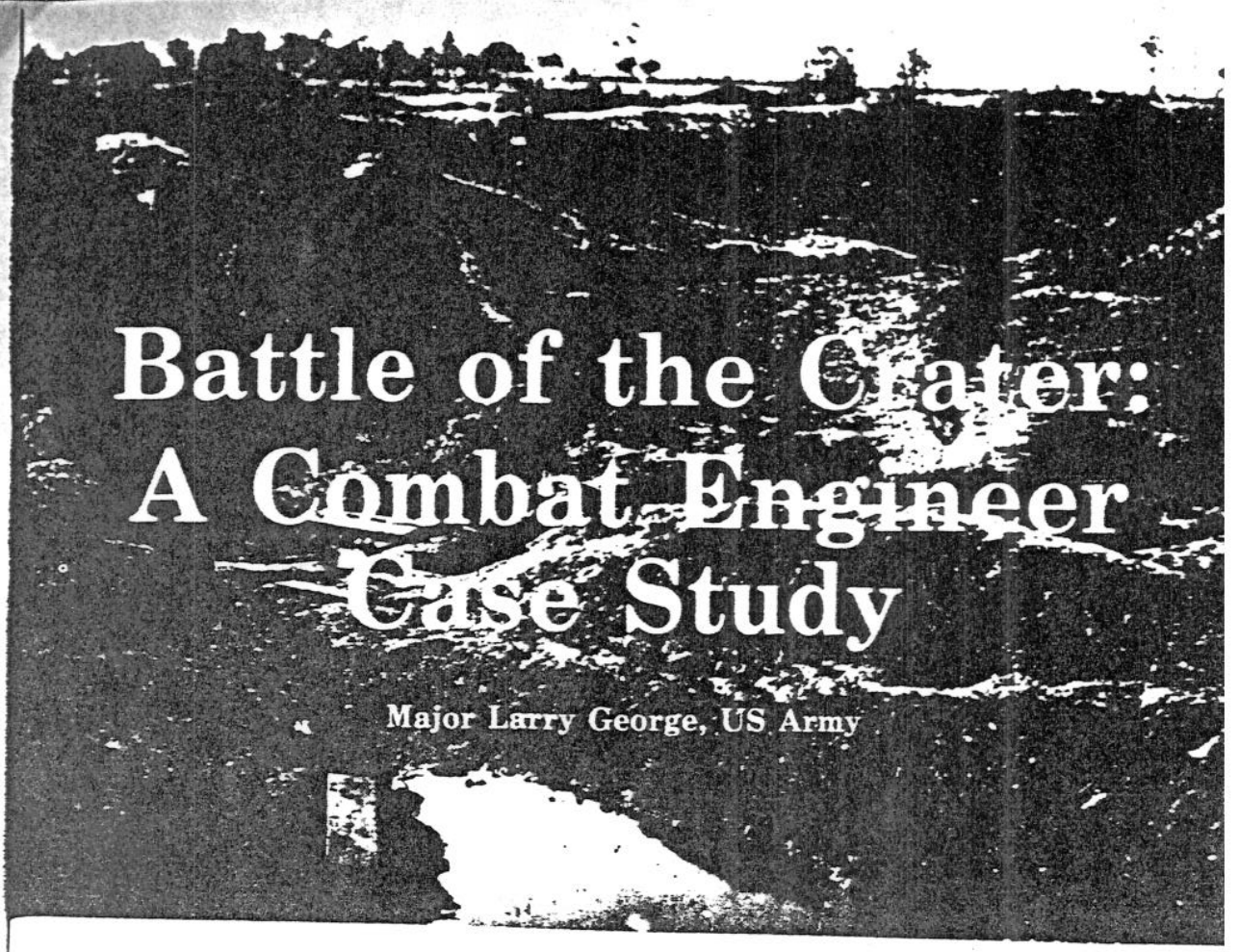

Battle of the Crater: A Combat Engineer Case Study

Major Larry George, US Army

The Union's 10-month siege of Confederate positions at Petersburg in 1864 contained a clever attempt to break the stalemate. This action, which at first appeared successful, quickly produced heavy casualties for the Union forces. An analysis of this event highlights some lessons that apply even today. This article won the US Army Command and General Staff College's 1983 Arter-Darby Military History Writing Award for excellence in professional scholarship.

JUST before dawn on 30 July 1864, a tremendous explosion tore a gap in the Confederate fortifications protecting Petersburg, Virginia. At least 278 Confederate soldiers were killed or wounded. The Confederate front line was replaced by a crater 170 feet long, 60 to 80 feet wide and 30 feet deep. Trenches were empty for 200 yards on either side of the crater. The Army of the Potomac's IX Corps, supported by the V and XVIII Corps and nearly 100 artillery pieces, began an assault to seize the high ground known as Cemetery Hill, threatening the city of Petersburg and the rear of the Rebel lines.

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The lead division did not immediately take the now undefended high ground. Its members went, instead, into the crater formed by the blast. In getting through their own fortifications and the Confederate obstacles, the regiments of the 1st Division had intermingled, and no one could control the confused mass. The follow-on divisions attempted to press forward, but they only added to the confusion.

