



Soldiers from C Battery, 2nd Battalion, 319th Field Artillery fire an M777 during a live-fire exercise. (Courtesy photo)

Smoke employment in the battle for Mosul

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A three-day engagement during the battle for western Mosul in 2017 demonstrated considerations for the use of artillery-delivered smoke in a dense urban environment. These best-practices in support of Iraqi Security Forces (ISF) could inform operations in future conflicts as the U.S. Army prepares for large-scale combat operations against a determined enemy in dense urban terrain. This article will describe the environment in which the operation

took place, explain the risks that leadership considered during the operation, and highlight three observations from the use of artillery-delivered smoke in the urban terrain of northwest Mosul.

In 2017, Task Force (TF) Falcon, the 2nd Brigade Combat Team, 82nd Airborne Division provided support to the Iraqi Security Forces' efforts to liberate the city of Mosul from the Islamic State. The employment of fires by U.S. forces in support of the ISF provided the

tactical overmatch necessary for success.

The battle for western Mosul lasted from January to July 2017. From June 2 through 4, 2017, the ISF executed an operation on the outskirts of the Juhuri hospital complex in the Zanjili district of northwestern Mosul to rescue dozens of Iraqi civilians held hostage by ISIS fighters. In support of the operation, TF Falcon's Direct Support Artillery Battalion, 2nd Battalion, 319th Airborne Field



Artillery Regiment, provided integrated fires to assist the ISF. This article focuses specifically on two obscuration fire missions employing M825A1 improved white phosphorus smoke munitions to deny ISIS's ability to see the ISFs maneuver and gain a relative tactical advantage.

In 2017, the Zanjili district was a densely packed urban environment organized in generally geometric patterns with buildings arranged in neat blocks bounded by generally wide, straight roads. Structures varied from two to three-story residential and small business buildings to high-rise buildings more than five stories tall. The Jumhuri hospital complex

east of the Zanjili district consisted of several high-rise buildings with five or more stories including the main hospital building. This main building, the Jumhuri hospital, stood more than seven stories high and dominated the surrounding terrain. It served both as the operational headquarters of ISIS in western Mosul and was used to stockpile weapons and equipment. Directly west of and adjacent to the hospital complex, ISIS occupied the Zanjili district using buildings that were formerly homes and businesses as bunkers, fighting positions and engagement areas. A four-lane thoroughfare, running from the northwest to southeast, separated the hospital complex from Zanjili. ISIS fighters positioned in the Jumhuri high-rises could easily observe ISF moving into the area and the four-lane thoroughfare made an ideal engagement area. Iraqi forces conducting the mission expected to receive indirect and heavy weapons fire from the hospital buildings before encountering ISIS fighters employing small arms, machine guns and hand grenades from positions dug into the smaller, lower buildings of Zanjili. Both Iraqi and U.S. leadership identified the need for a smokescreen to deny enemy observation and facilitate ISF maneuver into the objective area.

The ISF depended upon U.S. forces for integrated fires to support their operation. Despite their possession of indirect fire systems, ISF could not employ them with the adequate precision and mass required to enable the operation. The 2-319th AFAR employed its organic M777A2 battery and a reinforcing M109A6 Paladin platoon from the 2nd Battalion, 82nd Field Artillery to provide the necessary close supporting fires.

At the time, the M825-series improved white phosphorous projectiles were the only U.S. smoke munitions available for 2-319th AFAR to employ in support of the operation. The 155 mm M825-series smoke projectile is superior to the U.S. Army's M116-series HC

Smoke projectiles in both the time required to build the smoke screen and the amount of time the smoke lingers, affording longer duration smoke screens with fewer rounds. Because of this, the U.S. Army has gradually phased the M116 HC smoke munition out of its inventory. However, the white phosphorous wedges used in the M825 munition burn at nearly 5,000 degrees Fahrenheit causing a risk of collateral damage to structures and non-combatants. In June 2017, there were no U.S. 155 mm HC smoke projectiles in the U.S. Central Command area of responsibility.

Despite the inherent risk of white phosphorous, the command deemed the likelihood of civilian casualties exceptionally low because nearly all civilians had fled the Zanjili district as a result of the intense fighting around the Jumhuri hospital the week prior. This conclusion was supported by full-motion video feeds from intelligence, surveillance and reconnaissance aircraft that failed to detect any civilian patterns of life in the area. Additionally, many of the structures in the objective area were constructed from concrete reducing the likelihood that the structures themselves would catch fire. Thus, the command's decision to employ M825 munitions demonstrated a deliberate, necessary risk acceptance to enable the success of the Iraqi forces in their mission to rescue hostages.

The 2-319th AFAR captured three important observations that apply to the employment of artillery smoke in a dense urban environment. First, the conditions in the dense urban terrain caused variances in the meteorological conditions at surface level that changed the effectiveness of the smokescreen. This "micro-MET" at the surface could be dramatically different from what was captured in the meteorological data—the MET message—used to account for weather variations in the calculation of accurate firing data. This compounded as things caught on fire in the engagement



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area, causing micro high- and low-pressure systems in the urban canyons between the buildings that resulted in localized high winds that dramatically disrupted the smokescreen.

To mitigate this, the battalion executed the smokescreen as multiple, one-gun adjust-fire missions. As the conditions on the ground changed, the battalion fire direction center (FDC) adjusted the aim points and height of burst to sustain the necessary duration and thickness of the smokescreen. This enabled the battalion to continue firing with one or more guns while adjusting others to prevent a lapse in obscuration. The FDC quickly realized that if it managed the smokescreen as a single linear mission with multiple aim points, any adjustment would require the battalion to cease-firing on the

entire mission. This would waste time, obscuration and ammunition as more ammunition would have to be fired to re-build the screen inputting the adjustments.

Secondly, when the battalion fired M825 at the standard height of burst of 100 m, the smoke billowed ineffectively on the tops of and behind buildings. The FDC reduced the height of burst, sometimes as low as 20 meters above the ground, to place obscuration with some modicum of precision.

Finally, the FDC realized that the propellant charge affected how the screen materialized. The buildings in the immediate objective area became intervening crests that had to be accounted for in the technical firing solution. Firing a higher charge, at a lower quadrant elevation, and with a reduced height of burst, rounds

cleared the intervening crests, but often impacted long from the aim point. The FDC reduced the charge to the lowest possible to achieve the range with the highest possible angle of fall to mitigate the intervening crest and contain the M825's felt wedges to a more confined area. This increased the probability that the desired effects were achieved in the target area.

By the end of the three-day operation, 2-319th AFAR fired more than 135 M825 smoke rounds, providing nearly 90 minutes of smoke. These effects enabled Iraqi forces to rescue dozens of Iraqi civilians held hostage by ISIS fighters and escape from the ISIS-held area in western Mosul with no subsequent reports of civilian casualties caused by the smokescreen. The timeliness of the rescue and the superior positions of ISIS justified the need to accept the risks inherent to the use of M825. This engagement demonstrated that the use of white phosphorous in cities is not only possible but effective. These considerations can shape how the Army trains the fires force for the use of artillery-delivered smoke in a dense urban environment for future combat on an uncertain battlefield.

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