

EFFECTS OF WEATHER AND TERRAIN

Effects of Weather and Terrain in Combat Operations

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Abstract

Terrain and weather has no favorites, it did one of two things; it either helped one force or provided a stumbling block for the other.

When thinking of the terrain, it is imperative that the commander considers factors such as hills, mountains, streams, rivers, and valleys which will effect the execution of an operation (Headquarters, Department of the Army, 1993). Even though the outcome of a combat operation is not solely dependent upon the elements of terrain and weather; it heavily influences the outcome and success of the operation. The type of weather hinders equipment emplacement, employment, and mobility of maneuver elements on the battlefield and the weather adversely affects the morale of Soldiers and their ability to perform.

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World War I

During the years of uncertainty and territorial gain was a necessity; the US participated in one of the major wars of all mankind, also known as The Great War. The onset of war and the outcome of wars were significant in forming the foundation of America today. During World War I, significant elements such as the weather and terrain played a major role in the outcome of war and combat operations within the area. As the possibility of war surfaced and became inevitable, it was apparent that the terrain and weather had no favorites on the outcome, it did one of two things; it either helped one force or provided a stumbling block for the other. The terrain and weather provided advantages and disadvantages depending on the mastermind behind the strategy. When thinking of the terrain, it is imperative that the commander considers factors such as hills, mountains, streams, rivers, and valleys that can influence the type of operation executed (Headquarters, Department of the Army, 1993). The terrain can affect the movement of personnel, functionality of equipment, survivability and placement of troops. The weather is very crucial in the onset of a Soldier's morale, level of performance and quite important the ability to survive.

Mobility

World War I was plagued with many battles going on simultaneously and in multiple places throughout the world such as Germany, France, Russia, Italy, and as far east as Africa. Many of the battles occurred in the territory of France between the Germans and the French. One of the most well known is the Battle of Verdun.

The Battle of Verdun was suppose to commence on 10 February, was plagued with postponement for nine days due to bad weather (Keegan, 2001). Due to the amount of

rainfall, the grounds were saturated and because the terrain predominately consisted of flatlands with many hills impeded on the employment of artillery equipment. Mostly consisting of hills used as strategic battle positions simply because whoever occupied the top of the hill or higher elevations could look down and prey on their enemy, providing a huge advantage. The roads were generally made of hard, compact dirt. Due to the rain, the roads became soft and made it extremely difficult to move heavy pieces of equipment. The transportation of troops was restricted to foot movement. Contributing significantly to the mobility hindrance of vehicles, equipment and the troops were the geological location and the type terrain. The terrain was of a rugged nature because of the intense deformed rocks generated by the separation of North America and Europe by the widening of the Atlantic Ocean. The surfaces sunk below sea level which caused the accumulation of marine strata in horizontal layers. This kept the water shallow, but manageable to move upon. As Germany advanced from the east, often on wet grounds, exposed from cover, and on low grounds only to face high forest ridges that extended many kilometers in a different directions. Many years prior to the German advances, the development of French forts on the cuervas near Verdun surfaced; in about 1915, the bombardment of artillery shells destroyed them and they became sparingly manned. For German thinkers, this seemed to be a great advantage, however, the inclement weather of snow and being cold hindered the advancement of the logistical support.

Survivability

“The logistical support was slowed because of having to travel on the cold, wet, muddy roads; having to cross gullies, ravines and streams.” (Winters, 1998)

The French provided heavy resistance as the Germans underwent their struggles

during the austere environment, establishing the motto “They shall Not Pass”.

The Germans continued their move forward later ceasing on of the three French ports, Fort Douaumont (Winters, 1998).”

Logistic movement was crucial in the aspects of getting food and supplies to the fighting forces. The cold, wet, rain, and mountainous terrain created stumbling blocks in ensuring timely receipt of supplies. Pinching rations intake became a common practice for the forces. During this time period, the equipment used by the forces was state of the art. Though they the uniforms were made of wool/polyester mix and soaked up the moisture during the snow and rainy periods, the forces were able to implement survival tactics to keep themselves warm and protected from the elements. Building small fires during the day, bundling up with their comrades, and keeping a positive mind set surely aided to the survival of the forces.

