

## Subterranean Warfare: A New-Old Challenge

---

Yiftah S. Shapir and Gal Perel

Subterranean warfare is not new in human history. Tunnels, which have been dug in all periods for various purposes, have usually been the weapon of the weak against the strong and used for concealment. The time required to dig tunnels means that they can be an important tool for local residents against an enemy army unfamiliar with the terrain. Tunnels used for concealment purposes (defensive tunnels) can be distinguished from tunnels used as a route for moving from one place to another. The latter include smuggling tunnels used to smuggle goods past borders (as in the Gaza Strip), escape routes from prisons or detention camps, offensive tunnels to move forces behind enemy lines, and booby-trapped tunnels planted with explosives under enemy facilities (a tactic used by Hamas).

Operation Protective Edge sharpened awareness of the strategic threat posed by subterranean warfare. The IDF encountered the tunnel threat long ago, and took action to attempt to cope with this threat, but the scope of the phenomenon, as became apparent in July-August 2014, was portrayed as a strategic shock, if not a complete surprise, requiring comprehensive reorganization to handle the problem. Some critics argued that an investigative commission was necessary to search for the roots of the failure and punish those to blame for it.

This article will review subterranean warfare before and during Operation Protective Edge, and will assess the strategic effects of this mode of warfare.

### **The IDF vs. Subterranean Warfare**

Subterranean warfare has appeared many times in the Arab-Israeli context, and the IDF and the Ministry of Defense have dealt with various aspects of the phenomenon of subterranean warfare for many years. On rare occasions

Hizbollah chose to operate underground during the years the IDF controlled the security zone in Lebanon. Already in September 1996, a force from the Egoz Unit under the command of Erez Zuckerman fought in a labyrinth system of tunnels used by Hizbollah terrorists in Jabal Sujud.<sup>1</sup> In the Second Lebanon War, a force from the Maglan special forces unit conquered a fortified Hizbollah dugout adjacent to the Shaked post; two IDF soldiers and five Hizbollah operatives were killed in the battle.<sup>2</sup> After the war, Hizbollah built an extensive system of concealment and military tunnels within the villages,<sup>3</sup> and possibly tunnels for cross-border penetration as well.<sup>4</sup>

During the second intifada, the Palestinian terrorist organizations in the Gaza Strip made extensive use of tunnels for smuggling weapons from Egypt to the Gaza Strip and for attacking IDF forces in Gush Katif. The IDF launched many raids against the tunnels, and by June 2004 had destroyed over 100 of them. A special heavy piece of equipment, called a trencher, was acquired and used to dig a trench along the Philadelphi axis. Shafts were dug at random places into which explosives were inserted in the hope of making the tunnels collapse, and rows of houses close to the Rafah road were demolished. The problem, however, was not solved.

Digging a tunnel is estimated to take about three months and costs about \$100,000. Such tunnels can be concealed so that their openings are inside houses or greenhouses, and can be dug in advance without being used until the crucial time.<sup>5</sup> Past significant attacks included the booby-trapped tunnels in the IDF's Termit outpost, in which three soldiers were wounded in September 2001;<sup>6</sup> the booby-trapped tunnel in the IDF's Orhan outpost, in which one soldier was killed and five wounded in June 2004;<sup>7</sup> and the attack on the Joint Verification Team (JVT) outpost in Rafah in December 2004 in a powerful booby-trapped and cross-border tunnel attack, which left five soldiers killed and six wounded and was considered the most deadly tunnel attack during those years.<sup>8</sup> Hamas' best-known offensive tunnel, whose exit was 100 meters inside Israeli territory near the Kerem Shalom border crossing, was used on June 25, 2006 in an attack by a terrorist squad that killed two IDF soldiers and kidnapped Gilad Shalit.<sup>9</sup>

In October 2006, IDF forces demolished 13 smuggling tunnels on the Philadelphi Route.<sup>10</sup> In November 2007, the IDF demolished tunnels infrastructure hidden within a tomato hothouse and designed for attacking targets in Netiv HaAsara and Kibbutz Erez.<sup>11</sup> The following year, in November 2008, a paratroopers battalion commanded by Yaron Finkelman operating

in Operation Double Challenge killed six terrorists and demolished the opening of a tunnel concealed within a building 300 meters from the fence on the Gaza Strip border.<sup>12</sup>

