LANDMINES IN THE 1991 GULF WAR: A SURVEY AND ASSESSMENT

INTRODUCTORY REMARKS

Acknowledgments

This report was compiled in a brief period of time. It would not have been possible without the cooperation of Department of Defense and service professionals: Don Hakenson and Robert Swartwout of the Center for Unit Research and Records; Tom Campbell of OSD/Washington Headquarters Services, Directorate for Information Operations and Reports; Charles D. Melson, Head, History and Museums Division and Chief Historian, USMC; and many others.

Background

In March 2000, the Vietnam Veterans of America Foundation (VVAF) asked The Dupuy Institute (TDI) to survey the operational experience of the Allied-Coalition forces in the 1991 Persian Gulf War for information on the deployment and employment of landmines. Based upon its extensive experience with Gulf War unit records and previous related studies, TDI brought unique experience and expertise to the analysis.

TDI's initial evaluation of the extant literature on landmines in the Gulf War indicated that no systematic attempt had been made to examine unit operational records for evidence relating to the problem. Further, and in the absence of a systematic approach, much of what has been represented as analysis has been based upon hearsay, anecdotal evidence, assumptions unrelated to the military-operational context, and misunderstandings of modern weapons and how they are employed on the battlefield.

The report that follows may be regarded as an approach to an understanding of the use of landmines in the Gulf War. It was not possible in the brief time allocated for its completion and given the limited resources brought to bear, to do more than survey Gulf War operational records and related documents. Nonetheless, the principal author believes that this report will provide a firm basis for defensible conclusions with respect to the subject of inquiry.

Definitions

For purposes of this report, the 1991 Gulf War has been divided into three periods, corresponding to the operational context in the theater. These periods are:

(1) The pre-operational period (DESERT SHIELD)
(2) The operational period (DESERT STORM)
(3) The post-operational period

The pre-operational period was a period of insertion and build-up of the Allied-Coalition ground forces in the region. It extended from August 7, 1990, when Operation DESERT SHIELD began, to February 24, 1991, when Allied-Coalition forces began the ground war (G-Day). The pre-operational period included important military operations by both sides. The principal Iraqi offensive operation of the war, which resulted in the Battle of Khafji, occurred during the pre-operational period.

The operational period (DESERT STORM) commenced at 0400C hours, February 24, 1991, when Allied-Coalition forces began the ground phase of the campaign and may be said to have concluded with the initiation of the temporary cease-fire at 0800C hours on February 28, 1991. However, the Iraqis finally accepted the cease-fire terms at Safwan Airfield on March 3, and there was significant fighting subsequent to the temporary cease-fire, particularly in the XVIII Airborne Corps zone.

Following the cease-fire, there was a period of re-positioning and re-deployment. US forces began to leave the theater as early as March 8, 1991.

Abbreviations

Most abbreviations will be explained in the text the first time they are used. Time will be expressed as given in reports, either “C” (local time), or “Z” (Zulu, in this instance, local minus three hours).

DESERT SHIELD

There are few references in US operational records to defensive (counter-mobility) use of landmines during the pre-operational period. This is somewhat surprising, since the posture of Allied-Coalition forces during this period was uniformly defensive.

Use of Defensive Minefields Prohibited

In fact, the commander of the 20th Engineer Battalion (Combat)(Corps), which supported the 101st Airborne Division (Air Assault) in the XVIII Airborne Corps zone, noted a prohibition against the use of mines for defensive purposes:

> Now initially, my concern was that I was about the most forward unit sitting there and were the Iraqis to come across Kuwait into Saudi Arabia, there was not much of a defensive plan. We were initially questioning why we were not out putting in mine fields and tank ditches and all the things that we had trained to do. We knew of the prohibition against mine fields and tank ditches, but we still felt that if the purpose was to keep the man from coming into Saudi Arabia, then we should be putting up something to prevent that. Well, apparently the guys that are paid to know this knew that he wasn't going to do this--or [at least] anytime soon, because it was putting in his defensive belt and continued to add to that. So we never did put up what I would consider a very serious defensive barrier out there.[1]

The author was unable to locate specific operational orders or plans prohibiting the use of defensive minefields, but there is no doubt that the prohibition was in place. One possible motivation for the prohibition may have been a desire on the part of operational planners to prevent or limit Iraqi knowledge of the build-up of the XVIII Airborne Corps on CENTCOM's (Central Command) western flank. There is a glimpse of this mindset in the records of the XVIII Airborne Corps Artillery:

> ARCENT was convinced that Iraq was unaware of the XVIII Airborne Corps' movement into the Rafha area. All units were prohibited from firing unless enemy units crossed

[1] Oral History Interview, DSIT AE 068, LTC Frank D. Ellis, Commander, 20th Engineer Battalion, Interview Conducted 15 March 1991 near Rafha, Northern Province, Saudi Arabia, Interviewer: MAJ Robert B. Honec, III (116th Military History Detachment).

the border or firing was required for self-defense. During this time period, the use of counterfire radars was minimized to reduce unit signatures.[2]

First FASCAM Minefield Emplaced in Combat

Although the use of landmines by the Allied-Coalition forces during the Gulf conflict was limited, the pre-operational period witnessed a historic first when a USMC artillery battalion laid the first FASCAM (family of scatterable mines) minefield emplaced in combat. This occurred during defensive operations connected with the Battle of Khafji (Jan. 29-Feb. 1, 1991). Khafji resulted from a limited Iraqi offensive along an approximately 70-kilometer front on the Saudi-Kuwaiti border from the Gulf coast to the "heel" of the Kuwaiti "boot." The main attack was made along the coast road against Joint Forces Command-North (JFC-N) forces defending in the vicinity of the abandoned Saudi town of Khafji.

At about the same time the Iraqis attacked Khafji on the coast, the Iraqi 5th Mechanized Infantry Division made a series of battalion- and brigade-sized assaults further inland against the MARCENT sector. In the 1st Marine Division zone, encompassing the southwest border of Kuwait from the "elbow" to the "heel," the Iraqis attacked the division's screenline at OPs (observation posts) 4, 5, and 6. The OPs were abandoned police posts at locations where there were holes cut in the border berm that would allow passage of vehicular traffic. Marines of Task Force Shepherd, supported by artillery and ground-attack aircraft, contained and turned back the Iraqi main effort at OP 4, near Umm Hujul, after it had penetrated the screen line. Sporadic incursions at OPs 5 and 6 were also beaten back.

During this fighting TF Shepherd was supported by the 5th Battalion, 11th Marines. This artillery battalion consisted of 12 M198 towed 155mm howitzers, 6 M109A3 self-propelled howitzers, and 6 M110A2 203mm howitzers. The FASCAM mission was fired during the evening of January 30 in order to close a gap in the berm between OPs 4 and 5. According to the combat chronology of the 5/11, at 2220 hours January 30, "TF Shepherd requested the FASCAM minefield be laid at grid QS63056235. Batteries Q, R, and S each fire 16 rounds of

[2] Headquarters, XVIII Airborne Corps Artillery. Chronicle of XVIII Airborne Corps Artillery Activity During Operation Desert Storm. 2 May 1991, p. 3.

RAAM [Remote Anti-Armor Mine] long duration and 4 rounds of ADAMs [Area Denial Artillery Munition[3]] long duration."[4]

The tactical effect of this fire mission, which was completed at 2252 hours and put 360 rounds (2,592 antitank mines and xxx anti-personnel mines) on the breach, apparently was to redirect the Iraqi attack: "The attacking Iraqi mechanized brigade was diverted to the only remaining gap[,] where it was met by direct and indirect fires."[5]

The Iraqis did not test the FASCAM minefield by attempting to attack across it. An Iraqi troop movement observed in the vicinity of the minefield at 0600 hours on the morning of January 31 was dispersed by "a battery two VT [Variable Time]," and no further movement was reported in its vicinity.[6]

DESERT STORM

US Marine Corps Experience

The Iraqi barrier system was reportedly forbidding, extensive. It had been inflated in pre-DESERT STORM estimates to the status of an "impenetrable barrier." Even though subsequently it was breached with relative ease, the operation in the MARCENT sector was spoken of as "a classic, absolutely classic military breaching of a very, very tough minefield, barbed-wire, fire trenches-type barrier."[7]

In reality, of course, any barrier system is only as formidable as the forces defending it, and the Iraqis never—either in MARCENT or the VII Corps sector—put up a coordinated, effective resistance. Although occasionally local resistance was intense, in most instances, personnel and material losses during the breaching were incurred during combat engineer-type operations to gap and pass through the barrier system. USMC operational records indicate that losses were small and that breaching of the minefield belts

---

[3] The ADAM projectile is a specialized 155mm artillery munition. The acronym is alternatively given as Artillery-Delivered Anti-Personnel Mine.

