives. These criteria are known as measures of performance (MOPs) and measures of effectiveness (MOEs). A *measure of performance* is an indicator used to measure a friendly action that is tied to measuring task accomplishment (JP 5-0). MOPs help answer the question "are we doing things right?" A *measure of effectiveness* is an indicator used to measure a current system state, with change indicated by comparing multiple observations over time (JP 5-0). MOEs are used to answer the question "are we doing the right things?" These measures help determine if changes to the stabilization lines of effort are necessary and are essential to conducting accurate assessments. MOEs and MOPs are also important tools for identifying transition points during a stability operation, such as when an operation can transition from the transformation phase to fostering sustainability.

6-31. Many cultures in the Middle East and other desert environments do not share the sense of urgency and haste common in western cultures. Commanders may have to temper their temporal expectations when assessing progress towards political and military objectives in these environments. Commanders avoid

pressing forward with timelines and initiatives if HN partners baulk at the desired pace. Fostering sustainability requires buy-in; it is better to work at a slower pace with partners than at a quicker pace without.

Note. Commanders should consult the USAID's *Field Operations Guide for Disaster Assessment and Response* when conducting their assessments and developing MOEs for relief operations.

Information Operations

6-32. Information operations are an important component of effective stability operations and necessary for influencing both the enemy and HN audiences. Vigorous information operations influences the perceptions, decisions, and will of the threat, the enemy, the population, and other audiences in support of the commander's mission. Information operations objectives are translated to information-related capability tasks that are then executed to create the commander's desired effects in and through the information environment. These operations isolate a threat or enemy from sources of support; neutralize hostile desert populations or gain the support of neutral populations; and mitigate the effects of threat information operations, misinformation, and rumor. Developing an effective assessment plan is essential to ensuring that information operations objectives achieve their intended effect.

6-33. Contrary to the popular image, many desert nations have advanced information technology and communications infrastructure with populations accustomed to receiving information through diverse media. Information operations account for this diverse information environment and should leverage all forms of media to reach the intended audience. This includes using social media, internet-based news services, and broadcast media to influence the largest possible audience. Commanders also recognize that technologically savvy inhabitants of many deserts can easily upload and transmit information to an international audience through social media. The information operations plan should address methods for interacting with the populace via social media and combatting misinformation distributed by the populace. To build trust and demonstrate responsiveness, units can conduct this interaction in real-time through certain social media platforms.

Adaptability

6-34. Adaptability is critical to stability operations in the desert as units often need to perform tasks outside their traditionally prescribed capabilities. This is compounded by the fact that various towns and villages in a single AO may progress at different rates through the stabilization framework. For example, one village with a particularly troublesome insurgency may remain in the initial response phase longer than a more stable village that can transition to the transformation phase. If a single unit has responsibility for both villages, it may have to conduct offensive operations to defeat the insurgency in the less stable village, while working to restore essential services in the other. Stability operations require adaptable units that can simultaneously function as security forces, engineers, and civil affairs, often in the same AO. Rapidly flexing between tasks requires Soldiers/Marines willing to use unorthodox methods to meet the needs of the local populace.

6-35. Commanders foster adaptable units through mission command. They address the disparate conditions encountered in their AO by relying on decentralized leadership and decision making to drive subordinate initiative. Mission command empowers subordinates to meet the commander's intent by taking proactive steps to stabilize their respective AO regardless of where it is in the stabilization framework and irrespective of conditions in adjacent areas. This approach maintains unity of effort and allows a single organization to simultaneously conduct stability operations tasks appropriate to the conditions on the ground.

6-36. The commander and staff support adaptability through careful analysis and detailed planning to account for the patchwork nature of stabilization operations. The ethnic and cultural diversity of many desert regions results in varying degrees of progress as different AOs transition from instability to recovery. Effective and thorough staff planning generates detailed civil considerations and provides decision support tools that allow commanders to adjust course quickly as conditions evolve. The staff assesses how developments in one AO may impact stabilization operations in other areas. They develop branches and sequels to facilitate rapid transitions to address contingencies across subordinate AOs.

Aggressive Coordination and Synchronization

6-37. Effective stability operations require active coordination with unified action partners and HN authorities. The increased number of participants (both military and nonmilitary) and the disparate missions they execute can create a significant coordination and synchronization challenge. To mitigate this, commanders establish a CMOC to coordinate stabilization activities across the AO. The CMOC coordinates civil, military, HN, NGO, and IGO actions by reviewing stabilization plans, developing and assessing MOEs and MOPs, and ensuring that unified action partners work together towards the same goal.

6-38. Through the CMOC, commanders initiate cooperative efforts with participating civilian agencies and determine where their objectives and plans complement or conflict with those agencies. Commanders can then match Army/Marine Corps capabilities to the needs of the supported agencies. Reconnaissance and liaison elements—heavily weighted with civil affairs, engineers, and medical personnel—may need to be deployed immediately to determine what type of support agencies need. Overall, consistent, regular coordination fosters trust and makes unity of effort possible in operations where unity of command is challenging to achieve.

6-39. Commanders consider establishing, as necessary, separate organizations for area security and stability operations. This technique can increase coordination among unified action partners while improving the public's perception of the stabilization effort. Organizing forces in this way enables units tasked with conducting stability operations to avoid the stigma of being associated with continued acts of violence in the AO. It may also encourage NGOs and IGOs to work more closely with Army/Marine Corps forces by distancing them from offensive operations still occurring in parts of the AO. Together, this can increase popular support for economic, governance, and infrastructure initiatives.

Perseverance

6-40. Stability operations often rest on Army/Marine Corps forces enabling the success of a legitimate HN authority. Achieving this end state requires the perseverance to partner with HN leaders and influence them to address the underlying causes of instability or revise their policies to address the concerns of disaffected portions of the population. Stability successes achieved by U.S. forces alone are likely short lived. Through perseverance and an accurate understanding the society's history and culture, commanders gain an advantage in identifying the problem, recognizing root causes, quickly engaging and assisting key HN leadership, and planning and executing successful stability operations.

6-41. Perseverance requires Army/Marine Corps leaders to balance initiative with patience as they work by, with, and through their HN partners. These leaders respect the HN culture and treat their counterparts as peers, recognizing that, without buy-in, objectives met will not last. This often requires compromise to ensure that systems, processes, and institutions developed are acceptable to the HN.

Restraint

6-42. Stability operations generally place restrictions on the ability to use force. Unlike offensive and defensive operations where commanders seek to apply overwhelming combat power at decisive points, restraint is essential to success during stability operations. Tolerance for collateral damage is significantly less during stability operations than during large-scale combat. Excessive, wanton, or inadvertent use of force can significantly destabilize a fragile AO regardless of the progress made to that point.

6-43. Area security and stability operations requiring the use of force employ combat power selectively, discriminately, and precisely in accordance with assigned missions and prescribed policy limitations. Commanders often adjust criteria for the use of force and escalation of force procedures when AOs transition to predominately stability operations.

6-44. Many cultures that inhabit desert regions take significant offense to mixed gender searches or questioning and, although this is not a use of force, commanders still exercise restraint and patience by respecting the HN culture. Soldiers/Marines should only conduct mixed gender searches under extreme circumstances. Leaders make every effort to conduct same gender searches even if this means delaying operations.

MOVEMENT AND MANEUVER/MANEUVER

6-45. Just as the use of force is more restrictive during stability operations, movement and maneuver/maneuver is often limited by requirements to restore a sense of normalcy to the AO. To reduce impacts on the local populace and bolster the legitimacy of the HN authority, commanders will likely face additional constraints (must do) and restraints (cannot do) that directly impact movement and maneuver/maneuver. For example, constraints may require commanders accommodate the location of traditional nomadic camps regardless of their proximity to Army or Marine Corps forces. Restraints, for example, may prohibit the use of rotary-wing aviation below certain altitudes to prevent disturbing livestock or animal herds. Adhering to these limitations may seem risky or counterintuitive; however, they are necessary to return a fragile or failing state to stability. Ultimately, the goal of stability operations aims to reduce the need for U.S. forces at all. As stability operations are successful and Soldiers/Marines transition responsibilities to the legitimate civil authority, limitations on movement and maneuver/maneuver will probably increase.

INTELLIGENCE

6-46. Just as in the offense and defense, intelligence and operations officers, in coordination with the rest of the staff, develop a synchronized and integrated information collection plan that satisfies the commander's information requirements. However, during stability operations, the information collection plan is informed by the CMOC and may be driven by data collection in support of MOEs and MOPs. Information collection during stability operations also relies heavily on data provided by the HN government, NGOs, and IGOs.

6-47. Within the constraints of OPSEC, commanders share relevant information and coordinate stability operations with other agencies and forces operating in their AO. Commanders work within foreign disclosure limitations to foster information exchange among U.S. forces, HN authorities, partner nations, NGOs, and IGOs. Commanders provide information to these partners to leverage their capabilities and achieve unity of effort. They use information provided by partner organizations to shape stability operations and better direct their efforts. Often, the HN, NGOs, and IGOs possess far greater access to the civilian populace and have a wealth of knowledge on the AO.

6-48. One of the most valuable methods for obtaining intelligence in support of stability operations is face-to-face encounters with targeted audiences by unit patrols, HUMINT specialists, MISO specialists, and civil affairs teams. Commanders conduct routine engagements with key civilian leaders in their AO to track the progress of stability operations and exchange information. A unit can gain valuable information by conducting periodic surveys or opinion polls of civilians to determine changes in their perceptions and attitudes. A continual Army/Marine Corps presence provides the desert population a sense of security and allows Soldiers/Marines to develop a detailed knowledge of the "patterns of life" in their assigned AO. Armed with this knowledge, they can detect the absence of the normal or the presence of the abnormal that might indicate a potential threat.

FIRES

6-49. Stability operations are characterized by restrictive fire support coordination measures that limit the use of indirect fires to prevent unintentional civilian casualties and foster a return to normalcy. However, units can employ nonlethal fires, such as illumination, to enhance U.S. or HN forces ability to operate during periods of limited visibility. Nonlethal direct fire munitions are also critical during stability operations to provide police with graduated escalation of force measures for addressing criminal behavior such as looting or rioting.