By the time some semblance of order had been restored, the Confederate forces had recovered sufficiently from the initial shock of the blast to bring musket and artillery fire on the flanks of the Northern troops. Union attempts to move forward were repulsed by a desperate counterattack. Accurate artillery and mortar fire began to wreak havoc among the hundreds of men in the crater and, more importantly, to cut off the withdrawal route from the crater to the Union lines. After 10 hours of intense hand-to-hand combat and tremendous suffering from the heat and dehydration, the Union forces succumbed to a final Rebel assault. As Bruce Catton has said:

The Army of the Potomac was led to disaster many times, and there is a rather horrible fascination about tracing the steps by which, in each case, it reached its destination. Usually those steps seemed quite reasonable at the time, and they were generally taken with the best intentions in the world, and almost invariably they form a chain of events which might have been broken almost anywhere.[1]

This "horrible fascination" probably explains why the Battle of the Crater is the most analyzed of any of the episodes in the 10-month Union siege of Petersburg. In addition to the elements of high tragedy which make it such an interesting tale, the battle also serves as an excellent tactical case study. It provides lessons in leadership, the command and control of ground forces with limited communications and the exploitation of tactical surprise.

The Battle of the Crater also demonstrates the importance of a key member of the combined arms team—the engineer. To develop this premise, the engineer doctrine and organization in the Army of the Potomac will be reviewed, and the proposed and actual employment of engineers in the battle will be described. In addition, the impact of the use and nonuse of available assets will be analyzed, and lessons which can be applied on the modern battlefield will be discussed.

Engineer Forces and Doctrine

The Army of the Potomac had two formal engineer units: the US Army Engineer Battalion and the Engineer Brigade (Volunteer). Both were attached to the headquarters. The battalion was, in fact, the only regular engineer organization in the entire Union Army and had been in existence only since the beginning of the war (Figure 1). The duties of the Corps of Engineers then, as now, included the construction of permanent and field fortifications, obstacles and the:

. . . preparation of passage of rivers, . . . movement and operation of armies in the field, and the necessary reconnaissances and surveys for the execution of these functions.[2]

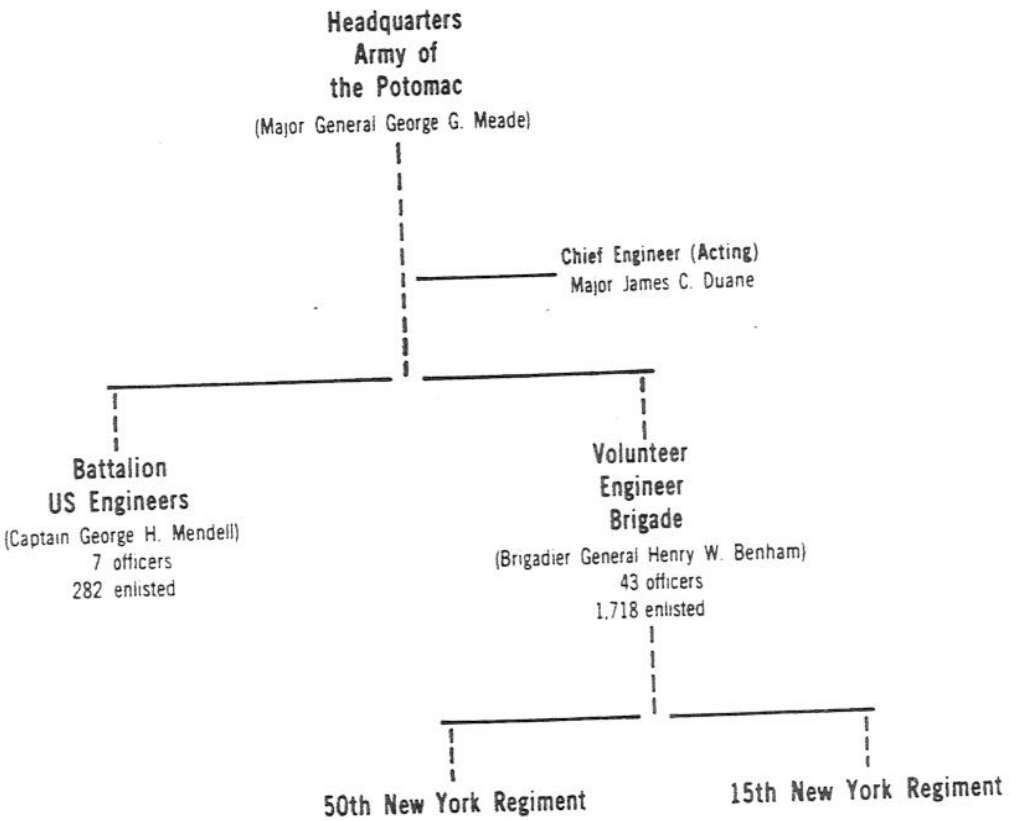
Engineer officers worked either with the formal engineer units, performing surveys and reconnaissance directed by the Army of the Potomac, or were detailed as chief engineers of the corps. Much of the work that would now be considered combat engineering was accomplished by a corps of pioneers drawn from each regi-

ment. These line soldiers were equipped with tools from the Army headquarters and would clear or "slash" the front of a position and construct or repair bridges, barricades and temporary defenses. The strength of a pioneer organization in the Army of the Potomac was fixed at 2 percent of the effective strength of its infantry brigade.[3]

The technical aspects of siege warfare were also the responsibility of the engineers. Thus, according to the Engineer Battalion's monthly report for July 1864, the engineer officers were:

. . . principally occupied in superintending the various operations of their profession, such as the preparation of siege materials, the construction of redoubts, batteries, parallels, and boyeaux, together with conducting the necessary surveys, and preparing complete plans and maps of the environs of the city and its approaches

Engineer Organization



Source: Phillip M. Thienel, "Engineers in the Union Army, 1861-1865," *Military Engineer*, Volume XLVII, 1955, p 37.

