SUBTERRANEAN OPERATIONS (SbTO) HANDBOOK

ASYMMETRIC WARFARE GROUP

12 August 2015

DISCLAIMER: The information contained herein is not current U.S. doctrine or policy and is not meant to supersede doctrine, commander's guidance, or established unit standard operating procedures. Examine and use the information in light of your mission, the operational environment, the Law of Armed Conflict, and other situational factors. This document does not constitute the provision of additional information or the approval of additional information upon request.

DISTRIBUTION STATEMENT: Distribution authorized to US Government agencies and their contractors; operational use; 11SEP15. Other requests for this document shall be referred to Asymmetric Warfare Group, Fort Meade, MD 20755.

EXEMPTION NOTICE: This document contains information that may be exempt from mandatory disclosure under the Freedom of Information Act.

COPYRIGHT NOTICE: This document may contain copyrighted information.

TABLE OF CONTENTS

FOREWORD

This third edition of the U.S. Army Asymmetric Warfare Group (AWG) *Subterranean Warfare Handbook* contains updated information for Soldiers preparing for combat in areas containing subterranean systems and underground facilities. This information is the result of observations made by Soldiers and AWG operational advisors as well as information obtained from historical sources, law enforcement agencies, search and rescue organizations, and technology experts.

The subterranean operational environment presents a Soldier with unique challenges that compound the difficulties already faced by those in combat. Friendly forces must be cognizant of threats not only from above ground or from the air but also from below.

Underground operations place Soldiers in difficult situations with limited visibility and movement/communication/tracking limitations—made all the more challenging by potential environmental risks such as flooding, cave-ins, suffocation, and harmful air quality as a result of smoke, airborne debris, or hazardous subterranean gas inhalation. In addition, Soldiers will potentially encounter poisonous reptiles and/or harmful insects in tunnels.

Adversaries have built tunnels and underground facilities to provide personnel and asset protection, and covert freedom of movement. The likelihood that our Soldiers will be required to fight underground increases as tunneling technology proliferates and the practice of tunneling becomes increasingly widespread.

Our intent in writing this version of the handbook was to produce a document that could inform planning and training for subterranean operations in any theater.

INTRODUCTION

When a military force owns terrain, has air superiority, or possesses significant intelligence, surveillance, and reconnaissance (ISR) advantages, less capable forces will find themselves at a great disadvantage. Subterranean systems and underground structures may afford the opposing force the only remaining medium in which to continue the fight and covertly maintain the initiative against its militarily more powerful opponent. Enemy and military uses of underground tunnels, caves, and aquifers date back to the beginning of time. Throughout history, subterranean warfare has continued to evolve. The use of subterranean systems can provide and/or facilitate:

- Movement routes after the loss of freedom of maneuver above ground
- Protection from air and land detection via undetected underground movement, and aid in subsequent insurgent staging area operations
- Evasion of capture by ground forces via tunnel systems
- Covert infiltration of force protection/border sites or areas
- Breaching of secure areas to capture/kidnap or kill personnel
- Prison ingress and/or prisoner egress (escape)
- Secure communications, especially in urban environments, through land lines or runners
- Concealed/covert locations for rest, storage, medical treatment, command nodes, resupply activity, and observation, particularly as a means to avoid airborne detection and facilitate movement/concealment
- Secure cache sites for weapons, materiel, equipment
- A surreptitious means to deliver weapons and assets to targets
- Opposing force personnel and materiel surveillance
- Smuggling (e.g., narcotics along the U.S.–Mexico border; weapons along the Israel–Egypt border, etc.)
- Covert mining of enemy positions (e.g. the Messines Ridge operation in WWI)
- Infiltration of friendly force positions
- Launching an attack against personnel and/or a facility

This handbook consists of four chapters. Chapter 1 describes a few historical examples of subterranean warfare. Chapter 2 identifies and describes the categories of SbT facilities and tunnels. Chapter 3 describes techniques and considerations for the conduct of subterranean warfare. Finally, Chapter 4 contains an overview of some of the hazards, medical considerations, and rescue techniques associated with subterranean operations.

CHAPTER 1

HISTORY OF SUBTERRANEAN WARFARE

Ancient Times: Large defensive walls constructed around cities have been in use for thousands of years. During periods of invasion or siege tunnel systems were often dug to permit escape and passage of water or supplies beyond enemy lines.

Middle Ages: Castles and fortresses provided formidable protection against enemies and it would often take engineers to devise siege engines and sabotage tunnel systems in order to collapse walls and breach defenses.

Modern Wars: In the American Civil War tunnel systems were used on more than one occasion. In the Battle of Vicksburg in 1863 and the Siege of Petersburg Union forces dug sabotage tunnels beneath Confederate lines and detonated a large amount of gun powder.

The British began digging a massive defensive tunnel complex at the Rock of Gibraltar in the late 1700s and construction would continue until the 1960s. Used all the way through the Cold War it consisted of over 34 miles of tunnels with various rooms for storage, vehicle maintenance, power generation, berthing, command and control, and care of wounded.

In World War II the Germans conducted much of their V-2 rocket production, assembly and launch testing from underground facilities in order to protect them from Allied bombing campaigns.

The Vietnam War saw very successful use of battlefield tactical tunnels by Viet Cong guerillas against U.S. and Allied forces, especially around the area of Cu Chi. Tunnels ranged from simple cave like tunnels to large, multilevel complexes then extended for miles. Entrances were well concealed and often booby-trapped. Air and water locks, and false side tunnels were used to confuse searchers.

Recent Era: North Korea, no doubt based on the lessons learned from the Korean War, has become the most fortified country in the world. North Korea embarked on a fortification program in 1962 to put most of its critical military infrastructure underground. This effort included building an airbase into a granite mountain with room for an entire regiment of aircraft and its associated maintenance and support facilities.[1] In the Syrian conflict opposition forces are digging sabotage tunnels to destroy Syrian government and military facilities. Syrian opposition are also digging tunnels to move around the battlefield undetected and for protection from air attack and ISR platforms.[2] After the invasion of Afghanistan in 2001, Taliban and Al Qaeda fighters escaped into the mountainous cave complexes on the border between Afghanistan and Pakistan to evade detection and capture. These were also the same complexes that afforded Mujahedeen fighters protection against the Soviet invaders in the 1980s. Hamas uses tunnels for smuggling goods from Egypt into the Gaza strip to avoid the Israeli blockade. Hamas is also known to dig tunnels

[1] http://nsarchive.gwu.edu/NSAEBB/NSAEBB372/docs/Underground-GoingDeep.pdf

[2] http://www.foxnews.com/world/2013/08/05/syria-rebel-moles-wage-battle-from-underground-tunnels/

to protect senior leaders from Israeli air attack and to infiltrate into Israel to conduct attacks.[3]

[3] http://en.wikipedia.org/wiki/Palestinian_tunnel_warfare_in_the_Gaza_Strip

CHAPTER 2

CATAGORIES OF SUBTERRANEAN SYSTEMS

For the purpose of the handbook we will use the lexicon designed by the Maneuver Center of Excellence. Other organizations categorize subterranean systems using several different methods, such as purpose, depth, construction method, and whether they are manmade. Appendix C discusses several of those methods.

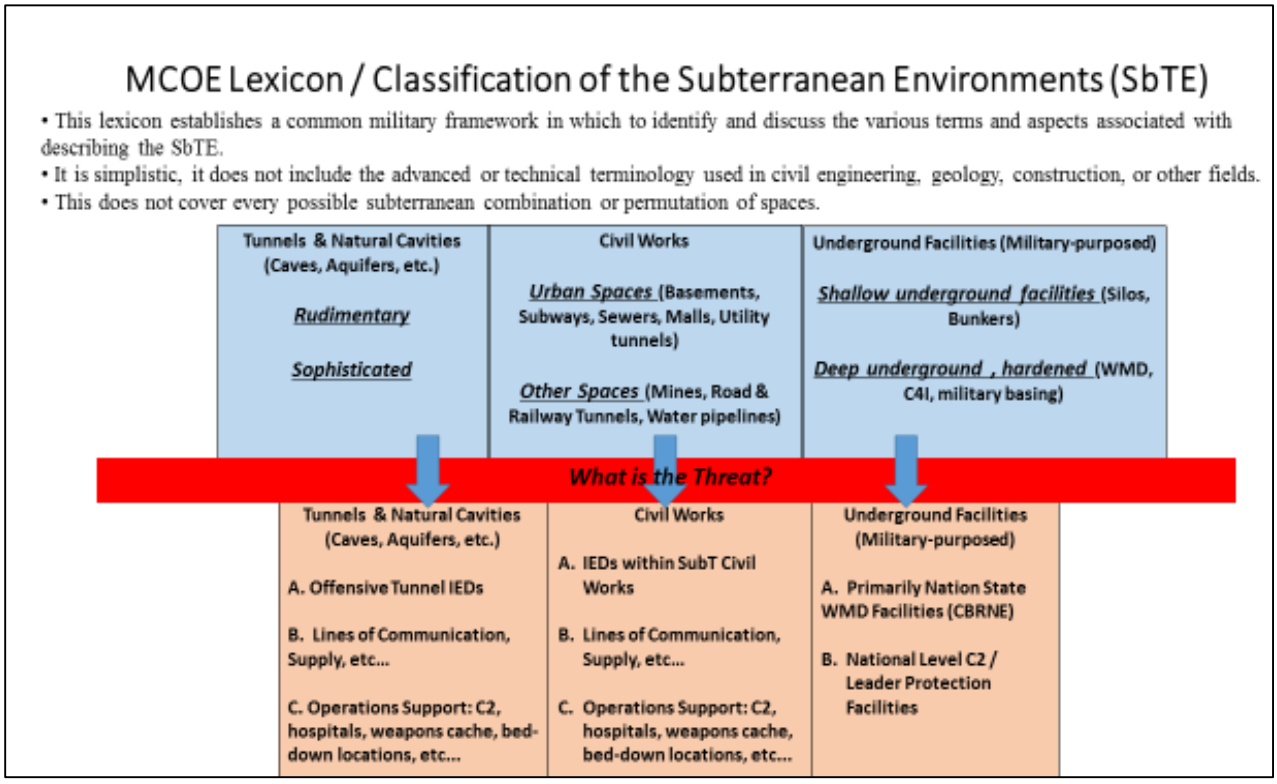

Figure 1 MCoE Lexicon

Tunnels, Natural Cavities, and Caves

The first category of subterranean systems is tunnels, natural cavities, and caves. This category is further subdivided into rudimentary and sophisticated systems. Sophisticated tunnels are differentiated from rudimentary tunnels by any kind of shoring (wood, brick, concrete slabs) along the walls to prevent tunnel collapse. Sophisticated tunnels may also have lighting or power cords, ventilation shafts, and drainage pipes and pumps. Rudimentary tunnels will have none of these things. The characteristics of the tunnel itself (height, width, length, with or without shoring and what kind of shoring, with or without power and ventilation, connected or disconnected to other tunnels or structures, etc.) is what is important, not the categories themselves. The categories merely serve as names of indicators that should cause tactical leaders and analysts to recognize that they are faced with a different environment. Sophisticated tunnels, basements, and underground facilities may be indistinguishable (all separate categories) and some underground facilities may have segments of each of the different types of systems. For example, a rudimentary

tunnel may connect to a sophisticated tunnel, which may lead to a deep underground facility, which may have its own subway, which might at some point be connected to a public transportation line. Such facilities do exist and do not lend themselves to easy classification.

Urban Subterranean Systems

The second category is comprised of urban subterranean systems. The first subcategory is substructures, such as basements and parking garages. These can be very sophisticated and can include all of the infrastructure (shoring, drainage, power, etc.) associated with sophisticated tunnels. The second subcategory of urban subterranean systems are civil works, including subways, sewers, aqueducts, and aquifers.

Underground Facilities

The third category is underground facilities. These are subdivided into shallow underground facilities (SUFs) and deep underground facilities (DUFs). These facilities will likely have all of the characteristics of sophisticated tunnels, and will probably include redundant power, water, ventilation, and communications infrastructure. These facilities will also likely have blast doors, which are clear indicators that the enemy is trying to protect something. The presence of blast doors does not, however, necessarily indicate a sophisticated use, such as C4I or the presence of WMD. Many countries protect artillery, short range rocket systems, and anti-aircraft artillery in such facilities. Such facilities may also house perfectly harmless civilian infrastructure.

CHAPTER 3

SUBTERRANEAN WARFARE TECHNIQUES

Subterranean operations may occur as the result of deliberate planning or as a reaction to an immediate threat or opportunity. Hastily planned subterranean operations are not advisable because of the planning required.

Planning Considerations

Detailed knowledge of the nature and location of subterranean systems and underground structures is of great importance to personnel planning to conduct operations in these environments. Planning considerations for subterranean operations should include:

- Commanders need to strike a balance between seizing underground facilities before the enemy has a chance to defend them and maintaining the initiative. Commanders should have a clear end state in mind before sending troops underground.
- A thorough analysis of the reasons to place troops in a subterranean environment. Subterranean combat is physically and psychologically demanding and must be carefully thought out prior to committing troops.
- Be prepared to execute the remediation process by aligning the proper time and resources for occupation by friendly forces or structural/functional defeat of the facility.
- A redundant communications network that will connect surface and sub-surface maneuver elements, aerial platforms, and ISR sensors.
- Accountability of personnel entering and exiting the environment.
- Specialized equipment and enablers.
- Providing support above ground for those elements deployed in subterranean areas. Ensure that situational awareness is maintained above and below ground.
- Sealing off access routes to underground passages.

Additional considerations include:

- Engineer support: In the event of a tunnel collapse, leaders need to consider personnel and equipment that may be needed for rescue operations. Engineers may also be required for remediation of subterranean systems.
- Explosive Ordnance Disposal (EOD) support: To assist in cache recovery, booby traps, robotic support.
- In the case of a chemical or biological facility consider special equipment to locate, detect, sample, and neutralize. Decontamination, MEDEVAC, and transport should be considered.
- The facility may contain Toxic Industrial Chemicals/Materials (TIC/TIM) such as missile fuel and oxidizers that exceeds standard HAZMAT handling procedures.

Intelligence Preparation of the Operational Environment

To provide a complete understanding of the operational environment, intelligence preparation of the operational environment (IPOE) should include consideration of subterranean systems and underground structures in the unit's area of operations (AO) and in the unit's area of interest (AI).

NAIs should be developed for underground structures/systems within the AO. Target Intelligence Packets (TIPs) should be built for individual underground facilities. Because tunnels and underground infrastructure may extend into areas controlled by foreign governments, criminal groups, and insurgents, intelligence products should be routinely reassessed for physical changes, civil considerations, and cultural and economic significance of subterranean systems in the AI.

Reconnaissance

Reconnaissance elements may be required to confirm or deny the presence of subterranean systems. Indicators of the presence of subterranean systems may include ventilation shafts, sink holes, subsurface vibrations or digging sounds, and steam, among others.

Additional indicators associated with the presence of subterranean systems are not necessarily tangible. Human behavior can be just as valuable at locating and identifying underground systems in the AO. The terrain itself may provide clues to the presence of tunnels and UGFs. Concealing portals and avenues of approach will often not be entirely possible.

Units operating inside underground systems may choose to use robots or dogs for reconnaissance purposes. (Refer to the section later in this chapter on "Robotic Platforms")

Reporting

A Commander is only going to be able to adequately weigh options and decide on an appropriate course of action if a comprehensive intelligence picture has been created. The reconnaissance and reporting you provide will be critical in forming that picture. Use the SALT-E report format for reporting information about underground facilities.

S – Size (how big is the portal or vent shaft, for utilities look for capacity)
A – Activity (what is going on, may indicate what the UGF is used for)
L – Location (grid location)
T – Time
E – Equipment (especially construction equipment, ventilation, or odd structures that may be related to the UGF)

Site Survey

Site surveys are important to planning defensive positions (e.g. FOBs) in order to visualize where infrastructure and vulnerabilities exist. Plot site information on a map (use of

imagery is preferred), and use this data to identify the most likely area from which the enemy can tunnel.

- Identify and document all known vulnerabilities.
- Document surface and sub-surface infrastructure that can be used to circumvent force protection.
  - Entry control points: bases and borders
  - Storm drains/electrical/communication/sewer drains or tunnels: Determine which transit on/off base or near borders and what, if any, countermeasures have been installed.
- Surrounding local infrastructure: plot distances from the perimeter to local business/residence structures.
- Identify and document known blind spots/dead space, and plot the distance to the perimeter.
- Pre-existing subterranean or irrigation infrastructure: Plot locations and distances from the perimeter.
- Ask the local population about tunnels, sewers and construction projects. Be cognizant of tunnel activities (unusual noises, unusual vibrations, collapsed foundations, and collapsed terrain).

Tunnel Remediation/Destroying the Tunnel

After a tunnel is detected and secured, a decision must be made to maintain the tunnel for friendly use (training, analysis, etc.) or to remediate the tunnel (process for rendering a tunnel unusable or denying access). Keep in mind that you may not be allowed to destroy tunnels used for civil infrastructure.