SUSTAINMENT/LOGISTICS

6-50. Stability operations may require sustainment/logistics support to systems and organizations that are not traditionally supported by Army/Marines Corps logisticians. The ability to support these systems and entities may require special authorization, authorities, limitations, and procedures. However, this support can prove instrumental in building HN capability and capacity as well as supporting IGOs, unified action partners, and other groups seeking to transition an AO back to HN legitimate authorities.

6-51. Stability operations often place increased demand on the following classes of supply:

- Class I: Until essential services are restored, HN forces, IGOs and NGOs, the local populace, and unified action partners may require bulk Class I support from U.S. forces. The demand for bulk Class I is more pronounced during humanitarian assistance missions.
- Class III: Army/Marine Corps forces may need to support HN forces with POL until local sustainment and distribution systems return to operational capacity. Sustainment planners ensure fuels provided are compatible with HN equipment.
- Class IV: Army/Marine Corps forces use construction material and barriers to support infrastructure repair, physical security improvements, and survivability improvements to HN security force installations.
- Class VIII: Depending on the capability and capacity of the local health care system, commanders plan for an increased demand for medical supplies to treat both HN forces and the local populace. Because the area may lack essential services, the need for medication and supplies to treat endemic diseases can be significant. Malaria is common in many desert regions.

6-52. When the host nation lacks medical capabilities, units anticipate providing medical support to stability operations to HN forces, security personnel, and the desert populace. Unlike Army/Marine Corps forces, HN soldiers and civilians are not generally evacuated outside of theater and, depending on the availability of resources, may not qualify for extended treatment at U.S. facilities in theater. Commanders leverage NGOs, IGOs, and the HN government to develop and support a medical treatment and evacuation plan for the local populace. Often, U.S. forces support this plan by providing both standard and nonstandard air and ground platforms for patient transportation and evacuation.

PROTECTION/FORCE PROTECTION

6-53. Priorities for protection often change as the focus of decisive action shifts from large-scale combat operations to stability operations. Commanders continue to identify threats and hazards, critical assets, vulnerabilities, and risk; however, critical assets, threats, and vulnerabilities will likely differ during large-scale combat operations. Critical assets requiring protection during stability operations consist of HN infrastructure (such as oil and gas pipelines), ports, water treatment plants, power plants, and hospitals; HN government and security facilities; and economic centers, such as markets.

6-54. Army/Marine Corps forces may also protect sensitive religious, cultural, or historical sites from attack or desecration. Ethnic tensions increase during periods of instability and grow when factions attack or loot important religious or cultural sites. Commanders coordinate with HN authorities to identify sensitive sites and allocate forces to securing them in accordance with the local customs and norms.

6-55. Stability operations in the desert present unique protection challenges as forces that had previously been conducting mounted maneuver are now operating dismounted in largely urban areas. In addition to this deliberate transition, new units are likely to be introduced into theater. Civil affairs teams, security force assistance units, and provincial reconstruction teams are critical to effective stability operations; however, they do not possess the inherent capability to protect themselves from significant threats. As such, commanders allocate available security forces and additional resources to support these forces when necessary. They also establish a quick reaction force for their AO and plan operations so that units can provide mutual support.

6-56. The threat during stability operations often consists of irregular enemy forces, including guerrillas and insurgents. As Soldiers/Marines operate more closely with HN civilians, they become more vulnerable to attack by insurgents or guerrillas hiding among the population. When partnering with HN security forces, the risk of a FSF attack increases. Commanders recognize the changing nature of protection requirements during stability operations and apply all the elements of combat power to mitigate risk and protect U.S. forces, foreign partners, and the populace. (See ATP 3-37.15 for additional information of FSF attack prevention and response.)

Air and Missile Defense

6-57. Generally, the threat from air and missile attack is low during most stability operations. However, commanders can still use protection techniques associated with air and missile defense to protect critical

assets. Commanders protect critical infrastructure by expanding the use of the CAL and DAL to identify and protect assets deemed vital to stabilization efforts. During stability operations in the desert, critical assets may include oil and gas infrastructure, hospitals, police stations, government buildings, water treatment plants, power stations, and markets. Commanders use the CAL and DAL concept to allocate security forces, such as military police, to protect assets from sabotage or ground attack by guerrillas or insurgents. They also work with HN authorities and security forces to improve physical security and survivability measures at these sites.

Chemical, Biological, Radiological, and Nuclear Operations

6-58. Although the threat of conventional CBRN weapons is typically reduced during stability operations, the risk that insurgent or guerrilla forces may acquire and employ toxic industrial chemicals as weapons remains. To prevent this, commanders make every effort to account for and secure toxic industrial chemicals in the immediate aftermath of large-scale combat. Units must secure chemical production sites, fertilizer plants, and munition depots until units can transfer their control to a legitimate authority. Commanders ensure Soldiers/Marines maintain access to MOPP gear if any threats of CBRN or toxic industrial chemical use arise.

Survivability

6-59. Transitioning from offensive operations to stability operations will likely trigger an increased requirement for Class IV supplies to harden both HN facilities and those occupied by U.S. forces. Commanders improve survivability at sites where Soldiers/Marines frequent. They use physical security site assessments to identify risks and assess vulnerabilities at static locations occupied by U.S. forces. This includes not only billets and outposts, but HN security force camps and sites. Commanders also implement access control procedures to ensure that unauthorized civilians or FSF do not enter sensitive areas and attack unsuspecting Soldiers/Marines.

Area Security

6-60. Commanders protect the local population by performing area security/rear area security to defeat attacks by insurgents or guerrillas and conducting police operations to protect civilians from lawlessness, rioting, and looting. Police operations are best accomplished by working with local police and HN security forces to establish order. If a local police force is unavailable, commanders prepare to provide this essential service until HN police get the training and equipment to maintain order. Military police are manned, trained, and equipped to provide policing expertise. Leaders tasked with restoring law and order should request additional military police forces.

6-61. During stability operations, Army/Marine Corps forces often provide security for HN government personnel, NGOs, IGOs, unified action partners, and the local populace. Providing security to unified action partners, HN government personnel, NGOs, and IGOs allows these agencies to focus their efforts and capabilities on the stabilization tasks they are uniquely qualified to support.

TRANSITIONS

6-62. The transfer of an AO to a legitimate authority relieves Army/Marine Corps forces of area security/rear area security responsibilities and represents a transition from stability operations to operations to shape or prevent. Conditions on the ground and resources available determine what security and cooperation tasks have priority during and after the transfer or authority. It is possible that Army/Marine Corps forces occupy long-term garrisons to prevent a recurrence of hostilities, as happened in Europe, Japan, and Korea in the twentieth century. Alternatively, a more robust security cooperation arrangement involving international peacekeeping forces might supplant a U.S. presence. Regardless of the tasks required in a specific AO, Army/Marine Corps units continue to accomplish the missions that reflect their strategic roles of shape, prevent, win, and consolidate gains in support of U.S. interests.

6-63. Transitioning an AO from military to civil control requires focus, careful planning, and close coordination among unified action partners. Transitions are gradual and often occur on a case by case basis across recovering states. AOs where units met clearly distinguished stabilization objectives gradually

transition to the legitimate civil authority. AOs may not meet stability objectives at the same pace and all AOs will not transition along the same timeline. Criteria for determining when to transition an AO is based on conditions, not time, and requires the presence of a civil authority capable of executing all the stability operations tasks on its own. This is especially true in the desert where ethnic differences and the inequitable distribution of resources can create drastically different conditions across a single state.

6-64. Just as transitions across a recovering state are gradual and vary by AO, transitions within an AO are gradual and require HN forces to supplant Army/Marine Corps forces at the individual, team, squad, and unit levels. Both the JFC and the HN civil and military leadership monitor this transition to ensure unity of effort and cohesion. In addition to threat considerations, planning for transitions in the desert requires all parties thoroughly understand—

- Formal and informal civilian leadership and relationships.
- Government institutions and administrative functions.
- Ongoing reconstruction projects.
- Economic systems and initiatives.
- NGOs and IGOs remaining in the area and the services they provide.
- Significant key events likely to affect operations.

Appendix A

Desert Regions of the World

This appendix provides locations of deserts. It also gives sizes and country affiliations for these deserts.

NOTABLE DESERTS OF THE WORLD

A-1. This appendix provides brief descriptions of notable deserts of the world. Soldiers/Marines can obtain more detailed information from the Defense Intelligence Agency. Figure A-1 illustrates the locations of notable deserts. Table A-1 on page A-2 details size and country data on the world's deserts.