Figure 1

incident to offensive movements against the fortified position taken up by the enemy in front of Petersburg.[4]

Tactical Setting

The task facing the Union engineers was formidable. A report from Major James C. Duane, the acting chief engineer of the Army of the Potomac, described the Rebel works as a complex system of redoubts connected with infantry parapets. The ground to the front was further obstructed by abatis, stakes and entanglements. Duane recommended an attack by regular approaches but cautioned that the siege would be a long one.[5] The enemy could, if the defensive line were carried, fall back to another equally strong position, continuing this process until the Union forces could reach Cemetery Hill which overlooked the city (Figure 2).

Lieutenant General Ulysses S. Grant was not sure that he could afford the time. He had successfully pushed General Robert E. Lee south to Richmond and Petersburg, but the cost had been high. Casualties numbered more than 55,000 in the battles at the Wilderness, Spotsylvania Court House and Cold Harbor. It was conceivable that a continued stalemate could result in President Abraham Lincoln's defeat in the fall elections. Furthermore, Grant's object was Lee's army, not Petersburg itself. The city was the key to Richmond, and, if it fell, Lee might be forced out of his trenches where Grant believed the superior numbers of the Union Army could be decisive.

Grant's options for attack were limited. Lee was operating on interior lines in Petersburg and had been consistently successful in thwarting Grant's flanking attempts. Earlier fighting at Cold Harbor had demonstrated that a frontal assault on fortifications was a futile waste of men. Even the "school solution" of a siege by regular approaches would probably produce a great loss of life by sharpshooters and mortars. An officer in the Engineer Battalion analyzed the situation as requiring a rapid penetration by specially chosen troops, preceded by an intense artillery barrage, to burst through the works and seize the interior.[6]

As chance would have it, the Army of the Potomac had such an opportunity. Colonel Henry Pleasants, a regimental commander in the IX Corps, proposed to take advantage of the favorable topography by excavating a mine under the Confederate line, filling it with gunpowder and blowing a hole in the defenses. Pleasants, a mining engineer by profession, believed his regiment of Pennsylvania coal miners could dig the 500-foot tunnel and conceal its presence from the Rebels.[7]

Duane disagreed with Pleasants' assessment. Such a tunnel was a major engineering project, requiring skilled workers, special equipment and working conditions not to be found on the battlefield. Proper shoring materials were not available to prevent the proposed tunnel from collapsing. If this problem were somehow overcome, the mine was too long to be adequately ventilated. Furthermore, the Southerners would probably detect the operation and could easily defeat it with a countermine.

Given these objections, Major General George G. Meade, the commander of the Army of the Potomac, was understandably unenthusiastic about the project. On the other hand, the forces around Petersburg were in a stalemate, with few prospects for a quick resolution. Meade gave Major General Ambrose E. Burnside, the IX Corps commander, permission to start

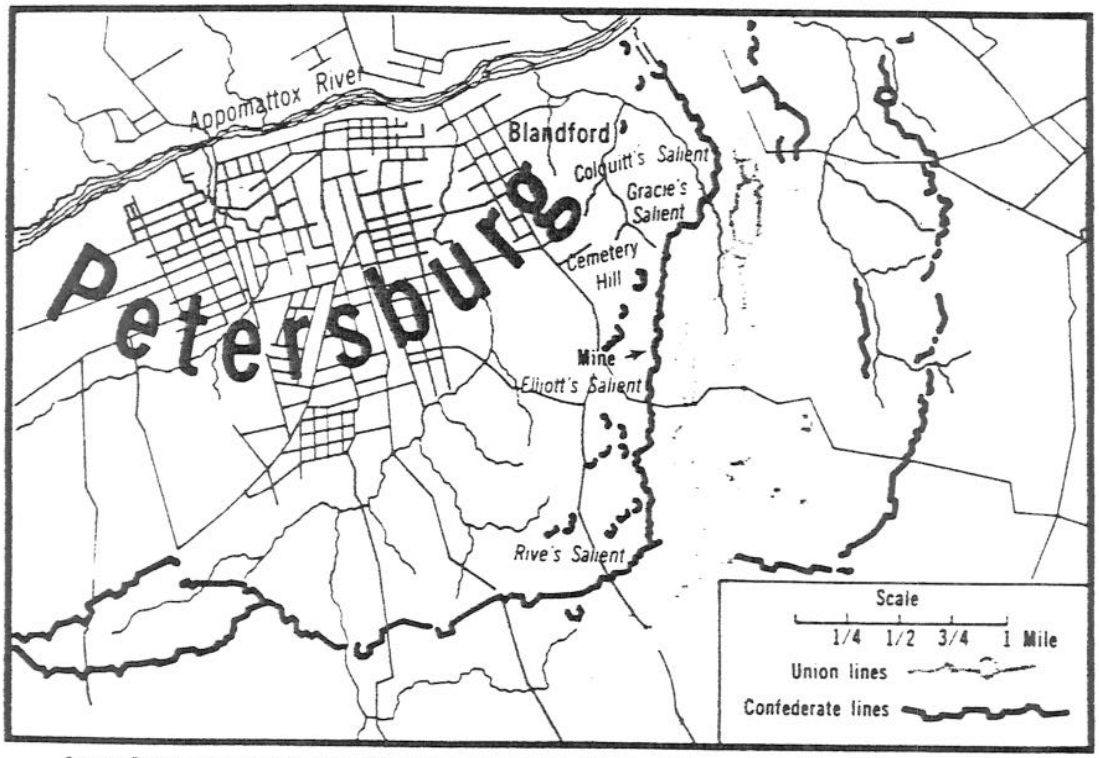
the mine, mostly to keep the troops occupied.