Morale of Troops

The morale of the fighting troops at Verdun was quite high, especially with the birth of the new field artillery technology. This high morale quickly diminished as the battle continued on its course. The Germans experienced losing up to 340,000, in which 119,000 or 35 percent labeled as dead or missing in action (MIA) and expending over 27 million artillery rounds. The French on the other hand, during their defensive stand off and the commencement of a counter offensive strike proved to be just as inefficient as the Germans. They tallied up over 378,000 casualties with approximately 135,000 listed as dead or mission in action and expending over 23 million rounds. As you can see, this would affect the morale of troopers even in today’s force. The troops on both sides, the German and the French under went an incredible amount of battle casualty loss. The

ability to re-supply the troops put a damper on their morale as well. Re-supply was limited because of the terrain, however getting a letter from a love one was the biggest morale booster of all time. Today, as the US Service Members undergo the vigor's of war, a simple letter or contact from home has proven to be number one on the want list.

Ability to Conduct Operations

Though this battle lasted from February 21, 1916 to December 18, 1916, a period of eleven months was labeled as one of the most intense artillery battles of all time (Weingartner 1996).

The Germans ability to execute their offensive attack was a rough plan, however it was mauled or rendered insufficient after taking a look at the acreage of terrain that was captured, the number of artillery shells fired, and the number of casualties suffered compared to the duration of the battle itself. As the Germans proceeded from Verdum to the Maginot Line in 1916 by way of the north, the hills and wooded areas and ravines could provide great concealment and protection as they prepared for the movement into the battle (Weingartner, 1996).

Most importantly, if the German forces attacked from the north, it would decrease the capabilities of the French's 75mm field gun which when firing, its projectors could not sweep the slopes and ravines beyond the hills where they were forming up. This well executed and thought out plan enabled the Germans to move large amounts of troops and equipment provided they attacked Verdun from the east (Winters, 1998).

Advantages and Disadvantages

The terrain in this region did not receive or achieve any major gains or significant advantages of each other, even though the terrain and geographical locations played a

vital role in the conduct of this operation, the weather and terrain did not necessarily hinder the outcome. However because of the strategy of the Germans attacking from the east it rendered them exposed at lower grounds and forcing them to encounter the task of tackling high grounds to reach their objective, so they regrouped and made plans to attack from the north. This may have appeared to be a great advantage for the Germans, but they encountered nature's elements such as snow and poor visibility delayed their attack for several hours. If the Germans moved more westward, it would involve going through several more lowlands. However the hills provided the French with excellent observation points because entering from the west, the terrain was more gently inclined. The wooded forest, high hills pretty much surfaced vulnerability in the low grounds and in the valleys. As the French used the high grounds as a strategic strong point, could have been the basis of where the slogan "Take the Hill" derived from.

Conclusion

Fighting a battle in a cuesta, rocky environment presented it challenges. By the time the fighting had stop, many of the well thought out advantages of occupying Verdun resulted in millions of casualties and very little territory. The unskilled tactics and nature's terrain and weather plagued the outcome. It is quite obvious that the combination of tactics and strategy may vary, but play a vital role in the execution of war. Ironically, whether we realize it or not, terrain and weather creates an advantage to both sides. It is up to the thinkers to figure out how to manipulate and take advantage of the terrain and weather and use it to their advantage prior to the adversary. The outcome may depend upon it. As World War I ceased its fire in the middle of 1918; approximately 24 years later in 1942, tension arose and the onset of World War II commenced.

World War II

Throughout the history of battle weather and terrain has always been a major factor in the planning and execution of battles. During WWII two examples of the effects of weather and terrain were the Invasion of Normandy known as Operation “Overlord” and The Battle of the Bulge. During Operation Overlord a slight change in the weather could have resulted in a disastrous outcome for the Allied Forces and during the Battle of the Bulge if the weather had not favored Hitler’s forces the results could have been much different.