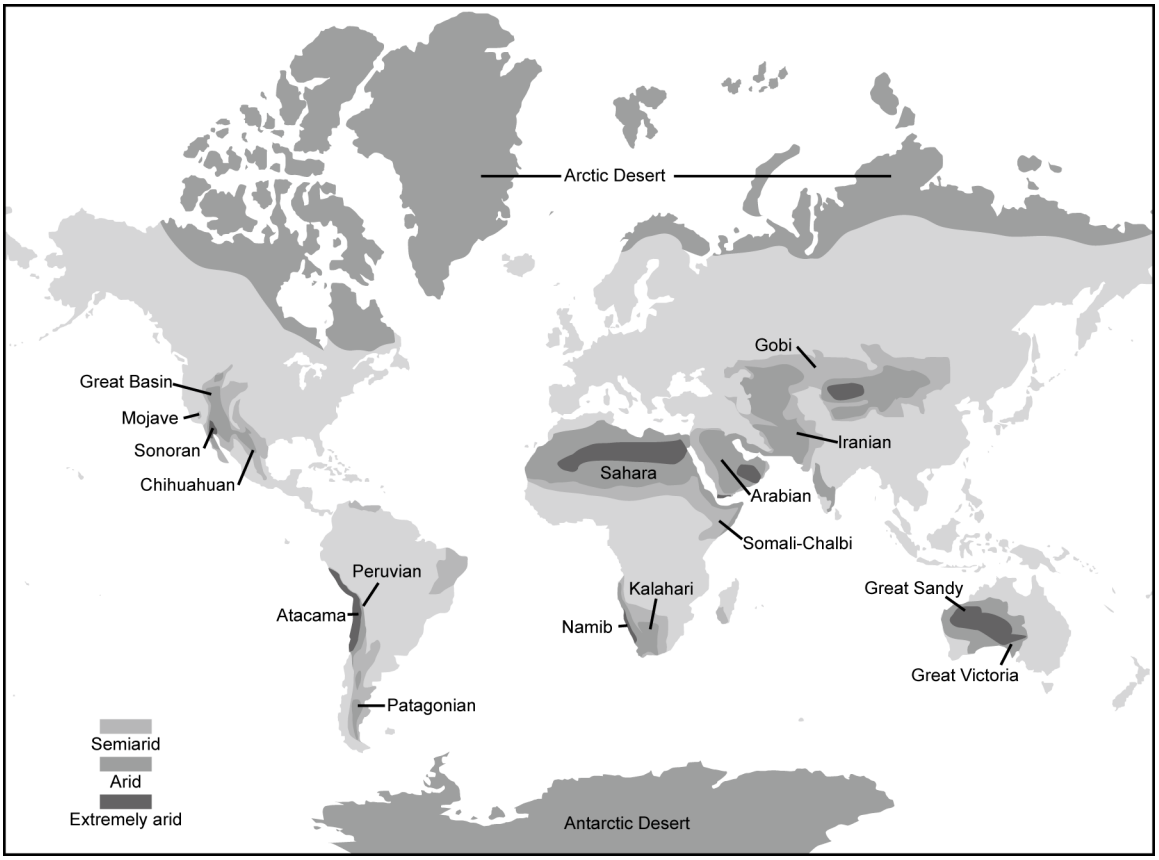

Figure A-1. Notable deserts of the world

Table A-1. Notable deserts of the world

Deserts	*Size*	*Remarks*
Antarctic	5.5 million square miles	Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom claim territorial sovereignty over areas of Antarctica. Claims of Argentina, Chile, and the United Kingdom overlap. The United States does not recognize the claims of other governments and reserves the right to assert claims; Russia has taken a similar position.
Arctic	5.4 million square miles	Parts of Alaska, Canada, Greenland, Iceland, Norway, Sweden, Finland, and Russia
Arabian	1 million square miles	Saudi Arabia, Yemen, Oman, Kuwait, and United Arab Emirates
Atacama	54,000 square miles	Northern Chile
Chihuahua	175,000 square miles	Mexico
Colorado Plateau	130,000 square miles	Along the Colorado River in southern California
Gibson	120,000 square miles	Western Australia
Gobi	500,000 square miles	Parts of Mongolia and China
Great Basin	190,000 square miles	United States
Great Sandy	150,000 square miles	Western Australia
Great Victoria	250,000 square miles	Western and southern Australia
Iranian	100,000 square miles	Iran
Kalahari	220,000 square miles	South Africa, Botswana, Namibia
Kara-Kum	135,000 square miles	Uzbekistan and Turkmenistan
Kyzyl-Kum	115,000 square miles	Kazakhstan, Uzbekistan, Turkmenistan
Mojave	54,000 square miles	Southern California
Namib	13,000 square miles	Angola, Namibia, South Africa
Patagonian	260,000 square miles	Argentina
Sahara	3.5 million square miles	Northern Africa
Simpson	56,000 square miles	Central Australia
Sonoran	120,000 square miles	Southwest Arizona, southeast California, northern Mexico
Syrian	190,000 square miles	Northern Saudi Arabia, eastern Jordan, southern Syria, and western Iraq
Taklamakan	105,000 square miles	China
Thar	75,000 square miles	India, Pakistan
50,000 square miles = 130,000 square kilometers		

Appendix B

Techniques for Operating Equipment in the Desert

This appendix discusses techniques for operating vehicles and maintaining equipment in the desert. It first discusses driving in the desert. Next it discusses recovery and maintenance of equipment in the desert environment. Next the appendix discusses wheeled vehicles. The appendix closes with two discussions: radios and general tips.

DRIVING

B-1. In addition to the requirements outlined in AR 600-55, commanders preparing for a deployment to the desert incorporate the following into their driver's training program. Marines refer to all applicable driver's training service regulations and doctrine when developing their driver's training program.

DUSTY CONDITIONS

B-2. Convoys operating over unimproved roads or trails should double the intervals between vehicles to allow time for dust to dissipate. When driving on extremely dusty roads or trails, and if traffic conditions permit, units can use a staggered column formation with vehicles alternately driving on the left and right side of the road. However, this technique increases the enemy's ability to estimate the size of friendly forces through its tracks while also increasing the chance that a vehicle may strike a mine or improvised explosive device.

B-3. During extremely dusty conditions, the convoy commander slows the rate of march and increases intervals. Operators who cannot see the vehicle in front of them should notify the convoy commander and, if necessary, pull over to the shoulder and park until the dust dissipates. Vehicles that pull off or stop must notify vehicles behind them to avoid a collision or accident. The convoy head warns vehicles to return to column formation if encountering traffic. The convoy's trail ensures that stopped vehicles are not left behind without security once the convoy begins moving again. (See ATP 4-11 for more information on motor transportation and convoy operations.)

SANDY DESERTS

B-4. Sandy deserts may be relatively flat or interspersed with windblown dunes. When driving in sand, drivers should consider the following:

- Drivers exercise caution when operating wheeled vehicles in damp sand. Damp sand can accumulate between tire treads and result in limited surface traction.
- Track vehicle operators carefully note a lack of steering response, which indicates a buildup of sand between the rear sprockets and treads. If operators allow the buildup of sand to continue, it can force the tread off. Backing up the vehicle typically removes sand that has accumulated between the track and rear sprocket.
- Operators can improve wheeled vehicles traction by reducing air pressure in their tires. However, prolonged driving on partially deflated bias ply tires can overheat the tires and break down the sidewalls. Vehicles equipped with radial tires or a central tire inflation system are not affected by the lower tire pressure if the operator adheres to the maximum speed listed in the TM.
- Drivers ensure loads are evenly distributed to prevent the vehicle from becoming mired in loose sand.
- Drivers use all-wheel drive or a lower gear to prevent becoming stuck in loose sand.

- Before entering the sand, drivers should select a gear that will allow the vehicle to maintain as much torque as possible without causing the wheels to spin.
- Commanders preconfigure recovery assets to assist large vehicles, such as heavy equipment transport systems and semi-tractor trailers, as they become stuck in loose sand more often.

B-5. A hard crust may form over sand exposed to intermittent periods of flooding or rain and extended drought. This crust may improve traction and support vehicle operations while minimizing dust. Consider the following techniques when driving on a crust:

- Use staggered columns to facilitate movement. Vehicles should not follow one behind the other.
- Ensure vehicles maintain a minimum speed (determined from experience) to prevent breaking through the crust.
- Avoid sharp turns and abrupt starts or stops that could cause a vehicle to break through the crust.
- Reconnoiter areas that are a different shade to ensure they are not softer than the surrounding crust.

CROSSING DUNES

B-6. Crossing dunes requires careful reconnaissance to check the overall slope, composition of loose sand, and the angle at the crest to ensure the vehicle will not become high centered at the top. Normally, the upwind side of the dune has a fairly gradual slope while the downwind side has a much steeper slope. If satisfied the vehicle can traverse the dune, the driver should drive the vehicle straight up the dune at an appropriate speed, crest the dune, and maintain a controlled descent on the other side.

ROCKY AREAS

B-7. Rocky areas can extend for several miles and are especially prevalent in mountainous and rocky plateau deserts. Prolonged operations over rocky areas cause extreme wear on tracks, wheels, springs, and shock absorbers. Rocks and stones can lodge between the tires on vehicles equipped with dual wheels causing severe damage to tire and brake components. Vehicles can follow one another in this type of terrain, and it may be feasible to reconnoiter and mark a route. Drivers should brake as the vehicle's wheels traverse large rocks to avoid heavy, jarring impacts, allowing the axle to settle relatively gently on the far side of the rock.

SALT MARSHES

B-8. Salt marshes are normally impassable; however, marsh mud can be used on top desert sand to produce an excellent temporary road. Many desert areas have salt marshes either in the center of a drainage basin or near the seacoast. Old trails or paths may cross the marsh, which are visible during the dry season but not in the wet season. In the wet season, standing water indicates trails due to the crust being too hard or too thick for the water to penetrate. However, troops should avoid trying such routes with load-carrying vehicles without prior reconnaissance and marking.

POLAR DESERT REGIONS

B-9. Army/Marine Corps forces exercise care when starting and operating vehicles in polar desert regions. Vehicle operators consider the following when driving wheeled vehicles on ice or snow:

- Vehicles equipped with mud and snow tires will slide more easily on icy road surfaces than those with commercial tread. Mud and snow tires are more effective off-road or on roads covered with loosely packed snow.
- All-wheel drive vehicles without chains generally perform better than two-wheel drive vehicles with chains on rear wheels.
- Chains give a good bite in snow or mud but tend to slip on ice and packed snow.
- Icy road surfaces liberally sprinkled with sand, salt, or dirt provide improved traction.
- Fresh snow may conceal icy road surfaces.
- Bridges ice before roads and may remain icy after snow has melted on roads.
- Evenly distributing a load will improve traction.
- Vehicles require three to eleven times more distance to stop on roads covered with ice or snow.

- Isolated patches of ice may coat otherwise clear roads, especially in shaded areas.

Note. For more information on operating wheel vehicles in winter conditions, refer to TC 21-305-20/AFMAN 24-306(I) and applicable TMs. For more information on operating track vehicles in winter conditions, refer to TC 21-306 and applicable TMs.

RECOVERY

B-10. Track vehicle recovery methods are the same in the desert as in temperate climates. Soldiers/Marines implement the techniques described in paragraphs B-11 through B-15 for wheeled vehicle recovery in desert sand or salt marshes. Wheeled vehicles should carry the following items to assist with recovery:

- Steel or aluminum channels, at least for the driving wheels. These are pierced to reduce weight and ribbed for strength. Troops can use pierced steel planking or galvanized iron as a substitute.
- Canvas mats, preferably with laterally reinforcing strips of metal interwoven to improve strength and increase traction.
- Jacks and jack blocks.
- Tow ropes or cables.
- Shovels.