Pleasants and his men faced formidable obstacles, both technical and bureaucratic. Since it considered the likelihood of the mine's success to be low, Army of the Potomac headquarters did not support the operation. Surveying instruments, proper digging tools and wheelbarrows for removing the spoil were requested but never received. In many cases, items such as sandbags and shoring materials were promised but never delivered.

The bureaucratic difficulties were eventually overcome by ingenuity, improvisation and perseverance. The miners fabricated their own tools, built boxes to carry the spoil and found their own supplies. The engineering problems remained, however. Fortunately, the civilian experience of the men and their leader made it possible to design and execute a shoring system to prevent the collapse of the tunnel. Here again, the greatest difficulty was in obtaining materials, but Pleasants located an abandoned sawmill and was able to cut his own timbers.

As prophesied by the engineers, the ventilation of the mine was the greatest

Petersburg Fortifications



Source: *Battles and Leaders of the Civil War*, edited by Robert U. Johnson and Clarence C. Buel, The DeVinne Press, N.Y., 1889. Volume IV, p 538.

Figure 2

technical challenge. Pleasants' solution was particularly ingenious. The miners dug a vertical shaft close beside the tunnel, from a point just behind the Union trench (and concealed from view by a clump of bushes), to a recess in the tunnel wall. Then, a wooden tube was constructed along the full length of the tunnel, with one end protruding beyond a door in the mouth of the mine. The miners then closed the door and built a fire under the vertical shaft. The draft created as the smoke and heated air went up the shaft pulled bad air out of the tunnel and fresh air in through the wooden tube.

Three weeks after the work began, the mine was completed. The inner end was directly under the Confederate fortifications, 20 feet below an area known as Elliott's Salient. A 75-foot gallery had been dug at right angles to the main tunnel and charged with 4 tons of gunpowder (Figure 3).

The Federals had not been entirely successful in concealing the mine. The Southern soldiers guarding Elliott's Salient had heard the tunneling and sank several unsuccessful countermines. Pleasants suspended operations for several days, and the Rebels finally decided that the threat was not significant. Their engineers had investigated the area and determined that such a mine was impossible for soldiers to excavate. General Pierre G. T. Beauregard, in charge of the Petersburg defenses, did, however, take the precaution of placing an entrenchment across the gorge of the salient and established batteries of mortars to place fire on the threatened point.

Grant recognized the opportunity the mine presented and planned a major operation to take advantage of it. He sent the II Corps and the cavalry north to threaten Richmond and draw away some of the Petersburg defenses. The ruse was successful. Five divisions were rushed north by Lee, leaving only three divisions with an effective strength of 18,000 men to face three Union corps.

Concept

The orders from Meade's headquarters were very detailed and explicitly recognized the importance of the mobility task:

1. . . . General Burnside will . . . prepare his parapets and abatis for the passage of the columns, and have the pioneers equipped for work in opening passages for artillery, destroying enemy abatis, &c., and the entrenching tools distributed for effecting lodgements, &c. . . .

* * *

7. Major Duane, acting chief engineer, will have the pontoon trains parked at convenient points in the rear prepared to move. He will see that supplies of sandbags, gabions, fascines, &c., are in depot near the lines ready for use. He will detail engineer officers for each corps.

* * *

9. Corps commanders will report to the commanding general when the preparations are complete. . . .[8]

Meade's order emphasized the need to prepare the Union fortifications for passage and for pioneers to clear paths through the Rebel obstacles—and with good reason. In the IX Corps sector, the Union trench was 8 feet deep, with a high parapet on the side toward the enemy and a heavy barrier of abatis to the front. A quarter of a mile to the rear, on the eastern slope of a ravine, there were gun pits, with artillery placed to knock down parties trying to storm the trench. For protection from Southern fire, there was a deep covered way which left the trench at almost a right angle, crossed the ravine

