What happened during the 1996 shelling of Qana and why it matters today?

Capt. David R. Williams

Because of a single United Nations (U.N.) report written almost 20 years ago, much of the international community has believed that Israel committed genocide at Qana, Lebanon in April of 1996. In military circles, the event is considered the twentieth century's most notorious artillery firing incident. It happens to be also its most unexamined one. Few today even know it happened, let alone understand its implications for warfare in the 21st century.

Despite what the U.N. or the press claim, the truth has never been uncovered until now. The incident goes like this.

In April 1996, Israel launched Operation Grapes of Wrath, a 16-day campaign to end the shelling of Galilee by Hezbollah from southern Lebanon. On the seventh day of the conflict, between 11 a.m. and noon local time April 18, witnesses observed several Hezbollah militants establish a mortar position about 220 meters southwest of a U.N. refugee compound in the Hezbollah-controlled village of Qana, Lebanon. That afternoon an Israeli Maglan patrol, consisting of a company-reduced element of Special Forces, booby-trapped an avenue of approach leading to Qana. At 1:52 p.m. Hezbollah militants, emblazoned with U.N. flak jackets and steel helmets (acquired most likely by Hezbollah April 15 when its members shot a U.N. peacekeeper attempting to report Hezbollah rocket fire) fired eight 120 mm mortar rounds at the patrol. Once they finished firing, eyewitnesses on the ground later confirmed these same militants ran and hid in the compound where their own families were located. Minutes later Israeli locating identified the point of origin (POO) as a cemetery near an intersection in Qana 170 meters from the headquarters of a Fijian battalion of the U.N. Interim Force in Lebanon (UNIFIL). At the time the compound housed about 800 Lebanese refugees. The Maglan patrol then radioed for fire support from an Israeli three-by-four (three batteries, four guns per battery) M109A2 battalion positioned just inside Lebanon proper. The call-for-fire (CFF) was assigned to a single four-gun battery. From 2:07 p.m. to 2:12 p.m. it fired 36 high explosive (HE) rounds consisting of 26 and 10-point detonating (PD) and variable time (VT) fuzes, respectively.

The fire mission was a disaster. All 36 rounds missed the mortar site. Thirteen rounds (four fuze PD and nine VT) impacted on the UNIFIL compound and killed 106 refugees. An investigation was completed a month later by Maj. Gen. Franklin van Kappen, a Dutch military adviser to the U.N. Van Kappen, whose expertise is naval communications, did not explore artillery dispersion, manual gunnery procedures or target location error, but instead focused solely on cratering data with the assumption that a concentration of the more lethal VT fuzes on the compound was de facto evidence of an intentional shift in Fires by the Israelis (Figure 1).

Van Kappen's perfunctory report concluded it was "unlikely that the shelling of the (UN) compound was the result of gross technical and/or procedural errors." Over the years, Israel's enemies circulated his findings as bona fide proof the targeting of the UNIFIL compound was purposeful. To this day, the report elicits much calumny upon the Jewish state with some Arab news services even dubbing it a new "Holocaust." It is probably for this reason that a paucity of research exists about this firing incident where much can be learned. The purpose of this paper is to critically examine the facts of this fire mission and apply the concepts of dispersion, the five requirements for accurate fire (RAF), and target location error (TLE) to determine the most probable sources of error that day.

First, we need to define the five RAF, which may be understandably foreign to branches outside of the field artillery. The goal of every firing battery is to hit or at least achieve an effect on a target on the first attempt. In order to accomplish this goal, firing units must meet the five RAF, which are target location and size, firing unit location, weapon and ammunition information, meteorological information, and computational procedures.

This paper will be confined to a thorough discussion on the relevant elements of the five RAF, and how they account for the observable errors at Qana. It is only by culling this data from the historical record that we can, almost two decades later, finally and correctly explain the source of error(s) on April 18, 1996.

Now, let us examine the essential data of the firing incident. The four-gun battery likely laid their howitzers on an azimuth of fire (AOF) of 0500 mils, plus or minus 0200 mils. This can be inferred from the crater analysis in Figures 1 and 2 and van Kappen's description of the firing point. Calculating a back azimuth from Qana, the center of battery was most likely located about one kilometer north of the Blue Line – a U.N. demarcation boundary– at grid 36S YB 08831 65815, altitude 405 meters. The COB was approximately 12,100 meters from the mortar site located at YB 14345 76585, altitude 298 meters. The battery loaded seven increments of M4A2 propellant, or in the more common parlance of the field artillery, charge 7 white-bag (7WB), to engage the target. The fire direction officer (FDO) selected low-angle fire (a firing quadrant less than 800 mils), evidenced by the rapidity in which four guns fired 36 rounds of HE (in five minutes) and the destruction of a high-rise building just short of the UNIFIL compound along the AOF. Furthermore, each howitzer almost certainly received the fire mission in two separate commands – one for fuze PD and the other for fuze VT – with differing quadrants, but both around 441 mils.