[4] 1st LAI, C/C, 1 Jan-28 Feb 91; 5/11 Marines, C/C, 1 Jan-28 Feb 91.

[5] 5/11 Marines, C/C, 1 Jan-28 Feb 91.

[6] *Ibid*.

[7] CENTCOM Press Briefing, 27 Feb `91.

was accomplished efficiently and expeditiously with minimal delay.

1st Marine Division Zone

The 1st Marine Division (1st MarDiv) breached the Iraqi fortifications in the region northwest of the Al Wafrah Oil field (the "heel" of the Kuwaiti "boot"). In the division's zone the barrier system varied in depth from 2 to 20 kilometers, with two minefield belts. Incredibly, the first belt was delimited by barbed wire. The 1st MarDiv described it as "a front barbed wire fence, a 120m[eter] deep AP/AT minefield and a rear barbed wire fence."[8] The location of the second belt was not marked by wire. In addition, it was deeper, "better laid out and more dangerous."[9]

The Iraqi plan evidently was not to oppose the breaching of the first minefield belt, but to counterattack the Marines while they were trapped in the second belt and the area between the belts and presumably exposed and immobilized in kill zones.

In the event, the 1st MarDiv lost one tank during the ground war, an M60A1 equipped with a mine-roller (nicknamed "roller dude"). This tank was lost to an Iraqi mine during the breaching of the first obstacle belt on G-Day. The first minefield belt was breached by Marine combat engineers in 24 minutes. The second belt was breached in 15 minutes. Delays were minimal and mostly attributable to the need to process masses of Iraqi prisoners.[10]

2d Marine Division Zone[11]

The 2d Marine Division (2d MarDiv), operating on MARCENT's left flank, faced the Saddam Line in the region opposite Al Jaber Airbase (although the airbase was in the 1st MarDiv zone). In the 2d MarDiv zone, the line was approximately 2 to 4 kilometers deep and consisted of two obstacle/minefield

---

[8] 1st MarDiv Summary of Action, G-Day, 24 Feb 91.

[9] Lt. Col. Charles H. Cureton, *With the 1st Marine Division in Desert Shield and Desert Storm* (Washington, D.C.: HQ, USMC, History and Museums Division, 1993), 76-77.

[10] *Ibid.*, 75-78.

[11] 2d MarDiv C/C, 1 January-13 April 1991; 2d MarDiv COC, Jnl, 24 Feb 91; 2d MarDiv Sitrep (G-3 Ops), 251111Z Feb 91; Actions of the 1st (Tiger) Brigade, 2d Armored Division, During Operation Desert Shield/Operation Desert Storm, 10 Aug 90-1 Mar 91.

belts like that in the 1st MarDiv zone (of which it was the northwestern extension).

On the 24th, the 6th Marines moved as the lead element of the division in the breach assault. The division deployed 247 tanks (64 M60A1 and 183 M1A1); 6 of these tanks (2%) had blades (track-width mine plows).

The "Significant Events" portion of the 2d MarDiv's G-3 (Operations) Sitrep for February 24, 1991, recorded personnel and material losses to land mines in the passage of the two Iraqi minefield/obstacle belts. At 0604C, Breach Lane Blue 3 "lost mine plow and rake." By 0724C, 1/6 Marines and 2/2 Marines had passed through the first minefield, and 1/8 Marines was in the first obstacle belt; four vehicles were reported damaged. At 0850C 2/2 Marines "performed 2nd breach Blue Lanes 3 and 4." Trouble developed at the Green Lanes at 0920C, which the 6th Marines reported "slow due to heavy [i.e., in terms of density] mines." Since the Blue Lanes were reported clear at 0937C, traffic was shifted to them for the final passage of the minefields.

By 2100 hours, the Marines and the attached Tiger Brigade of the US Army's 2d Armored Division had attained Phase Line RED, the G-Day limit of advance, and were consolidating along it. The 2d MarDiv had successfully passed its combat power into Kuwait and was poised beyond the Saddam Line to continue its attack on the following day.

2d MarDiv casualties on the 24th totaled 14 (2 KIA, 12 WIA), of which 4 appear to have been due to mines. At 241945C there were 4 WIA in the 8th Tanks ("hit mine").