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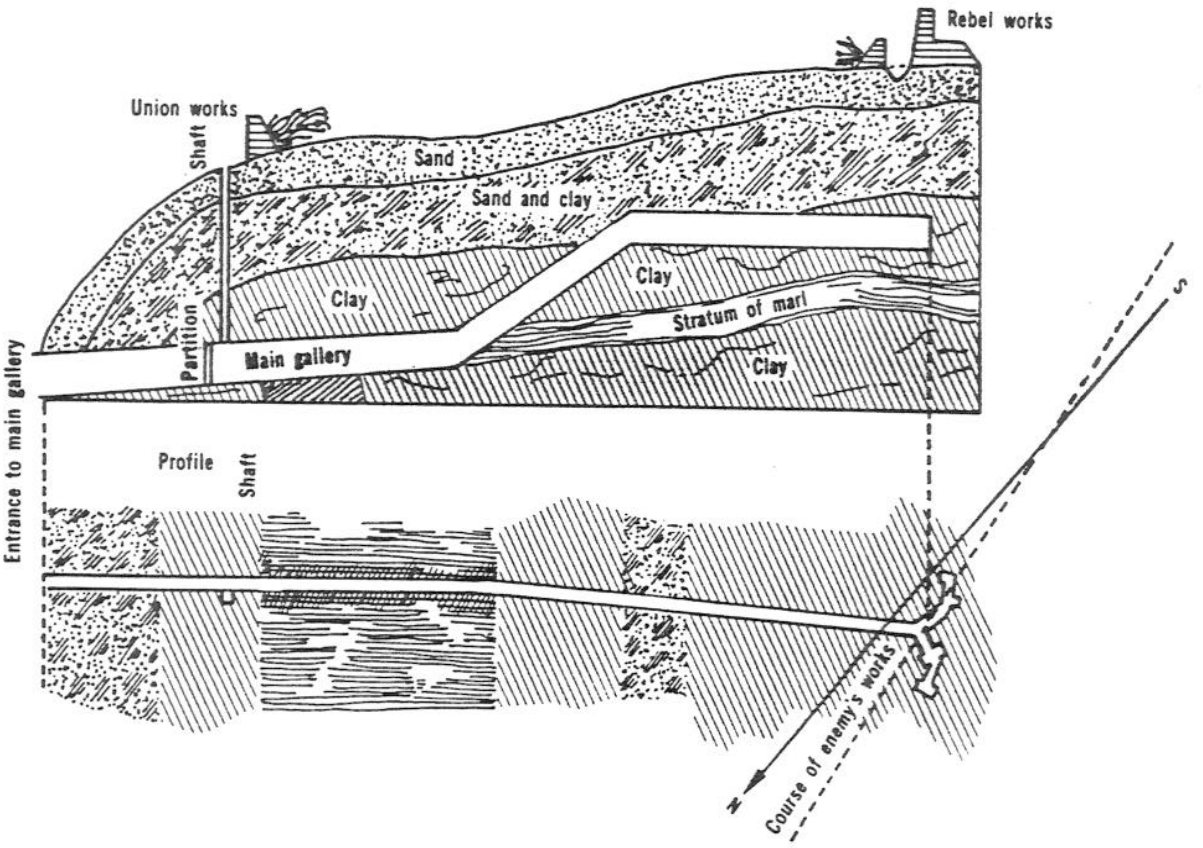
and ended behind the gun pits.

The Confederate side was much the same, with abatis and chevaux-de-frise to the front, a deep, strong trench, covered ways to the rear and batteries posted to beat off any attack.[9] Opposite Burnside's forces, in the Elliott's Salient area, there was a fort with brass cannon. The salient was a re-entrant to the Rebel line, protected by batteries in a rough semicircle which could deliver flank fire on the salient, the Union line and the ground in between. For this reason, Duane had earlier opposed the proposed assault in this area, preferring a conventional siege operation elsewhere.[10] Once through the initial line, passage remained difficult. As the after-action report of the IX Corps states:

The lines of the enemy on either side [of the crater] were not single, but involuted and complex, fitted with pits, traverses,

The Mine



Source: *War of the Rebellion. A Compilation of the Official Records of the Union and Confederate Armies.* US War Department, US Government Printing Office, Washington, D.C., 1892, Series I, Volume XL, Part 1, p 559.

Figure 3

and bombproofs, forming a labyrinth as difficult of passage as the crater itself.[11]

Such an area would make the control and maneuver of formations extremely difficult, particularly under fire. It is apparent that the operation was heavily dependent upon the rapid exploitation of the surprise and the opening created by the explosion. If the lead elements could not move quickly to the high ground before the Confederates recovered, the Union soldiers would be forced to maneuver over very difficult terrain under flanking fire from left and right. Engineer operations would have to concentrate on improving mobility and removing any impediments to rapid movement. Once the high ground was seized, the emphasis would shift to survivability.

Execution

How were Meade's orders implemented? They seem to have been followed closely at the Army level. According to the monthly report of the 50th New York Volunteer Engineer Regiment, the pontoon train had been drawn up on the evening of 29 July and was prepared to move to the Appomattox River. When the order ending the engagement was received, the trains moved back to the headquarters area.[12] As ordered, Duane sent engineer officers down to the corps. Major Nathaniel Michler, assigned to the XVIII Corps, reconnoitered the corp's position but found that Major General Edward O. Ord's subordinate generals were already familiar with the terrain. They had, in fact, selected the attack positions which Michler was going to recommend. The XVIII Corps also had two engineers from its parent headquarters, the Army of the James.