Invasion of Normandy

Mobility

Worried about the military survival of the Soviet Union, the U.S. War Department decided in early 1942 to launch an invasion across the English Channel into Normandy (Winters, 1998). It was necessary for the Allies to execute the assault during low tide for the purpose of revealing beach obstacles and to prevent the grounding of the landing crafts (Winters, 1998). Also rough seas would cause the small landing crafts to take in water and slow down their movement (Unknown, 1984). In order to support precise bombing, effective air cover, and the large scale airborne operations, clear skies and a full moon were also necessary. Another factor that has to be considered was the location for the Allied force landing. The coast of Normandy only offered a few areas that would support the landing of such a large force (Unknown, 1984). The cliffs, reefs, and wide tidal ranges were natural obstacles that the planners had to consider (Unknown, 1984). The Allies chose a five-mile cliff less area that was designated as “Omaha Beach” (Unknown, 1984).

Survivability

It was ideal that favorable weather conditions last for at least 36 hours in order to support the re-supplying of equipment and reinforcements necessary for the securing of the beachhead and sustaining the force (Winters, 1998). D-day initially was to take place between April and May when the weather was more favorable. The date was changed because the size of the force was changed to a larger size. It was then decided that the invasion would take place on either the 4th, 5th, or 6th of June (Winters, 1998). If the invasion could not take place during one of these dates then the invasion would have to be moved to the 19th of June which turned out to be the time that Normandy experienced its largest storm of 1944.

Morale of Troops

The Allied Soldiers trained for months leading to the Invasion of Normandy. The actual date of execution was always changing mainly due to weather conditions. This had a negative impact on the troops that have been waiting on crowded ships waiting for the assault. Also the rough seas would cause the Soldiers to get completely soaked as soon as they entered the small landing crafts and the majority of troops were sea sick before hitting the shores of Normandy (Unknown, 1984).

Advantages of Weather for the Allies

Fortunatley for the Allies, Hitler did not have the same weather forcaster. Field Marshall Rommel knew that the best weather for a landing was in spring and that the next best weather would not be until late July (Winters, 1998). Knowing this he left France right before the invasion to meet with his family and Hitler (Winters, 1998). Also the

Germans were expecting a storm, so on 6 June they ordered all their sea-patrol crafts to remain in port. Due to these conditions, the Allies were able to move a large amphibious force undetected for many kilometers (Winters, 1998). Thus as Gen. Omar Bradley stated “In this capricious turn of weather, we had found a Trojan Horse” (Winters, 1998).

Battle of the Bulge

In December 1944 the Germans launched a desperate offensive using the cover of fog and thick terrain to move 25 divisions virtually undetected by the Allies. This operation was known as The Battle of the Bulge. One of the main factors that caused Hitler to select this attack on the Ardennes was the terrain leading to the intended point of attack which heavily forested and gave his forces concealment from air observations both during the buildup and the actual attack (Winters, 1998).

Mobility

Due to the thick terrain of the Ardennes, The Battle of the Bulge was known as a battle for the roads (Parker, 1991). Hitler used the inclement weather to move his divisions knowing the Allies would not be able to fly any reconnaissance missions. The fog, clouds, drizzle, and terrain concealed German movements as the attack began (Parker, 1991).

Survivability

The rain, snow, and thick forest made of road movement very difficult. The Germans controlled most of the roads making it difficult for the Allies to resupply their forces. Many units found themselves cutoff from re-enforcements.

Advantages of Weather and Terrain

As previously stated, the Germans used the inclement weather to move their forces

into place and continued to use it in their favor through the early stages of the operation. The thick terrain did not allow the Allies to conduct large scale operations to counter the attack. The lack of Allied air cover contributed to the initial success of the German attack (Parker, 1991). The weather also became an advantage for the Allies. In the later stages of the operations, the Germans were unable to move cross country thus slowing down their movement (Parker, 1991). The skies began to clear which favored the superior Allied air power. The Allies were able to fly 294 sorties on the 23rd of December and another 2381 on the 24th (Parker, 1991). They hit every road and railway thus cutting off the German resupply operations and ending the German offensive.