Clearly, the 2d MarDiv had a more difficult time than the 1st in its breaching operation, incurring more casualties and material losses and encountering some difficulties and delays. Nonetheless, it broke through the Iraqi fortifications easily and attained its limit of advance.

Summary[12]

USMC battle casualties in the Gulf totalled 177. Of that number 75 (42%) were attributed to shrapnel (i.e., shell fragments), 60 (34%) to accidents, 18 (10%) to friendly fire,

[12] See Persian Gulf Campaign: U.S. Marine Corps Operations, Desert Storm MarCent Command Brief, dtd 5/16/91.

14 (8%) to (downed) aircraft, 7 (4%) to land mines, and 3 (2%) to gunshot.

Marine Corps materiel losses in the Gulf included 6 M60A1 tanks, of which 5 were mine plows; 5 APCs, including 3 AAVs and 2 LAVs, and 9 aircraft. Battle casualties connected with these materiel losses were 22 KIA and 88 WIA.

US Army Experience

The extensive Iraqi minefield-obstacle system opposite the planned VII Corps breachhead imposed little delay on coalition forces when DESERT STORM was launched. British forces commander Gen. Sir Peter de La Billiere stated:

> [T]he breaching proved much easier than expected. Just before noon [February 24] armoured bulldozers of the 1st Mechanized Infantry Division (the Big Red One) began ploughing through the minefield and within eighty minutes they had opened up sixteen lanes, enabling US cavalry units to push through, brush past poorly defended Iraqi positions and establish a semicircular screen some fifteen kilometres to the north.[13]

The Iraqi fortifications scarcely deterred the Allied-Coalition assault in the VII Corps sector. A prescient post-mortem concluded:

> At the tactical level, the integrity of the actual Iraqi defenses in the first echelon were irregular and erratic. Many defensive positions were shallow, ditches were not filled with oil. Strong points did not have mutually supporting fields of fire, and minefields were not concealed. The original intelligence picture painted a picture of an impregnable defensive line reinforced by a second line of reinforced brigade strong point positions. The defensive design was to allow initial penetration, but block the Coalition forces at the second belt and destroy them with local counterattacks. A fatal Iraqi mistake was that they had developed a defense based on the lessons of the infantry intense Iran-Iraq War and not on the nature of a defense designed to stop or defeat massed armor formations. In

[13] Gen. Sir Peter de La Billiere, *Storm Commander: A Personal Account of the Gulf War* (London: Motivate Publishing, 1992), 280.

essence, the Iraqi defensive belts became prisons from which the conscript divisions could not escape.[14]

The Problem of Unexploded Ordnance

Unexploded ordnance (UXO) posed a major problem for Allied-Coalition ground forces during the 100-hour war to liberate Kuwait. The experience of the 1-7 IN (1st Battalion, 7th Infantry Regiment), the lead battalion of the 1st Brigade, 1st Armored Division, was indicative: "once across the border into Iraq, the terrain became rough and unexploded ammunition was being encountered by some units."[15]

Iraqi minefields were not considered much of a problem, likely because they were not often covered by fire, but even "fake" minefields were plowed for passage by tanks with mineplows.[16]

At PL (Phase Line) Libya, the problem of unexploded ordnance was again encountered by 1-7 IN: "Movement was quite hazardous as tracked vehicles would set off explosions[,] and fragments would careen wildly off the sides of adjacent vehicles."[17]

In the cavalry units, moving ahead of the heavy forces, UXO was a continuous concern. The experience of
In the 1-7 IN, immediately following the cease-fire:

> We found ourselves sitting essentially on top of a bunker complex that had been hit several times by air- and ground-launched weapons and unexploded bomblets were a great concern. One young medic, PFC Mike Burgess, lost a leg and very nearly his life after stepping on one near what had been an Iraqi aid station….The area had been cleared by the engineers, but we discovered that some of the bomblets had settled under the sand because of the heavy rains. Movement was greatly restricted and combat engineer vehicles with rakes mounted cleared roads from position to position for movement. We were all relieved several days later when

---

[14] Maj. Steven M. Zotti, *Mailed Fist or Pursuit Operations: An Operational Analysis of VII Corps During the Gulf War*. Fort Leavenworth, Ks.: US Army Command and General Staff College, 1997.

[15] Smith, 24.

[16] Smith, 25.