Duane consulted with Major General Gouverneur K. Warren, the V Corps commander, on the best routes for troop movement. During the battle, Duane remained in the V Corps sector and assisted the chief of artillery in directing fire.

The officer assigned to the IX Corps was First Lieutenant William H. H. Benyaurd. Although only detailed on 29 June, he had been the officer on duty with an engineer company working on the corps front since early June, primarily supervising the construction of artillery positions, repairing approaches to the lines and constructing expedient fortification materials. During the assault, Benyaurd initially stayed with Burnside at corps headquarters and later visited different parts of the battlefield. He did not direct engineer operations.

Since the IX Corps was making the main attack, it had been given specific instructions. However, Burnside elected to modify the attack order in some areas. He did have regiments detailed as engineers in three of the four divisions, and the pioneers were equipped with clearing and entrenching tools. In the lead division, however, Brigadier General James H. Ledlie placed the engineer regiment at the rear of the assaulting forces. According to their orders, the 35th Massachusetts Volunteers were to follow the two attacking brigades and "would be set at throwing up intrenchments on the hill beyond the crater."[13] As mentioned earlier, Burnside did not have his assigned engineer lead these work parties, apparently preferring to direct operations himself.

More importantly, however, the corps commander did not prepare his own obstacles for passage. Burnside had decided that the parapet and abatis would not significantly hinder the assault. Furthermore, he later testified:

. . . there was no expectation on my part that that portion of the order could be carried out without discovery and without very great harm to the troops that would have to prepare these works, ...[14]

This decision was not reported to the Army of the Potomac. As a result of Burnside's decision, the lead brigade's soldiers were weighted down with their weapons and equipment in an 8-foot ditch when the mine exploded. They could not scale the wall. Individual efforts succeeded in getting some men over the parapet, but they lost all semblance of order in the process. Officers could not re-form their regiments, and most of the lead brigade wandered over to the crater to look at the hole. The soldiers then scrambled down the side of the 30-foot-deep crater and began digging out half-buried Rebels and artillery pieces.

Since the engineer parties were not with the lead brigade, the only gap in the Confederate obstacles was directly in front of the crater. The follow-on brigades were funneled toward the explosion site. Upon reaching it, they, too, sought shelter in the crater and the Confederate trenches on either side.

As would happen again in World War I, these soldiers had learned the lessons of trench warfare too well. Now, although opposed by only light musket fire, they began digging in instead of pressing forward. The 35th Massachusetts Regiment (pioneers), for example, "followed its brigade and immediately began changing the fortifications about the crater to face in the other direction."[15] Presently, all of the 1st Division was jammed in the crater, a mob totally out of control.

A rapid advance by the 2d and 3d Divisions might have salvaged the attack, for the Rebels had not fully recovered from the explosion and the initial artillery barrage. These divisions suffered the same mobility problems as the 1st Division getting through the lines, and the way was now blocked by 1st Division soldiers in the crater and adjacent trenches. Brigadier General Robert B. Potter of the 2d Division was able to maneuver some of his soldiers around the crater, attempting to move toward the crest. The labyrinth of ditches and rifle pits made progress extremely difficult, particularly with increasing heavy fire from the now recovered Rebels. Potter's unsupported attack was eventually forced back.

In the end, the Union lost more than 4,000 men, most of them killed or captured in the crater. The Confederates suffered roughly 1,500 casualties in retaking their original positions.

Impact of Engineer Operations

How did the engineer operations contribute to the Union failure, and why did they occur? The first problem was a lack of support for the mining operation by the Army engineer officers. Pleasants' men did the work entirely on their own. Repeated requests for tools, shoring materials and other implements were never satisfied by the Army of the Potomac. Burnside, in fact, had to send for a theodolite from a friend in Washington, even though survey instruments were available in the Engineer Battalion.

Several reasons for the lack of support can be hypothesized. The mining operation did not conform to existing doctrine, and it violated conventional wisdom on the feasibility of military tunneling. There seems to have been a "not invented here" mentality concerning the proposal throughout Army of the Potomac headquarters. The combination of these fac-

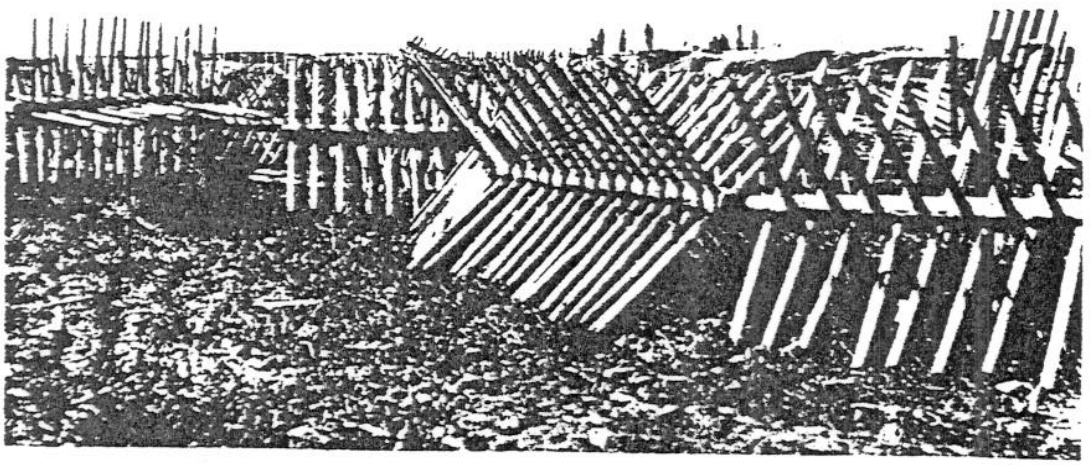
Battle-weary Union soldiers in the trenches at Petersburg

tors led Duane to denounce the project as "claptrap and nonsense."