Conclusion

Weather and terrain are key elements in combat operations. This was evident during the Invasion of Normandy and the Battle of the Bulge. During both battles inclement weather played a key role in the movement of large forces undetected by the opposing force. During the Invasion of Normandy the Allies gambled by going on the 6th of December and caught the Germans by surprise. In turn during the Battle of the Bulge the same weather that provided initial success for Hitler's forces turned against him to provide a final blow to his Third Reich.

During the year of 1950, tension between the North and South Korea began to escalate, establishing the onset of war in the cold, wet, and mountainous region of Korea – known as the Korean War.

Korean War

Mobility of Troops

The effect of weather and terrain influences in combat operations as hindering the mobility of troops. This was evident under the winter conditions during Marines Corp combat operations at the Chosin Reservoir in 1950. The strong cold, wet climate with the uneven mountainous terrain created hard situations for conducting the combat operations between the Chinese and U.S. Forces.

The terrain was vital for the movement of combat vehicles, tanks, and artillery through the narrow and unpaved roads, high grounds and twisted passes. The most critical roads during this battle were the roads linked the UN positions and the base for supply at the port of Hungnam. During the winter operations, the terrain was frozen, making it difficult for the tanks and trucks to move through the icy slopes, and many times tanks were lost due to the terrain. Due to subzero conditions, other small vehicles, infantry, and support units had to stop their movements making them vulnerable and easy targets for the enemy.

Unlike the Chinese forces, American forces had better clothing to handle the cold, but their equipment used to protect their extremities failed in many times. One example was that in whatever conditions the heavy marching shoepack caused the foot to sweat excessively. During winter operations, when temperatures dropped under zero degrees, the leather boots didn't keep out the cold or wet. When Soldiers wore the waterproof boots, their feet would sweat, and when they stopped moving, ice would form inside the boots causing frostbite. During movements in warm conditions their feet would sweat excessively causing severe blistering of their feet.

Survivability of Troops

The First Marine Division at the Chosin Reservoir was improperly prepared to meet the ruthless winter during the Korean War. The survival of the American forces during the Korean War was very difficult. The excessive cold and wind get many of the Marines into fright. The cold for them was like enemy. To survive, the Soldiers had to live with frostbite, frozen feet, hands and faces. Due to the cold weather the Soldiers would put on them more of their clothes. They would carry their canteens under the clothes or some reserve socks close to their bodies. The water in their cans and individual canteens would turn into ice and many would eat the snow instead water.

During extreme cold conditions their C-rations would freeze. The Soldiers could only eat the dry food of their rations. The tools for digging trenches couldn't be for help because the ground was frozen. The cold even froze the oil on weapons.

Due to the cold the combat vehicle would often warm in a few hours so that would prevent the malfunction of the vehicles. If that would happen, the mechanics would have to repair them, but would get freeze and pain on their hands. The ambulance vehicles also malfunctioned due to cold and the wounded would freeze to death.

The cold and wet weather when Soldiers kept their position, they would freeze to death. They dug foxholes and used sleeping bags to keep themselves warm. This was causing them to fall asleep and the Chinese Soldiers would sneak up on them and kill them. When they ate the frozen rations, the Soldiers would often gain uncontrollable diarrhea.

Morale of Troops

The extreme cold weather had a negative impact on the moral of the Soldiers.

Soldiers were often cold and hungry. The lack of adequate cold weather clothing was very significant. Soldiers at times more concerned with keeping themselves warm rather than fighting.

Ability to conduct operations

During the Chosin Reservoir operations Marine Forces had a difficult time operating their weapons and equipment in the cold mountainous terrain. The high ground wouldn't allow the units to lay telephone lines between them. On 29 November 1950, King Company, 9th Infantry Regiment could not lay a telephone line with its Headquarters leaving them without communications and thus eventually being overrun by the Chinese.

The carbine worked sluggishly in subfreezing temperatures and required 5 to 20 warm-up shots before it would fire in full automatic. In hot weather, a small amount of dust and moisture together would cause it to misfire.