[17] Smith, 27

> we were able to move approximately 20 km deeper into Kuwait and out of this hazardous area.[18]

The 3d Brigade, 3rd Armored Division, reported that it "took no casualties from direct or indirect enemy fire, but that "several casualties did occur from mines and dud ammunition during hostilities and afterward from secondary explosions while destroying captured and abandoned Iraqi equipment."[19]

The 20th Engineer Brigade encountered an extremely hazardous environment in the Al Bussayah region, which it was attempting to pass through at the time of the cease-fire. Lieutenant Colonel Ellis recalled:

> And the road around Al Busayyah was literally just saturated with unexploded ordnance.
>
> MAJ HONEC: What types? American, Iraqi?
>
> LTC ELLIS: American ordnance, ICMs and Gator mines it appeared. And as we were ... they were trying to cut a road past it, it was very slow going because they were clearing the road as they went. Because of the number of munitions that were on the road that came out of the town, the decision was made by the group commander and the commander of the 37th, to try to grade a bypass around it. And this is what they were doing, and they held up traffic—rightly so--for several hours as they tried to get this around.[20]

The Army's concern with the problem of UXO and one of its consequences, an increased probability of fratricide, was addressed in the Center for Army Lessons Learned (CALL):

> During Operation DESERT STORM, the combined dud rate of multiple engagements with improved conventional munitions (APICM, DPICM, CBUs) cause obstacles and safety concerns for the maneuver commander. Some maneuver commanders hesitated to employ the munitions, especially if the unit might have to move through the area later. Soldiers were killed and wounded while handling unexploded submunitions. Some thought the rounds were "empty" because they appeared

---

[18] Smith, 32-33.

[19] Headquarters, 3d Brigade, 3rd Armored Division, "Memo: Personnel Aspects of Operation Desert Storm for Historical Records," dtd. Mar. 14, 1991.

[20] Ellis interview, *op. cit.*

> empty. Commanders can create Restricted Fire Areas (RFAs) where they anticipate subsequent maneuver to control this problem. Dud-producing missions would then require coordination with the maneuver headquarters. Depending upon the type of forces and fires involved, these missions would be restricted or carefully recorded. Our soldiers and junior leaders must be educated with both the safety and tactical knowledge that will prevent handling unexploded ordnance. Finally, as with ammunition and pyrotechnics, leaders must not tolerate breaches of basic discipline in dealing with UXOs.[21]

As mentioned above, the UXO problem persisted after the temporary cease-fire. The choice of an appropriate site for negotiation of a permanent cease-fire was hampered by the necessity to clear UXO. The 1st EOD (Explosive Ordnance Disposal) Group, described Safwan Airfield, the site eventually chosen, in these terms:

> Talked with VII Corps LNO (Liaison Officer) at G-3 Opn's ARCENT about tasking on peace negotiation site. They are aware of extreme concentrations of Gator minefields adjacent to the proposed site. They were also advised that numerous ATACMS (Army Tactical Missile System) were fired into that area as recently as 18 hours before. The scope of clearance and timeframe allowed has yet to be determined.[22]

Gator Munitions

The Gator munition is an air-delivered SCATMINE [Scatterable Minefield] system that is produced in two versions -- one USAF, designated CBU-89/B, that contains 94 mines (72 AT and 22 AP) and one USN, the CBU-78/B, which contains 60 mines (45 AT and 15 AP). Gator munitions can be emplaced anywhere in a war theater that can be reached by tactical and strategic air assets. An average Gator minefield covers an area approximately 200 x 650 meters.[23] This is predicated on the delivery of 6 Gator dispensers, each containing 72 AT and 22 AP mines, by 1 Gator sortie. For planning purposes, two

---

[21] CALL Newsletter No. 92-4, *Fratricide: Reducing Self-Inflicted Losses*, ch. 3, "Fratricide Reduction Measures."

[22] 1st EOD. Daily Journal, 1-15 March 1991. Entry for 0315 hours, 1 March 1991.

[23] The Gator munitions are fully described in US, Department of the Army, *FM 20-32 Mine/Countermine Operations* (Washington, DC: HQs, DA, 1998), p. 14 et sq.

Gator sorties are considered sufficient to fix or block a typical adversary battalion, depending on the orientation of the minefield to the target battalion's axis of movement.

