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GOING UNDERGROUND – A SUBTERRANEAN CAPABILITY FOR THE CAF

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JCSP 47

Service Paper

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PCEMI 47

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CANADIAN FORCES COLLEGE - COLLÈGE DES FORCES CANADIENNES

JCSP 47 - PCEMI 47

2020 – 2021

SERVICE PAPER – ÉTUDE MILITAIRE

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Word Count: 2,557

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Nombre de mots : 2.557

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AIM

1. The aim of this service paper is to detail how the Canadian Armed Forces (CAF) should force generate a joint capability to counter the use of subterranean environments by state and non-state actors within the contemporary operational environment (COE). The United States (US) and Israel are making significant efforts in understanding the unique considerations in the field of subterranean operations. The CAF needs to keep pace with research and development in this existing, not emerging, environment. This service paper is informational in nature and recommends cooperation with the US and Israel as well as continued exploration by the L1s.

INTRODUCTION

2. Subterranean operations have been a fixture in conflict throughout the ages. Recent examples include the Japanese defences at Okinawa in World War II, the Viet Cong underground systems of the Vietnam War, the Taliban caves of Afghanistan, the Hezbollah and Hamas tunnels encountered by Israel, and most recently, the Islamic State (IS) tunnels encountered in Mosul.¹ In each of these cases, overmatched adversaries have moved underground to gain relative superiority over their opponent, whether it be to negate technological shortfalls or to enable clandestine manoeuvre.² Regardless of whether the underground facilities are found in rural or urban terrain, or if they are existing civil works, rudimentary tunnels, or hardened military facilities, they provide numerous advantages to defending forces.³ North Korea, for example, has been very active in preparing military facilities underground:

By 1990, the North Korean's had constructed between 8,000 and 15,000 underground bases, factories, and installations, dug over 500 miles of subterranean networks, and employed over 500,000 people in 150 different subterranean factories impervious to direct hits and nuclear

¹ Department of the Army, ATP 3-21.51, *Subterranean Operations* (Washington, D.C.: Department of the Army, 2019), 2.1; Daniel Solescu, "Challenges Faced by the Romanian Land Forces Regarding Training for the Operations in the Urban Environment," *Land Forces Academy Review* 25, (2020): 142; Joshua Bowes *et al*, "The Enemy Below: Preparing Ground Forces for Subterranean Warfare" (master's thesis, Naval Postgraduate School, 2013), 1; Haley Mercer, "Shaping the Deep Fight: Operational Implications for the 21st Century Subterranean Conflict" (master's thesis, School of Advanced Military Studies, 2019): 3; Benjamin Runkle, "Preparing for Warfare's Subterranean Future," last modified 16 April 2015, <https://warontherocks.com/2015/04/preparing-for-warfares-subterranean-future>; Namak Khoshnaw, "Explore the IS Tunnels," BBC, last modified 22 November 2018, <https://www.bbc.co.uk/news/resources/idt-5c6bc253-d161-41f4-8501-4e7cacf047d5>

² Bowes *et al*, 9; Solescu, 137; Yiftah Shapir and Gal Perel, "Subterranean Warfare: A New-Old Challenge," in *The Lessons of Protective Edge*, ed. Anat Kurz and Shlomo Brom, (Tel Aviv, Israel: Institute for National Security, 2014), 51.

³ Bowes *et al*, 16.

strikes. They built aircraft hangers suitable for fifty to sixty fighter aircraft with the ability to accelerate underground before take-off. The North Korean's construct (sic) and store over 10,600 artillery pieces underground. Additionally, 10,000 underground facilities serve the primary purpose of stockpiling food, equipment, and munitions to support a multi-domain fight unaided for at least six months.⁴

A coalition fighting the North Koreans will see itself fighting beneath the Earth's surface. Military commanders at all levels must consider the subterranean environment in each of their areas of operation. The United States and Israel recognize the difficulty of subterranean operations, collaborating since 2015 to research and develop anti-tunneling capabilities.⁵ In contrast, Canada does not have doctrine or a capability for operating effectively underground. As such, it needs to address this capability gap to meet the needs of the current and future operating environment.