The machine guns were difficult to operate in extreme cold because of the heavy frost would on the unjacketed parts. When the temperatures were at sub-zero the mortars were also difficult to operate. The base plates of the mortars would freeze and the firing pins would break frequently. Due to the cold and wet the artillery would fire slow and in shorter distance. Due to the cold weather Soldiers' hands would freeze and they couldn't fix their weapons if it malfunctioned.

During the 12-14 day battle of the 1st Marine Division around the Chosin Reservoir operation their steel helmets would freeze and cause them to get frostbite on the ears.

Advantages and Disadvantages on outcome

From the clothing which Chinese had were the quilted-cotton pants and their long shirts would hang over their pants. They would also wear tennis shoes with heavy cotton socks. If they became wet, the Chinese Soldier would freeze. These tennis shoes didn't protect Chinese Soldiers from the cold, and many of them had hard endureances from frostbite.

The American Soldiers had better clothing and gave them better protection against the cold. During the cold, most significant logistical support for the American Forces was by airlifting. Due to the cold weather the Soldiers had cold-injuries. At the Chosin Reservoir Operations, most important place for transporting the wounded and supplies was the landing field at Hagaru-ri.

Medical support was very difficult due to the extreme cold. The plasma and sedatives would freeze. The Soldiers would go into the warming tents to warm their water, but if the just put the water away from the stoves about more than eight feet, the water would freeze.

In the other hands the wounds would freeze so fast which prevents the wounded to loose too much blood.

The cold weather also exaggerated air support in many times. The mechanics would have hard work on planes when they worked without gloves on their hands. The cold would cause to feel pain on their hands when they would touch metal parts of the planes. The equipment with mechanical-bomb and rocket-loading would often freeze and many times the Soldiers would have to load the munitions with their hands. The cold, wet, and wind would cause ice on U.S. aircraft carriers and many times the ice would choke the deck and made difficulties when need to refuel, load, and make some services. The ice

also would cause risks and difficulties when the aircrafts needed to takeoff or land. The wind, snow and when clouds were low also would cause risks to the pilots during conducting with their flying support missions. Regardless of these difficulties, air support confirmed that it was vital element during the US Marine Corps at Chosin.

CONCLUSION

In conclusion, as we can understand, the effects of cold weather and terrain during Korean combat operations were not only comparison as battle against the enemy, but also as a battle for survival from cold temperatures. The US forces had difficulties during combat operations in Korean War.

Vietnam

In the field of Vietnam, all days were the same: hot and wet, or hot and dry, but always dangerous. The weather was unpredictable and planning undesirable. It was a misty, cool morning with some low-hanging fog when we lifted off, but shortly after takeoff, we broke into the clear and you could see the 105mm artillery pounding the areas around the LZ as we headed in. Vietnam, even in war, was scenic, with the green jungle, heavy forested mountains, and wild-looking rivers crisscrossing the terrain. I unhooked my seat belt, switched the selector switch on my M-16 to full automatic-rock 'n' roll-and fired bursts into the brush to the left, toward the mountain over the dry five-foot-tall elephant grass.

Mobility of Troops

The Bell UH-1 helicopter, popularly known as the "Huey," was the worker-horse aircraft for U.S. forces in Vietnam. Well adapted for jungle warfare, the Huey could fly at low altitudes and speeds, land in small clearings, maneuver to dodge enemy fire, and

carry an array of powerful armaments, B-52 Stratofortress designed to carry nuclear bombs on long-range, high-altitude, F-4 Phantom Fighter Plane armed with a 20mm cannon and air-to-air missiles, M48 Tank- a diesel-powered 90mm turret-mounted main gun-7.62mm machine gun-.50caliber machine gun, M113armored personnel carrier served valuable transport, reconnaissance and fire support functions in a variety of terrain, Mark I P.B.R. , a small, fast, lightweight craft as the main vessel of riverine operation, M60 machine gun fires up to 550 high-velocity bullets from a gas-powered, belt-fed system at a range of over 1,900 yards, Redeye Anti-Aircraft short range, shoulder-fired missile launcher, M19/60mm Mortar fires as many as 30 high-explosive, smoke, or illumination rounds per minute, 105mm Howitzer fires about three to eight rounds per minute.