In the Gulf War, Gator munitions were used primarily to interdict, that is, prevent or hinder enemy use of an area or route for supply, communications, or movement. The munition was utilized in this manner not only in the main theater of operations (Kuwait and southeastern Iraq), but also in the wider "Scud War," in which it was used to interdict the movements of the highly-mobile transporter-erector-launchers of the Scud ballistic missiles. The records of the Gulf War Air Power Survey (GWAPS) indicate that Allied-Coalition air forces delivered 1,314 Gator munitions, or 0.63 percent of approximately 210,000 air-delivered, unguided munitions "employed" in the Gulf War.[24]

Supplies of Gator munitions in Central Command were never larger than 47 percent of the projected requirement. Table 1, derived from GWAPS data, shows USAF CBU-89 supplies and requirements during the pre-operational period.[25]

Table 1: CBU-89 Supplies vs. Requirements in CENTCOM

Date	O/H	Rqmt	% O/H vs Rqmt
12/1/90	1,387	2,950	47
1/1/91	3,165	8,410	38
2/2/91	2,798	8,410	33

However, despite the ambitious requirements, CBU-89 (and CBU-78 [USN and USMC]) were employed on a lesser scale. As mentioned above a total of 1,314 Gator munitions were expended during the war. Table 2, shows the numbers of these munitions by the services during the Gulf conflict and the cost of the effort.[26]

Table 2: Gator Munitions Expended in the Gulf Conflict Numbers and Costs

Service/ Munition	Number	Unit Cost $	Total Cost $

[24] The total of 1,314 Gator munitions expended includes 1,105 by the Air Force, 148 by the Navy, and 61 by the Marine Corps (GWAPS, 2:206, Table 12, "Listing of Selected Munitions Employed in Desert Storm, 17 Jan-28 Feb 1991"). The total of 210,000 unguided munitions is based on GWAPS, *Summary Report*, 226; 17,000 PGMs (Precision-Guided Munitions) were expended during the war.

[25] Derived from *GWAPS*, 5:600, Table 193.

[26] Derived from *ibid.*, pp. 550-554, Tables 188-191.

USAF CBU-89	1,105	39,963	44,159,115
USN CBU-78	148	39,963	5,914,524
USMC CBU-78	61	39,963	2,437,743
Totals	1,314		52,511,382

The GWAPS notes "several cases near the end of the war in which bridge approaches were mined to trap Iraqi ground forces in the KTO [Kuwait Theater of Operations]."[27] The Ar Rumaylah or Fish Lake Causeway over the Euphrates River Valley morass of Lake Hammar and its approaches were attacked repeatedly by a variety of air-delivered munitions during the ground war. At this point in the war, only two routes into the region of Iraq north of the Euphrates River were available to Iraqi forces attempting to withdraw from the KTO: the Fish Lake Causeway and associated expedient constructions by Iraqi engineers and the main north-south road through Basra. A B-52 mission of February 27 "scattered CBU-89 [Gator] mines along the the approaches to the Al Rumayla [sic] bridge, helping create a bottleneck that hampered the flight of the Iraqi Army."[28] Interdiction missions on February 28 again "hit bridges and causeways to keep trapped Republican Guards and other remaining Iraqi ground units bottled up."[29]

The employment of Gator mines in the Gulf War created a significant potential for fratricide. Mistakes of omission and commission associated with the use of the munition were addressed in the Army's fratricide publication, which incorporated the observations of the Army Engineer School[30]:

> Operation DESERT STORM was the first time scatterable mines were used by U.S. forces. Many units did not follow the doctrine for reporting, recording and marking of minefields. This was not only a joint problem between the Army and Air Force, but also an internal Army problem. FM 20-32, Mine/Countermine Operations, is under revision and will address scatterable minefield reporting, recording, marking and reorient emphasis from static barriers to dynamic (scatterable) barrier operations. Solutions include training with scatterable minefields in CPXs and FTXs; including minefield

[27] *GWAPS*, 2:178n.

[28] *Ibid.*

[29] *Ibid.*, 5:241.

[30] CALL, *op. cit.*

locations in your liaison officer (LO) checklists; and, development of a "flash" traffic format or quick report similar to NBC reports. Note that any use of FASCAM (and possibly some use of dud-producing submunitions) requires appropriate reporting. Although the Air Force delivered the GATOR missions mentioned in the Engineer School observation below "well beyond the Fire Support Coordination Line (FSCL)," this became a major problem when maneuver caused to FSCL to update rapidly to the north and east. "...Army planners released use of scatterable mines to component services without specifying the appropriate control measures as per doctrine. CENTCOM Air Force (CENTAF) flew over 35 GATOR missions (the exact number is not known), without reporting, or recording missions...During the ground offensive, units found themselves maneuvering in GATOR minefields, without any knowledge of their existence." --- U.S. Army Engineer School Operation DESERT STORM Observation

SOME CONCLUSIONS

This has been a limited, exploratory effort. Nonetheless, some conclusions may be stated confidently, based upon analysis of the records examined.