Figure 2 illustrates the distribution of impacts at Qana superimposed onto Google Earth as recorded by van Kappen's crater analysis from 1996. Two distinct impact areas are depicted with their approximate mean points of impact (MPI) 180 meters apart. The MPI's were determined by drawing a line parallel to the gun-target-line (GTL) containing an equal number of rounds to the left and right. A second line was drawn perpendicular to the line of fire through each impact areas containing an equal number of rounds short and long of that line. The MPI's are located at grid YB 14283 76600 and YB 14382 76747, containing 17 and 19 rounds, respectively. Since variations were almost exclusively range errors along the GTL, each round was then measured to its respective MPI and a mean and standard deviation were computed for range. This data is shown in the table below.

Before delving into the details of the distribution of these impacts, a brief discussion on dispersion and standard deviation is necessary. Despite commonly held beliefs, a particular number of rounds fired with the same deflection, quadrant and charge will not impact at the same point, but instead will array in a scattered, elliptically-shaped pattern not at all dissimilar from the impact points at Qana. This phenomenon is called dispersion and it is caused by systemic errors that cannot be mitigated no matter how strenuously a unit manages the five RAF. These systemic errors are numerous but, in their most basic form, include the effects of slight variations in the conditions of the bore, carriage and in the projectile itself as it pierces through the atmosphere several thousand feet above the Earth, sometimes at supersonic velocities. These dispersion patterns follow a cumulative normative distribution (Figure 3) with 68 percent of all rounds falling within one standard deviation — plus or minus — the mean. In artillery firing tables, which are employed by the armies of virtually all Western nations, this standard deviation is mathematically adapted to a simpler value called probable error (PE), a more binary concept easier for the soldier to comprehend: one probable error – plus or minus the mean – captures 50 percent of all rounds.

In artillery firing tables, probable error (range) is a function of the range to target. In the case of Qana the PE (range) was 29 meters, meaning 50 percent of all rounds should have impacted within 58 meters on either side of each MPI. That probable error converts to a standard deviation of 43 meters. Based on the dispersion pattern of both impact areas, the calculated mean and standard deviation from the MPI are 41 and 31 meters, respectively, in range for the southern zone. The northern impact area has a mean and standard deviation of 41 and 44 meters, respectively. These computations were then ran through a normal distribution calculator in Microsoft Excel and used to create a bell-shaped curve to depict the frequency of impacts on either side of the mean given each MPI's standard deviation. This data is depicted in Figure 4, which illustrates that the dispersion pattern realized by that Israeli firing battery is completely consistent with widely accepted ballistic data and what we know about dispersion as it relates to cumulative normative distributions. With that established, is it important to emphasize that each impact area (south and north) must be analyzed in isolation from the other, for each is the result of differing fire commands. The following discussion on accurate computational procedures — the fifth RAF — will explain why.

Although there are many elements of quadrant, only one might easily explain the distribution of impacts at Qana, specifically the two distinguishable MPIs separated by 170 meters along the GTL.

So let us rethink the problem. We observe two distinct impact areas, one with a concentration of projectiles fuzed with VT, indicating that those projectiles were fired with a separate quadrant. But why? All artilleryman know that a VT fuze is fired on the same quadrant as a PD fuze for the simple reason that a VT fuze emits a continuous Doppler signal, and once armed, detonates only when its radio waves detect that it is precisely seven meters above the ground. So at this point we must deduce that a mistake was made. Pause to consider the common operational doctrine in Western armies at the time to determine firing data was standard manual computations. So, when the FDO directed a mix of PD and VT fuzes for this immediate suppression mission, his personnel would have leapt into action to determine fire commands from their graphical firing table (GFT), which is a visual slide-ruler representation of the artillery firing tables based off the range-to-target of 12,100 meters. A 100/R value of 8 mils would have been determined. The angular measurement of 100/R is based on the mil-relation formula used in computing an increase in trajectory when firing a regular time (TI) fuze. Typically it will be divided by five and applied to the standard elevation for that range so that the TI fuze will function at an optimal 20 meters above the target It appears that in the confusion of this fire mission the entire value of 100/R was applied to what should have been the VT quadrant. This mistake would have caused the projectiles fired with this additional angular measurement to impact approximately 112 meters beyond the intended target. This invalid computational procedure alone constitutes nearly two-thirds of the total distance (or error) between both MPI's, and explains why the two separate impact areas exist.