Standard-Issue Equipment issue proved poorly adapted to jungle and counter-insurgency warfare. Individual soldiers often customized their gear, abandoning some equipment altogether, augmenting it by trading with other GIs, or even using equipment taken from the enemy. The standard-issued equipment is Headgear (steel helmet), Uniform, Rifle (M16), Mark 2 Anti-Personnel Hand-Rifle Grenade, M18A1Claymore Anti-Personnel Mine, Canteen, and Food, Backpack, and Footgear.

Survivability of the Troops

Ia Drang Valley vegetation included dense, mature rainforest, and widely scattered small grassland openings. Air cavalry and air-transported ground units crisscrossed the region, seeking signs of North Vietnam Army (NVA) presence. They flew at treetop level, along river valleys, bobbing up and down from clearing to clearing looking for movement, signs of habitation, or an enemy response. By 1965, the conflict in Southeast

Asia was escalating rapidly. Large numbers of U.S. ground forces moved into coastal positions in support of the South Vietnamese military. Meanwhile, both the (NVA) and the Viet Cong operated widely and effectively in the inland areas under the protective cover of tropical rainforest dominated by Napoleonic maneuver into a death grip of attrition.

The first major U.S. unit deployed to South Vietnam was the first Air Cavalry Division. Equipped with more than 400 helicopters and fresh from two years of testing new concepts of air mobility in the United States, the division sought to apply those tactics to combat. Through stealth and surprise, following by close and intermingling combat, the NVA rendered U.S. artillery and air ineffective in fighting reminiscent of the most intense battles in Virginia's Wilderness. Again, as at LZ X-Ray, tree, shrubs, anthills, deep grass, and brush became vital tactical factors. When the fighting stopped near the following day, the U.S. battalion had 272 casualties including 151 dead.

The fighting had been very costly during those five days in the Ia Drang Valley: 305 American dead versus an estimated 3500 for the NVA. Fighting there also redefined the war rather than moving it toward an end. General Kinnard saw that through air mobility the first Cavalry was "freed from the tyranny of terrain." Year's later, historian Gen. Dave Palmer labeled the fighting in the Ia Drang as "one of the war's rare decisive battles." Clearly, air mobility had changed the way in which war would be fought in the jungle.

Morale of the Troops

The Vietnam War was fought without the popular support, and a way to sustain itself. It was not capable of defending itself against the Viet Cong. Why was American

involving them selves in a war that profit them nothing? The American never formally declared war against North Vietnam, but was drawn in a war that committed over 200,000 ground troops, without a proper Congressional debate. The war was fought primarily because of President (Kennedy, Johnson, and Nixon). The congress did something that should have never happen, which rubber-stamp the Tonkin Gulf Resolution. This stamping permitted an undeclared war to the fought for uncertain reasons. The American involvement in Vietnam is link to the most notably crises the Watergate, since the war was fought on the undemocratic nature of American politics. Since the beginning, the war use immoral tactics.

The CIA, Special Forces and American advisers were involved in these immoral tactics. Attention was focus on the American policy supporting military coups, and immoral methods to achieve assassinations and terrorism. How is that American society who is supposed to be committed to ideals of civil liberty, can committed and pursuit war? Americans could only prevent military defeat, through the use of massive air power. The use of air power brought doubt in every one's mind and raise concern about the impotence of U. S. ground forces, and concern about the use of aerial bombardment, and chemical weapons used. The American draft raised issues about the fairness of the American society. Black, ethnic and poor people could not enter the draft, but white middle class people could. The way the draft was done, other countries could see that American society had serious problem and winning a war would be easy. The resolve of the enemy points to the moral weakness of the Americans. American moral disintegrated. American soldier became more dependent upon drug and alcohol. The moral of the American troops and immorality cause officers to be killed by their own

troops. As the moral collapsed, American service members became increasingly unpredictable. The My Lai massacre is not an isolated incident, but a central focus for the American realization about themselves.