Personnel Casualties and Landmines

Various official statements have been made respecting US battle casualties in the Gulf conflict. According to one, US forces incurred 148 killed in action (KIA) during the war. These data cover the three-month period January 17-March 17, 1991. Among the 148 KIA, 10 or 6.76 percent, were attributed to landmines. Of these landmine casualties, none were incurred in the pre-operational period, eight during DESERT STORM, and two in the post-operational period.[31]

Except for the US Marine Corps tabulation cited earlier, this apparently is the only DoD database that analyzes Gulf War battle casualties by causative agent. However, as noted, it is limited to the KIA. In addition to the KIA, there were 243 wounded in action (WIA) and 42 captured or missing in action (CMIA).[32]

---

[31] Desert Storm Hostile Deaths, a tabulation prepared by OSD/WHS and generously provided in response to the author's query.

[32] See *GWAPS*, 5:657, Table 207, Desert Storm Summary of U.S. Personnel Losses by Day (as of 1 March 1991), which is attributed to USCINCCENT SITREPs.

The percentage of all battle casualties caused by landmines in modern warfare is not definitely known, although data adduced from various conflicts indicate that it is likely small relatively in stereotypical conventional conflicts like the Gulf War. Casualty analyses are usually based upon medical admissions, and it is generally conceded that the proportions observed among the wounded (including, of course, mortally wounded) treated by medical personnel can be extrapolated confidently to all "bloody losses." Such analyses indicate that artillery (including bombs and grenades) and small arms fire are the principal causes of bloody losses in ground combat. Rarely does the catch-all category "other" (excluding gas casualties in World War I) account for greater than five-ten percent of all bloody losses.[33]

The same would appear to be true of the Gulf conflict, although of course the law of small numbers would apply. Looking at data on known landmine casualties – seven percent of all US KIA and four percent of all USMC battle casualties – it may be estimated that approximately five percent of all US battle casualties were caused by landmines.

Looking specifically at landmine casualties, it may be observed that US munitions (UXO) likely accounted for a greater number and proportion than Iraqi landmines. This is the sense of observations gleaned from a survey of the operational records, recognizing the fact that UXO in its various forms included a variety of ordnance, not just landmines.

Material Losses and Landmines

Landmines (AT mines) accounted for a disproportionately large number of Allied-Coalition forces' tank losses. These were incurred chiefly in the breaching operations in MARCENT, but many vehicle losses carried under the rubric "landmine" were due to UXO. One source states that 60 percent of all Allied-Coalition vehicle losses were attributable to landmines (AP and AT).[34] Again, the law of small numbers would apply.

---

[33] See Army Operational Research Group (AORG), Memorandum No. F.6, *Trends in Warfare* (April 1955).

[34] Harry N. Hambric and William C. Schneck, "The Vehicular Mine Threat," *Proceedings of the Sixth Annual TARDEC Combat Vehicle Survivability Symposium (U).* 1:54.

Certainly, in MARCENT breaching operations, most heavy armor casualties were due to mines. These included six M60A1 tanks, of which five were mine plows, and three AAVs.[35] Correlation with operational records indicates that virtually all of these losses were due to landmines (but, again, the numbers are small). These losses did not affect USMC combat power and only minimally impeded operations.

Landmines and Operations

Although the extensive Iraqi minefields and barrier systems in the MARCENT and VII Corps sectors were judged to be formidable obstacles to the Allied-Coalition offensive, they were in fact easily breached and overcome. Their designed purpose to restrict, delay, stop, and impose additional casualties on the attacker was defeated by the preparatory bombardments, thorough engineering operations and countermeasures, and the speed and overwhelming force of the Allied-Coalition attack. Where occasionally in the barrier zones local resistance was fierce, or counterattacks were made, the combat outcomes were not affected by the minefields. In the one instance in which the Marines were actually stopped in a minefield lane, the advance was redirected to other lanes and the delay was minimal.

