



# SUBTERRANEAN ROLE 1 MEDICAL FACILITY

## Enhancing Battlefield Casualty Care in Large Scale Combat Operations and Multi-Domain Operations

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### ABSTRACT

The increasing use of drones and precision artillery on the modern battlefield poses significant threats to medical operations, highlighting the need for innovative solutions to protect medical assets and enhance casualty care. The purpose of this paper is to explore the concept of subterranean Role 1 medical facilities to provide continuous Echelon I medical care in a concealed environment, reducing mortality across the battlefield. The 550<sup>TH</sup> Medical Company Area Support (MCAS) assessed the feasibility and effectiveness of a subterranean Role 1 through a Field Training Exercise (FTX). The results showcased the potential of subterranean medical facilities enhancing continuity of care without compromising proximity to the frontlines, enabling Commanders to counter emerging threats and protect medical personnel by incorporating this configuration in Army Medical Doctrine. The research contributes to the development of innovative strategies for medical operations in large-scale combat and multi-domain operations, providing recommendations for future training and doctrine development.

### SUBTERRANEAN ROLE 1 MEDICAL FACILITY: ENHANCING BATTLEFIELD CASUALTY CARE IN LARGE SCALE COMBAT OPERATIONS AND MULTI-DOMAIN OPERATIONS

The growing intricacy of global conflicts allows the U.S. Army to reevaluate its training as it transitions into Large-Scale Combat Operations (LSCO) and Multi-Domain Operations (MDO). As U.S. adversaries continue to adapt their capabilities by exploiting their weaknesses, the U.S. Army must continue to reinforce their training in all areas, specifically on the ones the enemy could exploit. In modern conflicts like the Russia-Ukraine War and the Hamas-Israel Conflict, the most casualty-producing type of weapon is artillery. The total number of deaths and injuries in the Russia-Ukraine War continue to grow daily, with artillery collecting almost 80% of casualties from both sides in 2024. (Suciu, 2024). Countries, like Ukraine and Israel, have identified the use of subterranean facilities to avoid the repercussions of artillery, provide shelter to their refugees, and establish a haven for Medical Treatment

Facilities (MTF). The lessons learned from modern conflict demands the U.S. military MTFs to operate under robust cover and concealment, like subterranean and underground facilities, to minimize casualties and maximize mission effectiveness.

More importantly, leaders across the U.S. Army must understand the importance, complexity and relevance of subterranean operations in modern warfare, especially with the emergence of new technology. The Ukraine-Russian war evolved through the employment of drones. In 2025, drones dominate the battlefield, inflicting over 70 percent of casualties on both sides, and up to 80 percent in some battles (Santora, Jakes, Kramer, Hernandez, & Sholudko, 2025). Incorporating the capability of subterranean Role 1 operations in Army Medical Doctrine will enable Commander's to provide continuous Role I of medical treatment in a concealed and covered environment from drones and artillery, reducing mortality across the battlefield.

## **HISTORICAL CONTEXT OF MEDICAL SUBTERRANEAN OPERATIONS**

As the U.S. prepares for potential conflicts against Near-Peer Adversaries, using innovative operational strategies such as subterranean operations is essential to counter air domain advantages. Analyzing historical subterranean engagements can help integrate these strategies into future medical operations.

During World War I, the British Army utilized existing tunnels in Arras, France, to create an underground hospital, enabling rapid treatment, evacuation and hospitalization of up-to 700 Soldiers despite German bombardments.

In World War II, Malta faced over 3,000 air raids, leading healthcare facilities like the Royal Navy Hospital Mtarfa to construct subterranean tunnels for patient safety and continuity of care. The British also established over 34-miles worth of defensive tunnels at the Rock of Gibraltar enabling medical treatment, hospitalization, safe evacuation and logistical support. In Bosnia, they built a treatment facility half below the surface capable of providing treatment with limited patient holding and surgical capabilities, camouflaged with a screen of pines to avoid enemy detection. None of the camouflaged medical facilities in that forest were found by the enemy. (Rogers, 1957)

The Vietnam War further exemplifies the success of tactical tunnels. The Viet Cong's extensive tunnel system allowed them to evade U.S. aerial bombardment, while allowing them to provide vital medical treatment and logistical capabilities without exposure to enemy forces.