B-11. Once a vehicle becomes mired, Soldiers/Marines excavate the ground under the vehicle in a gradual slope towards the direction of recovery to a point where no part of the underside touches the ground. Soldiers/Marines lay channels or mats under or against the wheels facing the direction of recovery. They can reduce tire pressure to increase traction, but this also lowers the vehicle.

B-12. Once the vehicle begins to move, the driver must maintain speed until the vehicle has reached the nearest hard surface. At this point Soldiers/Marines re-inflate the tires, inspect the vehicle for damage, and collect recovery equipment.

B-13. Vehicles equipped with winches can self-recover if Soldiers/Marines have an anchor available.

B-14. Soldiers/Marines can use a rubberized fabric balloon on light-weight vehicles to lift them free of broken crust. Soldiers/Marines place the balloon under the vehicle and inflate it with the vehicle's exhaust. Recovery is possible once the vehicle's body is off the ground.

B-15. Soldiers/Marines separated from their unit should stay with their vehicle if it breaks down or becomes mired. A unit can find a vehicle more easily than a lone Soldier/Marine.

MAINTENANCE

B-16. Prolonged driving on rocky plateau deserts can damage tracked vehicle suspension. Operators must ensure vehicles have the correct track tension for the given conditions. Torsion bars and suspension arms will likely require frequent replacement. To prevent damage to internal parts of the idler and suspension arms, field maintenance units require tools for tapping and removing sheared bolts.

B-17. Maintenance personnel must inspect and adjust transmission bands frequently, especially on vehicles operating in hot barren mountains. This maintenance helps reduce transmission overheating.

WHEELED VEHICLES

B-18. Wheeled vehicles are subject to brake system component failures and power steering leaks in rocky plateau deserts. Vehicles equipped with manual transmissions tend to suffer clutch failure caused by drivers slipping the clutch. Vehicles with automatic transmissions often overheat in these conditions. Vehicle operators stop frequently to allow the transmission time to cool. Tire consumption is also very high, and all

vehicles should carry at least one spare tire. The unit's authorized stockage list of tires should be considerably increased. Approximately one of every four vehicles should carry slave cables to account for battery failure.

B-19. If possible, Soldiers/Marines equip vehicles with the following items when operating away from maintenance units or facilities:

- Extra fan belts.
- Two spare tires.
- Extra oil.
- Extra radiator hoses.
- Heavy duty tape.
- Extra air and fuel filters.
- Jack stand support plate.
- Tow rope or cable.
- Extra water cans.
- Siphoning hose and funnel.
- Slave cables.

RADIOS

B-20. Soldiers/Marines must keep radios, regardless of type, cool and clean. They keep radios in the shade whenever possible and ensure adequate ventilation. Units have additional radios available in communications centers, such as command posts, to allow rapid replacement if the set in use shows signs of overheating.

B-21. Desert operations require dispersion, yet the environment is likely to degrade the transmission range of radios, particularly at very high frequencies. This degradation most often occurs during the hottest part of the day, approximately 1200 to 1700 hours.

B-22. Commanders identify primary, alternate, contingency, and emergency means of communications to build resiliency into their communications plan. Techniques for operating in a communications-degraded environment or for improving transmission range include—

- Establishing retransmission stations.
- Using airborne retransmission stations.
- Using vehicles with radios to relay messages between retransmission stations.
- Using alternative radio links such as very high frequency multichannel telephones, satellite phones, or high frequency single-sideband modulation.
- Using wire communications during local security or static defensive operations.

GENERAL TIPS

B-23. General predeployment tips to prepare equipment for desert operations include:

- Adjust battery specific gravity to the environment (refer to appropriate TMs).
- Increase on-hand stockage of oils and lubricants.
- Use high-grade 20W-50 oil as it works well in desert conditions.
- Check lubrication orders and TMs for the correct viscosity of lubricants at higher temperatures.
- Protect exposed electrical cables and wires with electrical tape.
- Increase authorized stockage lists for the following parts due to high failure rates:
  - Tires.
  - Track components.
  - Suspension components for both wheel and track vehicles.
  - Brake shoes.
  - Bearing and bushings.
  - Plastic and rubber parts, including seals and gaskets.

- Air filters.
- Oil filters
- Generator components.

B-24. Daily tips for operating equipment in the desert include:

- Check track tension daily.
- Set voltage regulators at the lower end of specifications.
- Erect screens to block blowing sand in maintenance areas.
- Check tire pressures and fuel levels at median temperature point during the day.
- Maintain water on hand to replenish depleted batteries.

B-25. General tips for operating equipment in the desert include:

- Check drive belt adjustment frequently.
- Conduct proper engine cool down and shutdown procedures, especially for diesel engines.
- Start vehicles regularly to maintain batteries.
- Adjust fluid levels in closed, pressurized systems to account for expansion due to extreme heat.
- Keep lubrication to the absolute minimum on exposed or semi exposed moving parts to include the working parts of weapons.
- Keep optics covered and clean them with a soft paintbrush or a low-pressure air system. These tools can also be used to avoid the excessive use of oils and lubricants when cleaning weapons.
- Ground all refueling equipment.
- Replenish radiators with a combination of coolant and potable water whenever possible.
- Use plastic bags, tarpaulins, or canvas sheets to protect equipment during maintenance or when not in use.
- Use muzzle plugs or caps to protect weapons.

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Appendix C

Techniques for Fratricide Reduction in the Desert

This appendix discusses techniques that Soldiers/Marines use to reduce fratricide in the desert environment. It first discusses the fratricide problem in the desert environment. Then it discusses briefs and rehearsals. The appendix concludes with a discussion incorporating fratricide reduction to the operation order.

FRATRICIDE REDUCTION

C-1. The ability to engage forces at extended range and the lack of easily identifiable terrain features to control maneuver increases the risk of fratricide during desert operations. This is compounded by the tempo of large-scale combat in the desert, where maneuver forces can rapidly cover large areas of unrestricted terrain and occupy new positions unbeknownst to other friendly forces in the area. These factors increase the need for clear communication, easily understood fire support coordination measures, and an accurate common operational picture among all friendly units. *Fratricide* is the unintentional killing or wounding of friendly or neutral personnel by friendly firepower (ADP 3-37). Like other risks, commanders use the risk management process to identify fratricide hazards and then develop and implement controls. (See ATP 5-19 for detailed instructions on integrating the risk management process into operations.)

MAGNITUDE OF THE PROBLEM

C-2. Technological advances in optics, communications, and firepower make it possible to quickly engage targets or call for fire at extended ranges. However, the rapid pace and tempo of desert operations means that these engagements may occur before Soldiers/Marines can confirm whether a potential target is a friend or foe. Confirmation is further complicated during periods of limited visibility when sandstorms, blowing dust, or smoke obstruct the battlefield/battlespace.

C-3. In addition to relying on visual recognition, commanders use control measures to synchronize fire and maneuver and to prevent units from inadvertently targeting friendly forces. They also use command and control systems to promote a common operational picture that enables forces to know their own location as well as those of adjacent friendly units. Finally, units develop and standardize simple procedures for marking vehicles and equipment to aid in visual recognition from both the ground and the air.

REACTION TO FRATRICIDE INCIDENTS

C-4. Vehicle crews and teams take the following steps when engaged by suspected friendly fire:

- React to contact until the vehicle crew recognizes it as friendly fire.
- Cease fire.
- Identify self and attempt to make contact with the friendly unit.
- Use a visual recognition signal, such as smoke, to identify self as friendly. Units standardize visual recognition signals per SOPs.
- Report on the higher headquarters' network:
  - Unit location.
  - Distance and direction of incoming fire.
- Protect Soldiers/Marines and request medical assistance as needed.
- Do not return fire after identifying the other unit as friendly.

C-5. Units that mistakenly engage friendly forces take the following actions:

- Cease fire.
- Identify self and attempt to make verbal contact with the friendly unit.
- Use visual recognition signals, such as smoke, to identify self as friendly.
- Report on higher headquarters' network:
  - Unit location.
  - Estimated location of engaged unit.
  - The type of fire.
  - The target effects.
- After identifying self as friendly and receiving confirmation from the other unit, attempt to assist the unit with tactical casualty care, security, and casualty evacuation.

C-6. Units that observe a friendly fire incident take the following actions:

- Seek cover and protect self.
- Report on the next higher network:
  - The location of both units.
  - The location of the incident.
  - The distance and direction between engaged units.
  - The type of fire.
  - The target effects.
- Establish communication with engaged units and identify self as friendly.
- Use visual recognition signals, such as smoke, to identify self as friendly.
- Once identified as friendly, provide assistance with tactical casualty care, security, and casualty evacuation.

PREVENTIVE MEASURES

C-7. Incorporating composite risk management to reduce the potential for fratricide occurs throughout the operations process. The rapid pace of desert operations and the tendency for engagements to occur at extended ranges requires careful planning and preparation to prevent fratricide. During planning, commanders ensure controls are integrated into the scheme of maneuver and scheme of fires to prevent targeting friendly forces. When preparing for desert operations, units thoroughly rehearse the scheme of maneuver and ensure subordinates understand the location and mission of adjacent units and ways to distinguish friendly from enemy forces on the battlefield/battlespace. During execution, commanders control movement and adjust operations in accordance with synchronization matrices and timetables as units progress on the battlefield/battlespace. Afterwards, units assess the effectiveness of their preventive measures and identify how fratricide prevention techniques can be improved for future operations. Graphic control measures are critical to preventing fratricide and are used throughout operations to synchronize fire and maneuver in desert areas that lack easily recognizable terrain

Measures During Planning, Preparation, and Execution

C-8. Commanders and staff complete measures to mitigate the risk of fratricide during desert operations. The measures discussed in paragraphs C-9 through C-11 reduce the risk of fratricide and are integrated into planning, preparing, and executing operations.

Planning

C-9. Commanders identify, articulate, and implement fratricide control measures when planning an operation in a desert environment. Fratricide prevention considerations during planning include—

- Clearly articulating the enemy's disposition, anticipated location, and most likely course of action.
- Identifying equipment and uniform that distinguishes the enemy from friendly forces.
- Clearly designating subordinate unit AOs.