The defensive use of landmines by Allied-Coalition forces was minimal. The first combat use of FASCAM occurred during the pre-operational period and was apparently instrumental in redirecting an Iraqi attack. Offensively, Gator munitions were used extensively both in the principal war theater and in the "Scud War." Gator munitions were apparently effective in some instances (as noted) toward the conclusion of the ground war. However, Gator munitions were a primary component of the UXO problem that plagued Allied ground forces both during and after DESERT STORM.

[35] DESERT STORM MARCENT Command Brief, "Marine Battle Statistics, Marine [Material] Losses," May 16, 1991.

APPENDIX I:
UXB: THE VIEW FROM THE FRONT

At 0710Z hours February 27, 1991, the 20th Engineer Brigade retransmitted an XVIII Airborne Corps G-3 Message, Subject: Unexploded Munitions.[36] Reformatted excerpts follow:

1. The purpose of this message is to remind all XVIII Abn Corps soldiers to leave unexploded mines alone.
2. Coalition aircraft and enemy AAA have littered the corps area of operations with dangerous unexploded ammunition. A wide range of unexploded munitions to include six or more types of cluster munitions,…
3. Due to rapid Allied advance, activated Gator minefields could be encountered….Extreme caution must be exercised in moving/maneuvering through areas where air strikes have been conducted.
4. All units are reminded to leave unexploded ordnance alone. Areas should be marked for proper disposition by EOD personnel. XVIII Abn Corps has suffered several severe injuries as a result of unexploded munitions being disturbed.
5. This message is to be disseminated to the lowest level.

[36] Message Information Update, Rear CP File, 20 EN BDE, 28 FEB 91.

Sources

1st EOD Group. Daily Journal, 1-15 March 1991.

197th Infantry Brigade (M), Operation Desert Storm, Summary of Operations, 17 January-10 March 1991.

Center for Army Lessons Learned [CALL]. *Fratricide: Reducing Self-Inflicted Losses*. CALL Newsletter No. 92-4.

Cohen, Eliot A., et al. *Gulf War Air Power Survey* [GWAPS]. 5 vols. and *Summary Report*. Washington, D.C.: U.S. Government Printing Office, 1993.

Constantine, Donald. "Sappers Forward: Preparing Engineers for Desert Storm." *Military Review,* (March 1992), 22-27. Engr School's role in overcoming Iraqi obstacle system.

Cureton, Lt. Col. Charles H. *With the 1st Marine Division in Desert Shield and Desert Storm.* Washington, D.C.: HQ, USMC, History and Museums Division, 1993.

Headquarters, 3d Brigade, 3rd Armored Division, "Memo: Personnel Aspects of Operation Desert Storm for Historical Records," dtd. Mar. 14, 1991.

Headquarters, XVIII Airborne Corps Artillery. Chronicle of XVIII Airborne Corps Artillery Activity During Operation Desert Storm. 2 May 1991.

Hedges, Chris. "With a Bang! Bang!..Bang! War Cleanup Goes On." *NY Times* (15 October 1992), A4.

Johnson, Richard H. "The Lethal Legacy of Land Mines." *Army* (January 1994), 34-39.

La Billiere, Gen. Sir Peter de. *Storm Commander: A Personal Account of the Gulf War* (London: Motivate Publishing, 1992).

Oral History Interview, DSIT AE 068, LTC Frank D. Ellis, Commander, 20th Engineer Battalion, Interview Conducted 15 March 1991 near Rafha, Northern Province, Saudi Arabia, Interviewer: MAJ Robert B. Honec, III (116th Military History Detachment).

Roos, John G. "CMS Encountered Minefield in US Before Winning Kuwait Clean-Up Award." *Armed Forces Journal International,* (November 1991), 24.

Scales, Brig. Gen. Robert H., Jr., et al. *Certain Victory*. Washington, D.C.: Office of the Chief of Staff, US Army, 1993.

Schwarzkopf, H. Norman. *The Autobiography: It Doesn't Take A Hero*. New York: Bantam Books, 1992.

Smith, Lt. Col. Stephen S. *The 1st Battalion 7th Infantry in the Gulf War*. Carlisle Barracks, Pa.: USAWC Military Studies Program, 1993.

Zotti, Maj. Steven M. *Mailed Fist or Pursuit Operations: An Operational Analysis of VII Corps During the Gulf War*. Fort Leavenworth, Ks.: US Army Command and General Staff College, 1997.