In modern warfare, Israel's Sammy Ofer Fortified Underground Hospital can be rapidly transformed into a 2,000-bed facility capable of withstanding various attacks while ensuring continuity of care. Similarly, Ukraine utilized subterranean operations for surgical teams to reduce mortality rates amid heavy casualties.

As adversaries adapt their tactics, U.S. forces must also train in subterranean operations to effectively employ medical assets. The 550TH Medical Company Area Support (MCAS) conducted Role 1 subterranean operations to validate and standardize these concepts across the Army.

## **ROLE 1 SUBTERRANEAN OPERATIONS CONCEPT**

Through lessons learned from historical medical subterranean operations and recent conflicts, the 550TH MCAS shaped the concept of Role 1 subterranean operations. From 14 to 16 January of 2025, the 550TH MCAS assessed the concept through a Field Training Exercise (FTX). The Commander's intent for conducting subterranean operations was to provide concealment of enemy aircraft and drones for the Role 1. The Role 1 consisted of one medical treatment team and two evacuation teams, with the Commander conducting the

assessment. The Role 1 subterranean operations concept focused on a sophisticated version of Category 1, using lessons learned from the Guerrilla Surgeon of a Bosnian concealed medical facility during World War II to create the proof of concept. The Commander of the 550TH MCAS, CPT Ryan C. Brown, arranges the execution of the concept into three categories: excavation, structure and medical capabilities.

### **EXCAVATION**

The 550TH MCAS had organic equipment to excavate the prescribed dimensions using standard issued equipment like the individual Soldier's Entrenching Tool and shovels from the Basic Issue Items (BI) in each vehicle. However, the unit requested engineer support for the operation, significantly reducing Fully Operational Capable (FOC) times by around 83 percent. Prior to execution, the 618TH Engineer Support Company excavated the area.

### **STRUCTURE**

The construction of the Role 1 structure consisted of five steps: build foundation, frame entrance, frame exit, frame left and right-side walls, and frame ceiling. The building operation took approximately 14 hours. The structure's measurements were 12 ft (144 in) long, 14 ft (168 in) wide and 8 feet (96 in) high. The unit employed a six-to-six work-rest cycle where six Soldiers worked, while the other six rested. While two Soldiers would build the structure, the other four would move supplies and equipment to ensure building continuity during the operation.

### **MEDICAL CAPABILITIES**

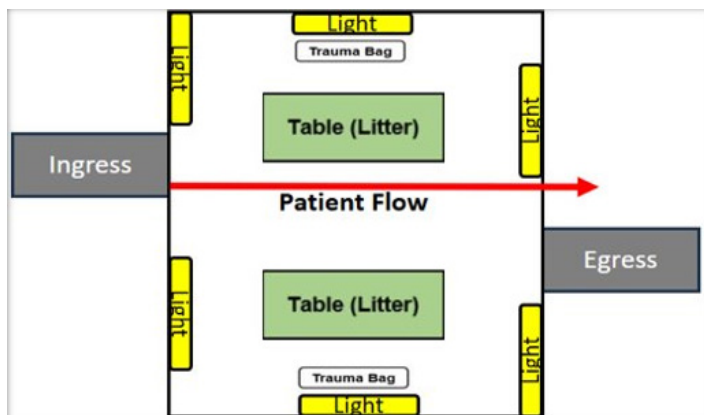
A Role 1 medical facility employs three of the ten medical functions: Medical Command and Control (C2), Medical Treatment and Medical Evacuation. The Commander's intent was to evaluate the Role 1's ability to employ its capabilities in a subterranean environment, their location and required equipment. Based on these requirements, the unit created the Medical Concept of Operation for the subterranean Role 1 (see Figure 1).



