Mine Field Breaching in Desert Storm

During the Gulf War, Iraqi troops laid over seven million mines throughout Kuwait, which resulted in a need for advanced techniques allowing American troops to quickly breach landmine-afflicted areas.

MiCLiC detonation. *c/o SSG Warren Causey*

by Thomas Houlahan, Director Military Assessment Program

Introduction

Gulf War analysts and historians have tended to focus either on the air war or on the great maneuvers of the ground war. The mine field breaches, between the two, is usually given short shrift. Every Coalition unit that entered Kuwait on G-Day (24 February 1991) did so only after breaching two major mine fields.

The assault into Kuwait involved five separate breaching operations. Along the coast, Joint Forces Command East (JFC-E) pushed through the mine fields in its sector, then attacked northward to Kuwait City. To the west of JFC-E, the 1st Marine Division smashed through the Saddam Line and headed for Kuwait International Airport. To the west of the 1st Marine Division, the 2nd Marine Division broke through the mine fields, then drove to seize the crossroads at al-Jahra, cutting off Iraqi forces in Kuwait City and southern Kuwait. To the west of the two Marine divisions, Joint Forces Command North (JFC-N) drove northward into western Kuwait before heading east for a link-up with the 2nd Marine Division. This involved two breaches, the easternmost by Saudi forces, the westernmost by Egyptian forces.

The Iraqi Mine Fields

All told, the Iraqi Army laid over seven million landmines in Kuwait. About 3.5 million of these were methodically laid throughout the two mine fields running across southern Kuwait, each varying in depth from 60 to 150 meters. These mine fields ran from the coast to the Wadi al-Batin, a wide, shallow (in most places less than 100 feet deep) valley which ran along the western border of Kuwait.

Around 600,000 of these mines were anti-tank mines, of which there were 10 different types. Anti-tank mines are mostly used to produce "mobility kills" by blowing off tracks, sprockets or road wheels. Crewmen will often be shaken up, but fatalities are relatively rare. The most common anti-tank mines (more than two-thirds) in the mine fields were the Italian Valsella VS 1.6 and VS 2.2 anti-tank mines. The VS 1.6 (1.85 kg of explosive) and 2.2 (2.13 kg of explosive) are both blast mines. Both

Valmera-69 and VS 2.2 mines. *c/o Thomas Houlihan*

are made of plastic and cannot be detected easily. They are also blast-resistant, so they cannot be set off by explosive mine clearing techniques like the launching of Mine Clearing Line Charges or the dropping of fuel-air explosives.

In general, anti-tank mines were protected by antipersonnel mines, of which there were eight different types. The most common anti-personnel mines (again, over two-thirds) in the mine fields were also Italian, the Valmera-69 and the Valsella VS-50. The Valmera-69 is blown 18 inches into the air by a kicker charge after it is stepped on (or is set off by trip wire), then explodes. The 1,200 pre-formed metal fragments it sprays can kill at 25 meters and wound at over 150. Valmera-69s were often placed at the leading edges of mine fields. The VS-50 is a blast mine (negligible fragmentation) and is relatively small (43 grams of explosive as opposed to 420 grams in the Valmera-69's main charge), but it cannot be set off by explosive mine clearing techniques. Typically, three VS-50s (although other antipersonnel mines, including the Valmera-69 were also used) would be placed around each anti-tank mine in a triangle, one between the attacker and the anti-tank mine and one to the AT mine's left and right. This was done to protect the AT mines from dismounted deminers.

The Iraqis faced a distinct disadvantage in terms of terrain. There was virtually no vegetation in which to hide the mines. In addition, in many cases, mines were planted, only to have the sand above them blow away, exposing them for all to see. With the Valmera-69, this was especially problematic. With five pronounced spikes (the activating fuses) on top of the mine, Valmera-69s tended to stick out like a sore thumb. The poor training of Iraq's combat engineers was another problem with the Valmera-69. Each mine comes with a 15-foot trip wire, which was supposed to be deployed and tied to a stake. It was not terribly unusual to see a Valmera-69 trip wire tied to a stake a foot from the mine, with 14 feet of trip wire coiled up uselessly near the stake.

Coalition Breaching Equipment

Mine Clearing Line Charge (MiCLiC)

MiCLiC is a string of 1,750 lbs. of C-4 plastic explosive with an attached 5-inch rocket. The C-4 is pulled across a mine field by the five inch rocket, then it is detonated. The overpressure produced by the detonation sets off most simple pressure mines in the vicinity of the explosion. MiCLiCs are also effective to a limited degree against mines designed to resist explosive mine clearing techniques. If these mines are more or less directly beneath the MiCLiC, they will be obliterated by the explosion. If they are not, the MiCLiC will usually not set them off.

