

The Urgent Subterranean Problem

By Captain Cameron Ugan

Tunnels and trench warfare have endured on the battlefield for centuries, providing critical protection from enemy fire and concealed routes for moving troops and supplies between fighting positions. Subterranean (Sub-T) networks are far less common because their construction demands extensive labor. However, the rise of conflicts involving Sub-T environments—and the potential for largescale combat operations (LSCO)—has made subterranean threats more urgent and more dangerous, with no readily available solutions. The tunnel systems in Gaza have offered a necessary wake-up call, exposing strategic shortfalls in how the United States approaches this operational domain.

The looming threat of LSCO has dramatically increased the likelihood of fighting in major metropolitan areas. Globally, 192 countries possess some form of Sub-T infrastructure—sewers, subway systems, caves, or archaic tunnel networks.[1] The last major conflict in which extensive tunnel systems were used for combat and combat support was the Vietnam War, where Viet Cong tunnel complexes played a central role.[2] However, historical tactics from Vietnam offer limited insight for today's metropolitan-urban environments. U.S. strategy at the time relied heavily on destroying vast sections of jungle terrain, a method incompatible with modern urban operations.

Contemporary LSCO threats demand urgent action. The central challenge of Sub-T warfare today is the difficulty of achieving decisive effects without destroying the tunnel system entirely.[3] The mass-destruction approach used in Vietnam is a last resort in urban areas, where minimizing collateral damage and maintaining the support of the local population are essential in an already highly dynamic operating environment.

Beyond the general lack of experience operating in large Sub-T environments, numerous tactical complications arise the moment forces enter a tunnel system. Sub-T terrain severely degrades communication systems that rely on line-of-sight or satellite connectivity. Ballistic engagements in enclosed spaces carry an elevated risk of traumatic brain injuries (TBIs) due to amplified overpressure. Close, dark quarters filled with unfamiliar threats impose extreme cognitive and physical strain on Soldiers, increasing the likelihood of stress-related disorders. The physical dimensions of tunnels further constrain operations by limiting the size and amount of equipment that can be brought underground.[4]

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None of these challenges matter, however, if the tunnel system cannot be located—a recurring issue in the Gaza area. Missing a tunnel entrance negates building-clearing efforts and leaves ground forces dangerously exposed.[5] Together, these factors illustrate the significant tactical problems posed by Sub-T networks.

Despite the many tactical challenges posed by Sub-T environments, the strategic problem lies in the broader operational implications. Tunnel networks play a central role in the doctrine and strategy of Hamas, a U.S.-designated terrorist organization that routinely endangers civilians and violates human rights. Its willingness to place noncombatants at risk and disregard the integrity of Gaza has enabled a strategy built around exploiting dense urban terrain and extensive tunnel infrastructure. By employing tactics such as using civilians as "human shields," Hamas creates a layer of civilian infrastructure between itself and its adversary—one that opposing forces are reluctant to breach due to the risk of mass civilian casualties and the potential loss of international support.[6] This dynamic complicates efforts to achieve decisive effects in Sub-T environments and underscores the operational challenges tunnel systems create.

The lessons emerging from Gaza have created important opportunities to refine methods for countering Sub-T environments. External tunnel identification begins with strong intelligence collection and detailed analysis of ground-level indicators. Cataloging these indicators is essential. For example, certain types of bedrock are far easier to excavate than others. Gaza sits on sandstone, which enables rapid expansion of tunnel networks. In contrast, areas built on granite bedrock generally limit the scale of newly constructed conflictrelated tunnels, suggesting that any existing systems are older and less extensive. Geospatial tools and intelligence assets can integrate Sub-T considerations into broader operational planning, improving the ability to detect, characterize, and anticipate subterranean threats.[7]

Another critical method of anticipating Sub-T threats is detailed analysis of satellite imagery to identify subtle changes, anomalies, or patterns associated with tunnel entrances. Artificial intelligence (AI) can augment this process when sufficient data exists to train models capable of detecting these indicators at scale. Emerging technologies—such as thermal imaging and groundpenetrating radar mounted on drones—can generate detailed renderings that help identify tunnel locations within dense urban terrain.