In Duane's behalf, however, it should be noted that engineer assets were (as is often the case) a scarce resource. He already had major demands on those assets just in preparing positions and in supporting frequent crossings of the Appomattox and James Rivers. The proposed assault of Petersburg, whether by regular approaches or with the mine, would require the full commitment of his engineer soldiers and materiel. Thus, while Duane can be criticized for a lack of imagination, it can be argued that he was employing his resources in those tasks he believed had the greatest chance of success.

According to the Board of Inquiry, which was called to investigate the Battle of the Crater, one of the principal causes of the failure was, "No proper employment of engineer officers and working parties, and of materials and tools for their use, in the Ninth Corps." Further, the board stated that, even if failure had

Confederate obstacles in front of works at Petersburg



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not resulted from other causes (lack of leadership, in particular) and the crest had been reached:

. . . success might have been jeopardized by the failure to have prepared in season proper and adequate debouches through the Ninth Corps lines for troops, and especially for field artillery, as ordered by Major General Meade.[16]

While Burnside's contention that the positions could not have been safely prepared prior to the attack was disputed by the board and by other witnesses, his decision did have some rational basis. Similarly, the charge that he failed to provide working parties and tools was not entirely fair. Working parties were designated for each division, and, in Potter's division, the pioneers were at the head of the brigades to help clear the way. The fact that engineers were not with the lead elements of the 1st Division can probably be attributed to the poor leadership of Ledlie—one of a number of his failings, including personal cowardice.[17]

The failure to employ the engineer officer sent down to the IX Corps, however, is more difficult to understand. The problem was not limited to this battle: Duane testified that he had been directed not to interfere with operations in the IX Corps area. When officers had been sent to direct engineer operations, Burnside would not allow them to do so.[18] Benyaurd's testimony to the Board of Inquiry also reflected the same unexplained strain in relations with the IX Corps.[19]

Part of the problem might well have been that Benyaurd suffered in comparison with the previous chief engineer of the IX Corps, Major James St. Clair Morton. Before joining the IX Corps, Morton had so distinguished himself that he had been promoted to brevet brigadier general of Volunteers, but he preferred to stay with his own service and retained, instead, his regular rank in the engineers. Burnside had been:

. . . strongly attached to [Morton], having learned to hold his abilities in the highest estimation, and to depend on him as one of the best, most intelligent and most reliable advisors.[20]

Morton died leading an assault against the works at Petersburg on 17 June. The replacement provided by Army of the Potomac Captain Franklin Harwood was relieved by Burnside "because of his indisposition to personally superintend his work upon my line, intrusting it to enlisted men."[21] It is likely, therefore, that Benyaurd was viewed as an outsider from higher headquarters, and there was insufficient time to establish a good rapport with the corps commander before the attack. The IX Corps history merely reports that: "It is true, that General Burnside did not employ the engineer officer who was sent to him, for the simple reason that he preferred his own judgement."[22]

Finally, Duane can be criticized for not taking a more active role in ensuring that the engineering tasks required by Meade's order had been performed. The orders clearly convey the importance that the commander placed on the preparation of the obstacles for passage, yet Meade's principal engineer staff officer did not inspect the IX Corps area for compliance with the orders. As a minimum, Benyaurd should have been instructed to report the condition of the obstacles back to headquarters.

Conclusions

What lessons does the Battle of the Crater hold for a modern commander? First, engineer operations can often mean

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the difference between success and failure. It is possible that, with proper leadership, the Union attack might have succeeded despite the mobility problems. After all, the lead division was virtually unopposed following the explosion and only had to cover 500 yards to reach its objective. On the other hand, the adequate preparation of passages and the proper positioning of pioneers might have precluded the disorganization of the maneuver forces and the resulting loss of control that made the lack of good leadership so catastrophic.

There is an obvious analogy between the explosion of the mine and the use of a tactical nuclear weapon on the modern battlefield. Several authors have used this battle to model the potential problems associated with either exploiting or defending in this situation.[23] The Union failure is also an instance of the more general problem of exploiting tactical surprise. As S. L. A. Marshall pointed out in *Men Against Fire*, psychological shock from sudden surprise affects both the attacker and the defender, and an attacker's partial victory often leads to ultimate failure.[24]

Physical and psychological shock from, for example, the detonation of a friendly nuclear device, coupled with initial, easy success in penetrating hitherto heavily defended enemy lines, can lead to complacency and a reluctance to take additional risks. The commander of the offensive forces must, therefore, plan for the employment of engineer assets in the mobility mission to ensure that forward movement is not delayed.