During the entire period that included Operations Cast Lead and Pillar of Defense, not much tunnel warfare activity was recorded, but in November 2013, IDF forces destroyed two cross-border tunnels.<sup>13</sup> In March 2014, the IDF demolished another cross-border tunnel.<sup>14</sup> Tunnel warfare began even before Operation Protective Edge was declared, during the escalation that took place following Operation Brother's Keeper. On July 6, 2014, in response to rocket fire from the Gaza Strip, the IDF took preventive action against a cross-border tunnel in the Rafah area that led to the death of six Hamas operatives.<sup>15</sup> As a result, Hamas intensified its rocket fire, further escalating the conflict and leading the IDF to launch Operation Protective Edge on July 8, 2014. An attempted attack on July 17 by 13 terrorists emerging from a cross-border tunnel near Kibbutz Sufa was foiled,<sup>16</sup> and led to the beginning of the land-based operation.<sup>17</sup> During the land campaign, brigade combat teams, including infantry, armored forces, and combat engineers engaged in the detection and demolition of both combat tunnels within the Gaza Strip and cross-border tunnels.<sup>18</sup>

During Operation Protective Edge, Hamas and Islamic Jihad operatives carried out a number of attacks in Israeli territory using cross-border tunnels. Terrorists attacked an IDF pillbox tower near Nahal Oz, killing five soldiers.<sup>19</sup> On August 1, 2014, a Hamas force violated the ceasefire, killing three Givati Brigade soldiers, and escaped through an offensive tunnel to Rafah, taking with them the body of First Lieutenant Hadar Goldin. A total of 34 cross-border tunnels used by Hamas were destroyed.<sup>20</sup> The tunnels detected by the IDF during Operation Protective Edge were complex tunnels, with a number of entry and exit shafts. The main tunnel route was often split, and sometimes there were parallel routes. For this reason, dealing with the tunnels was no simple task.

### **Anti-Tunnel Warfare**

Anti-tunnel activity can be divided into activity to detect the tunnels and activity after a tunnel is detected. Due to the concealed character of the tunnel, detecting it constitutes a major part of the operation.

The tunnel can be detected when it is being dug (mainly through noise created during the digging), or afterwards when the tunnel is dormant and waiting to be used – a much more difficult process.

The methods used to detect tunnels while they are being built usually rely on attempts to detect the noises accompanying the digging through sensitive underground microphone systems (geophones). Once a tunnel is already dug, construction noises cannot be relied on; the empty spaces underground must be detected through other methods. Land penetrating radar has been tried, as well as various methods (also based on geophone systems) that try to identify the structure of the terrain by analyzing initiated sound waves, both through controlled explosions and through mechanical hammers that generate vibrations. Methods using sensors based on optical fibers, mapping changes in ground-generated infrared radiation, and microgravity measurements have also been tried (i.e., sensors that attempt to detect minute changes in the earth's gravity).

All these methods for detecting targets are still in the early stages of development. As of now, earth-penetrating radar is only capable of detecting objects at a depth of a few meters, while the tunnels are likely to be dozens of meters underground.

Geophone systems have a similar problem. Geophysicists have used these systems for many years in their efforts to map geological strata and detect mineral deposits. However all the methods are based on measurements affected by an infinite number of factors that must be isolated. Geophones are sensitive to background noises – any movement above ground creates sound waves that the geophones absorb. In addition, the results are very dependent on the contours of the terrain, changes in the land strata, the weather, and land humidity.

All the proposed systems are based on large arrays of sensors, with computer software to analyze the results. However, the algorithms used to detect geological strata at depths of hundreds of meters have proven unsuitable for detecting empty spaces at a depth of a few dozen meters. Here the major challenge to systems developers is to develop the algorithms needed to detect small empty spaces at a depth of a few dozen meters in any type of land, while neutralizing all the other interfering factors. This is a difficult problem, to which a solution is yet to be found – not in Israel, nor elsewhere in the world (the US Department of Homeland Security, for example, which is confronted with smuggling tunnels on the US-Mexico

border, has been working on this). Note that despite the large scale US investments in this problem, tunnels do not pose a threat of the same scope that they do for Israel.