Such considerations are:

- Size: It may be impractical to seal or block a large (or long) tunnel. Alternatives are to block certain or main sections only (entry, exit, intersections, etc.).
- Method of construction: Additional technical solutions will be needed to destroy or deny use of reinforced tunnel sections (those that are constructed of materials other than bare stone or dirt).
- Number of access points: Blocking or sealing only known access points lends to tunnel vulnerability to further use via other unknown entry points.
- Demolitions: Each tunnel system differs in size and construction, and as a result, each tunnel system will require a different quantity and placement of explosives. Because of the complexity of charges needed to destroy some tunnel complexes, an engineer team should support the operation.
- Concrete: Low-grade concrete can be pumped into the tunnel system. Larger tunnels and the amount of concrete that may be needed will present unique logistical problems.
- Excavation equipment: Equipment can be used to dig up a tunnel system, destroy its entrances/exits, and collapse it.

Even after remediation, a tunnel should never be presumed permanently destroyed or inoperable. New access points can be dug to gain access to sections of the tunnel that are not sealed, or new tunnel passages can be dug alongside any blocked part of the sealed tunnel. Some level of continued monitoring to identify tunneling indicators should be employed to ensure the tunnel has not been reactivated.

Movement

Movement techniques during subterranean operations will vary based on METT-TC (Mission, Enemy, Terrain and weather, Troops available, Time available, and Civilian considerations). The subterranean environment is unforgiving. Communications and navigation are hindered, so movement should be well planned, decisive, and contingencies should be thought out in advance.

This description provides an instructive method for leaders to review when developing SOPs and planning movement through subterranean systems, such as tunnels and irrigation systems. The example illustrates how the patrol is organized to provide front and rear security, maintain communications with other elements, gain contact with the smallest force possible, and position the leader to provide effective command and control.

Task Organization

A recommended task organization of five main elements: External Security, Support, Assault/Clearing, Command Element, and the Reserve/QRF.

External Security Element- Responsible for cordoning off the area and providing security during the operation. The External Security Element has subordinate teams dedicated to Blocking Positions, Indirect Fire Support, and ISR. Blocking Positions should be placed on all Avenues of Approach/Egress and at any known external exits from the facility. ISR elements will assist in identifying enemy reinforcements, and Indirect Fire Teams will provide fire support.

Support Element- The Support Element is a multi-disciplined team with equipment and enablers that provide capabilities needed to accomplish the mission. Examples can include: CBRN, site exploitation, medical and casualty evacuation, detainee control, vehicle transportation support, robotic reconnaissance teams, extraction, and mountaineering teams. A Casualty Collection Point should also be staged to provide emergency medical care in the event of injuries from enemy contact, chemical exposure, and environmental hazards such as tunnel collapse.

Assault/Clearing Element- Responsible for entering and clearing the tunnel and neutralizing the threat. The Assault/Clearing Element will have multiple Tunnel Clearing Squads, each with personnel dedicated to Communications and Recon using robots or dogs. The Assault/Clearing Element should also have a dedicated “Map Man” and an attached Breaching Team. The “Map Man” keeps track of the direction and distance the Squad moves, draws a map as the squad moves, and communicates all movements to the Company CP. An RTO should be designated to maintain constant communications with the Company CP. Ideally, some sort of Recon assets should be provided to the squad, such as

robots or Military Working Dogs (MWD); the handler controls the asset and keeps the squad informed. Finally, a dedicated Breaching Team should be available to breach any obstacles that the squad can't handle with organic tools using mechanical, ballistic, exothermal, or explosive means.

Command Element- A Command Post (CP) will maintain accountability, communications, and situational awareness and should have teams dedicated to each of those functions. The CP should be established at the entrance to the subterranean facility so that it can maintain accountability of all personnel and teams moving in and out of the facility. This will also facilitate communications between Surface and Sub-Surface elements. In order to create a detailed map, the CP should maintain constant communications with the lead element in the facility as clearing teams make progress. That map will add to the company's Common Operating Picture (COP), which the Commander can use to synchronize Surface and Sub-Surface activities, mitigate fratricide, and integrate enablers into the fight.

Reserve/QRF- Is able to assume the Assault/Clearing mission on order and serves as a Quick Reaction Force in the event of contingencies.

Tunnel Clearing Techniques

Approach

The enemy may defend the approaches to subterranean systems with mines, ambushes, or snipers. One of the best historical examples of this was the Battle of Okinawa in World War II where the Japanese army built an extensive underground cave system. The Japanese defended the openings to these caves with an interlocking network of trenches and fortified machine gun emplacements.

- When fighting irregular forces, defensive preparations of subterranean systems will typically not match the scope and sophistication of the above-mentioned Japanese defense of Okinawa; however, the dangers are the same. Soldiers should use observation, reconnaissance, and, when possible, information obtained by local inhabitants to develop a clear understanding of any preparations and/or defenses the enemy may have established.
- The patrol should locate other entrances and exits prior to entering a subterranean system, ensuring that enemy escape routes are secured.
- Entering a tunnel from another entrance/exit, an unexpected direction, will increase the chances of surprise.

Tunnel/Facility entrance

Assess entrances for the possibility of booby traps. Use ISR, direct observation, and other standoff capabilities to determine the threat level. Remote opening can mitigate collateral damage from booby traps.

Initial entry

Once the entry is open, air quality should be determined. The clearing team enters and establishes a foothold. The team should sample the air (see "Air Quality" in Chapter 4) to determine if it is safe to continue past the initial foothold. Small tunnels may require the use of a safety line for the lead element to assist in recovery. Ballistic shields may also be used to provide cover.

> ***Note: Assess size considerations—when entering a crawl space, if your head and chest will fit, usually the rest of your body also will fit. If you must remove your helmet to enter a crawl space, the space is generally not large enough for you to enter.***

Movement techniques

- When the team is moving inside the tunnel, the distance between personnel will vary according to size of the tunnel, limited visibility, threat, etc.
- If you encounter fast-flowing water in the tunnel, or if a sewer contains slippery obstacles, intervals should be increased to allow team members to react if one man slips. The use of a safety rope/safety line can assist the team in clearing these hazardous areas.
- The team should move slowly, continuously looking for booby traps and clearing corners as they approach them.
- Team should periodically halt and conduct SLLS (Stop, Look, Listen, Smell).
- Mapping- For every leg of the movement, distance traveled, azimuth, and approximate incline/decline should be relayed to the Command Post. The Command Post and lead element should constantly update the map. This will allow the surface elements to track and mark the progress of clearing teams.
- Marking-As the tunnel clearing team continues to move through the tunnel, the rear security should mark the route (with chemical lights, chalk, spray paint, etc.). A unit marking SOP should include considerations for SbTO.
- If possible, never stop in a long, straight stretch of the tunnel. Move to a turn or corner to conduct halts. This will give the clearing team cover during enemy contact.
- If other entrances/exits are encountered, the clearing team should take the same precautions as with the initial entry. Other entrances/exits could be booby trapped.

> ***Note: Ricochets generally follow a flat, hard surface (such as a wall composed of stone/concrete/steel), so keep off the walls when moving.***

Tactical Call-Out

This technique can be used to assist in removing personnel from a tunnel prior to committing soldiers to a subterranean environment. Tactical call-out (TCO) is an approach to getting a target out of a building or village. The TCO gives the assault force the opportunity to cordon the intended target area and gives the enemy an opportunity to walk out or surrender without duress or injury. It provides maximum force protection, augments the information operations plan and helps provide leads to future targets. Robots (which

can be mounted with a speaker to relay commands to personnel in the tunnel) can also be used to assist in TCO.

Step one: Containment. Make sure you have all known portals, vents and possible escape routes covered.

Step two: Call Out. Use loudspeakers or local national to communicate with personnel inside the tunnels. Request that all personnel exit the facility. As personnel exit ask if anyone remains inside. Robotics may help extend your reach and reduce risk.

Step three: Detainee Handling. Establish separate detainee handling areas for military aged males and women/children. Question detainees about what is inside the tunnels/structure/facility. Triage the detainees to determine who has information of intelligence value. Verify that no personnel are left inside the facility.

Step four: Clear the objective. Remember not everyone may have come out and anyone still remaining may resist. A good technique is to have the senior ranking detainee escort you into the facility. Be aware of his demeanor. He will naturally be nervous, but watch for signs of deception. Maneuver slow and deliberately. There may not be much cover in the tunnels, so be prepared to bring your own.

Booby Traps

When approaching and moving through subterranean systems, care must be taken to avoid booby traps. Enemy forces will frequently deploy booby traps near openings and junctions. The types of booby traps vary significantly based on geography, availability of materials, and the technical sophistication of the enemy force. Early warning devices may also be used to warn the enemy of the presence of intruders.

Examples of booby traps include:

- Nail boards and sharpened stakes
- Trip wire Improvised Explosive Devices (IED)
- Buried pressure plate IEDs or AP mines

Techniques for detecting and avoiding booby traps are as follows:

- Infrared (IR) designators, such as the AN/PEQ-2 Target Pointer/Illuminator/Aiming Light, used with night-vision goggles (NVG) can make trip wires sparkle to identify possible booby traps. The “sparkle” is the glint seen in the NVG lenses when the IR illuminator crosses the wire surface.
- A small rolled section of cloth ribbon can be used to identify trip wires. Hold the end of the roll and throw it up and down the tunnel. (Must have small weight at the end)
- Another technique to identify trip wires is to use a trip-wire feeler using a long pole, a string, and a weight.

- Standing water in tunnels provides excellent camouflage for anti-personnel mines and booby traps scattered on likely routes. Soldiers should avoid walking in water, if possible.

Climbing Skills

Operations in subterranean environments frequently require movement in areas with steep vertical climbs and drops. In these situations, skills and equipment associated with mountaineering and high angle rescue can prove to be highly valuable. This is particularly true when conducting medical evacuations. Detailed information on the skills and equipment required for accomplishing these tasks is contained within U.S. Army *Mountain Operations* Field Manual 3-97.6 and U.S. Army Military Mountaineering Field Manual 3-97.61. An additional resource is the AWG Soldiers' Guide to Mountain Warfare, which was produced by Center for Army Lessons Learned (CALL).

Communications

Constant communication between the tunnel and the surface is essential to facilitate tunnel clearance operations. Radio communications do not work well underground and units can expect many challenges attempting to communicate in a subterranean environment. There are several options to improve communications:

- Hard wire. Units may run communication wire to coordination points and use field phones (TA-312 or TA-1) to communicate with the surface. Units should expect a logistics challenge to maintain a stock of WD-1 communication wire since it is rarely used in forward combat operations.
- Repeater stations. If repeater stations are available or if a unit has radios which can function as a repeater this is an option. This may result in a team being stationed at a specific location in an UGF just so they can function as a repeater station.
- Relay runner. The best way to pass communications may be by using a messenger. In some cases this may be used in conjunction with a hard wire communication system. Depending on the size of the UGF something as simple as a bicycle may speed up considerably how fast a messenger can pass messages.
- Hand and arm signals. Underground facilities can be very noisy and the wearing of protective masks or breathing apparatuses can make any kind of voice communications difficult. In some cases being able to communicate using hand and arm signals will be much easier than voice communications.

GPS

Because subterranean environments obstruct clear views of the skies, GPS will not work without mesh-networks or repeater systems. Compasses do work underground; however, their performance may be impacted when used underground in areas with high concentrations of mineral deposits.

Robotic Platforms

Tunnels are an extremely hazardous environment, with the presence of both natural and man-made dangers and or obstacles. When available, robots should be utilized for exploration of tunnels before personnel make entry.

Capabilities: The particular mission set and tunnel configuration will dictate the best robot to use, if choices are available. Robots can provide standoff data collection (video and audio) before, during, and after clearing operations. Once deployed, robots can safely detect such hazards as enemy personnel, booby traps, animals (snakes/insects), and—if equipped with a gas meter—oxygen and hazardous gas levels (see "Air Quality" in Chapter 4). They can also be used for chemical detection by attaching a JCAD Chemical Detector. Ideally, robots should have the capability to operate in a water environment without a reduction of performance, communicate clearly, have powerful IR and white light sources, sensors, and use color video/camera systems.

Limitations: Most robots are not able to relay their location or heading. Communications is an issue once the robots get around corners, which affects video signal and radio communications. Obstacles such as water, stairs, and walls may present challenges as well. While a tethered robot will not suffer a degradation of signal, it cannot be recovered by the tether. Adding a 550 cord tether to a robot can assist with recovery if the robot gets stuck. Not every robot is equipped with an IR or white light source. Finally, battery life can be a limitation as well.

Technique: The tunnel clearing team can use the robot as a forward reconnaissance element conducting bounding overwatch. If the team loses control of the robot, the team can begin moving forward until it re-gains control of the robot. This technique requires rehearsals to become proficient in controlling the robot and incorporating the capability into the clearing team.

Note: Rehearsing to use a robot is a progressive exercise. Use the robot within sight inside a building, then down a hallway, around a corner, through a window, and progress to controlling the robot completely out of sight.

Equipment

The individual equipment kit for soldiers conducting subterranean operations should be tailored to meet the requirements of the mission. **Suggested equipment for individual soldiers conducting subterranean operations is as follows**:

- M-4 with:
  - Light (IR and white)
  - Suppressors to minimize noise in the tunnel (to avoid eardrum damage), decrease position signature, and to reduce white out of NVG when firing.
  - IR Laser (wire sparkling)
- Streamlined body armor to create a smaller/slimmer profile for tunnel movement. Plate carriers will provide a smaller/ slimmer profile.
- Helmet with chin strap extender (for wear over P-mask)

- NVG/thermals
- Head lamp
- Handheld floodlight to illuminate the tunnel during white light operations. Adding an IR cover can provide an IR source when operating under night vision.
- Radio
- Double hearing protection [ear muff type headset and earplugs]
- Eye protection (clear)
- Medical masks at a minimum; preferably respirators (for protection from dust, mold, etc.)
- Gloves and knee pads
- Chemical Protective Masks with:
    - Voice Emitters
    - Radio Cables (from mask to radio)
- Self-contained breathing apparatus (SCBA) provides an air source.
- Powered Air Purifying Respirator (PAPR)
- Emergency Air Supply
- CBRN Camelback
- Harness or rappel seat
- Small first aid kit: ensure anti-venom medication is part of the kit relative to animals/reptiles/insects indigenous to the operating environment. Appropriate medication should be carried to counter the effect of bites, which can result in pain, edema, chills, and or fever.[4]

At the team level and higher, additional equipment may include:

- Ballistic shield: for the lead personnel clearing the tunnel
- Compass and Pace Cord
- Graph paper / Notebook (Map Man)
- Marking Kit: Chemical lights, spray paint, chalk, 550 cord, etc…
- Mechanical breaching tools: Halligan tool, grappling hook, rope, tubular nylon, come-along/mechanical winch
- Gas meter (see “Air Quality” in Chapter 4)
- JCAD Chemical Detector
- Mountaineering equipment (to include 2 each locking carabineer, 1 each 14-foot sling, and 1 each 20-foot section of tubular nylon, and harness or rappel seats)
- SKEDCO Evacuation System

Other items to consider:

- Loud speakers/bull horns: to call the enemy in the tunnel
- Air horn: can be used to signal in the event of a cave-in, or can also be used to signal the surface team as to the location of tunnel entrances and exits, particularly if secured
- Map and imagery of the area above ground

[4] Hoogstraal, H., and Keirans, J. E., “The Ornithodoros Capensis Group of the Palearctic and Oriental Regions,” *The Journal of Parasitology*, 65(3), pp. 395–407, June 1979.

- Small caliber pistol, or pistol with a suppressor
- Handheld metal detector/titanium mine probe
- Laser rangefinder
- Mirror (can be used to reflect light from the surface down shafts in order to explore for/observe the presence of enemy activity)
- Whistle (for rescue use)
- Entrenching tool

Night Observation Devices and Light Sources

The lack of ambient light in a subterranean system will impact the effectiveness of the Night Vision Goggles (NVG) in subterranean systems. If the facility has electricity, consider turning the lights on. Otherwise, it will be necessary to use an IR light source, thermals, or white lights to enable subterranean operations.

IR light sources: The IR designator on the AN/PEQ-15 laser, "tac-lights" with an IR cover, or IR chemical lights will all provide enough infra-red illumination to enhance the capabilities of standard NVGs.

Thermal: The AN/PSQ-20 Enhanced NVG significantly enhances soldiers' ability to see in extremely low-light environments such as caves and tunnels by using an IR intensifier in combination with a thermal capability. PAS-23s and other thermal sights are also widely available.

White Light: In some situations, white light might be the preferred method for illumination in a subterranean environment. In order to quickly identify enemy personnel or other threats, a white light or IR light sources should be used. Therefore, units should practice operational procedures for switching between NVG and white light illumination to ensure that they can switch efficiently in an operational environment.

Military Working Dogs (MWD)

The advantages of using MWDs include their ability to detect explosives and drugs as well as to instill fear in the opposition. However, in subterranean environments some dogs' senses maybe overwhelmed by the lack of air flow and confined spaces. When planning operations, these advantages should be weighed against the MWD's potential vulnerability to drowning or lack of air, disorientation from an enclosed environment, and unusual sounds and susceptibility to booby traps. As with all enablers, MWDs need to be screened and trained to identify which enablers can operate in a subterranean environment.