**Medical Command and Control.** The Platoon Leader (PL) and the Platoon Sergeant (PSG) are collocated inside the subterranean structure. They have Medical C2 of the Role 1. The PL and PSG communicate verbally to the treatment team and through a Single Channel Ground and Airborne Radio System (SINCGARS) manpack with the evacuation teams. The platoon leadership must always use the Troop Leading Procedures (TLP) when conducting medical subterranean operations. When possible, leaders should reconnoiter (recon) the area prior to occupying and establishing the medical facility. Following the recon, the PL and PSG finalizes the plan, ensuring proper employment of their assets based on mission variables such as Mission, Enemy, Terrain/Weather, Troops and Support Available, Time Available and Civil Considerations (METT-TC). Critical to avoid detection is for leaders to emplace their rolling stock at a minimum distance of 100 meters from the subterranean Role 1.

**Medical Treatment.** The Role 1 provides medical treatment out of the subterranean facility. Similarly to establishing a traditional Role 1 (tented or hard stand), the subterranean Role 1 can provide two Advance Trauma Life Support (ATLS) beds. Depending on mission variables, the triage area is located under the camouflage netting either at the ambulance or on the ground with a medic to ensure continuous masking of heat signature and concealment from enemy drones, and aircraft. Upon ATLS bed availability, the PL informs the ambulance team who transports patients from the triage area to the facility.

Upon completion of patient care, the patient is moved to the holding area awaiting evacuation at the exit of the facility, or directly to the ambulance depending on availability to prevent enemy detection. Figure 2 outlines the subterranean Role 1 configuration for Medical Treatment. Although, the unit has a model and general assumptions on triage, patient tracking, flow and care they're unable to assess medical treatment during the January FTX.



**Medical Evacuation.** The evacuation teams are emplaced by the PL and PSG based on mission variables. When emplacing evacuation teams, leaders must disperse and camouflage the ambulances to avoid enemy detection of both the subterranean facility and the ambulances. Evacuation teams must preposition

their ambulances facing the direction of travel, ensuring the selected area is accessible to known improved or unimproved roads. Additionally, the evacuation teams must ensure to communicate internally through the SINCGARS, and externally through the supported unit's communication plan. It is critical to use camouflage netting capable of protecting the teams from the electromagnetic spectrum, reducing the probability of enemy detection (see Figure 3). When transporting patients to and from the medical facility, litter bearers must use a modified clover leaf method or the dog leg method to avoid building a natural route, avoiding detection of the subterranean facility and the concealed ambulance. The Commander was also unable to assess the Medical Evacuation capability of the subterranean Role 1 during the January FTX.



## TACTICAL CHALLENGES AND CONSIDERATIONS

While the unit was able to finalize the subterranean structure, they faced various challenges that prevented the Commander from assessing the subterranean Role 1 medical functions. The unit organized these challenges and considerations based on mission variables (METT-TC), the Army Health System (AHS) principles, medical limitations, and health threats.

## MISSION VARIABLES

When conducting subterranean operations, mission variables must be analyzed before the execution phase to ensure mission success. The 550<sup>TH</sup> MCAS outlined the tactical challenges and considerations for each mission variable, providing suggestions points accordingly.

**Mission (Consideration).** The mission type and its development will always dictate the execution and emplacement of the subterranean Role 1. Commanders must identify decision points to employ the subterranean Role 1. Typically, units will employ this Role 1 configuration during defensive operations and when static at a location for long periods of time.

**Suggestion Point.** Unit leaders must master the basics, especially troop leading procedures. It is recommended to conduct realistic training involving mission analysis and projecting decisive points for a unit to operate under subterranean conditions to reinforce critical thinking across all Army leaders.