- Establishing control measures to prevent units from mistakenly entering an adjacent unit's AO.
- Tying control measures and AOs to easily identifiable terrain features.
- Establishing restrictive fire support coordination measures—such as no-fire areas, restrictive fire areas, and restrictive fire lines—to limit fires around friendly forces.
- Establishing and briefing visual and auditory recognition signals, both near and far. Units preferably use recognition signals established by a common SOP.
- Using a graphic aid, such as a sand table, to clearly brief the mission and concept of operations.
- Establishing a redundant communications plan, to include a common higher headquarters network or "sheriff's net."
- Clearly briefing the ROE.
- Establishing intervals for communications checks and situation reports from subordinate unit.
- Establishing a means for ground forces to mark their vehicles for easy recognition from the air.

Preparation

C-10. Commanders incorporate the following measures to prevent or mitigate fratricide while preparing for an operation in a desert environment:

- Conduct rehearsals, such as a combined arms rehearsal, with all subordinate units.
- Conduct rehearsals on a full-size terrain model that depicts all control measures.
- Require subordinate unit leaders to walk and talk through their movement and tasks during the rehearsal.
- Conduct thorough communications checks between all subordinate units and the higher headquarters.
- Rehearse actions taken during a friendly fire incident.
- Rehearse casualty evacuation and medical evacuation procedures.
- Conduct backbriefs to ensure subordinates understand control measures, near and far recognition signals, and the location and mission of adjacent units.
- Require subordinates to brief the ROE and escalation of force procedures during the backbrief.

Execution

C-11. During execution, real-time risk management is necessary to overcome unforeseen fratricide risks. The following measures are used to mitigate the risk of fratricide when executing an operation:

- Conduct communications checks and receive periodic situation reports from all subordinate units.
- Control subordinate unit movements by phase line or other established control measures.
- Adjust operations as necessary in accordance with subordinate progress, rates of march, and movement tables.
- Ensure regular communication between adjacent units.
- Use multiple imaging systems to identify enemy vehicles or equipment; do not rely solely on thermal imaging systems as the resolution precludes accurate information.

Graphic Control Measures

C-12. Commanders and staff complete graphic control measures to mitigate the risk of fratricide during desert operations. Graphic control measures are standardized tools that commanders use to clarify their intent, add precision to their concept of operations, and communicate their plan. As such, clear graphics can be an important measure for reducing the risk of fratricide. Commanders at all levels must understand the definitions and purposes of operational graphics as well as the impact of the control measures on their operations. (See FM 1-02.2 for more information on graphic control measures.)

CONFIRMATION BRIEFS AND REHEARSALS

C-13. Confirmation briefs and rehearsals are primary tools in identifying and reducing fratricide risk. A *confirmation brief* is a brief subordinate leaders give to the higher commander immediately after the operation

order is given to confirm understanding (ADP 5-0). It reflects subordinate leaders' understanding of the commander's intent, their specific tasks, and the relationship between their mission and the other units' missions in the operation. A *rehearsal* is a session in which the commander and staff or unit practices expected actions to improve performance during execution (ADP 5-0).

C-14. Commanders consider the following when conducting confirmation briefs and rehearsals to aid in reducing fratricide:

- Confirmation briefs ensure subordinates understand their commander's intent, the mission, and the concept of operations. Confirmation briefs often identify areas of confusion, complexity, or planning errors.
- Confirmation briefs should require subordinates to identify the control measures that restrict their movement and fire.
- Subordinates brief both near and far recognitions signals during the confirmation brief.
- Rehearsals extend to all levels of command and involve all key leaders. At the small-unit level (company and below), all Soldiers/Marines and leaders participate in the rehearsal.
- Confirmation briefs and rehearsals ensure subordinates know where fratricide risks exist and what to do to reduce or eliminate the risk.

C-15. Maintaining situational awareness is key to fratricide reduction. Units establish techniques for gaining and maintaining situational awareness in their SOPs. Techniques include—

- Monitoring the next higher headquarters' network.
- Conducting regular communications checks and situation reports with adjacent units.
- Establishing redundant measures for accurately identifying each unit's location.

C-16. Reducing the risk of fratricide requires a holistic approach to comprehensive risk management. The following measures are not intended to restrict initiative; however, units can employ these measures as appropriate to further reduce the risk of fratricide:

- Units utilizing the MDMP include the risk of fratricide in their running estimates. These risks, and the associated controls, are expressed in the operation order or fragmentary order.
- To prevent fratricide, units use a combination of traditional land navigation skills and Global Positioning System-enabled precision navigation devices to communicate their location to adjacent units. This enables units to synchronize maneuver, enhance awareness, and avoid fratricide.
- The extended engagement ranges common to desert operations require the rapid identification of vehicles and equipment. Leaders train their Soldiers/Marines on target identification using equipment identification cards. Soldiers/Marines must be able to distinguish between friend and foe at maximum range using vehicle silhouettes.
- Soldiers/Marines maintain situational awareness and know unit locations, dispositions, denial areas (minefields), and contaminated areas.
- Soldiers/Marines attend individual and collective fratricide awareness training. This includes target identification and recognition, fire discipline, and leader training.
- Soldiers/Marines use a common language or vocabulary and doctrinally correct terminology and graphic control measures.
- Soldiers/Marines recognize the signs of combat stress. Leaders take quick, effective action to reduce stress and maintain unit cohesion.
- Soldiers/Marines keep the plan as simple as possible; the greater the variables in timing and movement, the greater the risk of fratricide.
- Soldiers/Marines use SOPs that align with doctrine to simplify orders and foster interoperability between units without habitual relationships. Leaders periodically review and update SOPs as needed.
- Leaders provide subordinates with the time to adequately plan, prepare, and communicate with each other.
- Leaders establish a common primary, alternate, contingency, and emergency communications plan all units taking part in the operation.

- Leaders collocate command posts when possible, especially during complex or risky operations such as a passage of lines, gap crossing, or breach.
- Commanders establish and exchange liaison officers as appropriate.
- Commanders ensure ROE are clear and understood by all.
- Units conduct thorough after action reviews on all fratricide or potential fratricide incidents.

C-17. During terrain analysis, Soldiers/Marines consider how they can use the desert terrain to mitigate the potential for fratricide while also identifying areas where the terrain may make fratricide more likely. This is particularly important when planning a defense and during engagement area development. Commanders ensure that fires into an engagement area do not put adjacent friendly units at risk and that battle positions are not sited within a friendly unit's field of fire. When possible, commanders use terrain features, such as hills or ridges, to separate friendly positions and prevent fires from inadvertently crossing unit boundaries.

FRATRICIDE REDUCTION TO OPERATION ORDER

C-18. Commanders can thoroughly integrate fratricide reduction techniques into an operation order. Paragraphs C-19 through C-25 list questions where they would likely appear in an operation order that the staff needs to answer for fratricide reduction. The answers to these questions may warrant evaluation in other paragraphs or when preparing for an operation. (See ATP 5-19 for more information on integrating risk management into operations.)

C-19. Concerning task organization, the staff answers the following questions:

- Has the unit worked under this task organization before?
- Are SOPs compatible with the task organization (especially with attached units)?
- Are special markings or signals (for example, cats' eyes, chemically activated lights, or panels) needed for positive identification of uniforms and equipment?
- What special weapons or equipment will units use? Do they look or sound like enemy weapons or equipment?

C-20. Concerning the situation, the staff answers the following questions—

- About enemy forces:
  - Are there similarities between enemy and friendly equipment and uniforms that could lead to fratricide?
  - What languages do enemy forces speak? Could these contribute to fratricide risk?
  - What are the enemy's deception capabilities and its past record of deception activities?
  - What is the disposition of enemy forces?
- About friendly forces:
  - When operating with FSF, are there similarities with the enemy in language, uniform, and equipment that could increase the risk of fratricide?
  - Could differences in equipment and uniforms among U.S. armed forces increase fratricide risk during joint operations?
  - What is the friendly deception plan?
  - What are the locations of adjacent units (left, right, forward, and follow-on)?
  - Are there neutrals and noncombatants in the area?
  - How experienced are the forces conducting the operation? Is this a unit's first combat operation?
  - Will fatigue be a factor for friendly forces during the operation? Has an effective sleep plan been developed?
  - Have units trained and are proficient with the equipment used during the operation? This is especially important for communications equipment and optics.
  - What are the expected MOPP gear requirements for the operation? How can this reduce situational awareness or the ability to communicate?

C-21. Concerning the weather, the staff answers the following questions:

- What are the expected visibility conditions (light data and precipitation) for the operation?
- What effect will heat and cold have on troops, weapons, optics, and equipment?

- Concerning the terrain, the staff answers the following questions:
  - How can the area's topography and terrain either increase the risk of fratricide or be used to reduce the potential for fratricide?
  - How do observation and fields of fire, avenues of approach, key terrain, obstacles and mobility corridors, and cover and concealment affect the potential for fratricide?

C-22. Concerning the mission, the staff answers the question: Is the mission, as well as all associated tasks and purposes, clearly understood?

C-23. Concerning execution, the staff answers the following questions—

- About maneuver: Are main and supporting efforts identified and aware of fratricide risks and prevention measures?
- About fires (direct and indirect):
  - Are priorities of fires identified?
  - Have staff developed target lists?
  - Have staff developed the fire execution matrix or overlay?
  - Have staff clearly identified attack aviation and close air support targets?
  - How will ground forces identify themselves to aviation assets?
  - What fire support coordination measures have been established?
  - Have final protective fires been designated?
- About engineer tasks:
  - Are the locations of friendly and enemy minefields known?
  - Are obstacles identified, along with the approximate time needed for reduction and breaching of each?
- About tasks to each subordinate unit:
  - Have staff developed the direct-fire plan?
  - Are support-by-fire positions established with clear limits and fields of fire?
- About coordinating instructions:
  - Will a rehearsal be conducted? What type of rehearsal will be conducted? Are direct and indirect fires included?
  - Are appropriate control measures clearly explained and illustrated in the operation order and overlays? Have they been disseminated to everyone who has a need to know? What is the plan for using these control measures to synchronize the battle and prevent fratricide?
  - Have target and vehicle identification drills been practiced?
  - Do subordinate units know the immediate action, drill, or appropriate signaling techniques if they come under unknown or friendly fire? Is there a backup action?