Training

Preparing for subterranean operations requires education, training, and rehearsals. Soldiers need to master skills associated with new equipment, adapt current procedures, and become confident with conducting operations in a new environment, both as an individual and as a member of a team. The United States' experience in the Vietnam War (where Army divisions established training programs for tunnel rats) and the Soviets'

experience during their war in Afghanistan (where they developed training curricula and schools for Soviet engineers and Afghan Special Forces) both reflect the importance of effective training programs to prepare soldiers for subterranean warfare. To develop the problem-solving capabilities and the ability to apply subterranean warfare skills in theater, training and education should be outcome based and soldier-centric.

Operating in subterranean facilities will be METT-TC dependent, but will generally depend on the size of the tunnel. Therefore, when developing SOPs and TTPs units should rehearse operating in various sized tunnels/facilities.

Small tunnels (e.g. the Cu Chi tunnels in Vietnam) may require Soldiers to crawl on their hands and knees, without body armor (and possibly without a helmet), clearing with a pistol, a flashlight (IR and White) and NVGs. If clearing large tunnel complexes in this manner becomes necessary—as it did in Vietnam—a special training course will have to be developed to teach these methods because Soldiers do not regularly train or maneuver this way in other circumstances.

Medium tunnels permit soldiers to maneuver with a one-man front wearing body armor and possibly carrying a ballistic shield. These tunnels offer more space, but are still very dangerous because one defender can hold off a much larger force.

Large tunnels allows for a front wider than a single man. For these types of tunnels, units may use standard CQB-style maneuvering, clearing hallways and rooms in the same manner as they would clear buildings on the surface.

Other training considerations include:

- Not all training for SbT operations requires a SbT facility. Glass house drills (or tape drills) for rooms and intersections can be conducted anywhere.
- The battle buddy concept is critical underground. Nobody should go anywhere by themselves and everyone should know where they are relative to the nearest un-cleared area.
- Commanders need to identify white-light criteria before they send troops into the tunnel. Use of white light prevents having to re-clear or re-search previously cleared areas, and also facilitates reporting, and monitoring the health of soldiers. Soldiers also need to train on conducting non-maneuver tasks in total darkness. Operating a radio, JCAD, or air quality sensor, drawing a map, and conducting first aid procedures are much more difficult in total darkness.

Major DoD installations and the Combat Training Centers have Military Operations in Urban Terrain (MOUT) sites with underground networks where subterranean warfare techniques can be practiced, refined, and drilled. In addition, many municipalities' emergency response organizations have fire houses or like facilities that units without access to a MOUT site may use to train on skills needed to operate in a confined space. A number of these sites are located at:

- Fort Hood, TX
- Fort Story, VA

- Fort Leonard Wood, MO
- Camp Atterbury–Muscatatuck Center, IN
- Tunnel Warfare Center, China Lake, CA
- Yuma Proving Grounds, AZ

Training events also may identify Soldiers who are prone to claustrophobia when placed in confined subterranean systems. Claustrophobia is the fear of having no escape when in a closed environment. The symptoms of a panic attack commonly last 30 minutes but sometimes can continue for hours.

Personnel without a history of claustrophobia can potentially experience panic attacks in subterranean environments. A person who otherwise may not have trouble in confined spaces may experience a panic attack after reaching a certain depth, distance, or time underground. Because most underground operations are conducted by small teams, the evacuation of even one person could compromise a mission's chance of success. Rehearsals should be conducted under the most realistic conditions possible to identify soldiers who exhibit symptoms of claustrophobia to minimize the risk of having to conduct an evacuation during an operation. Units can develop methods to monitor Soldiers symptoms during rehearsals.

During the Vietnam War, the 25th ID established a tunnel rat school at Cu Chi Base Camp. The school maintained a 500-foot underground tunnel system complete with false walls, dead ends, and booby traps. In addition to developing the skills needed to conduct underground operations, the school, with its underground tunnel system, also worked to identify those soldiers who would be ill-suited for underground operations.

Breaching in a subterranean environment is a complicated task. Units should train to conduct mechanical, powered, ballistic, exothermic, and explosive methods. Explosive breaching is the least preferred method in a subterranean facility due to overpressure, shockwave propagation, air contamination, and loss of visibility. For additional information on breaching contact the U.S. Army Engineer School.

Principles of Operating in a Subterranean Environment

Units conducting subterranean operations should plan in accordance with four principles that will enhance survivability and combat effectiveness in the subterranean environment.

- **Understand the Subterranean Environment**- Use OAKOC to gain an appreciation of the differences between subterranean terrain versus trench-lines or urban terrain. Adjust your task organization, establish priorities, and integrate enablers based on that estimate.
- **Plan and Prepare to Seize the Initiative**- Subterranean operations should be conducted deliberately. Plan every move with the threat in mind, and set conditions so the unit can maintain the offensive and take advantage of opportunities.
- **Maximize Use of Sensors, Overwatch, and Cover**- The subterranean environment puts the attacker at the disadvantage. Platoons and squads should take active and passive measures to protect themselves from surprise, observation, and detection.

Plan to counter enemy combat power with organic and attached sensors, overwatch, and other protective assets (Robots, Sniper Teams, MWD).

- **Assess Your Situation and Communicate**- It is vital that the commander synchronize surface and subsurface assets during subterranean operations. Subsurface elements are the only eyes and ears the commander has in a subterranean environment, they must actively keep the commander and other elements informed of their current situation, location, and status.

Squad Techniques

Below are some sample techniques that units can use as a guideline for developing their own SOPs and TTPs.

- Squad Order of Movement
- Squad Order of Movement (medium tunnel)
- Actions at Security Halts
- React to Contact
- Squad Assault (Part I &II)
- Squad Break Contact (Part I & II)
- React to CBRN or Low Oxygen Levels
- Mapping in SbT Operations

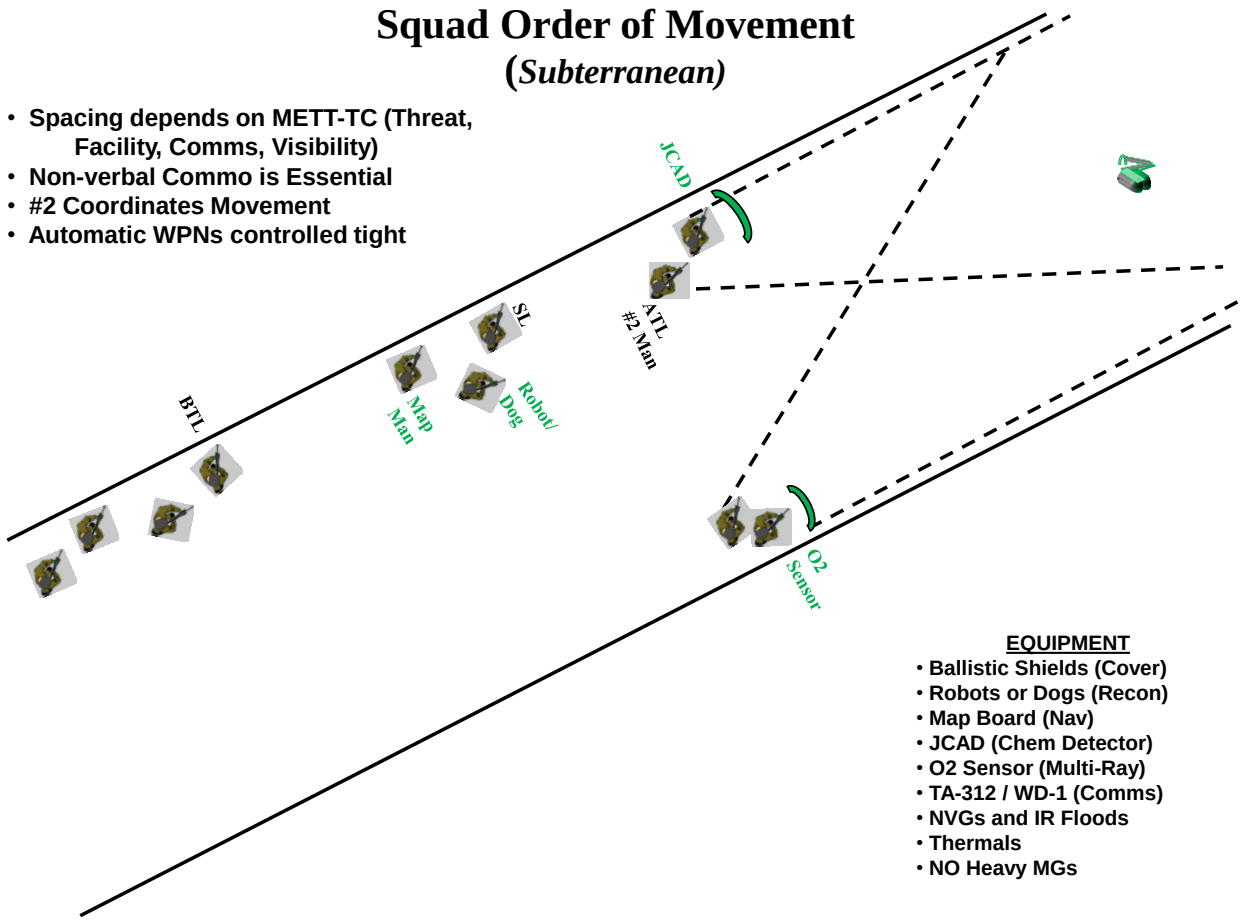

Figure 2 Squad Order of Movement (SbT)

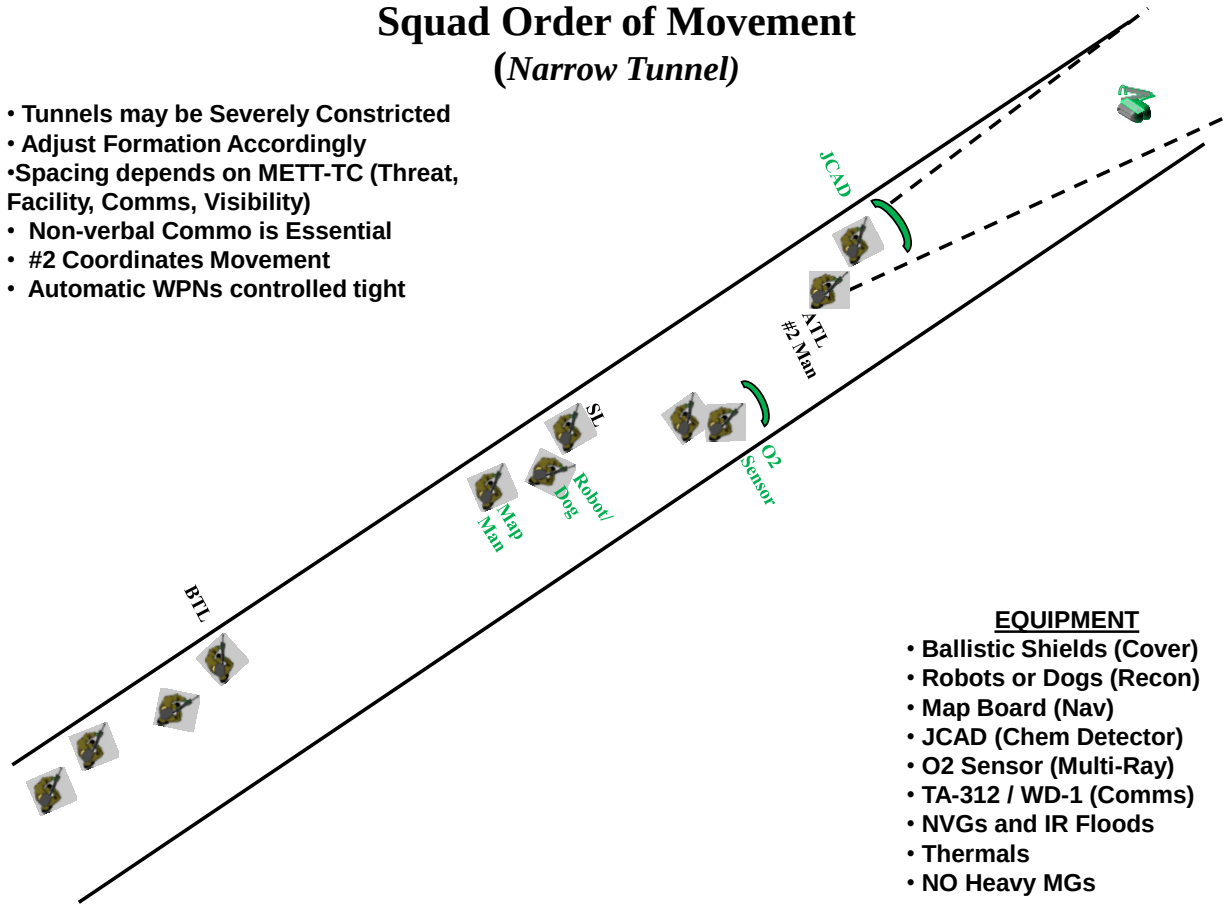

Figure 3 Squad order of Movement (narrow tunnel)