3. This paper examines current Canadian doctrine and capabilities and those of other nations with experience in subterranean operations, most notably the US and Israel. A review of existing subterranean literature will then be conducted to determine what capability gaps exist so that recommendations can be made as to how the CAF can force generate a joint capability to counter the increasing use of subterranean environments by state and non-state actors. Future conflicts will likely involve subterranean operations to some extent, so the CAF should prepare now so that its forces are well prepared. "We owe it to our servicemen and servicewomen to learn the lessons from recent conflicts and develop responses to the threats posed by tunneling before we commit them to battle."⁶

DISCUSSION

4. The subterranean capability gap exists in part due to a mindset that it is an extension of the urban environment.⁷ There are many historical examples of subterranean facilities constructed in non-urban environments, including those examples given above, and subterranean operations are fundamentally different. Urban doctrine does not adequately address the planning considerations of subterranean operations.⁸ Although urban and subterranean environments share many challenges such as confined mobility corridors, difficulty in maintaining communications, structural hazards, among others,⁹ some are especially prominent underground. Unlike urban environments, subterranean offers few options for an attacking force to contest the defending force's advantages.

⁴ Mercer, 24.

⁵ Runkle, para 11.

⁶ *Ibid.*, para 13.

⁷ Bowes *et al*, 6.

⁸ *Ibid.*

⁹ Department of the Army, 1.3.

Fires have limited effects as they will at best only rubble a small tunnel section (and any sophisticated adversary will have multiple entrances/exits and ventilation shafts), and a clearing force cannot mass fires.¹⁰ In urban operations, an assault force can decide where to breach and how to flow through an objective, whereas underground, attackers are canalized with no real alternative. Conditions unique to the underground environment are the lack of ambient light to enable the use of night vision goggles, poor communications, degraded global positioning system (GPS) reception, poor or potentially toxic air conditions, and psychological challenges.¹¹ This last point is especially concerning, as claustrophobic conditions are not generally a concern for soldiers. As such, ground forces need to be prepared so that they do not culminate in the mental, physical, and emotional domains faster than they would in other environments.¹² Training separate from, or in addition to, training in an urban environment is a necessity for the CAF so that its soldiers can effectively operate in the unique subterranean environment.

5. The Canadian Army's (CA) publication, *B-GL-300-001/FP-001 Land Operations*, describes many specific operations and environments in its chapter eight. Subterranean operations are not mentioned, with the exception of paragraph 832.1 which states that "Operations in built-up areas are characterized by a three-dimensional aspect to operations, at street level, on rooftops and in buildings, and underground in sewers and subway systems."¹³ Further, *Land Operations* states: "operations in urban areas have become routine in the contemporary operating environment (COE) and thus all forces deploying should be prepared to, and capable of, conducting full-spectrum operations (FSO) in both urban and rural terrain."¹⁴ As such, one would expect that subterranean operations are detailed within *B-GL-322-007/FP-001 Unique Operations - Urban*. Unfortunately, there is very little mention of the topic beyond the fact that urban operations must consider the subterranean environment.¹⁵ The US only introduced its *ATP 3-21-51 Subterranean Operations* in November of 2019. The US noted from its experiences that this unique environment needs its own consideration; Canada should consider it as well.

6. With doctrine, the CAF needs to develop a capability that augments or expands urban operations. It is not simply a dismounted infantry fight. To start, adversaries take great care in concealing their subterranean works. Intelligence, surveillance, and reconnaissance (ISR) activities are critical in enabling operational planning, design, and

¹⁰ *Ibid.*

¹¹ *Ibid.*; Bowes, 21; Mercer, 1.

¹² Anthony Randall, "The Moral and Ethical Leadership Implications for Close Combat Soldiers in Subterranean Operations," *The Impact of Diverse Worldviews on Military Conflict* (2018): 138.

¹³ Department of National Defence, B-GL-300-001/FP-001, *Land Operations* (Ottawa: DND Canada, 2008), 8.18.

¹⁴ *Ibid.*, 8.1.