Ability to Conduct Operation

It was difficult to conduct jungle operations when one has not had appropriate training. The Jungle had no roads and very little visibility. It was at times hot and cold, or hot and dry. The weather was unpredictable and one could not plan to defeat the enemy with success. Many soldiers lost their life due to inability to adapt to the surrounding and environment

Advantages and Disadvantages on Outcome

The area was dotted with large mounds of red dirt, most with brush and grass growing out of the tops. The size of these old termite hills ranged from that of a small automobile to that of a large pickup, and they offered excellent cover and concealment. The massif's lower slopes were covered with thick green foliage, elephant grass, and tangles of brush. Gullies and long fingers of ground led from the bottom of the mountain and blended into the woods and the dry creek bed where we stood. There were plenty of places for people to hide; the creek bed just inside the western edge of our clearing from the direction of the mountain, or the valley, and for us going the other way. That creek bed was a critical feature.

The US involvement in the Vietnam War was crucial and battling the elements of the jungle were quite challenging and required major adjustments, however as a result of the hot weather training, the US Forces mindset was better prepared to deal with conflicts in extreme weather for the future. In 1990, this training escalated to new heights as US

Forces deployed in support of Operation Desert Shield, which later evolved into Operation Desert Storm, putting an end to the Cold War.

Desert Shield/Storm

Mobility of Troops

The effects of weather and terrain played an important role in how troops mobilized during the Persian Gulf War in 1990-1991. The United States military, especially ground troops had not had much battle experience in desert environments since operations in Northern Africa during WWII. As covered earlier, the U.S. doctrine focused on the European theater of operations during most of the Cold War era. Desert Shield/Storm served as the test bed of lessons learned at the National Training Center (NTC) in Fort Irwin, California. The vast openness of the desert environment, the extreme heat conditions and environmental effects of sandstorms were crucial obstacles that had to be overcome by troops in theater.

Mobility of troops throughout such vast regions became extremely difficult without the support of the transportation element. Foot marches through the desert floor were a challenge as the type of terrain varied by region. From sandy, loose soil in the areas of northern Saudi Arabia to the hard-packed, rocky ground of southern Iraq, movement became dependent on wheeled vehicles, armored troop carriers, tanks, and air platforms.

Terrain in the border region of Iraq and Saudi Arabia presented a challenge to ground troops and their equipment. Movement during the daytime became a challenge as the extreme high temperatures would make the ground difficult to navigate as the heat would take its toll on the feet of troops laden with a full combat load of weapons and munitions.

Night movement had its challenges too. The naked, barren landscape provided no easily identifiable features in which to reference for navigation.

Weather had a tremendous impact on the mobility of troops in the form of extreme heat and intense sandstorms. Movement during the day was arduous as stated above. The intense heat prevented movement of any measurable distance as it would require troops to carry vast amounts of water. Temperatures ranged from intense heat during the day to drastically cooler temperatures at night. The sudden drop in temperature proved to be a challenge for the unaccustomed troops in the region.

During times of blowing hot winds, sandstorms became unbearable and movement of troops or vehicles would most certainly result in a catastrophe. The chance of disorientation during a sandstorm, whether on foot or vehicle, was high due to visibility being significantly impaired. Movement of any sort was highly discouraged and most units were static during times of severe sandstorms.

Survivability of Troops

When it comes to surviving in the desert environment, the phrase “know your environment” became the forefront of emphasis. As troops quickly realized during the Persian Gulf War, the heat that welcomed them as they met the tarmac of Saudi Arabian airfields was unlike anything they had experienced before, not even NTC.

The sun became the number one enemy of troops as there was no escaping its presence. The intense heat made it unbearable, exposed or in the shade. The propensity of sunburn was high, especially among the fair skinned personnel. Dehydration leading to hot weather injuries became the number one concern for the leadership. Millions of

gallons of water were at the ready in the form of bottled water and water bladders for hygiene purposes and equipment.