**Enemy (Consideration).** The growing use of drones and precision artillery in recent conflicts raises concerns when preparing for future conflicts. Near peer enemies might have the capability to identify friendly forces through surveillance drones, satellite imagery and electromagnetic emissions, enabling them to suppress friendly efforts through artillery, mortars, drone attacks, mounted and dismounted patrols, as well as Chemical, Biological Radiological and Nuclear (CBRN) capabilities.

**Suggestions Point 1.** Noise discipline must become second nature for personnel executing subterranean operations. Units can maintain noise discipline through training and enforcing strict noise protocols and by using noiseless generators to power the facility.

**Suggestions Point 2.** Camouflaging the area is essential to avoid detection. Units must consistently train on camouflage techniques of personnel and equipment. The entrances of the subterranean facility and all rolling stock must be under a camo net. A critical component to this is using camo nets able to disperse electromagnetic signature to avoid detection through thermal imaging.

**Suggestion Point 3.** In preparation of potential CBRN attacks during LSCO, medical units must train under CBRN conditions to include but not limited to operating under different levels of Mission Oriented Protective Posture (MOPP) gear and, train on patient and personal decontamination and operate using the NBC filtration system in their assigned ambulances.

**Terrain (Challenge).** Fort Bragg training areas are sandy and loose, which challenged the 618<sup>TH</sup> ESC and 550<sup>TH</sup> MCAS during the excavation and construction phases. When excavating and constructing the structure, the walls continued to collapse on both teams. To ensure the facility complied with the prescribed measurements, the building team had to regularly shift focus from building to shoveling the collapsed sand out of the site. These external factors doubled the unit's estimated FOC times.

**Suggestions Point 1.** In future preparation of LSCO, units must learn to adapt and overcome challenges across different terrains by planning for all external factors.

**Suggestions Point 2.** When deliberately executing subterranean Role 1 operations, medical units should request the engineers to widen and deepen the excavation to a size greater than the prescribed measurement of the medical facility. The unit can then backfill and camouflage the area with natural foliage.

**Weather (Consideration).** Climatic factors do affect the construction and employment of subterranean operations. A poorly built structure can lead the facility to flood, hindering patient flow and potentially damaging medical equipment.

**Suggestion Point 1.** The unit recommends building a French drainage system in the foundation of the facility to avoid flooding.

**Suggestion Point 2.** It is highly recommended to seal the entrances and to waterproof supplies and sensitive equipment to avoid potential damage.

**Troops And Support Available (Consideration).** Without support from the engineers, the unit would have completed the excavation in approximately 24 continuous hours instead of 4 hours. Engineer support is critical for this type of Role 1 configuration. Additionally, the unit had no means to observe approaching enemy forces, leaving the subterranean Role 1 with unaware of their surroundings for more than approximately 100-meter radius of the facility.

**Suggestion Point 1.** Medical units must include engineer support during the planning phase.

**Suggestion Point 2.** When available, units can request engineering support to build the foundation and structure of the facility, ensuring a rapid deployment of the subterranean Role 1.

**Suggestion Point 3.** When possible, units should establish fighting positions and Listening Post/Observation Post (LP/OP), providing friendly forces visibility of key locations and avenues of approach.

**Communications (Consideration).** Disrupted communications prevents medical units from synchronizing with the maneuver units, from coordinating medical evacuation and from receiving orders from higher echelons.

**Suggestion Point.** Units must train and rehearse medical subterranean operations using realistic scenarios where communications are disrupted. Training should include a variety of scenarios where communications are disrupted, where leaders only have the Operation Order and the Commander's intent while still expected to accomplish the mission. This will force Commanders to provide a thorough intent and leaders to ensure they fully understanding it, fostering a culture of analytical reasoning and problem-solving among Army professionals.

**Cover and Concealment (Consideration).** The 550<sup>TH</sup> MCAS occupied and established a subterranean Role 1 that provides concealment from the enemy and limited cover. Although the structure could potentially withstand the detonation of a grenade carried by a drone, it would not endure Near-Peer artillery capabilities.