¹⁵ Department of National Defence. B-GL-322-007/FP-001, *Unique Operations - Urban* (Ottawa: DND Canada, 2006), 32, 34.

execution of subterranean operations such that strategic aims are met.¹⁶ Adversaries can easily hide tunnel entrances within a building, and although Israel and the US have made significant investment in the field of locating tunnels, efforts have largely been unsuccessful.¹⁷ Aerial ISR is blind to underground activities, and as such, operational planners need to augment it with other ISR efforts.¹⁸ Israel has been experimenting with radar since 2014, but efforts have repeatedly failed due to the false positive readings that come because of the complex geology of the ground.¹⁹ Seismic efforts have also failed, with indications of underground tunnelling activity instead being nearby washing machines or underground animals.²⁰ Research needs to continue in this field, so in the interim, soldiers need to be trained and aware of the indicators of subterranean activity,²¹ and operational planners need to integrate intelligence activities such as SIGINT and HUMINT into the collection plan. The infantry cannot be solely responsible for the conduct of subterranean operations; enablers need to be made available to assist in the development of situational awareness.

7. Once ISR assets define the subterranean facility, there may be a requirement to fight within its confines (although the US doctrine notes that the level of effort and time required increases depending on whether the commander chooses to bypass, neutralize, control, contain, or clear the underground facility.)²² The CAF has very limited experience in this environment so the field observations and lessons learned of other nations are needed to force generate a subterranean force capable of each of the aforementioned tasks. Enhanced hearing protection and sound suppression accessories are required for each soldier due to the amplification of sound waves in the confined spaces.²³ Infrared lighting is required to enhance the effectiveness of night vision goggles due to the lack of ambient light.²⁴ Some nations have found that incendiary weapons are especially effective underground, although the CAF would need to consider the laws of armed conflict when employing weapons in such a manner.²⁵ One US officer recommended having ballistic shields, air quality monitors, and breathing apparatus either on each soldier or immediately available to them during operations.²⁶ Finally, communications are critical between those operating underground and those who are above. Current tactical radios do not work in the subterranean environment. The US is fielding new radios with self-healing FM networks, enabling soldiers to communicate

¹⁶ Mercer, 6.

¹⁷ Shapir and Perel, 56.

¹⁸ Runkle, para 6.

¹⁹ Yonah J. Bob, "Israel's Next Underground War," last modified 22 December 2019. <https://www.jpost.com/opinion/military-affairs-the-next-underground-war-611509>

²⁰ *Ibid.*

²¹ Bowes *et al*, 91.

²² Department of the Army, para 3-8.

²³ Bowes *et al*, 98.

²⁴ *Ibid.*, 88; Devon P Zillmer, "Training for Subterranean Operations in the KTO," *Infantry* 107, no. 3 (July-September 2018): 35.

²⁵ Bowes *et al*, 99.

²⁶ Randall, 137.

while underground.²⁷ While some of these capabilities would be a force multiplier in an urban environment as well, they are necessary for survival underground. It is clear that subterranean forces are a capability separate from urban.

8. The actual force package required to conduct operations in a subterranean environment will vary depending on the facility in question. Further, an advance, regardless of the task assigned, cannot focus on the subterranean environment itself; the assigned element must also consider the environment above.²⁸ Manoeuvring forces must consider their flanks - a subterranean force must consider its flanks in three dimensions. As such, the force package must be robust enough to conduct surface and subsurface operations concurrently, although to what level of effort each are conducted comes down to tactics. Consistent with urban operations, the army is not the only service who provides value added as the Air Force is a force multiplier with its ISR, tactical airlift, as well as its kinetic and non-kinetic effects to enable the subterranean operation, although Israeli Air Force efforts to accurately bomb tunnels in the Gaza Strip have not been efficient.²⁹ Electronic warfare, information operations, and other enablers, combined with the more traditionally applicable light infantry, reconnaissance, combat engineers, and Special Forces,³⁰ must be closely integrated and synchronized to conduct the concurrent surface, subsurface, and potentially super-surface operations. This is a joint fight.