Troops quickly learned to avoid the direct sunrays as the propensity of sunburn and chapped lips became frequent. Troops combated this by covering all exposed areas of skin and the use of sunscreen and using lip balm before stepping out of the shade became the norm. Most operations and work commenced during the cooler parts of the day which was in the afternoon and the early evening, whereas the rest periods were at the peak hours of the sun.

Morale of Troops

All levels of leadership made every effort to maintain the morale of the troops at a high state. Most units deployed early in anticipation of the war. Desert Shield became a long waiting game for troops who were anxious to conduct the mission they trained for in centers such as NTC. The weather played the worst role in affecting the morale of the troops. The never before felt temperatures of the desert became a challenge for the unaccustomed troops.

The desert, by nature, is sightless. A barren landscape can affect the morale of troops as it provides no visual excitement and distracts physical activities such as sporting events due to the intense heat. Another aspect that affects morale is the constant presence of dust in everything from the body to all equipment whether in or outdoors. This leads to a sense of constant filth and since water conservation was highly enforced, troop's cleanliness became a hindrance.

Ability to conduct operations

The weather and terrain played a pivotal role during the conduct of operations in the Persian Gulf War. Weather was the most influential aspect that determined whether operations prevailed. The effects were windblown sand for ground operations and cloud coverage for air operations.

During periods of high winds in the desert, ground operations came to a halt as troops were in danger of becoming disoriented and possibly lost. Convoy operations were almost impossible to conduct as visibility was heavily impaired. Air operations could not be effective if the targets were not positively identified. This was shown by the lack of sorties flown during periods of complete cloud coverage worsened by the smoke of burning oil wells, sabotaged by Saddam Hussein forces with the purpose of creating exactly that effect, no visibility.

Advantages and Disadvantages on outcome

The success of Desert Shield/Storm can be attributed to the adaptability displayed by all coalition troops, American as well as allied troops. Although the desert environment presented a challenge both in terrain and weather conditions, allied troops quickly adapted and overcame the dry climate and barren conditions of the Arabian Desert.

The advantages the desert environment presented were a vast open terrain with almost unlimited visibility during most days. This allowed the mechanized troops, which were the main bulk of the force, to move unhindered at a fast rate of speed across the flat, featureless desert terrain. Fire support units were able to conduct long-range air strikes and armored mechanized units destroyed enemy columns at distances in excess of two and a half miles, clearly far enough away from immediate enemy harm.

Visibility from the air created an almost video game like environment for pilots flying air missions. Targets were unable to seek cover in the naked landscape and were easily spotted and destroyed by coalition air forces. Clearly the terrain and for the most part the favorable weather played a key role in the coalition's swift victory over the Iraqi Army. But there were some disadvantages present as well; overcoming these was a must.

The desert affected not only personnel but equipment as well. Some equipment, mainly cargo trucks during that period were the same supplied during the Vietnam War and the newly acquired Hummer had not proven itself in the cruel desert terrain. Vehicles, both wheeled and track, required constant maintenance due to the dusty conditions in which they were operating. This required more repair parts and maintenance hours by repair personnel. Maintenance on weapons, radios and combat gear was done daily, as the dust became the troops primary companion.

The negative aspects of terrain on the battlefield are the almost impassable features found in desert environments. Besides being composed of loose, sandy soil, the desert is home to deep open depressions and gullies that presented a constant danger to drivers if not seen in time. In areas of jagged volcanic rock, tires were susceptible to damage causing great delays as maintenance in the open desert can be a nuisance.

The ability of the coalition forces, led by the United States, to utilize the weather and terrain to its advantage was instrumental to successfully repel the Iraqi forces and liberating Kuwait. Great leadership and careful analysis of the battlefield were the crucial elements that enabled coalition forces to operate swiftly and effectively in the unforgiving desert environment.

Conclusion

Due to the increase and regularity of combat operations, instituting weather and terrain consideration in the planning phase of today's combat operations is a must. Our Soldiers must be properly equipped and protected from the changing elements of the natural environmental. Being prepared will significantly maintain unit combat readiness and outcome of a combat operation.

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