The MiCLiC offered some advantages. The charges could be launched from the edge of the mine field, and from the relative safety of an armored vehicle, so combat engineers did not have to do as much work inside the mine field in an exposed position. The disadvantage was its undependability. Just over half of the MiCLiCs fired by the two Marine divisions functioned properly. For example, there were 55 total MiCLiC launches from Marine Mk-154 launchers. Thirty-three of these launched, achieved a successful lay and were command detonated from inside the vehicle, a 60 percent complete success rate. Fifteen required a combat engineer to exit the vehicle and place a block of TNT with a 30-second time fuse on the line charge to detonate it. On some of these MiCLiCs, the fuses failed, on others, the arrestor cable snapped, its connection to the tank or AAV was severed, and the ability to command detonate was lost. Seven line charges either landed off line or snapped their arrestor cables and flew into the mine field, where combat engineers could not reach them. The Mk-58 launcher, for reasons discussed below, had a lower complete success rate (about 50 percent).

Mk-58

Mk-58 is a trailer containing a single MiCLiC, designed to be pulled behind an armored vehicle. The Mk-58 had a few unique problems. First, it was difficult for a tank commander inside the turret to ensure that the trailer was correctly oriented before firing. The trailer also made it practically impossible for a tank to back out of a lane if it needed to. In addition, the electrical connection with the tank was fragile. In one instance, after a tank turret had swiveled to engage Iraqi machine-gunners on the other side of a mine field, the MiCLiC's firing cable had become caught on the storage rack on the back of the turret and had been ripped out. Cables could also be damaged as a tank negotiated rugged terrain.

Mk-154

Also known as a "Triple Shot Line Charge," the Mk-154 is an Armored Amphibian Vehicle specially equipped to launch three internally stored MiCLiCs.

Track-width mine plow. *c/o U.S. Army Countermine Systems Directorate*

Track-Width Mine Plow (TWMP)

The TWMP is basically a set of two blades, one mounted in front of each fender of a tank. Each blade has six large teeth (tines) on its bottom edge. The tines are designed to burrow beneath buried mines, scoop them up and shove them to either side of the tank. Each blade clears a path three feet, nine inches wide, and can remove mines buried up to a foot deep. There is a chain slung between the two plows, designed to set off tilt-rod-

activated mines between the vehicle's tracks.

Full-Width Mine Rake (FWMR)

The Full-Width Mine Rake is a wedge-shaped frame with 49 thin steel tines that burrow into the ground and push mines to either side of the vehicle, like a mine plow.

Mine Rake. *c/oU.S. Army Countermine Systems Directorate*

The main advantage of the mine rake is that it clears a path for the full width of an Abrams, with about a foot to spare on either side. Mine rakes also stand up exceptionally well to mine explosions. Mine plows and rollers are solid and absorb much of a mine's blast. A mine plow can therefore be put out of action by a single anti-tank mine detonation. Mine rakes allow most of the energy of the blast to pass through the tines, so they can survive multiple blasts. In addition, at only two tons, mine rakes are light, easily transportable, and easy to mount.

The down side of using the mine rake is that it is an exceptionally slow process. Since commanders often cannot afford to have their tanks and armored personnel carriers backed up waiting for the mine rake to finish clearing a lane, it is usually employed only after the vital armor assets have been pushed through the mine field.

The mine rake is one of the great stories of American ingenuity from the war. Though the concept had been studied, the U.S. Armed Forces had no effective full-width mine clearing apparatus at the time of Saddam's invasion of Kuwait. In November 1990, the Army's Countermine Systems Directorate at Ft. Belvoir, Virginia was tasked with producing the equipment. Using computer-aided design and stress assessment programs to develop the structure of the rake, engineers quickly made and field-tested two prototypes. Production began in early December. In January and early February 1991, 59 mine rakes were delivered to the Gulf.

Mine Clearing Roller System *c/o U.S. Army Countermine*

Mine Clearing Roller System (MCRS)

The MCRS consists of two sets of five large, heavy rollers which, like mine plows, are fitted to the front of each of a tank's tracks. However, the MCRS was cumbersome, heavy (the entire system weighs about 20,000 lbs.) and hard to transport. In addition, since they were originally designed for the firmer soil conditions of Europe, its rollers were unsuitable for the softer soil of the desert. Instead of rolling, they often merely skidded, pushing soil in front of them until they bogged down. The 1st Marine division attempted to proof two lanes with the MCRS. Both were unsuccessful, and one missed a mine, which blew apart a track of the tank pushing it, immobilizing the tank and blocking the lane.