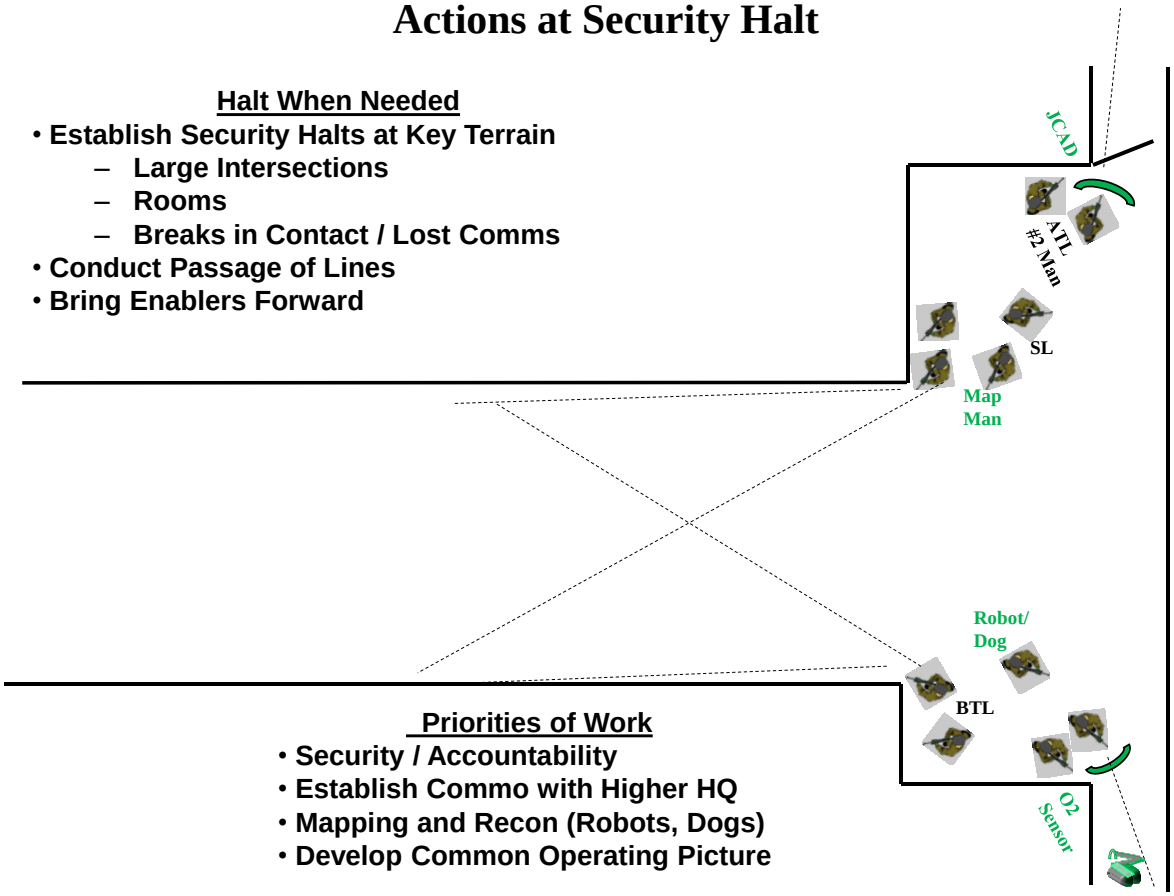

Figure 4 Actions at security halts

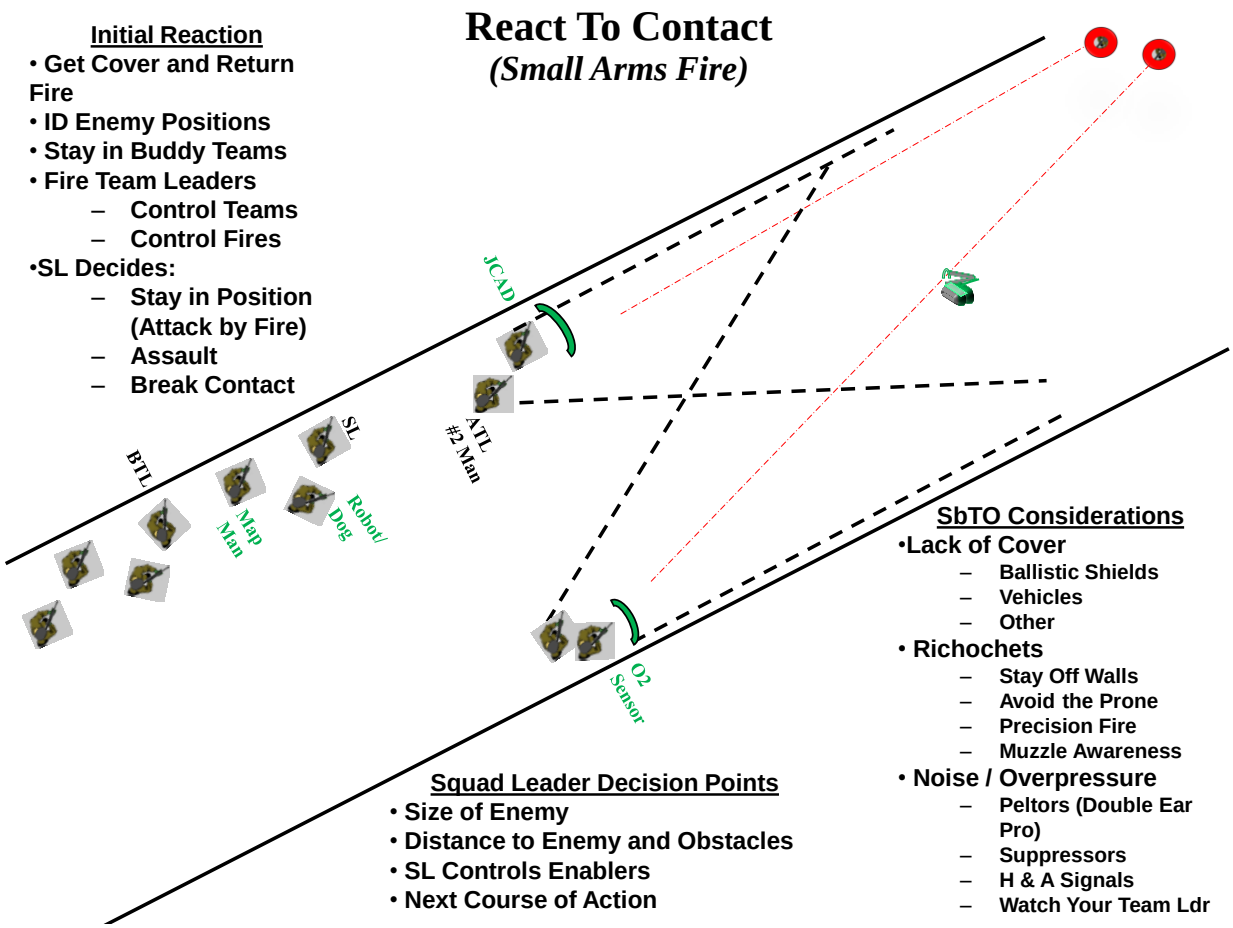

Figure 5 React to contact

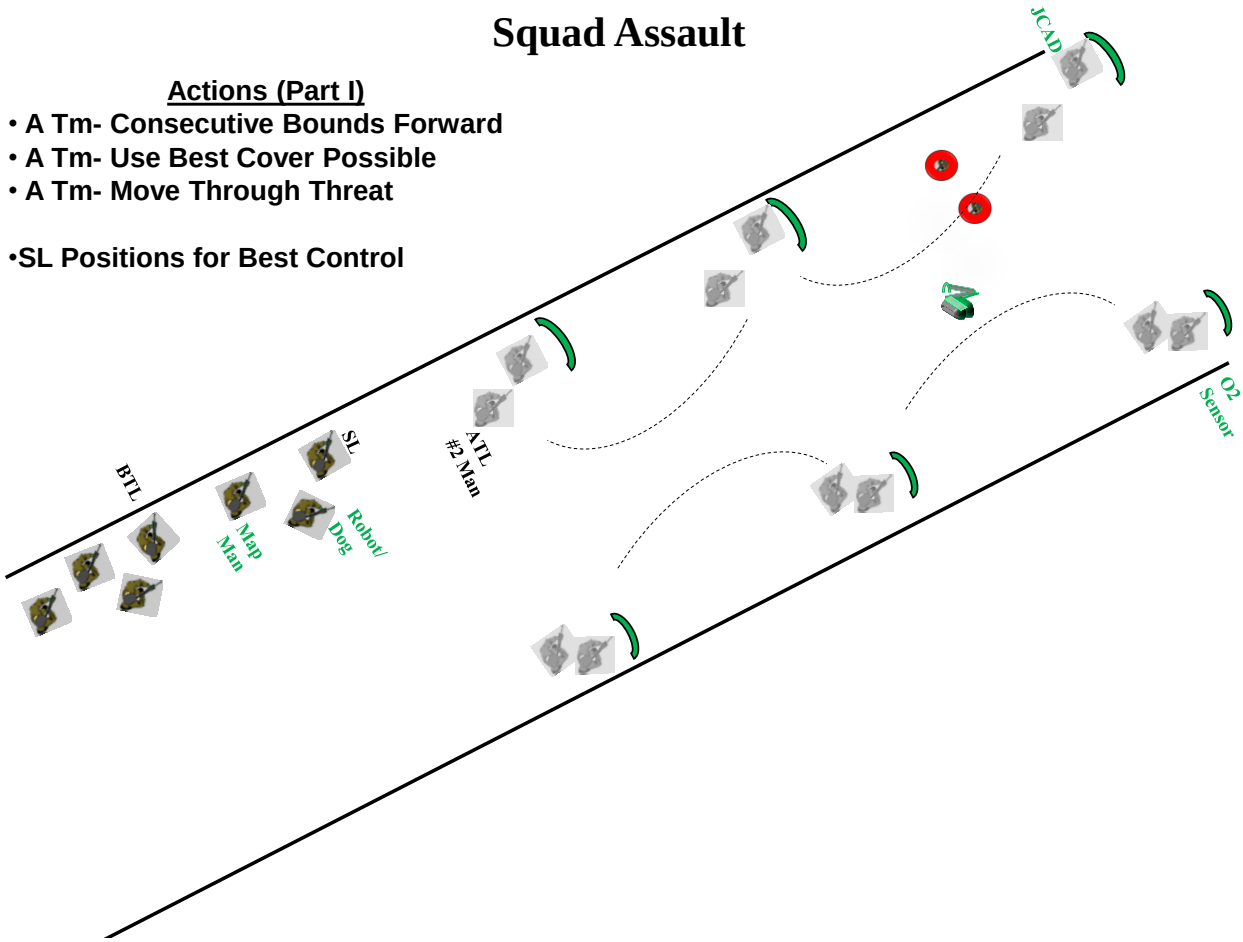

Figure 6 Squad Assault (part I)

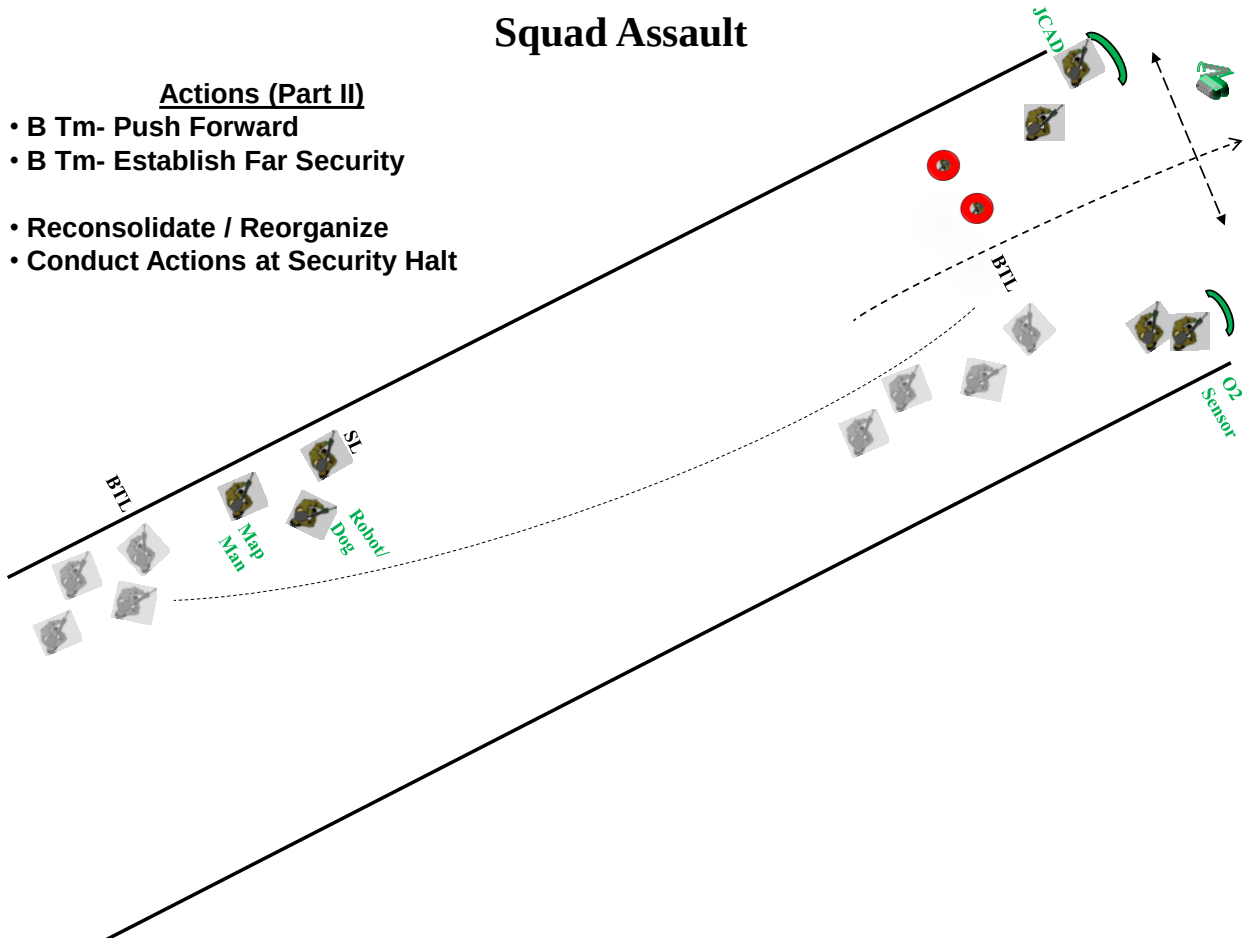

Figure 7 Squad Assault (part II)

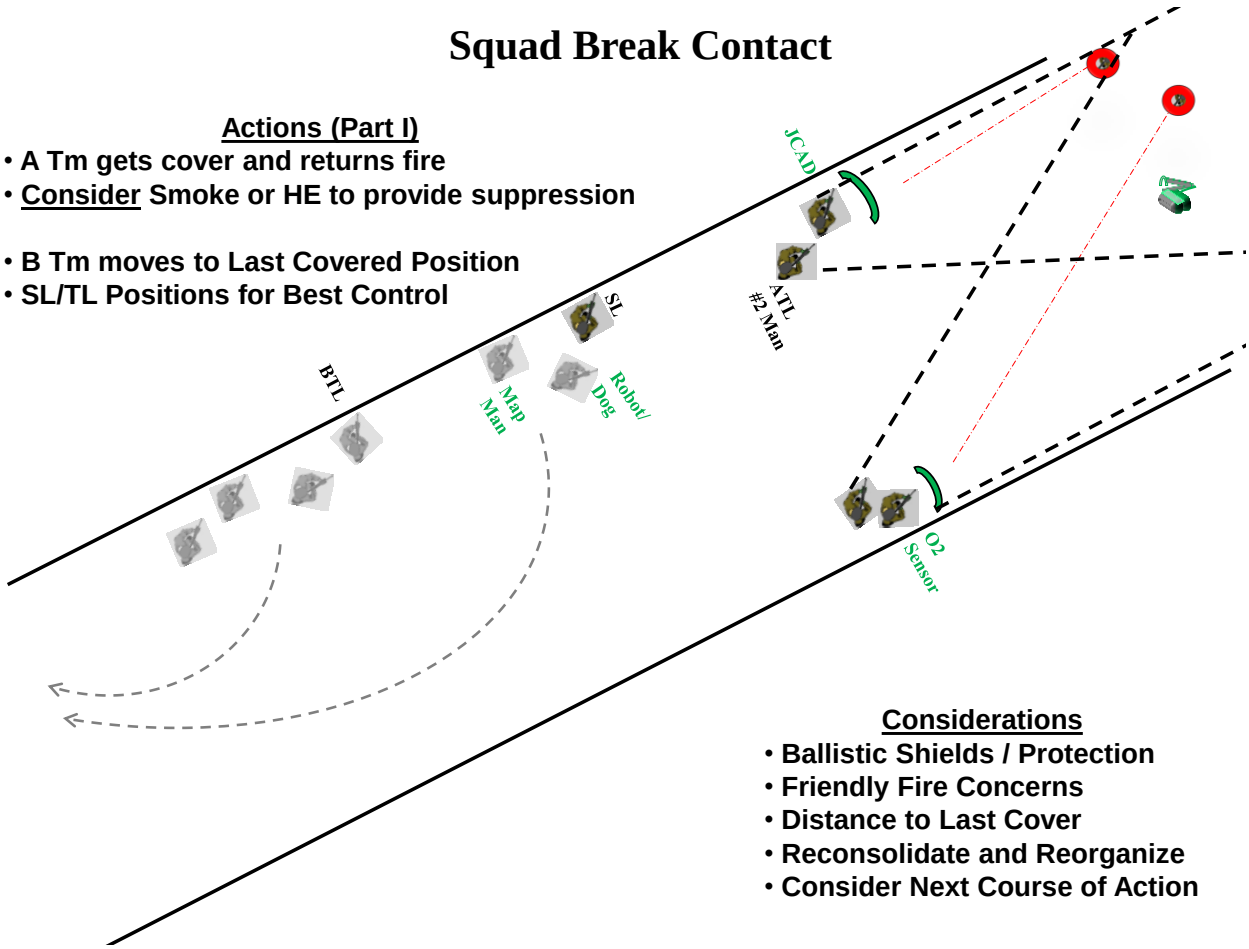

Figure 8 Squad Break Contact (part I)

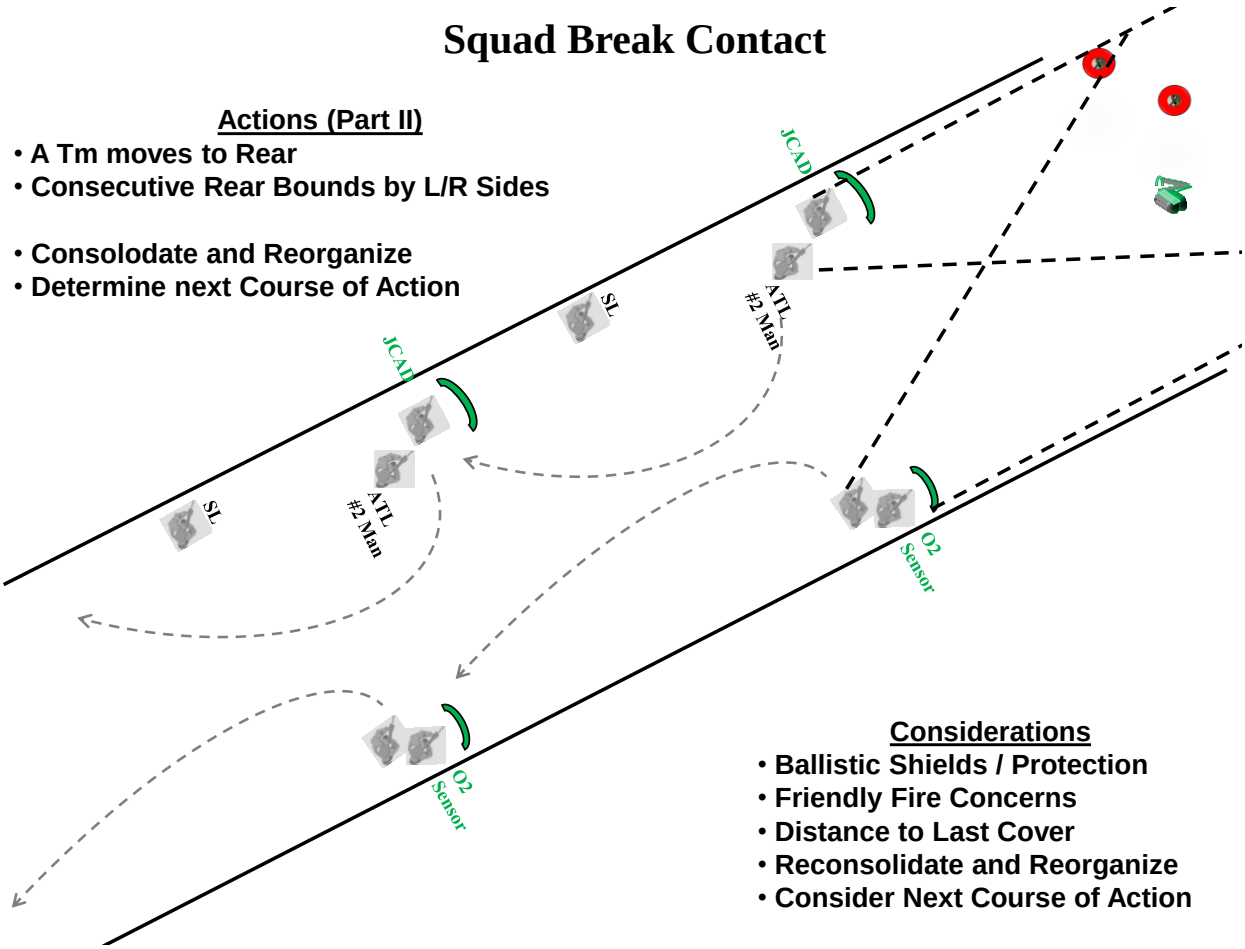

Figure 9 Squad Break Contact (part II)