When employed strategically, advanced imaging tools eliminate the element of surprise and enable friendly forces to rapidly isolate buildings suspected of containing tunnel access points. This allows units to secure the surrounding area before addressing the Sub-T component of the operational environment, significantly improving both tempo and force protection.

Because imaging technology has inherent limitations, some tunnels can only be identified by on-ground reconnaissance teams, depending on where their entrances are concealed. If friendly forces are to maintain a consistent chance of achieving decisive outcomes in Sub-T environments without resorting to widespread destruction, they must study and internalize the methods used by Hamas and incorporate the relevant lessons into training and operational design. Scouts and reconnaissance

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elements must be trained to recognize indicators of tunnel entrances and to assess subterranean systems on the ground within a given operational environment.[8]

Some measures to address the need for dedicated Sub-T training have already been implemented, including the establishment of the Sub-T training center at Fort Leonard Wood, Missouri, and the Sub-T complex at Fort Bragg, North Carolina. However, this training cannot remain an annual exercise or an occasional temporary duty (TDY) opportunity for a handful of Soldiers.[9] Maneuver elements operating in urban environments with a high probability of encountering Sub-T domains require a dedicated force to manage these challenges.

The most effective solution would be a specialized engineer platoon or company tasked with Sub-T operations and equipped with the tools necessary for success. This capability should be designated at the division level at a minimum—and more appropriately at the corps level. The assigned unit would send personnel to Sub-T courses and serve as the primary formation for trench and subterranean operations during training. Its mission must be to efficiently neutralize and clear Sub-T environments, providing commanders a reliable, expert capability for this increasingly critical domain.

Because Sub-T operations fall squarely within the engineer warfighting function, responsibility for this mission should be assigned to sapper or routeclearance elements. These formations must be integrated during mission analysis within the military decision-making process (MDMP) and carried through planning, preparation, and execution. Units with specialized expertise understand which intelligence products best support their mission; a dedicated Sub-T element is therefore optimally positioned to leverage the intelligencegathering methods described above and request tailored geospatial and technical intelligence.

The Sub-T component of the operational environment must be treated as a distinct submission requiring its own dedicated unit, planning considerations, and training pipeline. Only a purposebuilt formation can effectively neutralize and clear subterranean threats in support of maneuver operations.

Sub-T operations present a difficult challenge, but not an impossible one; they simply require dedicated time, training, and specialized units. The greatest potential pitfall is failing to anticipate Sub-T threats and focusing exclusively on surface-level maneuver. Such oversight eliminates any preparedness a maneuver element might have for a subterranean attack and forces it to divert combat power from its main effort to clear tunnels discovered during operations.

By assigning and attaching an engineer element specifically trained for Sub-T operations, maneuver forces remain free to secure the broader operational environment without risking inexperienced personnel in complex underground systems. A dedicated Sub-T engineer unit can apply specialized training, leverage tailored intelligence, and execute its mission with precision. The United States and its allies are well-positioned



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to apply lessons learned from subterranean combat in Gaza to address current shortcomings and prepare for imminent LSCO engagements in this unique operational domain.

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Endnotes

1 "192 Countries—Every Underground Cities & Secrets on Earth," Theboldearth.com, 2026, https://theboldearth.com/stories/underground-cities-caves-tunnels-every-country.

2 2 INSS, "What Have We Not Yet Grasped about the Strategic Implications of Gaza's Underground Challenge", August 3, 2025, https://www.inss.org.il/publication/gaza-tunnels/.

3 INSS, "What Have We Not Yet Grasped."

4 John Spencer, "Israel's New Approach to Tunnels: A Model Shift in Underground Warfare", *Modern War Institute*, 2 Dec. 2024, https://mwi.westpoint.edu/israels-new-approach-to-tunnels-a-model-shift-in-underground-warfare/.

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6 John Spencer, "Gaza's Underground: Hamas's Entire Politico-Military Strategy Rests on Its Tunnels", Modern War Institute, January 18, 2024.

7 "Subterranean Operations: Israeli Defense Force Lessons from Gaza," U.S. Army, September 10, 2025, https://www.army.mil/article/288356/subterranean_operations_israeli_defense_force_lessons_from_gaza.

8 "Subterranean Operations."

9 John Spencer, "Gaza's Underground."

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