It appears that the tunnel detection challenge is not an easy one. Already in his report for 2006, the State Comptroller warned that, “For over 20 years, the Palestinians have used tunnels for smuggling purposes, mainly between Egypt and the Gaza Strip. This problem has greatly intensified in recent years, and has become a strategic threat.” The report states that engineering efforts to counter the tunnel problem began as early as 1990, and mentions three different systems under development. By 2007, when the Comptroller wrote his report, none of these efforts had succeeded.

Additional systems were later developed. In early 2012, it was announced that a system called Mispar Hazak (“strong number”) would soon be deployed on the border with the Gaza Strip. Today, however, two and a half years later, there is still no effective system in operation. Another system is in development, and a great deal of money has been invested in it over the past two years.

Already in the early years of the twenty-first century, the IDF organized the Samoor (“weasel”) company for combating hidden weapons caches and tunnels, as part of the Yahalom Special Operations Engineering Unit of the IDF Engineering Corps. The unit is trained and equipped with means to operate within tunnels, including communications and breathing systems. Actually, the IDF prefers to avoid entering tunnels it has detected, if possible, because the attacking side has no advantage in a tunnel. This capability is designed for a scenario in which a soldier has been kidnapped, or in order to attack the enemy’s underground command and control positions.<sup>21</sup> As soon as a tunnel was detected, IDF forces took action to isolate the operating area and detect its additional shafts and branches. The Special Operations Engineering Unit planted explosives in order to demolish the tunnel. A number of methods were used to demolish tunnels during Operation Protective Edge, including aerial bombardment using JDAM bombs (called “kinetic drilling”), using water to make the tunnel collapse, and using liquid explosives by a special system dubbed “Emulsa.” In addition, elite IDF units were trained to fight within tunnels as “tunnel rat” units. In retrospect, the IDF learned that aerial bombardment of the tunnel shafts made it harder to detect the tunnels themselves.<sup>22</sup>

## Conclusion

The tunnels have been classified as a strategic threat, with the impression given that this is the gravest threat facing Israel. Arguments have since been made that the defense establishment is responsible for a strategic failure, and there have even been demands for an investigative commission on the matter.

There is no doubt that the tunnels are a serious problem. Those who say that the defense establishment should have directed more focused efforts to find a solution to the problem are correct, specifically putting in place a special agency to coordinate the efforts to solve the problem and provision of this agency with the proper authority and budget. On the other hand, it cannot be claimed that nothing was done. Efforts were made to solve the problem of locating the tunnels, and even though these efforts were unsuccessful, they should not be ignored. At least four different systems were developed at a large financial investment, though they failed to identify the tunnels. This indicates just how difficult solving the problem is.

At the same time, despite the great public attention paid to the problem of subterranean warfare, this does not mean that subterranean warfare is the major strategic threat to Israel. It is merely one of many kinds of warfare. A major investment in developing means for tunnel detection will necessarily be at the expense of other investments. In other words, the issue is currently in the headlines, but long term thinking should not be distracted by momentary criticism. A wise investment policy should maintain a balance between investment in defense and investment in offense (activity against the tunnels is necessarily defensive), and even in defense, a balance should be maintained in allotment of resources among all the threats that are still current.

## Notes

- 1 Moshe Tamir, *War Without a Sign* (Tel Aviv: IDF Publishing House, 2005), p. 145.
- 2 Ofer Shelah and Yoav Limor, *Prisoners in Lebanon* (Tel Aviv: Yediot Books, 2007), p. 161.
- 3 Idan Soncino, "Deep in the Earth: The IDF Continues Training for Underground Warfare," IDF website, July 16, 2012, <http://www.idf.il/1133-16580-he/Dover.aspx>.
- 4 Meir Orbach, Harel Eilam, and Doron Peskin, "Everything is Included in Hizbollah's Tunnels in the North," *Calcalist*, August 4, 2014, <http://www.calcalist.co.il/local/articles/0,7340,L-3637531,00.html>.
- 5 Amos Harel and Avi Issacharoff, *The Seventh War* (Tel Aviv: Yediot Books, 2004), pp. 293-97.