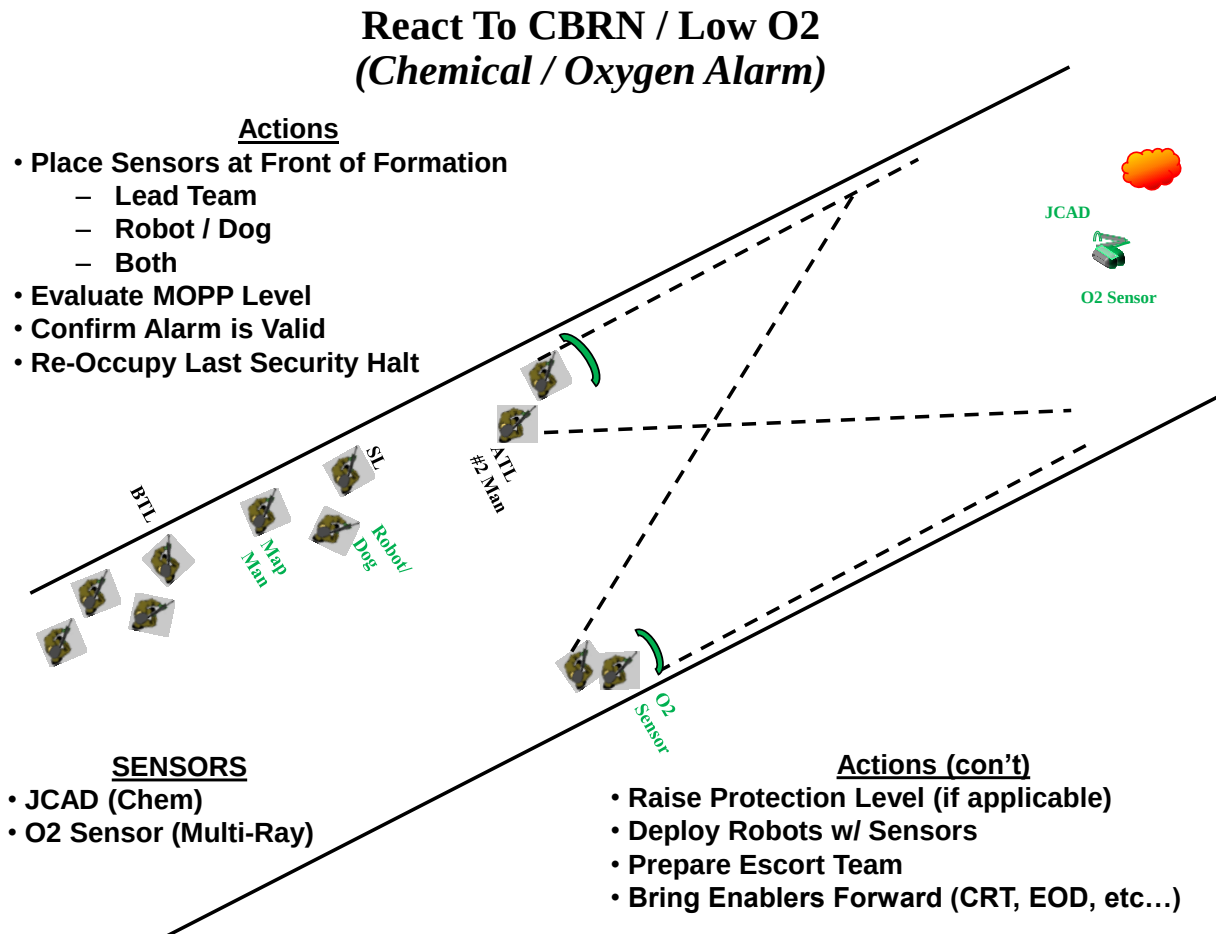

Figure 10 React to CBRN or low oxygen levels

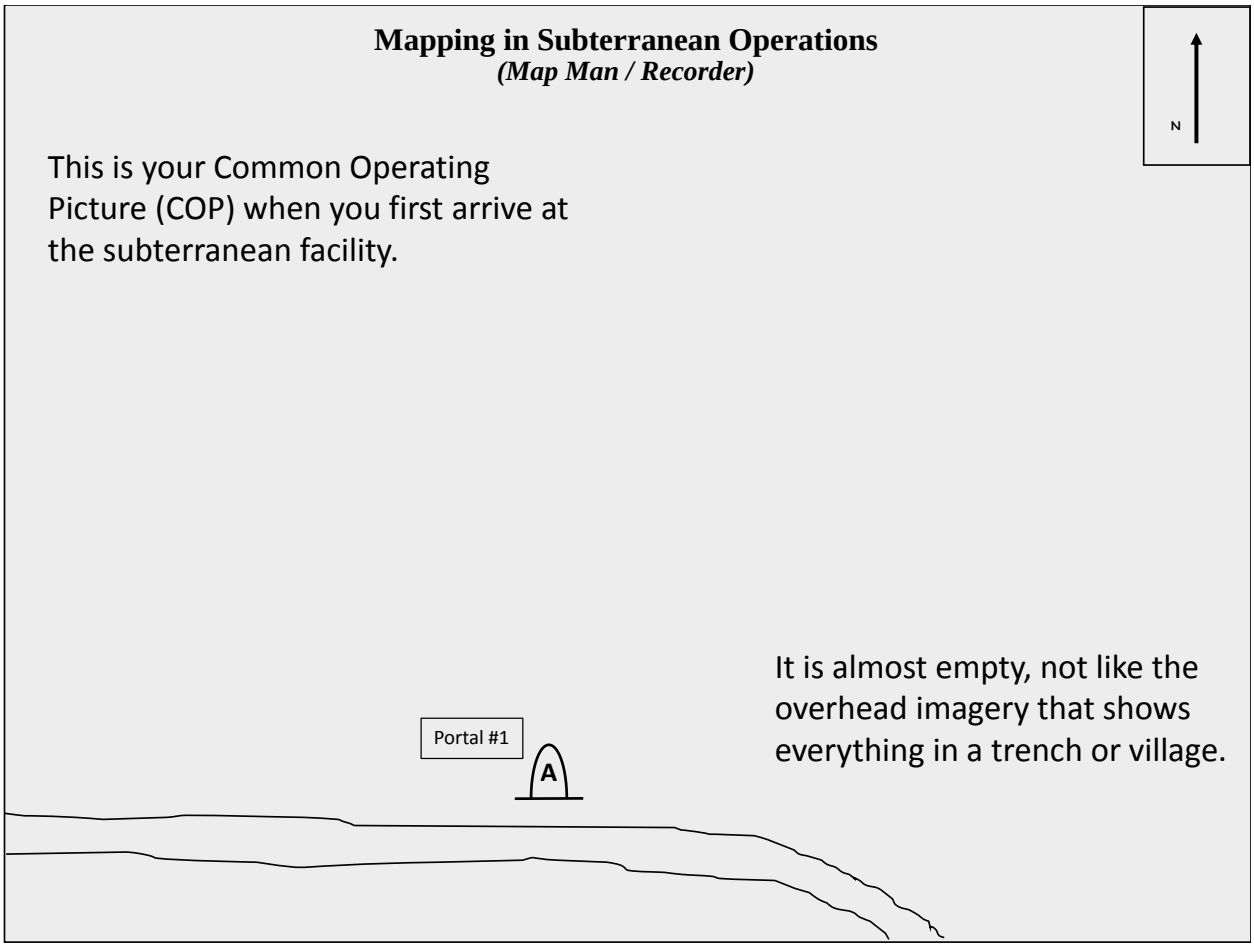

Figure 11 Mapping in SbT Operations (1 of 4)

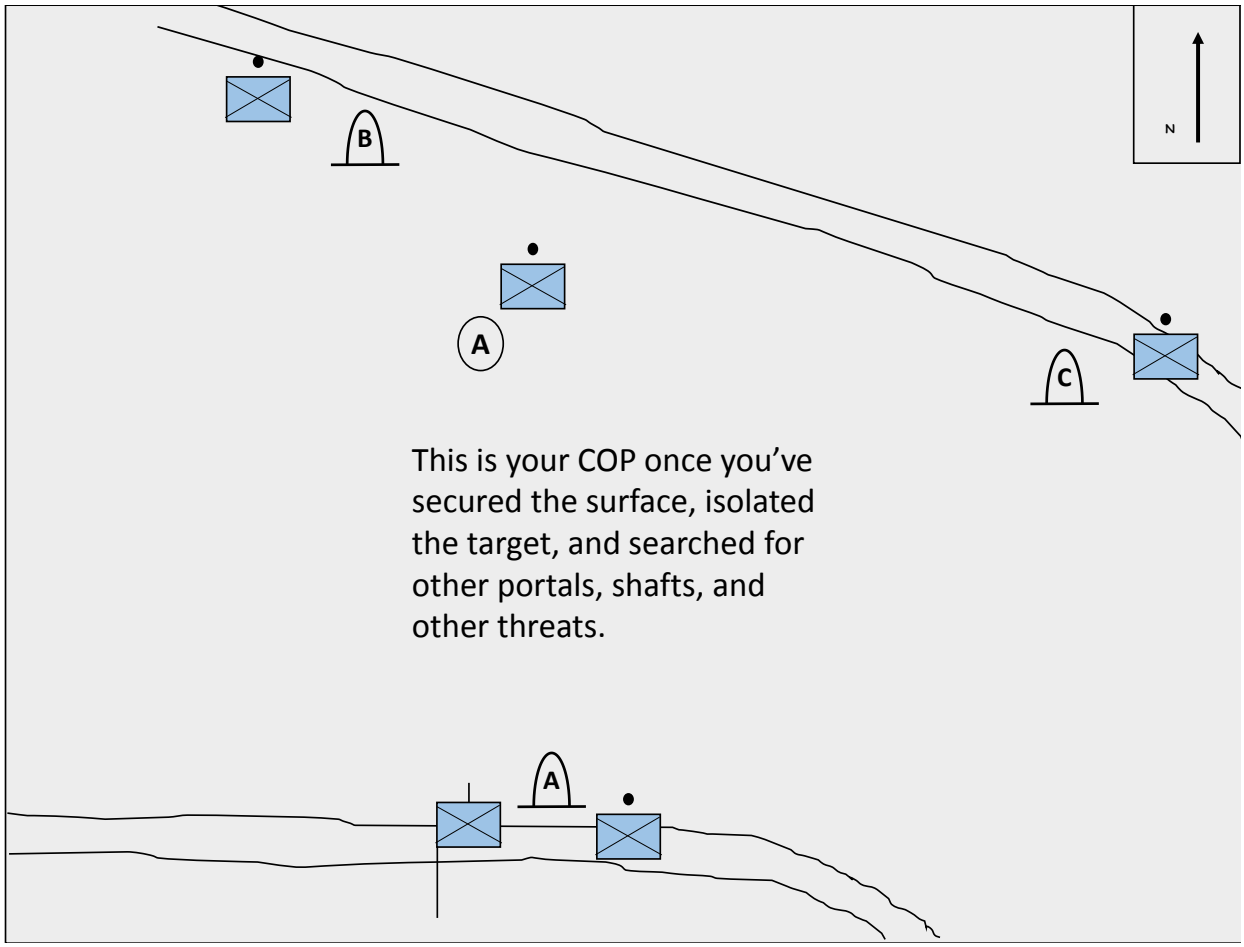

Figure 12 Mapping in SbT Operations (2 of 4)

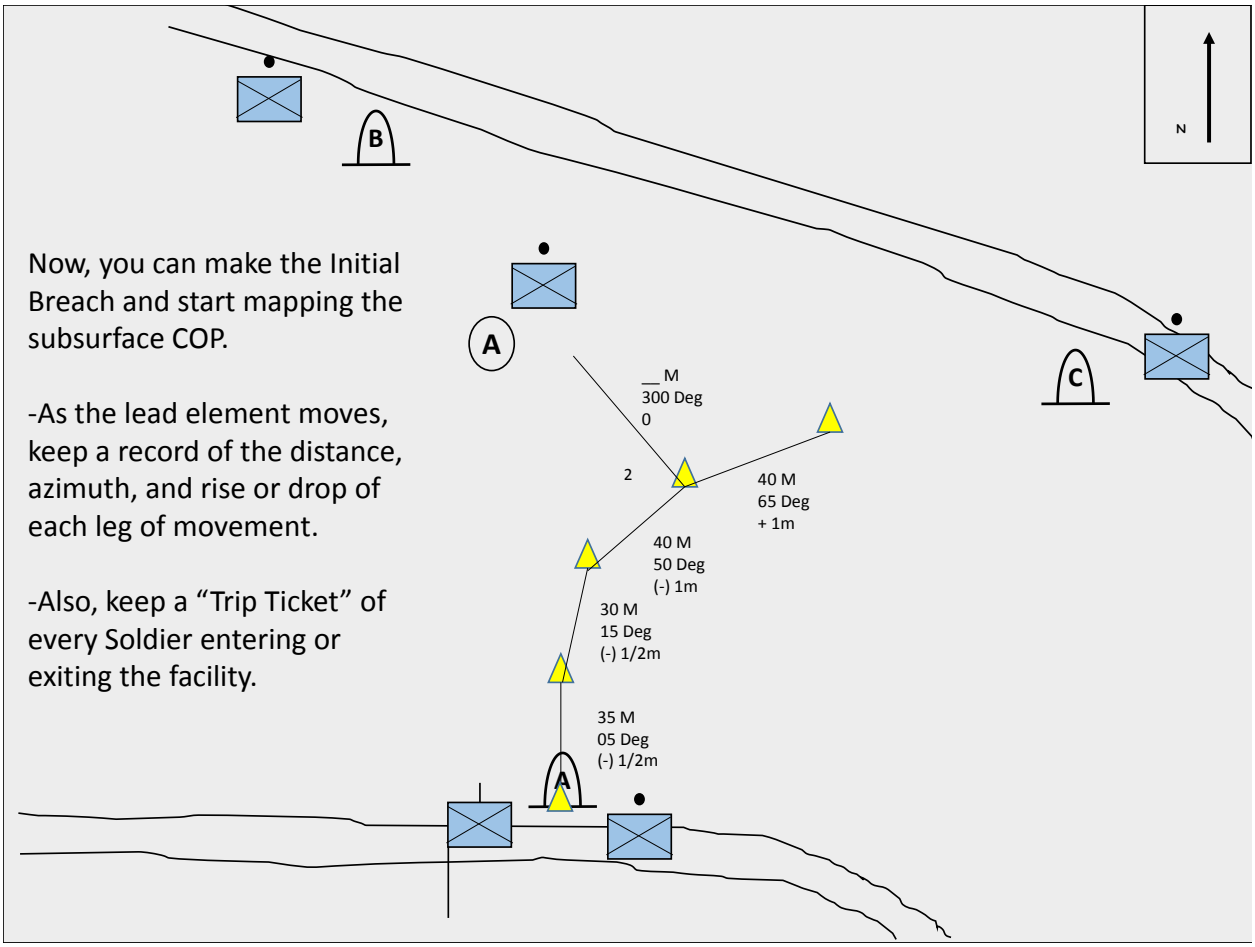

Figure 13 Mapping in SbT Operations (3 of 4)