Roller Dude

Designed by Marine combat engineers and manufactured by Navy Sea Bees, Roller Dude was essentially a steel pipe filled with concrete. The Marines would have far fewer problems with their Roller Dude than they would with the Mine Clearing Roller System provided by the Army. Roller Dude was lighter (about 8,000 lbs.) than the MCRS, so it worked well in soft soil, and unlike the MCRS, which only clears a path in front of each of the tank's tracks, Roller Dude rolled the area across the entire width of a tank.

Another difference between the two roller systems was that the Marine rollers were towed behind AAVs, not pushed in front of tanks. At first glance, this would appear a dangerous or even ridiculous configuration, since the vehicle had the proofing device behind it instead of in front of it. However, the roller was really only needed to proof the area between the tracks of the plow tanks. The AAV could travel safely in those tracks, because if there had been mines there, they would have been set off by the much heavier tank that preceded it.

Mine Flail

A mine flail is designed to be used against anti-personnel mines only. It essentially beats the ground with steel wedges attached by chains to a rotating axle. One mine flail was used in the 2nd Marine Division breach in an attempt to establish an extra lane after the main lanes had been breached and proofed. The attempt was unsuccessful. The flail set off an anti-tank mine, which destroyed the flail and crippled the armored bulldozer that was using it.

The Breaches

The two Saudi breach forces (JFC-E and the eastern prong of JFC-N) were aided immeasurably by the fact that the Iraqis had not buried the mines in their zones. Saudi engineers were able to clear most of the mines in their breach lanes by hand, and their breaches were largely uneventful.

A certain amount of hand demining was necessary in the 1st Marine Division's zone. The night before G-Day, two light infantry task forces performed the first night mine field infiltration in the history of the U.S. Marine Corps. They picked their way through the first mine field and took up positions between the two mine fields. From these positions, they guarded the division's flanks.

Allied planners had intended to launch a massive B-52 strike on the Iraqi trenchlines on the night before G-Day, but concerns about bombs landing on Marines working in the mine fields—blowing live mines around and chewing up the terrain on which Marine combat engineers would have to work on G-Day—made the conduct of the strike impossible. The raids were shifted northward, to the south of Kuwait City. Due to friendly fire concerns, the Marines had been unwilling to even discuss dropping fuel-air explosives on the mine fields.

For the main breaches, Marines in both divisions used the same technique. A tank would approach the first mine field towing a Mk-58. The tank would halt 70 meters from the beginning of a mine field and launch its charge. The line charge, 100 meters long, would be brought to rest a safe distance from the launcher by a 62-meter-long arrestor cable. For planning purposes, the Marines assumed that an 80-meter-long path would be cleared by the explosion, because the line charge would not land in a perfectly straight line, and the first eight meters or so of the line charge would detonate short of the mine field's forward edge.

After the charge launched by the tank exploded, the tank held in place to provide cover as a tank equipped with a Track-Width Mine Plow moved into the lane and went to work. Usually, about 95 percent of the mines in the plow's path were pushed aside or detonated harmlessly. In their preparations, Marine combat engineers found that when dealing with blast-resistant mines, a MiCLiC explosion would often leave as many as 25 percent of the mines in its path intact. This meant that instead of proofing lanes that were virtually minefree, the plows operated in areas still thick with mines. As a result, instead of serving as an ancillary lane proofing tool, they became an essential component of the breaching operation.

When it reached the end of the trough created by the MiCLiC's detonation, the plow tank backed to the beginning of the lane and a Mk-154 pulled up behind it and fired one of its three line charges over the plow tank and into the mine field.

The process of line charges followed by plow tanks was repeated until the lane was cleared to the far side of the mine field. It generally took Marine breaching teams about 15 minutes to push through each mine field. Mine rollers were then used to "proof" the lane, exploding the few mines that might have been missed.

After the lanes were proofed, they were marked by combat engineers. While marking the lanes, the engineers looked for any obstacle or mine that had either somehow escaped destruction or fallen back into the lane. Anything that could not be moved was destroyed in place.