**Suggestion Point 1.** Medical units should consider the concept of subterranean Role 1 operations as concealment from the enemy and not as a form of cover.

**Suggestion Point 2.** If the Commander's priority is cover from enemy artillery, units should consider occupying a Category 2 or 3 underground facility to provide that capability (see Figure 1 or refer to ATP 3-21.51).

**Suggestion Point 3.** If cover is a priority and there are no Category 2 or 3 underground facilities, units should consider enhancing the subterranean Role 1 structure by reinforcing it with materials capable of withstanding enemy artillery.

## ARMY HEALTH SYSTEM PRINCIPLES

The AHS principles are the foundation of field environment healthcare planning and execution (see FM 4-02). The 550TH MCAS assessed that the subterranean Role 1 concept conforms to five of the six AHS principles

**Mobility.** Although the Role 1's personnel and equipment remains highly mobile, the subterranean structure is not mobile. For safety consideration, units should not remove the structure when displacing to a new location.

**Suggestion Point 1.** During the preparation phase, units should pre-build the shoring in parts. Upon occupying the site, units can then assemble the shoring for a rapid deployment of the subterranean Role 1.

**Suggestions Point 2.** Working with the Army Futures Command to develop a product that is light and strong enough to serve as a shoring system for the subterranean Role 1. The product must include an easily deployable and reusable assembly with a drainage system in its foundation.

**Medical Limitations (Challenge).** Confined spaces and narrow passages restrict use of medical equipment, litter movement and medical personnel access. Additionally, poor ventilation hinders patient care for both the medical personnel and the patient due to low oxygen levels.

**Suggestion Point 1.** It is highly recommendable to transition from bulky outdated medical equipment to portable life support equipment such as battery powered compact ventilators, oxygen concentrators, wearable vital signs monitors and modular surgical kits.

**Suggestion Point 2.** When constructing a subterranean Role 1, units must include a ventilation system during the planning phase.

## HEALTH THREATS

Although there is no difference between injuries sustained in subterranean conditions and any other injuries sustained Operational Environment, ATP 4-02.4 outlines common conditions associated with subterranean operations, capable of increasing the number of casualties in the battlefield. (Headquarters, Department of the Army, 2021) These include operating in confined spaces and under limited visibility, fear of being trapped or buried alive, lack

of cover or concealment, and disorienting in both time and space. For more information on health threats while operating under subterranean or underground facilities see ATP 4-02.4 or ATP 3-21.51.

## CONCLUSION

Incorporating the capability of subterranean Role 1 operations in Army Medical Doctrine will enable Commander's to provide continuous Echelon I of medical treatment in a concealed and covered environment from drones and artillery, reducing mortality across the battlefield. The 550TH Medical Company Area Support's (MCAS) assessment of subterranean Role 1 operations through an FTX, validated the concept and highlighted its potential to enhance tactical combat casualty care in large-scale combat operations and multi-domain operations. By implementing lessons learned from historical medical subterranean operations and the 550TH MCAS assessment, the Army can develop innovative operational strategies to counter air domain advantages and protect medical assets during offensive and defensive operations. Although the subterranean concept requires further development, it is essential to integrate subterranean operations into future medical operations and provide leaders with the training and expertise necessary to execute these complex operations effectively in preparation of potential Near-Peer adversaries. Ultimately, the incorporation of subterranean Role 1 configuration into Army Doctrine will ensure continuity of care, enhance the survivability and effectiveness of medical teams on the battlefield in preparation of future conflicts.

The 550TH MCAS will apply all these lessons learned during Phase II of the proof of concept from 24 May to 05 June 2025. Phase II proof of concept consists of excavating two proximal sites, employing two ISU-90 containers as the structure instead of building one. The unit will use an Engineer Support Company to excavate and to backfill and camouflage the subterranean Role 1. The unit will also explore employing an enhanced Role 1 with limited patient hold, dental, x-ray and laboratory capabilities.

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