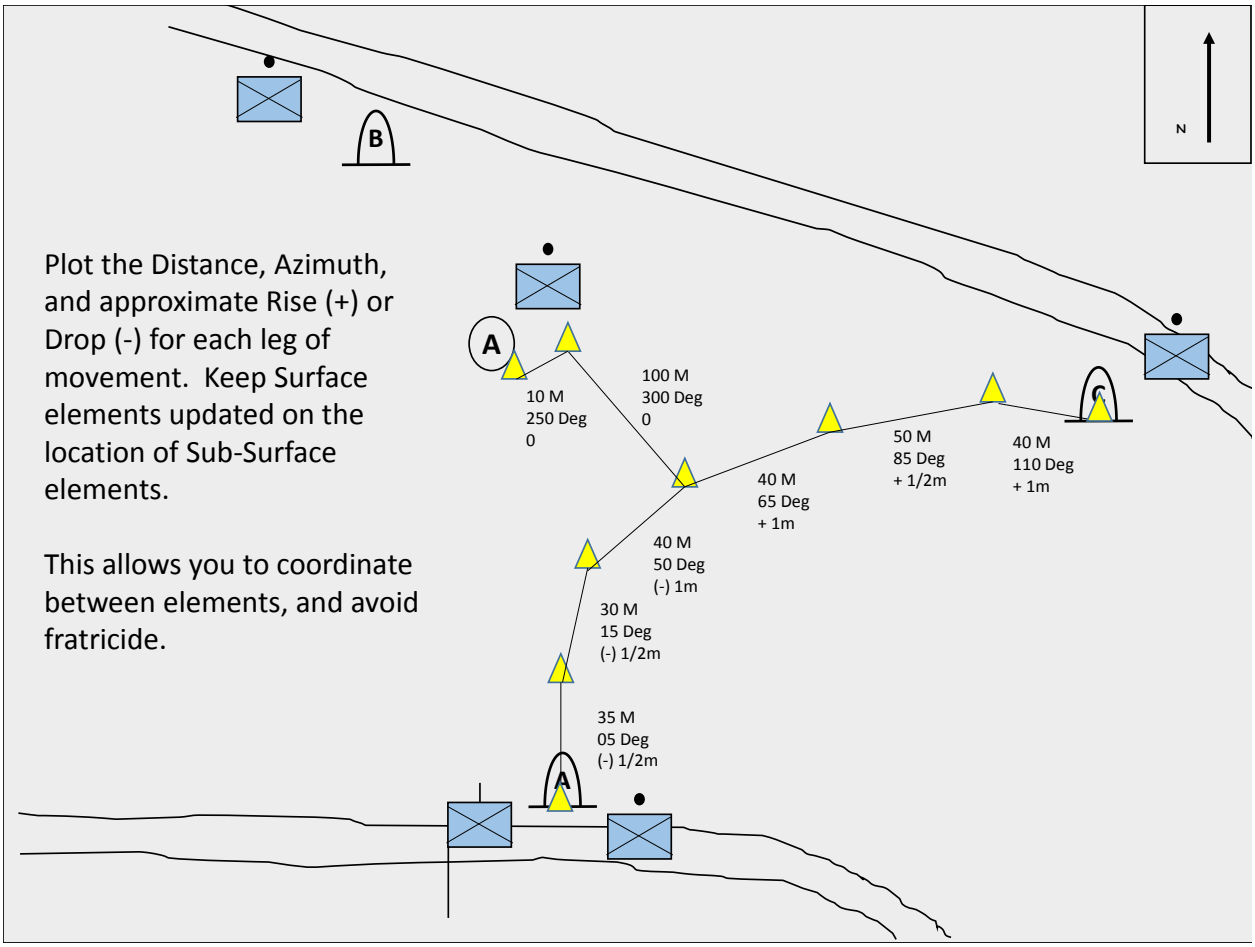

Figure 14 Mapping in SbT Operations (4 of 4)

CHAPTER 4

HAZARDS, TREATMENT, AND RESCUE

Whether entering a subterranean system in a permissive or non-permissive environment, there are hazards present underground that can expose personnel to risks that are immediately dangerous to life and health. Special considerations are required prior to conducting subterranean operations. When conducting risk assessments prior to training, appropriate contingencies must be developed to mitigate the hazards to Soldiers' safety and health.

Structural Considerations

Soil is very heavy. A cubic foot of soil weighs approximately 100 pounds, and a cubic yard can weigh as much as 2,700 pounds. In a collapse, the human body is not strong enough to support these loads. Therefore, before entering a subterranean system, and throughout the operation, personnel should be alert for problems with the structural integrity of the system. This is especially true in combat situations where explosions or fire may have undermined the support structure. Indicators of structural problems may include:

- Newly formed cracks in the soil near openings
- Loose rocks or dislodged construction materials overhead
- Damaged, cracked, and dislodged shoring
- Indications of fire damage to the support structure
- Moisture lines indicating a break in the soil

When a structural hazard is identified, the hazard should be communicated to everyone on the team. Mark and avoid the hazard if possible, or remove it. When shoring is required, it should be done by a trained structural specialist who will know how to transmit or redirect collapse loads to stable ground or structurally stable elements of the system by using proper engineering techniques and shoring materials.

Water

Water can be especially dangerous in an underground facility. Water traps are frequently built to restrict access to other parts of a tunnel and reduce the effect of gases and explosives. By attempting to traverse a water trap drowning becomes a serious concern. There may not be enough room within the water trap for any kind of SCUBA system to be used. Escaping air bubbles will also alert any enemy forces on the other side of a Soldier's presence within the water trap. In this case a Soldier will have to hold his/her breath while traversing a water trap and then rapidly exit while potentially facing adversaries. Another challenge is that while being submerged a Soldier's weapon may become filled with water and therefore not work properly immediately after surfacing on the other side of the water trap. It is also possible to electrify a water trap resulting in electrocution upon entering the water. Soldiers should consider checking water traps with volt meters prior to entering if electrification is suspected.

Air Quality

The air we breathe is a mixture of different gases. The composition of dry air at sea level is nitrogen (78.08%), oxygen (20.95%), argon (0.93%), carbon dioxide (0.03%), and other gases (0.01%). Air composition inside subterranean systems can be such that it is dangerous. The reasons for this danger include:

- Lack of ventilation
- Air can pick up other gases as it passes through a cave
- Settling of dangerous gases in low areas
- Decomposition of organic matter creating methane
- Particulate matter, such as dust or ash

Bad air in subterranean environments can at a minimum physically stress personnel and reduce stamina and effectiveness. Soldiers must be alert to symptoms that may indicate lack of oxygen or the presence of carbon dioxide.

> ***Note: Protective masks without a SCBA provide no protection against the absence of oxygen.***

Having breathing apparatus equipment available is the primary protection element against the absence of oxygen, in the presence of hazardous gases, or in the event of a cave-in. In the event oxygen levels drop below the level necessary to sustain life, or a meter detects the presence of gas, a SCBA must be donned. The term “self-contained” means that the breathing set is not dependent on a remote supply (e.g., through a long hose). SCBAs are used worldwide by the mining industry fire departments, military and law enforcement units that are required to enter and work in tunnels. However, SCBA systems require technical and logistical support that may only exist in specialty units such as CBRN, EOD, and SOF.

SCBAs fall into two different categories: open circuit and closed circuit. A closed-circuit breathing apparatus is a rebreather that uses soda lime to absorb the carbon dioxide of a user’s exhaled air to permit the rebreathing (recycling) of the substantially unused oxygen content of each breath. Fresh oxygen is added via a small cylinder to replenish the amount metabolized by the user. It is used when a longer-duration supply of breathing gas is needed, such as in mine rescue and in long tunnels, and when going through passages too narrow for a big open-circuit air cylinder. The benefit of a close-circuit system is that it is suited for long-term operations in a toxic environment and will provide a longer air source in the event of a cave-in. Open-circuit systems differ from closed-circuit systems in that they use filtered, compressed air rather than pure oxygen. It is what firefighters use and is similar to what scuba divers use. With this type of system, users are limited to the length of time that they can stay in a toxic environment.

Some of the most common bad air conditions are as follows:

- **Smoke**: Smoke inhalation caused by underground fires in subterranean systems can lead to a variety of hazards, including reduced oxygen levels, thermal injury to

upper airways, and chemical injury from inhaling toxic gases suspended in the smoke.

- **Oxygen**: Too much or too little oxygen both can be problems in subterranean environments. Air overly rich with oxygen creates the risk for an explosion. Oxygen deficiency, however, is more common in a subterranean environment. Whenever the atmosphere contains 19.5% oxygen or less, it is considered oxygen deficient (21% is normal). At 17% oxygen levels, personnel may begin panting, and at 15%, personnel will become dizzy and experience headaches. At lower levels, 9% and 6%, personnel will become unconscious and or die.
- **Carbon monoxide**: An odorless, colorless, and tasteless gas, carbon monoxide accumulates in low areas and displaces oxygen. Carbon monoxide is the by-product of fire and will occur naturally in any environment where there is fire. It also is produced by the exhaust from vehicles and generator equipment. It can react with blood to prevent the transfer of oxygen. Symptoms of dangerous levels of carbon monoxide are headaches and dizziness, and high doses can be fatal.
- **Carbon dioxide**: Carbon dioxide gas also is colorless and odorless. It enters caves and displaces oxygen in a variety of ways. It can be absorbed then released by water as it passes through soil with high concentrations of carbon dioxide, it can be generated as a result of breathing by people or animal life in the cave, or it can settle in areas without ventilation because it is heavier than oxygen. The presence of carbon dioxide is dangerous. Even low levels in the atmosphere (less than 1%) will cause lack of focus, loss of energy, weakness, and anxiety. Exposure to high levels (concentrations of 10–15%) for only a few minutes will lead to unconsciousness and suffocation, while higher levels will cause death within 1 minute.
- **Hydrogen sulfide**: Hydrogen sulfide gas is colorless but has the odor of rotten eggs. It reacts with enzymes in the bloodstream to inhibit respiration. High concentrations can shut down a person's lungs. Lower concentrations cause burning of the respiratory tract and the eyes.
- **Methane (natural gas)**: Methane is colorless and odorless and can cause asphyxiation. Methane, which is both flammable and explosive, is produced naturally through the decomposition of organic wastes in low-oxygen environments, such as sewers and tunnel systems.

Adequate ventilation will prevent most gases associated with bad air from reaching dangerous concentrations. Although mechanical means for ventilating subterranean systems may not be available, measures can be taken to reduce or avoid the risk, such as the following:

- Do not block/cover subterranean openings.
- Point vehicle exhausts away from openings.
- If working in a confined space, monitor each other for symptoms of exposure to bad air.
- Extinguish fires.
- Use caution when opening/entering sealed areas.

Gas (or air) monitors are of significant benefit if utilized prior to tunnel entry (e.g., placed on a robot) to detect the presence of poisonous, toxic, or harmful gases. Such monitors are used extensively in the fire, mining, and rescue environments and are simple to both

operate and maintain. Questionable air quality can exist at any time during tunnel operations, so the use of handheld/portable gas detectors is recommended at all times when entering and working within a tunnel. Plans for incorporating air-monitoring equipment into the unit's subterranean warfare SOPs should include procedures for equipment training, maintenance, and calibration.

Unexploded Ordnance

Recovery of unexploded ordnance (UXO) from an underground facility is time consuming. Safety must override unnecessary haste or convenience.

- Upon discovery of a cache, security must be maintained, and render-safe procedures should be conducted by qualified EOD personnel. Underground caches should be exploited using standard site-exploitation procedures. Recovery of munitions will be determined by the onsite commander and EOD personnel.
- When the cache does not contain any exploitable intelligence items, recovery of bulk UXO to the surface may require significant time and effort. Options available are blow in place (BIP) or structural collapse of the cache. If BIP is the method to be used, serious precautions must be taken. Analyze all available information, net explosive weight of the ordnance, location of local nationals, minimum safe distance, risk of sympathetic detonation of undetected UXO, fragmentary hazard from subsurface ground burst, and the potential effect of a blast on the local water supply and water contamination.
- Recovered munitions must be rendered safe and placed in a container for transport to the surface. Team members should move out of the well opening when UXO is being extracted to protect against vertical (drop hazard) impact detonation. Layout and subsequent removal of UXO from the cache should be supervised by EOD personnel. UXO can be removed from the cache with duffle bags, sling nets, sturdy boxes, backpacks, and vehicles. Site-exploitation procedures should be conducted on the surface to verify that all munitions have been removed, have been accounted for, and have exploitable value.

Medical Considerations

Common injuries caused by explosions and collapse that may be encountered in subterranean systems include fractures/lacerations, multiple traumas, closed head injury, hypothermia, and dehydration. In addition to these injuries, there are injuries common to victims of collapsed structure that are uncommon to routine medical emergency situations, as follows:

- **Claustrophobia:** Claustrophobia is the fear of having no escape when in a closed environment. The symptoms of a panic attack commonly last 30 minutes but sometimes can continue for hours
- **Dust impaction injury**: Collapses and explosions can create huge amounts of dust, which can obstruct airways, especially when victims are dehydrated.
- **Compartment syndrome**: In compartment syndrome, swelling inside a fascial compartment in the body compresses nerves and blood vessels, impairing the blood

supply. Without prompt medical treatment, compartment syndrome may lead to nerve damage and muscle death.

- **Crush syndrome**: Crush syndrome occurs when a victim has sustained a prolonged compressive force on a muscle mass. When an injured person is trapped by debris or a heavy weight, their tissue becomes compressed. The resulting lack of blood flow causes cells to die, creating toxins. When the weight is removed, the toxins rush into the bloodstream. If untreated, the toxins can cause cardiac arrhythmia, kidney failure, and death. These toxins are why victims who are trapped by debris may appear to be in stable condition but when freed quickly deteriorate and die.
- **Prolonged untreated trauma**: Common trauma injuries that have had time to progress result in problems that require adaptations because of the circumstances.

Hearing Loss

Blast waves from weapon discharges and explosions can cause tympanic membrane (TM) perforations (eardrum rupture). This risk is increased in the canalized space of subterranean environments. Although earplugs are effective in reducing the risk of TM rupture, the need to hear quietly spoken instruction or enemy movement is critical. Nonlinear hearing protection enables soldiers to hear verbal communications while mitigating the risk of TM perforation from blast waves.

More sophisticated units enable radio communications while still providing hearing protection and allowing ambient listening. Some of these systems enable amplification of low-level sounds, such as voice communication, to provide better hearing than an exposed ear, while still protecting the eardrums from perforation.

Rescue Operations

Conducting rescue operations in subterranean environments presents challenges sometimes different from those of rescue operations above ground. Although the medical approach to patient treatment remains the same, the operational environment can present circumstances that may be unfamiliar to rescue personnel. These challenges include difficult evacuation routes, administering first aid in confined spaces, and structural and material hazards.

Medical care problems: In addition to the medical conditions described previously, medical problems confronting personnel attempting to treat soldiers in subterranean environments include:

- Inherent delays in reaching injured personnel, especially when trapped
- Progression in trauma and medical problems beyond normal caused by delays in evacuation
- Inability to quickly evacuate patients because of their location or because they may be trapped

Medical objectives: The objectives of medical care in a subterranean environment are as follows.

- Increased survivability by prompt stabilization
- Expedited extraction by providing:
    - Stabilization of vital signs, allowing more time for extraction
    - Immobilization of fractures
    - Pain control
    - Patient cooperation through reassurance
    - Knowledge of specialized extrication techniques
- Communication with treatment specialists on anatomic and physiological issues
- Efficient preparation of injured personnel for handover

Vertical evacuations: SKED® litters are common equipment in most units and, with some exceptions, have great capabilities. The SKED® litter is effective for packaging a patient for vertical evacuation. In subterranean operations, the vertical evacuation may be from a cliff face in front of a cave or a vertical shaft into a tunnel complex. Because the SKED® litter does not provide cervical-spine immobilization, a backboard should be used with the litter for vertical evacuations. Patients should be "packaged" with supervision from medical personnel, when possible, and protected from further injury from the environment by leaving safety equipment (helmet, eye protection, etc.) in place when applicable.
Each SKED® Basic Rescue System typically comes complete with the following equipment:

- **SKED® stretcher:** This stretcher is fabricated from a special plastic formula that is both flexible and durable. Securing straps with steel buckles sewn into the stretcher through brass grommets contribute to its strength and durability.
- **Cordura backpack/towing harness:** This durable backpack includes shoulder straps and pockets for storing the SKED® accessories when not in use.
- **Horizontal lift slings:** A pair of 9,000-pound tensile strength slings are provided for hoisting the SKED® stretcher with a helicopter or other haul system in a horizontal position.
- **Vertical lift sling:** For vertical lifting of the SKED® stretcher, 30 feet of 3/8" PMI kernmantle rescue rope, with minimum break strength of 5,265 pounds, is included with a figure-eight knot in the middle.
- **Steel locking "D" carabiner:** A large steel locking "D" carabiner is included with the system for attaching the stretcher to a hoisting system. The carabiners rating is 9,000 pounds minimum break strength.
- **Tow strap:** This 6-foot strap with bronze snap hooks on each end attaches the SKED® stretcher to the backpack, creating a useful towing harness that can be used in several configurations for towing the SKED® stretcher by one or more people.
- **Removable webbing handles:** In addition to the four handles sewn permanently into the SKED® stretcher, there are four additional removable handles to allow carrying by up to eight rescuers.

APPENDIX A

REFERENCES

Asymmetric Warfare Group, *Adaptive Soldier Leader Training and Education (ASLTE) Plan of Instruction (POI)* (DRAFT, June 2013), Asymmetric Warfare Group (Fort Meade, MD), June 2013

Asymmetric Warfare Group, *Mountain Warfare Handbook*, Asymmetric Warfare Group (Fort Meade, MD), November 2008.

Asymmetric Warfare Group, *Outcome-Based Training and Education (OBTE) Integration Workshop—Summary*, Asymmetric Warfare Group (Fort Meade, MD), July 2009.