The lesson to be learned from this mistake is not that manual procedures should be tossed asunder. Far from it; those principles must always be taught and should be deeply inculcated by all artillery officers, even in the current era of technologically advanced Army battle command systems. One can, however, make an argument that a pure reliance on manual procedures exacerbated other human errors that April afternoon. The first and foremost error in that case was the result of the FDO failing to properly standardize fire order/commands.

Standardization, in the context of artillery operations, is the process of homogenizing fire orders and commands so that the same directives of what type of projectile and fuze is kept consistent based on the type of fire mission requested by the observer. For example, a FDO could standardize his fire order for troops in contact mission (the sort of CFF received from the Maglan patrol) as “immediate suppression.” This comports with doctrine. So instead of announcing every ingredient of the order (projectile, fuze, angle of attack, etc.), the FDO announces a seven syllable directive to his FDC operators, who in turn translate his tactical order to a technical command to the howitzer sections. Standardization, thus, is done for the express purpose of reducing noise and confusion in the FDC, while expediting fire mission processing time. Human computational error at Qana only followed the primary error in standardization.

If we dig deeper, we find that the first RAF — accurate target location and size — was not realized. Israeli Defense Forces (IDF) at the time admitted maps possessed by Northern Command and the firing unit did not show the actual perimeter of the UNIFIL compound and they erroneously plotted its center 100 meters north of its actual location (on their 1:20,000 scale map). This lulled the Israelis into thinking the headquarters itself was some 350 meters from the POO, which likely provided Northern Command ample justification to engage the target when conducting a collateral damage estimate on the cemetery.

Hezbollah surely knew Israel would loath targeting the cemetery given the general public's sensitivity to the dead.

Consider too that the means of target acquisition aggravated the errors associated with the first RAF. The unclassified target location error (TLE) of most counter-fire radar systems against mortars is 100 meters, or one percent of the range to target, whichever is greater. TLE is conceptually similar to dispersion. It is a sensor specific circular dimension around the actual target location that 90 percent of the computed target locations would be located, given a particular target acquisition platform (Figure 5). TLE is the trigonometric combination of circular error (ground location) and linear error (altitude location), and is induced by inaccurate GPS data, poor azimuth, range and elevation data, system calibration and user errors. Simply put, only about 90 percent of the time can such a target acquisition system identify a mortar POO within a 100 meter three dimensional radius of its actual location.

The Aftermath

So what can we learn from Qana and why does it matter almost two decades later? From a strategic standpoint it took the Israelis several years to realize the futility of heavy artillery bombardment against an enemy who uses U.N. peacekeepers and civilians for cover and concealment.

One relatively recent indirect fire retaliation, for example, occurred in December 2013 when IDF forces launched 32 non-line-of-sight, terminally guided Tamuz missiles from a M113 chassis at a Katyusha rocket POO in southern Lebanon, established most likely by a rival jihadist group to Hezbollah hoping to provoke Israel to attrite Hezbollah on their behalf. Clearly, international pillory has not forced Israel to cease reprisal and retribution for acts of violence, but perhaps it has nudged it to employ more imaginative solutions than traditional artillery when firing into a populated area. For in the years following Qana, Israel applied drastically different rules of engagement against both Hezbollah and its Sunni counterpart in Gaza, Hamas; rules explained to this author in 2010 by IDF officers from the captain to general officer-level that are unconscionably careful toward the limitation of collateral damage and loss of civilian life. These measures were witnessed during the last Israeli incursion into Gaza in the summer of 2014 when the IDF dropped leaflets and telephoned Gazans with time and locations of imminent bombings, all in an effort to quell international condemnation, and deflect criticism away from Israel when it was forced to prosecute targets adjacent to schools and mosques, targets Hamas itself established when it stored weapons and hid its militants in or near those locations.

What can be gleaned from a thorough investigation of Qana, in terms of technical and tactical fire direction, is that it was first and foremost a lack of standardization that caused the firing incident. Unrefined crew drills, inaccurate computational procedures and very poor target acquisition then caused the Israelis to miss the intended target. It was not some nefarious intention of killing Arab refugees as has been disingenuously suggested many times. Western armies should absorb this most painful lesson and apply it in future conflicts, as it is incredibly pertinent given the tactics, techniques and procedures of the common enemies of the United States and Israel, including now the Islamic State in the Levant, or ISIL. And since the foreseeable future entails further lethal engagements against an asymmetrical enemy of that type, willing to cloak itself using civilians within populated urban terrain, the mistakes made at Qana should not be forgotten now that we understand what truly happened.

Finally, reason must always trump emotion, particularly when investigating such a terrible firing incident. For the better part of two decades the latter bested the former. In summation, I find the shelling of Qana was the unfortunate result of technical and procedural errors caused primarily by a lack of standardization, the effects of which reverberate at the strategic level still today and likely far into the future.

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