- 6 Amos Harel and Amira Hass, "The Fatalities from IDF Fire in Rafah following the Blowing Up of the Termit Outpost," *Haaretz*, September 27, 2001, <http://www.haaretz.co.il/misc/1.736487>.
- 7 Amir Rapaport, "How to Solve the Threat of the Tunnels in Gaza," *Maariv*, August 21, 2004, <http://www.nrg.co.il/online/1/ART/771/180.html>.
- 8 Marwan Athamana and Amir Buhbut, "The Rafah Death Tunnels: 5 Soldiers Killed," *Maariv*, December 12, 2004, <http://www.nrg.co.il/online/1/ART/836/090.html>.
- 9 Shelah and Limor, *Prisoners in Lebanon*, p. 46.
- 10 Hagai Huberman, "5 Tunnels Discovered in Past 24 Hours on Philadelphi Route," *Arutz Sheva*, October 19, 2006, <http://www.inn.co.il/News/Flash.aspx/164555>.
- 11 Amir Buhbut, "Major Attack Prevented: IDF Exposes Tunnels in South," *Maariv*, October 15, 2007, <http://www.nrg.co.il/online/1/ART1/622/641.html>.
- 12 Amir Buhbut, "The Fence War: Deception is the Name of the Game," *Walla*, April 25, 2014, <http://news.walla.co.il/?w=/2689/2740287>.
- 13 "Southern Command Commander: Hamas Operation Will Meet with Painful Response," IDF website, November 1, 2013.
- 14 Yoav Zeitun and Ilana Couriel, "Terror Tunnel in Israeli Territory: Goal – Kidnapping," *Ynet*, March 21, 2014, <http://www.ynet.co.il/articles/0,7340,L-4501722,00.html>.
- 15 Yoav Zeitun, Matan Tzury, Ilana Couriel, and Eli Senior, "Heavy Rocket Barrages Aimed at the South, Interceptions over Ashdod," *Ynet*, July 7, 2014, <http://www.ynet.co.il/articles/0,7340,L-4539120,00.html>.
- 16 Amir Buhbut and Yanir Yagna, "13 Terrorists Tried to Attack from Tunnel in Israeli Territory," *Walla*, July 17, 2014, <http://news.walla.co.il/?w=/2689/2766112>.
- 17 "Egypt Accuses Hamas: It is Responsible for the Bloodshed in Gaza," *Wallla*, July 17, 2014, <http://news.walla.co.il/?w=/2689/2766557>.
- 18 Ilana Dayan, "Paratroopers Brigade Commander Request: Give the Fighters a Moment in the Sun," *Mako*, August 7, 2014, [http://www.mako.co.il/tv-ilana\\_dayan/2014/Article-55f4a1228f0b741006.htm](http://www.mako.co.il/tv-ilana_dayan/2014/Article-55f4a1228f0b741006.htm).
- 19 Yoav Zeitun, Ahiya Raved, and Noam (Dabul) Dvir, "10 Soldiers Killed Yesterday, Kidnapping Foiled," *Ynet*, July 7, 2014, <http://www.ynet.co.il/articles/0,7340,L-4551455,00.html>.
- 20 "Summing Up 50 Days of Warfare in Numbers," *Channel 2 News*, August 26, 2014, <http://www.mako.co.il/news-military/security/Article-83af72ede931841004.htm>.
- 21 Gili Cohen, "The Tunnels Failure: Only during the Fighting was a Procedure for Demolishing them Distributed," *Haaretz*, August 6, 2014, <http://www.haaretz.co.il/news/politics/.premium-1.239836>.
- 22 Amos Harel, "The Old World is Cracking, the Security Illusion has Exploded," *Haaretz*, August 29, 2014, <http://www.haaretz.co.il/news/politics/.premium-1.2419353>.