While most breaches went smoothly, the 2nd Marine Division had a problem in two of its lanes. In addition to the usual problems encountered with MiCLiCs, there were power lines just in front of the leading edge of the mine field, so a MiCLiC launched in one lane ended up draped across the power lines. Worse, these lanes contained British L-9 bar mines, which had been captured from Kuwait. Bar mines cannot be set off by explosive overpressure like the kind produced by MiCLiC. In addition, they can be fitted with anti-disturbance fuses, which are designed to set the mine off if an attempt is made to move it. Many of the mines in this sector were fused in this fashion. As a result, they were exploding on contact with mine plows, destroying the plow and disabling the tank that pushed it. Marine engineers would later complain that the mine plow was supposed to be able to absorb as many as three hits before becoming disabled. This may have been true as far as mines like the VS 2.2 (2.13 kg of explosive) went, but a bar mine (with 7.2 kg of explosive) was powerful enough to blow the plow apart. The problems caused by bar mines turned the establishment of these two lanes a five-hour ordeal. On G-day, the 2nd Marine Division would have eight tanks with mine plows and two AAVs disabled. The majority of the division's engineer equipment losses occurred in the Green lanes.

"Roller Dude" *c/o Maj. Wayne Sinclair*

Egyptian engineers did not use mine plows or mine rollers. Their breaches were established by tanks or M-113 armored personnel carriers launching Mk-58s, then employing Full-Width Mine Rakes.

Though each of the two main mine fields in the Egyptian zone was

thinner than those the Marines had to contend with (70 meters deep as opposed to 100–150 meters deep in the Marine zone), the Egyptians' job was a bit more complex than the Marines' was. First, in the Egyptian zone, there was a string of company-sized strongpoints running along the southern edge of the Iraqi defenses. The strongpoints were surrounded by mine fields and there were mine fields running between them. Though the mine fields between the strongpoints were relatively thin, this meant that there were three mine fields to breach rather than two.

In addition, the Egyptians would face the only working fire trenches in the Gulf War. Egyptian Rangers were able to capture an Iraqi engineer doing routine maintenance on the system. The Iraqi provided the Egyptians with details about the layout of the fire trenches. Each trench was about 1,000 meters long, made up of ten 100-meter sections. Three barrels of thickened fuel (also known as phougas) had been placed in each section. The sections had then been filled with oil. The phougas would be exploded electrically to start the oil burning. The barrels would be set off by wires running back to the main Iraqi trenches. The entire fuel distribution system was underground. From a central valve in a bunker, a network of pipes ran to another set of pipes, which ran behind each of the trenches. From these pipes, underground fill tubes would bring more fuel to the trenches.

Armed with detailed knowledge of how the fire trenches worked, the Rangers sabotaged them the night before G-Day. They created what would be an almost four-mile-wide fire-free zone by cutting the wires to the phougas barrels over that stretch of the system.

Between 3 and 4 p.m. on 24 February, two breaches were made in the mine field between Iraqi strongpoints. Each breach was made between strongpoints, far enough from each so that they could not bring effective fire on the breach force.

Virtually the moment the two battalions breached the first mine field, the Iraqis lit the fire trenches. Shortly after the breach was established, two mechanized brigades joined the breaching battalions north of the first mine field. Unfortunately, by the time the two brigades passed through the mine field, night had fallen and the brigades became tangled as they headed for the spot where the fire trenches had been sabotaged. It took until dawn on the following morning to untangle them.

Breaching of the main mine fields commenced at dawn on the following morning. Despite heavy shelling, the breaching battalions were able to push eight lanes through the two mine fields by early afternoon. Losses had been slight. One Mk-58 had tipped over as the tank towing it approached a mine field. Not knowing this, the tank commander launched it. The line charge landed too close to the tank, and when it exploded, it caused extensive damage to the tank and injuries to the crew. Due to incorrect wiring, another Mk-58 blew up instead of launching, killing two soldiers and wounding several others inside the M-113 towing it.

Conclusion

Though there were problems with some of the breaching equipment, the breaching effort must be regarded as one of the Gulf War's greatest success stories. Before the war, few analysts would have been willing to bet that either the Marines or the Egyptians would have made such short work of the mine fields (the delays in the Egyptian breach were due to factors other than mines) in their attack zones. The speed of the breaches allowed maneuver units to hit the Iraqi defenders before they were ready. As a result, in the Marine zone, what the Iraqis had planned as armored counterattacks in support of their front-line troops turned into anti-armor ambushes when they found that Marines, who had overwhelmed the front-line troops, were waiting for them in their staging areas. Thus, the skill with which the breaches had been conducted saved lives not only during the breaching, but also in the operations that followed.

While there is a tendency to see the Gulf War as a "one-shot deal" with little relevance to future wars, the fact is, sooner or later, American combat troops will run into mine fields that need to be breached quickly. With certain improvements in some of the breaching equipment (sturdier wiring on the MiCLiC, and a more robust mine plow, for example) used in Desert Storm, there is no reason to believe that this success cannot be repeated in the future.

Biography

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