Asymmetric Warfare Group, *Tactical Pocket Reference: Sniper Awareness and Counter-Sniper Tips*, Asymmetric Warfare Group (Fort Meade, MD), May 2008.

Asymmetric Warfare Group, *Tactical Pocket Reference: Tactical Site Exploitation*, Asymmetric Warfare Group (Fort Meade, MD), October 2008.

Bahmanyar, M., *Afghanistan Cave Complexes 1979-2004: Mountain Strongholds of the Mujahideen, Taliban and Al Qaeda*, Osprey Publishing (Oxford, UK), 2004.

Carter, J., "The World Fights Back," *The People*, 30 September 2001.

Center for Army Lessons Learned, Handbook No. 10-20, *Company Intelligence Support Team, Tactics, Techniques and Procedures,* CALL (Fort Leavenworth, KS), January 2010.

Center for Army Lessons Learned, Handbook No. 08-11, *Coin Patrolling*, CALL (Fort Leavenworth, KS), April 2008.

Center for Army Lessons Learned Handbook No. 12-13, *Soldiers' Guide to Mountain Warfare: Observations, Insights, and Lessons,* CALL (Fort Leavenworth, KS), May 2012.

Crossland, R., "Morlocks: Adversaries Go Underground," United States Naval Institute, *Proceedings Magazine*, **131**(4), pp. 40–42, 1 April 2005.

Department of Homeland Security, Office of Inspector General, "CBP's Strategy to Address Illicit Cross Border Tunnels," Report OIG-12-132, September 2012.

Federal Emergency Management Agency (FEMA), *Urban Search and Rescue Response System, Task Force Medical Team Training Manual*, FEMA (Washington, DC), April 2007.

Filkins, D., "G.I.'s Search Afghan Caves, Finding Trove of Material," *New York Times*, 7 April 2002.

Gall, C., "British Report a Taliban-Qaeda Arms Cache," *New York Times*, 10 May 2002.

Gourley, S., "JIEDDO Explores New Robotic Tools," *Army Magazine*, August 2012.

Grau, L. W., and Jalali, A. A., "Underground Combat: Stereophonic Blasting, Tunnel Rats and the Soviet Afghan War," *Engineer*, **28**(4), pp. 20–23, November 1998, www.globalsecurity.org/military/library/ report/1998/981100-underground.htm.

Gusinov, T., "Kyareses: Taliban's Death Trap or Escape Route?" *Military Intelligence*, **28**(2), pp. 46–49, 2002.

Headquarters, United States Military Assistance Command, Vietnam, "Subject: Lessons Learned Number 52-Operational Employment of the Mity-Mite Portable Blower," Serial #5373, 22 November 1965.

Higuchi, T., and Barnes, G., "Bamiyan: Buddhist Cave Temples in Afghanistan," *World Archaeology,* **27**(2), pp. 282–302, 1995.

Hoogstraal, H., and Keirans, J. E., "The Ornithodoros Capensis Group of the Palearctic and Oriental Regions," *The Journal of Parasitology*, **65**(3), pp. 395–407, June 1979.

Jalali, A., "Cave Warfare Demands Patience," *New York Times*, 2001.
Jentsch, C., "Karezes in Afghanistan," *Erdkinde*, **24**(2), pp. 112–120, 1970.
Jones, T., "Insight into Osama bin Laden's Hideout," *Australian Broadcast Corporation* broadcast, 19 November 2001, transcript available at: http://www.abc.net.au/lateline/content/2001/s420638.htm.
Judson, J., "Rapid Equipping Force Assessing Robots in Afghanistan's Tunnels, *InsideDefense.com*, 7 September 2012.
Kelso, P., "Ancient Water Trenches Give Taliban Ideal Defenses," *The Guardian*, 21 November 2001.
Lumpkin, J., "Looking for Terrorists' Afghan Caves: U.S. Steps up Efforts to Target Underground Complexes," *The Associated Press*, 1 November 2001.
MacGarrigle, G. L., *Taking the Offensive, October 1966–October 1967, The U.S. Army in Viet Nam*, Center of Military History, U.S. Army (Washington, DC), 1998.
Mangold, T., and Penycate, J., *The Tunnels of Cu Chi*, Random House (New York, NY), 1985.
Martin, L., "Warrens Where Death Greets the Unwary," *The Herald*, 12 October 2001.
McWethy, J., "Soldiers Undercover: Inside the Tora Bora Caves with US Special Forces; They are America's Least Visible Soldiers- and the Most Unconventional," *ABC News*, 9 January 2002.
Rottman, G., *Viet Cong and NVA Tunnels and Fortifications of the Viet Nam*, Osprey Publishing (New York, NY), 2006.
U.S. Army Doctrine and Training Publication No. 2-19.63, *Company Intelligence Support Team*, Headquarters, Department of the Army (Washington, DC), November 2010.
U.S. Army Field Manual 3-06.11 (FM 3-06.11), *Combined Arms Operations in Urban Terrain, Appendix J: Subterranean Operations*, Headquarters, Department of the Army (Washington, DC), 28 February 2002.
U.S. Army Field Manual 3-60 (FM 3-60), *Targeting (Draft), Appendix B: F3EAD*, Headquarters, Department of the Army (Washington, DC), 2009.
U.S. Army Field Manual 3-97.6 (FM 3-97.6), *Mountain Operations*, Headquarters, Department of the Army (Washington, DC), 28 November 2000.
U.S. Army Field Manual 3-97.61 (FM 3-97.61), *Military Mountaineering*, Headquarters, Department of the Army (Washington, DC), 26 August 2002.
U.S. Army Field Manual 90-8 (FM 90-8), *Counterguerrilla Operations, Appendix A: Subsurface Operations,* Headquarters, Department of the Army (Washington, DC), 29 August 1986.
U.S. Army Graphic Training Aid No. 90-01-22, *Company Intelligence Support Team (CoIST)*, Headquarters, Department of the Army (Washington, DC), December 2010.
War Department, The Adjutant General's Office, "Report on the Perception of Subterranean Sounds and the Plotting of Subterranean Work by Sound," Document No. 646, Government Printing Office (Washington, DC), 1917.
Wiseman, P., "Afghan Caves Thwart Invaders," *USA Today*, 6 November 2001.
http://www.foxnews.com/world/2013/08/05/syria-rebel-moles-wage-battle-from-underground-tunnels/

Note: Please visit the AWG portal through the Army Knowledge Online (AKO) portal to review all AWG products and to subscribe to the AWG New Product Subscription Service. The system will send you an e-mail to notify you when a new unclassified AWG product is available on the AWG portal.

NIPR Public Site: http://www.awg.army.mil/
NIPR External Site (CAC required):
https://army.deps.mil/Army/CMDS/AWG/AWGusers/SitePages/Home.aspx
SIPR External Site (CAC/SIPR Token required): https://portal.awg.army.smil.mil

APPENDIX B

ACRONYMS AND ABBREVIATIONS

AI	Area of Interest
AO	Area of Operations
AKO	Army Knowledge Online
ASLTE	Adaptive Soldier Leader Training and Education
AWG	Asymmetric Warfare Group
BCT	Brigade Combat Team
BIP	Blow in Place
CBRN	Chemical, Biological, Radiological, and Nuclear
CCP	Casualty Collection Point
CIB	Controlled Image Base
CoIST	Company Intelligence Support Team
DEA	Drug Enforcement Agency
DMZ	Demilitarized Zone
EOD	Explosive Ordnance Disposal
F3EAD	Find, Fix, Finish, Exploit, Analyze, and Disseminate
FM	Field Manual
FO	Focused Operations
GPR	Ground-Penetrating Radar
GPS	Global Positioning System
HVI	High-Value Individual
ICE	Immigration and Customs Enforcement
ID	Infantry Division
IPOE	Intelligence Preparation of the Operational Environment
IR	Infrared
ISR	Intelligence, Surveillance, and Reconnaissance
METT-TC	Mission, Enemy, Terrain and weather, Troops available, Time available, and Civilian considerations
MOUT	Military Operations in Urban Terrain
MWD	Military Working Dog
NBC	Nuclear and Biochemical
NK	North Korea
NSN	National Stock Number
NVG	Night-Vision Goggles
OBTE	Outcome-Based Training and Education
PAVN	People's Army of Vietnam
SALT-E	Size Activity Location Time and Equipment
SbT	Subterranean
SbTO	Subterranean Operations
SCBA	Self-Contained Breathing Apparatus
SLLS	Stop, Look, Listen, Smell
SOP	Standard Operating Procedure
TCO	Tactical Call-Out
TIP	Target Intelligence Packet
TM	Tympanic Membrane

TQ	Tactical Questioning
TSE	Tactical Site Exploitation
TST	Time-Sensitive Targeting
TTP	Tactic, Technique, and Procedure
UXO	Unexploded Ordnance

APPENDIX C

OTHER CATEGORIES OF SUBTERRANEAN SYSTEMS

There are many different types of underground facilities. They differ widely in how they are built, shape, size, depth, and purpose. There are several different ways to characterize subterranean facilities. They can be classified in terms of whether they are manmade or not, how deep they are, what their purpose is and how they were constructed. The terms used may often overlap and are not consistent between services, agencies and industries. This is why it is important to be familiar with the varying terminology and methods of categorization. What terminology you use to describe an underground facility may depend on what organization you are communicating with and the language they use to describe them.

Other ways to categorize underground facilities involves looking at how they were made, depth of facility, and what it is used for.

Manmade vs Natural: Many subterranean facilities are natural - such as caves and caverns. These can be adapted for human use or military purposes. Caves have been used for centuries for protection from the elements or hiding from an adversary. The Japanese used caves in WWII as hiding places for both civilians and military personnel. Operation Enduring Freedom saw both Taliban and Al Qaeda fighters using the vast cave network between Afghanistan and Pakistan to hide from friendly forces.

Manmade facilities are constructed by hand or machine and have a specific purpose in mind. Their design is deliberate (depth, layout, size of rooms, location, levels of protection are all carefully planned and executed). These can be constructed for subways and sewers, to facilitate road and rail traffic. They can also be used for military purposes.

How is it constructed? Underground facilities can also be characterized by how they were built.

Hand-Dug: Tunnel systems such as those used in Viet-Nam can be dug by hand with small tools over a period of weeks, months, or years. These systems are fairly shallow and range from short point to point tunnels to large multi-level complexes. Construction of these types of facilities are often easier to conceal from reconnaissance assets because of the lack of sophisticated equipment needed and the small amounts of earth displaced at any one time.

Cut-and-Cover: Many underground facilities are built by digging earth out of the ground, building the structure, and then covering them back over with original earth. They often have down ramps providing access from the surface to the facility and may have thick reinforced concrete walls and ceiling. Construction of cut-and-cover facilities is often in urban environments and may be indicated by the presence of large earth moving equipment like bulldozers, front-end loaders, excavators and dump trucks. The construction site will look like any other large construction project.

Tunneled: Deeper facilities located underground or within mountains are often excavated using drill jumbos, road-headers, and tunnel boring machines. For tunneled facilities the earth may be deposited outside the facility or shipped away to prevent an assessment of spoil volume. Concrete mixing plants and explosive storage will be located near the facility.

How deep is it? Depth is another way to categorize underground facilities. The 21 October 2011 Lexicon of Hardened Structure Definitions and Terms defines “shallow” as 20 meters or less space between the top of the functional area and the surface of the ground and “deep” is defined as greater than 20 meters. Examples of shallow facilities include cut and cover facilities, basement bunkers, and smuggling or escape tunnels. Examples of deeper facilities include mines, subway systems in some countries and most new military purposed facilities.

What is it used for? Underground facilities are used for the protection and concealment of valued personnel, equipment, functions, materials and capabilities. Just what these valued assets are can determine whether such use can be further characterized as state or non-state, tactical or strategic.

State uses: State uses of underground facilities include protection and concealment for command and control, weapons, including WMD and ballistic missiles and resources such as fuel or other assets.

Non-state uses: Non-state uses for underground facilities include legitimate businesses for climate controlled storage, tourism and mining. But there may be illegal non-state use of underground facilities such as smuggling. Violent extremist organizations may use underground facilities as protection from observation and attack.

Strategic uses: Strategic uses for underground facilities include tunnel complexes that support theater and national military objectives including command and control, weapons of mass destruction storage, and storage or concealment of other national, strategic or military assets.

Tactical uses: Subterranean facilities for tactical purposes may include caves, shallow tunnel systems, bunkers, or other underground structures that support battlefield operations such as concealment and movement of personnel, weapons storage and transport, command and control, and medical treatment.

APPENDIX D

DELIBERATE RISK ASSESSMENT WORKSHEET

1. MISSION/TASK DESCRIPTION Underground Training Facility Exercise		**2. DATE** *(DD/MM/YYYY)*
3. PREPARED BY		
a. Name *(Last, First, Middle Initial)*	b. Rank/Grade	c. Duty Title/Position
d. Unit	e. Work Email	f. Telephone *(DSN/Commercial (Include Area Code))*
g. UIC/CIN *(as required)*	h. Training Support/Lesson Plan or OPORD *(as required)*	i. Signature of Preparer

Five steps of Risk Management: (1) Identify the hazards (2) Assess the hazards (3) Develop controls & make decisions (4) Implement controls (5) Supervise and evaluate *(Step numbers not equal to numbered items on form)*

4.SUBTASK/SUBSTEP OF MISSION/TASK	**5. HAZARD**	**6. INITIAL RISK LEVEL**	**7. CONTROL**	**8. HOW TO IMPLEMENT / WHO WILL IMPLEMENT**	**9. RESIDUAL RISK LEVEL**
Underground Operations Personnel accountability	Lost or unaccounted personnel	M	- Use of tunnel entrance guards to control access to site - Positive head count of all personnel entering and exiting	**How:** Count all Soldiers In and Out **Who:** Tunnel Guard, PSG, OIC, Safety	L
			- 2 personnel required to perform headcount - Tunnel sweep after each iteration by 2 safety personnel	**How:** Briefings, SOPs, headcount **Who:** Tunnel Guard, PSG, OIC, Safety	

Additional entries for items 5 through 9 are provided on page 2.

EXTREMELY HIGH	**HIGH**	**MEDIUM**	X **LOW**

11. OVERALL SUPERVISION PLAN AND RECOMMENDED COURSE OF ACTION

12. APPROVAL OR DISAPPROVAL OF MISSION OR TASK **APPROVE** **DISAPPROVE**

a. Name *(Last, First, Middle Initial)*	b. Rank/Grade	c. Duty Title/Position	d. Signature of Approval Authority

e. Additional Guidance:

DD FORM 2977, JAN 2014 Page _1 of __4__ Pages

DELIBERATE RISK ASSESSMENT WORKSHEET					
4.SUBTASK/ SUBSTEP OF MISSION/TASK	**5. HAZARD**	**6. INITIAL RISK LEVEL**	**7. CONTROL**	**8. HOW TO IMPLEMENT/ WHO WILL IMPLEMENT**	**9. RESIDUAL RISK LEVEL**
			- Escorts for all VIPs / visitors - Exercise battle buddy system	**How:** OPORD, SOP, PCC/PCI **Who:** Designated escort personnel	L
Personnel movement	Slips/Trips/Falls, Obstacles	M	- Brief obstacles commonly associated with SbT structures - Modify movement formations to fit environment	**How:** Briefings, Rehearsals, PCC/PCI **Who:** OCs, Safety personnel	L
	Electrical Hazards / Electrocution	M	- Sub-panels marked for easy identification - Isolation, bonding to earth and testing to ensure electrical safety	**How:** Briefings, SOP, PCI, Spot Checks **Who:** RSO/OIC, all leaders	L
	Head Injuries due to concrete spalling/ structural failure/ sudden collapse, trips or falls	M	- Use PPE - Tiered med support, FLA on site - Dedicate CASEVAC force - Establish emergency signals - Rehearse Evacuation plan (in tunnel and ground evacuation route) - Installed land lines (mine phones)	**How:** Briefings, SOP, Rehearsals, OPORD **Who:** Safety Officer, RSO, Leaders	L
	Heat / Cold injuries	M	- Briefings on signs and symptoms, and potential for increased risk while wearing MOPP 4; SCBA.	**How:** Medical briefings, SOP, OPORD **Who:** RSO, all leaders	L
	Limited Visibility	M	- Personnel marking SOP - Use of NVG/NVD / Thermals / IR flashlight - Deliberate movement	**How:** SOP, OPORD, PCC/PCI **Who:** OIC/RSO, Leaders	L
		M	- Do not disturb any containers - Mark all areas with containers - Limit personnel exposure time - Leave for qualified personnel	**How:** Briefings, Rehearsals, OPORD, SOP **Who:** OIC/RSO, Leaders	L