9. Subterranean operations, much like the related urban operations, have the potential to be extremely demanding in terms of personnel and resources. As previously mentioned, subterranean operations can have significant negative psychological effects on soldiers. The CAF should maximize its use of remotely operated vehicles (ROVs) in an ISR role to determine the threat picture prior to committing soldiers. Task-designed ROVs could provide frontal protection to manoeuvring soldiers, much like the lead breacher in urban operations who carries the fragmentation blanket or ballistic shield. Israel has experimented with ROVs in tunnels but found they lose communications once 100 metres into a tunnel.³¹ It is clear that the requirements for self-healing communications and optics are the same for ROVs as with the soldiers. The CAF must explore further the use of robotics to reduce the risk to vulnerable soldiers in the complex environment.

10. To truly understand the gaps in subterranean capability, it needs to be trialed in a realistic training environment with proper equipment. The CAF does not currently have a subterranean training facility, and although the US's facilities fall short of the full scope of subterranean facilities, they are a potential interim solution.³² The construction of a

²⁷ Zillmer, 35.

²⁸ Solescu, 137.

²⁹ Omer Dostri, "The Buildup of Forces for IDF Underground Warfare," (2019): 5.

³⁰ Bowes *et al*, 94.

³¹ Runkle, para 8.

³² Bowes *et al*, 103-104.

rudimentary tunnel and/or underground facility would be costly but within the capability of the CAF, who could draw upon the US examples:

The [Combat Training Centres] and the majority of urban training sites have both rudimentary and sophisticated tunnels that can be used by U.S. forces. In addition to the CTCs, the Muscatatuck Urban Training Center (MUTC), Butlerville, Indiana, offers over one mile of searchable tunnels in which a unit might conduct training. Operated by the Indiana National Guard, the tunnels range from rudimentary to sophisticated, and can be modified to include opposing forces (OPFOR), weapons caches, or any number of other situations.³³

The individual soldier skills required to operate within a subterranean environment are similar to those required to operate within urban operations, the difference comes with the specialized equipment and psychological challenges. Training needs to focus on modifying traditional urban tactics, techniques, and procedures (TTPs).³⁴ The larger training bill comes with developing the expertise at the operational level to design, plan, and execute subterranean operations, while concurrently synchronizing effects above and below ground. Although the US Army allocated \$572 million into training and equipping active duty brigades to fight in large-scale subterranean facilities,³⁵ it is at the operational level that training efforts must be focused. Whether it be an infantry section clearing a rudimentary tunnel or a brigade group clearing a three-dimensional environment, planners and leaders must understand the considerations of such a fight. The CAF needs to get soldiers underground to start to develop this knowledge.

11. The CAF has a choice. It has institutionalized urban operations with individual and collective training, equipment, and doctrine. It could accept the risk of continuing to treat the subterranean environment as an extension of the urban. Both historic and recent experiences have demonstrated that threat actors are using the subterranean environment to achieve relative superiority, so the CAF would be accepting a significant risk. Currently, the CAF cannot expect its soldiers to operate underground without significant losses.

CONCLUSION

12. The CAF will likely face threat actors using the subterranean environment to achieve relative superiority at some point in the future. It is woefully unprepared for such a threat due to the CAF's current perspective subterranean is an extension of the urban fight. There are specialized equipment requirements and TTPs that must be captured in

³³ *Ibid.*, 104.

³⁴ Zillmer, 35.

³⁵ Mercer, 1.

doctrine, and the subterranean fight must be considered from an operational perspective and not just tactics. As such, there is an additional training requirement to fill this capability gap at the operational level. The US and Israel have taken an active interest in the subterranean fight, Canada should take the hint that the subterranean fight is not just a fad; it has been a fixture throughout history, continues to be prevalent, and will continue to be a threat in the future. The CAF needs to train its soldiers how to conduct subterranean operations or risk taking fully preventable casualties.

RECCOMENDATION

13. It is recommended that the CAF convene a subterranean working group consisting of representatives from across the L1s to further explore the future of CAF operations in the unique subterranean environment. The CAF should also engage the US and Israel to participate in their combined subterranean discussions. Finally, as the subterranean environment is also a component of the Canadian landscape, the CAF should engage its Public Safety partners to conduct joint training and to establish domestic subterranean security policy.

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