The defender, on the other hand, if allowed time to recover, will often react to surprise with an almost territorial response. Recognition that the entire Confederate position was threatened by the Union attack, fine field leadership and well-planned defenses enabled the Rebels to repulse the assault. Thus, from a defensive standpoint, the engineer countermobility and survivability missions can have a significant impact on the ability of a force to survive and then contain a penetration. One Confederate artilleryman even went so far as to declare that the engineer who constructed the defensive positions at Petersburg deserved the credit for the Rebel success.[25]

The Battle of the Crater also demonstrates the importance of the relationship between the supported commander and the supporting engineer. Burnside elected not to employ the expertise of the engineer officer assigned to his corps, preferring to trust his own judgment in the matter of preparing the Union positions for passage. Similarly, Burnside did not choose to have Benyaurd organize and lead the working parties with the lead division.

For their part, neither Duane nor Benyaurd seemed to have protested these arrangements, nor did they play a very active role in the battle. Despite the fact that Meade's order emphasized the need for rapid movement and the importance of what we would call the mobility mission, there seemed to be little or no effort by Duane to weight the main attack with his engineer assets or to verify that proper preparations had been made.

Field Manual 100-5, *Operations*, includes audacity as one of the fundamental operational concepts for the attack. It further points out that the realities of the modern battlefield will require commanders at all levels to take risks.[26] Risk-taking involves a prudent assessment of both the danger to soldiers and materiel and the likelihood of accomplishing the mission. The lack of support for Pleasants' mining operation from the engineer organizations in the Army of the Potomac

illustrates one of the difficulties in making that prudent assessment.

The dilemma may be posed as follows: Should the commander divert limited resources away from important activities which have a high probability of making some positive contribution to operations (at Petersburg, the construction of fortifications and siege preparations) and use them, instead, to support a higher risk, potentially high-payoff activity (the mine)? For example, engineers, artillery, attack helicopters, intelligence and electronic warfare assets will probably not be available in sufficient quantities to meet all valid requirements. Taking risks in the close-in battle to allocate these resources to the deep battle will require some tough decisions.

Finally, it should be noted that many factors contributed to the Union failure, any one of which could have been the "key" element. However, it is clear that the proper employment of the available engineer assets would have significantly improved the Union's chance of success.

NOTES

1 Bruce Catton, *The Army of the Potomac: A Stillness at Appomattox*, Doubleday & Co. Inc., Garden City, N.Y., 1953, p 238.

2 Francis A. Lord, *They Fought for the Union*, Stackpole Books, Harrisburg, Pa., 1960, p 82.

3 Phillip M. Thienel, "Engineers in the Union Army, 1861-1865," *Military Engineer*, Volume XLVII, 1955, p 37.

4 *War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*, US War Department, US Government Printing Office, Washington, D.C., 1892, Series I, Volume XL, Part 1, p 291.

5 *Ibid.*, p 292.

6 *Ibid.*, p 291.

7 See Henry Pleasants Jr. and George H. Straley, *Inferno at Petersburg*, Chilton Book Co., Radnor, Pa., 1961, for a complete discussion of the trials and tribulations of Pleasants.

8 *War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies, op. cit.*, p 43.

9 Catton, *op. cit.*, pp 218-19.

10 *War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies, op. cit.*, pp 163 and 285.

11 *Ibid.*, p 527.

12 *Ibid.*, p 300.

13 *Ibid.*, p 535.

14 *Ibid.*, p 69.

15 James L. Bowen, *Massachusetts in the War, 1861-1865*, Bowen & Son, Springfield, Mass., 1893, p 539.

16 *War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies, op. cit.*, p 127.

17 As Catton, *op. cit.*, p 246, has noted, the mess at the crater "was the kind of situation which generals in charge of infantry divisions had been created to unscramble." Brigadier General James H. Ledlie, however, spent the entire battle in a bombproof shelter, drinking rum he acquired from a brigade surgeon.

18 *Ibid.*, p 112.

19 *Ibid.*, pp 97-98.

20 Augustus Woodbury, *Major General Ambrose E. Burnside and the Ninth Army Corps*, Sidney Rider & Brother, Providence, R.I., 1867, p 416.

21 *War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies, op. cit.*, Part 3, p 109.

22 Woodbury, *op. cit.*, p 457. First Lieutenant William H. H. Benyaurd, it should be noted, was apparently a very capable officer—he was awarded the Medal of Honor for his actions in a subsequent battle. Captain Franklin Harwood later commanded the US Army Engineer Battalion.

23 See, for example, Lieutenant Colonel Frank B. Case, "The Petersburg Crater and Nuclear Weapons," *Military Review*, November 1960, pp 22-27; Major Raymond O. Miller, "A Stupendous Failure," *Military Review*, July 1960, pp 31-34; and Captain James F. Bell, "A Lesson (From the Civil War) in Nuclear Effects," *Infantry*, July-August 1961, pp 46-48.

24 S. L. A. Marshall, *Men Against Fire*, William Morrow & Co., N.Y., 1947, pp 192-94.

25 George S. Bernard, *The Battle of the Crater—July 30, 1864*, Fenn & Owen Publishers, Petersburg, Va., 1892, statement from Major David Waller, Confederate States of America, p 204.

26 Field Manual 100-5, *Operations*, Department of the Army, Washington, D.C., 20 August 1982, pp 2-7 and 8-8.

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