	Radioactive material (cont)		- Implement detection devices into formation - Report findings - Request and use Technical forces		
	Overpressure, Fire, Explosives	M	- Use pyrotechnics, ammo, and explosives underground only when required by the mission.	**How:** Briefings, PCC/PCI **Who:** RSO, Leaders	L
	High Noise Level	M	- Use layered hearing protection - Limit personnel exposure - Maintain awareness	**How:** PCC/PCI, OPORD **Who:** Safety Personnel, Leaders	L
	Air Quality	M	- Minimum of 1 trained air monitor with operational monitor device attached to each group. - Rehearse Low Oxygen SOP - Activate vent blowers 30 min prior to use of facility	**How:** PCC/PCI, OPORD **Who:** RSO, Leaders	L
	Emergency Evacuation	M	- Evacuate on command of OIC, RSO, Safety personnel, or Competent person IAW SOP. -Activate lighting to aid in evac -Rehearse emergency evacuation - Establish above ground rally point - Maintain positive head-count - Maintain communications - Establish primary and alternate evacuation routes - Establish evacuation teams IAW task organization	**How:** Briefings, SOP, Rehearsals, PCC/PCI **Who:** OIC, RSO, Safety Officer, Leaders	L
	Psychological	M	- Identify Soldiers who are claustrophobic prior to mission - Medical personnel on site	**How:** Confined Space trainer **Who:** Leaders	L

Vehicle operation underground	Driver limited visibility	M	- Constant communication between mounted and dismounted elements. - Slow deliberate movement - White light, NODs w/IR light	**How:** Driver Training, Briefings, SOP **Who:** OIC, PSG, Squad Leaders	L
	Vehicle exhaust	M	- Constant monitoring of air quality	**How:** Safety Personnel **Who:** Safety Officer, Air Monitor Person	L
Finding of UXO/IED	Inadvertent explosion	M	- Request enablers support - Establish stand off - Mark device - Report according to SOP or 9 line - Evacuate as necessary - Use of PPE	**How:** SOP, OPORD, Rehearsals **Who:** Leaders	L

DELIBERATE RISK ASSESSMENT WORKSHEET

Risk Assessment Matrix		**Probability** *(expected frequency)*				
		Frequent: Continuous, regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent occurrences	**Unlikely:** Possible occurrences but improbable
Severity *(expected consequence)*		**A**	**B**	**C**	**D**	**E**
Catastrophic: *Death, unacceptable loss or damage, mission failure, or unit readiness eliminated*	**I**	**EH**	**EH**	**H**	**H**	**M**
Critical: *Severe injury, illness, loss, or damage; significantly degraded unit readiness or mission capability*	**II**	**EH**	**H**	**H**	**M**	**L**
Moderate: *Minor injury ,illness, loss, or damage; somewhat degraded unit readiness or mission capability*	**III**	**H**	**M**	**M**	**L**	**L**
Negligible: *Minimal injury, loss, or damage; little or no impact to unit readiness or mission capability*	**IV**	**M**	**L**	**L**	**L**	**L**

Legend*:* **EH** – extremely high risk **H** – high risk **M** – medium risk **L** – low risk

13. RISK ASSESSMENT REVIEW

a. Date	b. Last Name	c. Rank/Grade	d. Duty Title/Position	e. Signature of Reviewer

14. FEEDBACK AND LESSONS LEARNED

15. ADDITIONAL COMMENTS OR REMARKS

DD FORM 2977, JAN 2014 Page ____ of ____ Pages

APPENDIX E:

EXAMPLE OPORD FOR SbT MISSION

SUSPENSE: UPON RECEIPT **Copy _____ of _____ Copies**

EXPIRATION:
UNIT
Location, XXX
DTG

FRAGO 1 to OPORD XXXX-XX

References:
a. 1:25,000 MAP SHEET
b. OPORD XXXX-XX5 OPN (INSERT OPERATION NAME)

Task Organization:

Co HQ (+)	2nd PLT (DO)	1st PLT (SH1(+))	3rd PLT (RESERVE)
CRT 1 (SH2)	FOs	FOs	FOs
SAPPER SQD (SH3)		SAPPER TM	
EOD (SH4)			

1. SITUATION.

a. Area of Interest. **See Exhibit 1 (Area of Operations) of Appendix 2 of ANNEX C.**

b. Area of Operations. See Exhibit 1 (Area of Operations) of Appendix 2 of ANNEX C.

(1) Terrain.

(2) Weather.

c. Enemy Forces.

(1) Enemy Courses of Action (COA).
(a) MLCOA:
(b) MDCOA:

d. Friendly Forces.

(1) Higher Headquarters Mission & Intent.
(a) Higher Headquarters Mission & Intent (Two levels up)
(b) Higher Headquarters Mission & Intent (One level up)
Mission:
Commander's Intent.

(2) Adjacent Units.

e. Attachments and Detachments.

2. MISSION.

3. EXECUTION.

a. Commander's Intent:

(1) **Key Tasks:**
(a) KT 1-
(b) KT 2-
(c) KT 3-
(d) KT 4-

(2) **End State:**

b. Concept of the Operation. This operation will be conducted in four phases.

(1) Phase I (Infiltration)

(2) Phase II (Seizure)

(3) Phase III (Assess)

(4) Phase IV (Security Operations)

See Exhibit 1 (CONOP & Scheme of Maneuver) of Appendix 1 (Design Concept) to Annex C (Operations). Decisive to this operation

(a) **Phase I (Infiltration)** This phase begins upon receipt of OPORD XXXX-XX and ends when the breach element reaches OBJ. Key tasks during this phase include building combat power at AA (MGRS Location), movement into sector, and movement from RP (MGRS Location) to ATTACK POSITION, link up with enablers, movement to the assault position, and establishing a SBF at the initial breach to OBJ.

(b) **Phase II (Seizure)** Begins with the tactical call out of OBJ and ends with the seizure of OBJ. Key tasks during this phase are the breach of the perimeter of OBJ and the UGF, establishment of a foothold on OBJ and containment of UGF, and the clearance of the UGF.

(c) **Phase III (Assess)** Begins when the seizure of OBJ is complete and ends when characterization of OBJ is complete. Key tasks include identification of hazards on OBJ, decontamination of troops as required, establishment of platoon patrol bases and company defense, and reporting results of exploitation to higher HQ.

(d) **Phase IV** (**Security Operations)** – This phase begins once the company defense is set.

(e) **This phase ends**: on order to conduct BHO with follow on forces. Key tasks

during this phase include observing MSRs, and BHO.

(f) **Scheme of Maneuver**: Refer to Exhibit 2 (Co SOM) of Appendix 1 (Design Concept) to ANNEX C (Operations)

(g) **Concept of Fires:** [ADD] Refer to Exhibit 1 (COF) of Appendix 2 to ANNEX D (FIRE SUPPORT)

c. Tasks to Subordinate Units.

(1) 2nd Platoon (DO) (+)
(a) Conduct movement to XXXX
(b) Seize OBJ
(c) Conduct Tactical Site Exploitation
(d) Facilitate assessment of OBJ

(2) 1st Platoon (SH1) (+)
(a) Conduct movement to OBJ
(b) Conduct tactical callout of OBJ and UGF
(c) Breach OBJ perimeter
(d) Secure a foothold on OBJ
(e) Contain UGF on OBJ
(f) Facilitate breach of UGF
(g) Pass DO into UGF on OBJ
(h) Establish chokepoint at entrance of UGF to ensure personnel accountability
(i) Establish ECP at perimeter gate of OBJ

(3) Enabler Pool (CRT/CST/NDT) (SH2)
(a) Link up with DO IVO ATTACK POSITION
(b) Establish external security
(c) Control access to OBJ and UGF

(4) SAPPERs (SH3)
(a) Attach a Sapper Team to SH1 to conduct dismounted route clearance for security elements
(b) Assess UGF entrances
(c) BPT breach UGF in order to allow FOM for DO
(d) BPT conduct breach in subterranean (SbT) environment
(e) Provide 1 x MultiRae to DO

(5) 718th EOD (SH4)
(a) Conduct tactical link up with SH2 at ATTACK POSITION
(b) Provide robot with JCAD and MultiRae to enter UGF to enhance GFC situational awareness
(c) Conduct tactical link up with SH2 at ATTACK POSITION
(d) Provide robot with JCAD and MultiRae to enter UGF to enhance GFC situational awareness
(e) BPT reduce explosive threats, non-WMD-related munitions, and assess potential threats

(6) 3rd Platoon (Reserve)
(a) Conduct movement to ATTACK POSITION.
(b) BPT assume DO
(c) Reserve priorities are: Reinforce troops in contact, facilitate CASEVAC and detainee transfer, and facilitate assessment of OBJ
(d) Transition to QRF role once DO has entered UGF

d. Tasks to Headquarters

(1) XO
(a) Ensure the commodity shops are closed out and secure
(b) Coordinate with the Distribution Platoon for ammunition drop off
(c) Conduct movement with Reserve force

(2) First Sergeant
(a) Refine and publish packing list
(b) Develop CASEVAC plan; establish CCP
(c) Confirm Class I & V distribution to PLTs and HQ
(d) Perform Initial and Final Manifest Calls
(e) Ensure S1 receives final copies of manifests
(f) Conduct movement with SH1
(g) Coordinate control measures for personnel accountability entering UGF

(3) FSO
(a) Prepare Fire Support Overlay, TTLODAC, and TLWS for this operation.
(b) Establish NFAs with radii of 200m around all friendly positions.

(4) CBRN NCOIC
(a) Plan Decontamination Point ICW enablers
(b) Plan Clean and Dirty Routes to Decon Point
(c) Coordinate with Supply Sergeant & S4 for JSLIST exchange as required

(5) Supply Sergeant
(a) BPT coordinate with S3 Air for LCLA aerial resupply.
(b) BPT coordinate with S4 & CBRN Officer for JSLIST exchange as required

(6) Communications NCOIC
(a) Issue dismounted radio sets to PLTs and HQ
(b) Establish FM & HF communication nets on OBJ LION IOT facilitate reporting to TF HQ

e. Coordinating Instructions.

(1) Timeline

DTG	Event	Unit
	Company Backbrief	CO CDR
	PL CONOP Backbrief	All PLs
	Combined Arms Rehearsal	CO CDR, enablers
	Communications Rehearsal	All Pax with Radios
	Work call	All
	Marshall at SP	All

	H-Hour	All
	COMMEX	All units
	Cross LD	All units
	Initiate first Work/Rest cycle transition	All units
	First Work/Rest cycle transition complete	All units
	OBJ seized; continue to assess/exploit the site; transition to security operations; O/O conduct BHO to responsible agency	All units

(2) CCIR:

(a) Priority Intelligence Requirements:

1. More than one squad of enemy on OBJ
2. Detection of CBRN threat/contamination in AO
3. Enemy ADA in the area
4. Presence of UGF
5. Type of entry to the UGF
6. Capture of an HVI

(b) FFIR:

1. Troops in Contact
2. Loss of squad-sized element
3. SM exposure to CBRN threat
4. Inability to breach UGF
5. Loss of CRT capability
6. Loss of EOD robot
7. Decontamination capabilities degraded
8. CIVCAS

(3) EEFI:

(a) Location of CP
(b) Location of HLZ locations
(c) Location of CCP
(d) Location of decontamination sites

(4) UGF Emergency Evacuation Criteria (LANDSLIDE)

(a) Explosive threat (Booby trap)
(b) Structural instability (Imminent collapse)
(c) Catastrophic contamination

(5) Uniform: Full kit, Assault Pack, weapon, JSLIST, and CBRN detection equipment.

(6) Fire Support Coordination Measures:

(a) GFC is approval authority for all indirect fire missions
(b) FSO will establish NFAs with radii of 200m around all friendly positions.

(7) Mission Oriented Protective Posture: GFC is approval authority for MOPP downgrade

(a) For deployment: MOPP 0
(b) Containment: MOPP 2
(c) Breach/Entry: MOPP 4

(8) ROE: There are potential civilian population clusters in AO. Civilian population has

access to UGF on the OBJ. All Soldiers have the inherent right to defend themselves and others, but will employ measured escalation of force as required by each situation. Soldiers may engage armed or uniformed combatants in IAW the weapons control status outlined in this order.

(9) Weapons Control Status

(a) Prior to breach of OBJ, WCS is TIGHT

(b) Inside the UGF, WCS is HOLD.

(c) WCS in any built-up area is HOLD for 7.62mm and smaller. No munitions larger than 7.62mm will be employed in built up areas without authorization from GFC.

(10) Work/Rest cycle is 8 hours rest/16 hours work. The first transition will begin at H+6 and be complete by H+8. H-Hour is the time SH1 crosses the Line of Departure. Rotation will go as follows:

(a) H+8 3rd PLT(QRF) replaces 2nd PLT (DO) in UGF, 2nd PLT replaces 1st PLT (SH1) as containment, 1st PLT becomes QRF

(b) H+16 1st PLT (now QRF) replaces 3rd PLT (now DO) in UGF, 3rd PLT replaces 2nd PLT (now SH1) as containment. 2nd PLT becomes QRF

(c) H+24 2nd PLT (now QRF) replaces 1st PLT (now DO) in UGF, 1st PLT replaces 3rd PLT (now SH1) as containment. 3rd PLT becomes QRF

(d) This rotation will continue as long as necessary or until the Commander changes it based upon the situation.

(11) Contingencies to rehearse:

(a) Contact during movement

(b) Contact during establishment of SBF

(c) Non-compliance with Tactical Callout

(d) Contact during containment

(e) Breach (external and internal to UGF)

(f) UGF collapse

(g) Presence of CBRN-E agent

(h) Reduced Oxygen situation

(i) Casualties during all phases of the operation

(j) Attempted civilian interaction with force

(12) All personnel that exit the UGF must be checked at the chokepoint for contamination.

4. SUSTAINMENT.

a. Logistics. Ration cycle will be M-M-M.

b. Personnel. Detainees, EPWs, and civilians found on OBJ will be collected and separated and TQ will occur.

c. Health Service Support.

(1) During Phase I the CCP will be located at.

(2) During Phase II, Company CCP will be established at. An alternate will be established at XXXX in the event that the primary site is unsuitable. These two sites will serve as CCP throughout the remainder of the operation. **HLZ XXXX is the nearest MEDEVAC HLZ**

from OBJ.

5. COMMAND AND SIGNAL.

a. Command

(1) Location of the Commander. GFC will be located with DO; 3rd in the order of march during movement; IVO XXXX during phase II(a) (Containment); at CP during seizure of the OBJ; at CP during security operations.

(2) Succession of Command. XO, FSO, Reserve PL, SH1 PL, DO PL.

(3) Liaison Requirements. The Co HQ will serve as the LNO element to all enablers and higher HQ.

b. Control

(1) Command Posts. The Company CP will be located IVO XXXX; established during Phase IIb-IV (Seizure-Assess-Security Operations).

(2) Reports. SPOT, SITREP, TIC, GCMs, BDA, GREEN 2, BLUE 1, YELLOW 3- Report PIR within 5 minutes of identification, Report FFIR within 15 minutes of event

(3) Markings
(a) VS-17 panels/blue chemlights will mark lanes in breaches
(b) DO will mark significant SSE locations with red chemlights
(c) CRT will mark SSE items (when assessment completed) with green chemlights
(d) UXO will be marked with orange chemlights
(e) UGF markings will be placed on the left side (9 o'clock) of lead element during initial entry.
(f) Overt directional markers to exit: TBD

c. Signal. See Exhibit 1 & 2 (SOI & Communication Architecture) to Appendix 2 (Voice & Data Network Diagrams) to Annex H (Signal)

(1) SOI in effect:

(2) Frequencies:
(a) Company-
(b) 1st PLT-
(c) 2nd PLT-
(d) 3rd PLT-

(3) P-FM
(a) TA-312
(b) HF
(c) Runner

(4) Passwords-
(a) Challenge/Password:
(b) Number Combination:

(c) Running Password:

(d) Emergency Evacuation: “LANDSLIDE” via FM and verbal (use running password when exiting UGF

ACKNOWLEDGE:

ANNEXES
ANNEX A- Task Organization
ANNEX C- Operations
Appendix 1, Exhibit 1 (CONOP)
Appendix 1, Exhibit 2 (Scheme of Maneuver, by Phase)
Appendix 2, Exhibit 1 (Area of Operations)
ANNEX D- Fires
Appendix 1 (Fire Support Overlay)
Appendix 2 (Fire Support Execution Matrix)
Appendix 3, Tab D (Target List Worksheet)
Annex H- Signal
Appendix 1, Exhibit 1 (BN SOI) TBP
Appendix 1, Exhibit 2 (Communications Architecture) TBP

APPENDIX F

LIST OF TACTICAL POCKET REFERENCES

Tactical Tunnel Considerations (FEB15)
WMD Elimination Tactical Planning Considerations (APR14)
Tactical Site Exploitation (FEB11)
Tactical Questioning (FEB11)
Search for Explosive Threats (APR11)
Actions upon Attack or Discovery of Chemical Agents (JUN10)
Mountain Warfare Handbook (NOV08)
Company Intelligence Support Team (CoIST) (DEC10)

Note: Please visit the AWG portal through the Army Knowledge Online (AKO) portal to review all AWG products and to subscribe to the AWG New Product Subscription Service. The system will send you an e-mail to notify you when a new unclassified AWG product is available on the AWG portal.

NIPR Public Site: http://www.awg.army.mil/

NIPR External Site (CAC required):
https://army.deps.mil/Army/CMDS/AWG/AWGusers/SitePages/Home.aspx

SIPR External Site (CAC/SIPR Token required): https://portal.awg.army.smil.mil

APPENDIX G

LIST OF FIGURES