C-24. Concerning sustainment, the staff answers the following questions:

- What are the locations of combat trains and is this known by all participating units?
- What are the locations of field trains and is this known by all participating units?
- How will Soldiers/Marines identify trains? Will vehicles be marked?
- Do medical and maintenance personnel know the routes between units and echelons?

C-25. Concerning command and signal, the staff answers the following questions—

- About command:
  - Are subordinate commanders familiar with each other? Have they rehearsed together and established communications?
  - What command is responsible for synchronizing fire and maneuver?

  - What is the succession of command and how will changes to command and control be communicated?
- About signal:
  - Do instructions include signals for special and emergency events?
  - Do instructions include how to identify friendly forces to aircraft?
  - What are near and far recognition signals? Are these common to the unit SOP or have they been established for this particular operation?
  - What are the primary, alternate, contingency, and emergency methods of communication? Who is monitoring each method of communication?
  - Has a "sheriff's net" or another emergency frequency been established?
  - What is the protocol for using the "sheriff's net" and who is responsible for monitoring it?

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Appendix D

Marine Corps Doctrinal Schema Conversions

This appendix provides cross-referencing for old and current Marine Corps doctrine publication numbering.

D-1. In 2016 the Marine Corps conducted a doctrine realignment project that resulted in reorganization and renumbering its doctrinal publications. Army versions of dual-Service manuals published prior to 2016 do not reflect current Marine Corps doctrine numbering. Table D-1 reflects the number conversion. Go to https://homeport.usmc.mil/sites/mcdoctrine/Shared%20Documents/Doctrine%20Hierarchy.pdf for the entire table.

Table D-1. Marine Corps Doctrinal Manual Number Conversion

New Number	*Old Number*	*Publication Title*
MCRP 3-40D.14	MCRP 3-17.7Q	*Water Support Operations*
MCRP 3-40B.2	MCRP 4-11B	*Environmental Considerations*
MCRP 3-40B.6	MCRP 4-11H	*Multi-Service Tactics, Techniques, and Procedures for Operational Contract Support*
MCWP 3-32	MCWP 3-40.4	*Marine Air-Ground Task Force Information Operations*
MCRP 3-32D.1	MCWP 3-40.5	*Electronic Warfare*
MCRP 3-20.6	MCRP 3-42.1A	*MTTP for Unmanned Aircraft Systems (UAS)*
MCRP 3-20.5	MCWP 3-42.1	*Unmanned Aircraft Systems Operations*
MCWP 3-20	MCWP 3-2	*Aviation Operations*
MCWP 2-10	MCWP 2-1	*Intelligence Operations*
MCRP 2-10B.1	MCRP 2-3A	*Intelligence Preparation of the Battlefield/Battlespace*
MCWP 6-10	MCWP 6-11	*Leading Marines*
MCIP 3-03Di	MCIP 3-33.03	*Security Cooperation*
MCRP 3-03A.2	MCRP 3-33.1C	*Multi-Service Tactics, Techniques, and Procedures for Civil Affairs Support to Foreign Humanitarian Assistance*
MCWP 3-02	MCWP 3-33.5	*Insurgencies and Countering Insurgencies*
MCRP 3-40E.1	MCRP 4-11.4A	*Recovery and Battle Damage Assessment and Repair (BDAR)*
MCTP 12-10A	MCWP 3-35.1	*Mountain Warfare Operations*
MCRP 12-10A.4	MCRP 3-35.1D	*Cold Region Operations*

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Source Notes

This division lists sources by page number.

1-2 **Figure 1-1.** Photo by Captain Katherine Milberry, 34th Expeditionary Combat Aviation Brigade, taken at Fort Irwin, California, 05 May 2018. Available at https://www.dvidshub.net/image/4398777/ntc-terrain.

1-2 **Figure 1-2.** Photo by Sergeant Nathan Franco, Fort Irwin Operations Group, taken at Fort Irwin, California, 27 October 2019. Available at https://www.dvidshub.net/image/5894526/troops-action.

1-3 **Figure 1-3.** Photo by Senior Master Sergeant Joseph Carter, 180th Fighter Wing, Ohio Air National Guard, taken over Antarctica on 14 December 2018. Available at https://www.dvidshub.net/image/5148168/beyond-endurance-keeping-airmen-safe-most-inhospitable-place-earth.

1-4 **Figure 1-4.** Photo by Airman 1st Class Andrew Kobialka, 366th Fighter Wing Public Affairs, taken at Bruneau Dunes State Park, Idaho, 13 March 2020. Available at https://www.dvidshub.net/image/6142560/airmen-ruck-26-miles-sand-dunes-tribute-bataan-death-march.

2-8 **Extending Operational Reach: The 101st Airborne Division in Operation DESERT STORM.** Vignette adopted from *Air Assault in the Gulf: An interview with MG J.H. Binford Peay, III, Commanding General, 101st Airborne Division (Air Assault)* (Washington DC: Center of Military History, 1991), https://history.army.mil/documents/SWA/DSIT/Peay.htm.

3-24 **Logbase ECHO: VII Corps Sustainment Planning During Operation DESERT STORM.** Vignette adopted from Stephen A. Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington DC: Center of Military History, 2002), 119, 131. Available at https://history.army.mil/html/books/070/70-73-1/index.html.

4-4 **The Battle of 73 Easting.** Vignette adopted from Stephen A. Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington DC: Center of Military History, 2002), 327–331.

4-9 **Turning Movement: Third Army in Operation DESERT STORM.** Vignette adopted from Stephen A. Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington DC: Center of Military History, 2002), 31–35, 189–197.

5-3 **Military Deception: 1st Cavalry Division in Operation DESERT STORM.** Vignette adopted from Stephen A. Bourque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington DC: Center of Military History, 2002), 141–146.

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Glossary

The glossary lists acronyms and terms with Army, Marine Corps, and joint definitions. Where the same term has different definitions used by the Army, Marine Corps, or joint, then parenthesis with applicable proponent precedes the given definition. The proponent publication for terms is listed in parentheses after the definition. Approved Marine Corps acronyms, terms, definitions, and addendums can be found in MCRP 1-10.2, *Marine Corps Supplement to the Department of Defense Dictionary of Military and Associated Terms*.

SECTION I – ACRONYMS AND ABBREVIATIONS

ADP	Army doctrine publication
AO	area of operations
AR	Army regulation
ATP	Army techniques publication
BDAR	battle damage assessment and repair
CAL	critical asset list
CBRN	chemical, biological, radiological, and nuclear
CEMA	cyberspace and electromagnetic activity
CMOC	civil-military operations center
COA	course of action
DAL	defended asset list
DOD	Department of Defense
DODD	Department of Defense directive
EMS	electromagnetic spectrum
EW	electronic warfare
FARP	forward arming and refueling point
FASCAM	family of scatterable mines
FM	field manual
FSF	foreign security forces
HLZ	helicopter landing zone
HN	host-nation
HUMINT	human intelligence
IGO	intergovernmental organization
IPB	intelligence preparation of the battlefield/battlespace
IR	infrared
JFC	joint force commander
JP	joint publication
LCSS	lightweight camouflage screen system

LOC	line of communications
MAGTF	Marine air-ground task force
MBA	main battle area
MCDP	Marine Corps doctrinal publication
MCIP	Marine Corps interim publication
MCOO	modified combined obstacle overlay
MCPP	Marine Corps planning process
MCRP	Marine Corps reference publication
MCTP	Marine Corps tactical publication
MCWP	Marine Corps warfighting publication
MDMP	military decision-making process
METT-T	mission, enemy, terrain and weather, troops and support available—time available
METT-TC	mission, enemy, terrain and weather, troops and support available, time available, civilian considerations
MIG	Marine expeditionary force information group
MILDEC	military deception
MISO	military information support operations
MOE	measure of effectiveness
MOP	measure of performance
MOPP	mission-oriented protective posture
MSR	main supply route
NGO	nongovernmental organization
NVD	night vision device
OPSEC	operations security
PAA	position area for artillery
POL	petroleum, oils, and lubricants
PPE	personal protective equipment
ROE	rules of engagement
SOP	standard operating procedure
SWEAT-MSO	sewer, water, electricity, academics, trash, medical, safety, other considerations
TM	technical manual
TTP	tactics, techniques, and procedures
U.S.	United States
UAS	unmanned aircraft system
USAID	United States Agency for International Development
USMC	United States Marine Corps
WBGT	wet bulb-globe temperature

SECTION II – TERMS

air assault

(joint) The movement of friendly assault forces by rotary-wing or tiltrotor aircraft to engage and destroy enemy forces or to seize and hold key terrain. (JP 3-18) (Marine Corps amplification) Operations in which air assault forces (combat, combat support, and combat service support), using the firepower, mobility, and total integration of assault support assets in their ground or air roles, maneuver on the battlefield under the control of the mission commander to provide mobility and firepower of the assigned mission. (MCRP 1-10.2)

airspace control

(joint) Capabilities and procedures used to increase operational effectiveness by promoting the safe, efficient, and flexible use of airspace. (JP 3-52) (Marine Corps amplification) A process that coordinates, integrates, and regulates the use of an airspace of defined proportions. It does not include measures that approve, disapprove, deny, or delay air operations. (MCRP1-10.2)

airspace management

The coordination, integration, and regulation of the use of airspace of defined dimensions. (JP 3-52)

amphibious operation

A military operation launched from the sea by an amphibious force to conduct landing force operations within the littorals. (JP 3-02)

area defense

(Army) A type of defensive operation that concentrates on denying enemy forces access to designated terrain for a specific time rather than destroying the enemy outright. (ADP 3-90) (Marine Corps) A type of defense in which the bulk of the defending force is disposed in selected tactical localities where the decisive battle is to be fought. Principal reliance is placed on the ability of the forces in the defended localities to maintain their positions and to control the terrain between them. The reserve is used to add depth, to block, or restore the battle position by counterattack. (MCRP 1-10.2)

area of operations

An operational area defined by a commander for land and maritime forces that should be large enough to accomplish their missions and protect their forces. (JP 3-0)

area security

A type of security operation conducted to protect friendly forces, lines of communications, and activities within a specific area. (ADP 3-90)

attack

(Army) A type of offensive operation that destroys or defeats enemy forces, seizes and secures terrain, or both. (ADP 3-90) (Marine Corps) An *attack* is an offensive action characterized by coordinated movement, supported by fire, conducted to defeat, destroy, or capture the enemy or seize and/or secure key terrain. (MCRP 1-10.2)

battle position

(Marine Corps) In ground operations, a defensive location oriented on an enemy avenue of approach from which a unit may defend. (MCRP 1-10.2)

biological agent

A microorganism (or a toxin derived from it) that causes disease in personnel, plants, or animals or causes deterioration of material. (JP 3-11)

biometrics

The process of recognizing an individual based on measurable anatomical, physiological, and behavioral characteristics. (JP 2-0)

breakthrough

A rupturing of the enemy's forward defenses that occurs as a result of a penetration. A breakthrough permits the passage of an exploitation force. (FM 3-90-1)

chemical hazard

Any chemical manufactured, used, transported, or stored that can cause death or other harm through toxic properties of those materials, including chemical agents and chemical weapons prohibited under the Chemical Weapons Convention as well as toxic industrial chemicals. (JP 3-11)

close area

The portion of the commander's area of operations where the majority of subordinate maneuver forces conduct close combat. (ADP 3-0)

combat power

(Army) The total means of destructive, constructive, and information capabilities that a military unit or formation can apply at a given time. (ADP 3-0) (joint) The total means of destructive and/or disruptive force that a military unit/formation can apply against the opponent at a given time. (JP 3-0)

command and control

(joint) The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. (JP 1) (Marine Corps amplification) The means by which a commander recognizes what needs to be done and sees to it that appropriate actions are taken. Command and control is one of the warfighting functions. (MCRP 1-10.2)

command and control warfighting function

The related tasks and a system that enable commanders to synchronize and converge all elements of combat power. (ADP 3-0)

confirmation brief

A brief subordinate leaders give to the higher commander immediately after the operation order is given to confirm understanding. (ADP 5-0)

consolidate gains

Activities to make enduring any temporary operational success and to set the conditions for a sustainable security environment, allowing for a transition of control to other legitimate authorities. (ADP 3-0)

consolidation area

(Army) The portion of the land commander's area of operations that may be designated to facilitate freedom of action, consolidate gains through decisive action, and set conditions to transition the area of operations to follow on forces or other legitimate authorities. (ADP 3-0)

countermobility operations

(joint) The construction of obstacles and emplacement of minefields to delay, disrupt, and destroy the enemy by reinforcement of the terrain. (JP 3-34) (Army/Marine Corps) Those combined arms activities that use or enhance the effects of natural and man-made obstacles to deny enemy freedom of movement and maneuver. (ATP 3-90.8/MCTP 3-34B [MCWP 3-17.5])

critical asset list

A prioritized list of assets or areas, normally identified by phase of the operation and approved by the joint force commander, that should be defended against air and missile threats. (JP 3-01)

culminating point

The point at which a force no longer has the capability to continue its form of operations, offense or defense. (JP 5-0)

cyberspace

A global domain within the information environment consisting of the interdependent network of information technology infrastructures and resident data, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers. (JP 3-12)

decisive operation

The operation that directly accomplishes the mission. (ADP 3-0)

deep area

Where the commander sets conditions for future success in close combat. (ADP 3-0)

defended asset list

A listing of those assets from the critical asset list prioritized by the joint force commander to be defended with the resources available. (JP 3-01)

defensive operation/s

(Army) An operation to defeat an enemy attack, gain time, economize forces, and develop conditions favorable for offensive or stability operations. (ADP 3-0) (Marine Corps) Operations conducted to defeat an enemy attack, gain time, economize forces, and develop conditions favorable to offensive and stability operations. The three types of defensive operations are area, mobile, and retrograde. (MCRP 1-10.2)

delay

(Army) When a force under pressure trades space for time by slowing down the enemy's momentum and inflicting maximum damage on enemy forces without becoming decisively engaged. (ADP 3-90) (Marine Corps) A form of retrograde in which a force under pressure trades space for time by slowing the enemy's momentum and inflicting maximum damage on the enemy without, in principle, becoming decisively engaged. (MCRP 1-10.2)

demonstration

(joint) In military deception, a show of force similar to a feint without actual contact with the adversary, in an area where a decision is not sought that is made to deceive an adversary. (JP 3-13.4) (Marine Corps amplification) Operation designed to divert enemy attention, allowing the forces of a Marine air-ground task force to execute decisive action elsewhere. It is a show of force that threatens an attack at another location but does not make contact with the enemy. (MCRP 1-10.2)

direct pressure force

A force employed in a pursuit operation that orients on the enemy main body to prevent enemy disengagement or defensive reconstitution prior to envelopment by the encircling force. It normally conducts a series of attacks to slow the enemy's retirement by forcing the enemy to stand and fight. (FM 3-90-1)

encirclement operations

Operations where one force loses its freedom of maneuver because an opposing force is able to isolate it by controlling all ground lines of communications and reinforcement. (ADP 3-90)

encircling force

(Army) In pursuit operations, the force which maneuvers to the rear or flank of the enemy to block the enemy's escape so that the enemy can be destroyed between the direct pressure force and encircling force. This force advances or flies along routes parallel to the enemy's line of retreat. If the encircling force cannot outdistance the enemy to cut the enemy off, the encircling force may also attack the flank of a retreating enemy. (FM 3-90-1) (Marine Corps) In pursuit operations, the force that maneuvers to the rear or flank of the enemy to block its escape so that it can be destroyed between the direct pressure force and encircling force. This force advances or flies along routes parallel to the enemy's line of retreat. If the encircling force cannot outdistance and cut off the enemy, the encircling force may also attack the flank of a retreating enemy. (MCRP 1-10.2)

envelopment

A form of maneuver in which an attacking force seeks to avoid the principal enemy defenses by seizing objectives behind those defenses that allow the targeted enemy force to be destroyed in their current positions. (FM 3-90-1) (Marine Corps) An offensive maneuver in which the main attacking force passes around or over the enemy's principal defensive positions to secure objectives to the enemy's rear. (MCRP 1-10.2)

exploitation

(Army) A type of offensive operation that usually follows a successful attack and is designed to disorganize the enemy in depth. (ADP 3-90) (joint) An offensive operation that usually follows a successful attack and is designed to disorganize the enemy in depth. (JP 2-01.3) (Marine Corps amplification) An offensive operation following a successful attack that is designed to disorganize the enemy in depth. It extends the initial success of the attack by preventing the enemy from disengaging, withdrawing, and reestablishing an effective defense. (MCRP 1-10.2)

fires

(joint) The use of weapon systems or other actions to create specific lethal or nonlethal effects on a target. (JP 3-09) (Marine Corps amplification) Those means used to delay, disrupt, degrade, or destroy enemy capabilities, forces, or facilities as well as affect the enemy's will to fight. Fires is one of the seven warfighting functions. (MCRP 1-10.2)

fire support

(joint) Fires that directly support land, maritime, amphibious, space, cyberspace, and special operations forces to engage enemy forces, combat formations, and facilities in pursuit of tactical and operational objectives. (JP 3-09) (Marine Corps amplification) Assistance to elements of the Marine air-ground task force engaged with the enemy rendered by other firing units, including (but not limited to) artillery, mortars, naval surface fire support, and offensive air support. (MCRP 1-10.2)

fires warfighting function

The related tasks and systems that create and converge effects in all domains against the adversary or enemy to enable operations across the range of military operations. (ADP 3-0)

fixing force

A force designated to supplement the striking force by preventing the enemy from moving from a specific area for a specific time. (ADP 3-90)

flank attack

A form of offensive maneuver directed at the flank of an enemy. (FM 3-90-1)

force protetion

Preventive measures taken to mitigate hostile actions against Department of Defense personnel (to include family members), resources, facilities, and critical information. (JP 3-0) (Marine Corps amplification) Actions or efforts used to safeguard own centers of gravity while protecting, concealing, reducing, or eliminating friendly critical vulnerabilities. Force protection is one of the warfighting functions. (MCRP 1-10.2)

force tailoring

The process of determining the right mix of forces and the sequence of their deployment in support of a joint force commander. (ADP 3-0)

fratricide

The unintentional killing or wounding of friendly or neutral personnel by friendly firepower. (ADP 3-37)

frontal attack

(Army) A form of maneuver in which an attacking force seeks to destroy a weaker enemy force or fix a larger enemy force in place over a broad front. (FM 3-90-1) (Marine Corps) An offensive maneuver in which the main action is directed against the front of the enemy forces. (MCRP 1-10.2)

infiltration

(Army) A form of maneuver in which an attacking force conducts undetected movement through or into an area occupied by enemy forces to occupy a position of advantage behind those enemy positions while exposing only small elements to enemy defensive fires. (FM 3-90-1) (Marine Corps) The movement through or into an area or territory occupied by either friendly or enemy troops or organizations. The movement is made, either by small groups or by individuals at extended or irregular intervals. When used in connection with the enemy, it implies that contact is avoided. (MCRP 1-10.2)

information environment

The aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information. (JP 3-13)

information operations

(joint) The integrated employment, during military operations, of information-related capabilities in concert with other lines of operation to influence, disrupt, corrupt, or usurp the decision-making of adversaries and potential adversaries while protecting our own. (JP 3-13) (Marine Corps amplification) The integration, coordination, and synchronization of actions taken to affect relevant a decision maker in order to create an operational advantage for the commander. (MCRP 1-10.2)

intelligence

(joint) The product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. (JP 2-0) (Marine Corps amplification) Knowledge about the enemy or the surrounding environment needed to support decision-making. Intelligence is one of the warfighting functions. (MCRP 1-10.2)

intelligence preparation of the battlefield/battlespace

(Army) The systematic process of analyzing the mission variables of enemy, terrain, weather, and civil considerations in an area of interest to determine their effect on operations. (ATP 2-01.3) (joint) The analytical methodologies employed by the Services or joint force component commands to reduce uncertainties concerning the enemy, environment, time, and terrain. (JP 2-01.3) (Marine Corps amplification) The systematic, continuous process of analyzing the threat and environment in a specific geographic area. (MCRP 1-10.2)

intelligence warfighting function

The related tasks and systems that facilitate understanding the enemy, terrain, weather, civil considerations, and other significant aspects of the operational environment. (ADP 3-0)

joint special operations area

An area of land, sea, and airspace assigned by a joint force commander to the commander of a joint special operations force to conduct special operations activities. (JP 3-0)

key terrain

(Army) An identifiable characteristic whose seizure or retention affords a marked advantage to either combatant. (ADP 3-90)

knowledge management

(Army) The process of enabling knowledge flow to enhance shared understanding, learning, and decision making. (ADP 6-0) (Marine Corps) The integration of people and processes, enabled by technology, to facilitate the exchange of operationally relevant information and expertise to increase organizational performance. (MCRP 1-10.2)

leadership

The activity of influencing people by providing purpose, direction, and motivation to accomplish the mission and improve the organization. (ADP 6-22)

logistics

(joint) Planning and executing the movement and support of forces. (JP 4-0) (Marine Corps amplification) All activities required to move and sustain military forces. Logistics is one of the warfighting functions. (MCRP 1-10.2)

main effort

A designated subordinate unit whose mission at a given point in time is most critical to overall mission success. (ADP 3-0) (Marine Corps) It is usually weighted with the preponderance of combat power and is directed against a center of gravity through a critical vulnerability. (MCDP 1-01.2)

maneuver

(joint) Employment of forces in the operational area, through movement in combination with fires and information, to achieve a position of advantage in respect to the enemy. (JP 3-0) (Marine Corps amplification) The movement of forces for the purpose of gaining an advantage over the enemy. Maneuver is one of the warfighting functions. (MCRP 1-10.2)

measure of effectiveness

An indicator used to measure a current system state, with change indicated by comparing multiple observations over time. (JP 5-0)

measure of performance

An indicator used to measure a friendly action that is tied to measuring task accomplishment. (JP 5-0)

military decision-making process

An iterative planning methodology to understand the situation and mission, develop a course of action, and produce and operation plan or order. (ADP 5-0)

mission command

(Army) The Army's approach to command and control that empowers subordinate decision making and decentralized execution appropriate to the situation. (ADP 6-0)

mobile defense

(Army) A type of defensive operation that concentrates on the destruction or defeat of the enemy through a decisive attack by a striking force. (ADP 3-90) (Marine Corps) Defense of an area or position in which maneuver is used with organization of fire and utilization of terrain to seize the initiative from the enemy. (MCRP 1-10.2)

mobility corridor

Areas that are relatively free of obstacles where a force will be canalized due to terrain restrictions allowing military forces to capitalize on the principles of mass and speed. (JP 2-01.3)

modified combined obstacle overlay

A joint intelligence preparation of the operational environment product used to portray the militarily significant aspects of the operational environment, such as obstacles restricting military movement, key geography, and military objectives. (JP 2-01.3)

movement and maneuver/maneuver warfighting function

The related tasks and systems that move and employ forces to achieve a position of relative advantage over the enemy and other threats. (ADP 3-0)

movement to contact

(Army) A type of offensive operation designed to develop the situation and to establish or regain contact. (ADP 3-90)

mutual support

That support which units render each other against an enemy, because of their assigned tasks, their position relative to each other and to the enemy, and their inherent capabilities. (JP 3-31)

named area of interest

(joint) The geospatial area or systems node or link against which information that will satisfy a specific information requirement can be collected, usually to capture indications of adversary courses of action. (JP 2-01.3) (Marine Corps amplification) A point or area along a particular avenue of approach through which enemy activity is expected to occur. Activity or lack of activity within a named area of interest will help to confirm or deny a particular enemy course of action. (MCRP 1-10.2)

offensive operation

An operation to defeat or destroy enemy forces and gain control of terrain, resources, and population centers. (ADP 3-0)

operations in depth

The simultaneous application of combat power throughout an area of operations. (ADP 3-90)

penetration

(Army/Marine Corps) A form of maneuver in which an attacking force seeks to rupture enemy defenses on a narrow front to disrupt the defensive system. (FM 3-90-1 and MCRP 1-10.2)

protection

(joint) Preservation of the effectiveness and survivability of mission-related military and nonmilitary personnel, equipment, facilities, information, and infrastructure deployed or located within or outside the boundaries of a given operational area. (JP 3-0)

protection warfighting function

The related tasks and systems that preserve the force so the commander can apply maximum combat power to accomplish the mission. (ADP 3-0)

pursuit

(Army) A type of offensive operation designed to catch or cut off a hostile force attempting to escape, with the aim of destroying it. (ADP 3-90) (Marine Corps) An offensive operation designed to catch or cut off a hostile force attempting to escape, with the aim of destroying it. (MCRP 1-10.2)

rehearsal

A session in which the commander and staff or unit practices expected actions to improve performance. (ADP 5-0)

retirement

(Army) When a force out of contact moves away from the enemy. (ADP 3-90) (Marine Corps) An operation in which a force out of contact moves away from the enemy. (MCRP 1-10.2)

retrograde

(Army) A type of defensive operation that involves organized movement away from the enemy. (ADP 3-90) (joint) The process for the movement of non-unit equipment and materiel from a forward location to a reset (replenishment, repair, or recapitalization) program or to another directed area of operations to replenish unit stocks, or to satisfy stock requirements. (JP 4-09) (Marine Corps amplification) The chance of hazard or bad consequences resulting in exposure to possible injury or loss. Risk level is expressed in terms of hazard probability or severity. (MCRP 1-10.2)

security cooperation

All Department of Defense interactions with foreign security establishments to build security relationships that promote specific United States security interests, develop allied and partner nation military and security capabilities for self-defense and multinational operations, and provide United States forces with peacetime and contingency access to allied and partner nations. (JP 3-20)

shaping operation

An operation at any echelon that creates and preserves conditions for success of the decisive operation through effects on the enemy, other actors, and the terrain. (ADP 3-0)

situation template

(joint) A depiction of assumed adversary dispositions, based on that adversary's preferred method of operations and the impact of the operational environment if the adversary should adopt a particular course of action. (JP 2-01.3) (Marine Corps amplification) A series of projections that portray, based on enemy doctrine, the most probable disposition and location of enemy forces within constraints imposed by weather and terrain. (MCRP 1-10.2)

space domain

The area above the altitude where atmospheric effects on airborne objects become negligible. (JP 3-14)

stability operation

An operation conducted outside the United States in coordination with other instruments of national power to establish or maintain a secure environment and provide essential government services, emergency infrastructure reconstruction, and humanitarian relief. (ADP 3-0)

striking force

A dedicated counterattack force in a mobile defense constituted with the bulk of available combat power. (ADP 3-90)

strong point

(Army) A heavily fortified battle position tied to a natural or reinforcing obstacle to create an anchor for the defense or to deny the enemy decisive or key terrain. (ADP 3-90) (Marine Corps) A key point in a defensive position, usually strongly fortified and heavily armed with automatic weapons, around which other positions are grouped for its protection. (MCRP 1-10.2)

support area

The portion of the commander's area of operations that is designated to facilitate the positioning, employment, and protection of base sustainment assets required to sustain, enable, and control operations. (ADP 3-0)

supporting distance

(Army) The distance between two units that can be traveled in time for one to come to the aid of the other and prevent its defeat by an enemy or ensure it regains control of a civil situation. (ADP 3-0) (Marine Corps) The distance between two units that can be traveled in time for one to come to the aid of the other. (MCRP 1-10.2)

supporting effort

(Army) A designated subordinate unit with a mission that supports the success of the main effort. (ADP 3-0) (Marine Corps) Designated subordinate unit(s) whose mission is designed to directly contribute to the success of the main effort. (MCRP 1-10.2)

supporting range

(Army/Marine Corps) The distance one unit may be geographically separated from a second unit yet remain within the maximum range of the second unit's weapons systems. (ADP 3-0 and MCRP 1-10.2)

survivability

(joint) All aspects of protecting personnel, weapons, and supplies while simultaneously deceiving the enemy. (JP 3-34) (Marine Corps amplification) The degree to which a system is able to avoid or withstand a man-made hostile environment without suffering an abortive impairment of its ability to accomplish its designated mission. (MCRP 1-10.2) (Army/Marine Corps) A quality or capability of military forces which permits them to avoid or withstand hostile actions or environmental conditions while retaining the ability to fulfill their primary mission. (ATP 3-37.34/MCTP 3-34C)

survivability operations

Those protection activities that alter the physical environment by providing or improving cover, camouflage, and concealment. (ATP 3-37.34/MCTP 3-34C)

sustaining operation

An operation at any echelon that enables the decisive operation or shaping operations by generating and maintaining combat power. (ADP 3-0)

sustainment warfighting function

The related tasks and systems that provide support and services to ensure freedom of action, extend operational reach, and prolong endurance. (ADP 3-0)

tactical mobility

(Army) The ability of friendly forces to move and maneuver freely on the battlefield relative to the enemy. (ADP 3-90) (Marine Corps) The ability to move within an engagement or battle. (MCRP 1-10.2)

targeting

The process of selecting and prioritizing targets and matching the appropriate response to them, considering operational requirements and capabilities. (JP 3-0)

tempo

(Army/Marine Corps) The relative speed and rhythm of military operations over time with respect to the enemy. (ADP 3-0 and MCRP 1-10.2)

turning movement

(Army) A form of maneuver in which the attacking force seeks to avoid the enemy's principle defensive positions by seizing objectives behind the enemy's current positions thereby causing the enemy force to move out of their current positions or divert major forces to meet the threat. (FM 3-90-1)

warfighting function/functions

(Army) A group of tasks and systems united by a common purpose that commanders use to accomplish missions and training objectives. (ADP 3-0)

withdraw

To disengage from an enemy force and move in a direction away from the enemy. (ADP 3-90)

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07 April 2021

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