Subterranean Operations and Operational Art

A Monograph

by

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Subterranean networks riddle the landscape of current and future US military battlefields. Guerilla fighters and conventional armies leverage subterranean networks to counter the technological supremacy of the United States. The primary research question asks how does the US military properly leverage operational art against subterranean networks in a joint environment. The underlying thesis of this study reasons that three of the tenets of operational art (basing, tempo, and risk), when properly managed in conjunction with airpower through the effective use of command and control, are effective in defeating the subterranean networks. Combatants in Vietnam and Afghanistan utilized subterranean compounds in an asymmetric environment to negate the technological superiority of the United States. Understanding the two examples highlights the need for an integrated approach.

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Abstract

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Acronyms

ADRP	Army Doctrine Reference Publication
ARVN	Army of the Republic of Vietnam
CAOC	Combined Air Operations Center
CAS	Close air support
C2	Command and Control
DOTMLPF-P	Doctrine, organization, training, material, leadership, personnel, facilities, and policy
FM	Field Manual
MAC-V	Military Assistance Command Vietnam
MCWP	Marine Corps Warfighting Publication
NVA	North Vietnamese Army
PACOM	Pacific Command
PGM	Precision Guided Munition
SOP	Standard operating procedures
TACP	Tactical Air Control Party
USMC	United States Marine Corps

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Introduction

Subterranean operations by enemy forces have added significant complexity to United States (US) military operations throughout the nation's history. Military forces have employed subterranean operations in warfare since armies began sieging fortifications and adversary strong points. The enemy's use of the subterranean domain has plagued US military operations throughout the nation's history, including, but not limited to, the American Civil War, World Wars I and II, the Korean War, the Vietnam War, and even the current operating environments of Operation Freedom Sentinel in Afghanistan and Operation Inherent Resolve in Iraq and Syria. Subterranean operations have appeared in both large-scale combat operations and counter insurgency fights. Despite the frequency of operating in a subterranean environment, doctrine has not given subterranean operations the same credence and coverage as urban, mountain, desert, and jungle environments.

Current US Army doctrine lists subterranean operations as a consideration in the 2006 edition of *Field Manual (FM) 3-06 Urban Operations.*[1] US Marine Corps doctrine devotes a slightly larger print area to underground operations and allocates a six-page appendix to the topic in the *Marine Corps Warfighting Publication (MCWP) 12-10B.1, Military Operations on Urbanized Terrain*.[2] Historically, subterranean operations appeared in US military doctrine in rudimentary form. Both the US military and its enemies have employed subterranean operations in past conflicts. However, the US military often fails to effectively capture the lessons learned in after action reports for future generations. Modern threats and the current operating environments are increasing the motivation to give subterranean operations the codified doctrinal space it deserves. Many organizations, such as the Army's Asymmetric Warfare Group, are preparing

[1] United States Department of the Army, *Field Manual (FM) 3-06*, *Urban Operations* (Washington, DC: Government Printing Office, 2006), 2-6.

[2] United States Department of the Navy, *Marine Corps Warfighting Publication (MCWP) 12-10B.1, Military Operations on Urbanized Terrain (MOUT)* (Washington, DC: Government Printing Office, 2016), Appendix E.

military commanders to defeat asymmetric threats and enhance multi-domain effectiveness.[3] Currently, the US Army is funneling over 570 million dollars into training and equipping active duty combat brigades to fight in subterranean facilities.[4]

The inherent logistical challenges associated with locating and mapping underground facilities are resource and time intensive. The psychological aspect of warfare drives combatants to seek any advantage, including subterranean systems in combat operations. If an enemy is at a technological disadvantage, operating underground might offer the only feasible solution to continue the fight and covertly sustain the initiative against a more powerful opponent. The enemy leverages these logistical challenges to trade time for space and continue operations against their opponent.

Unfortunately, the US Army struggles to adequately train the force to identify and defeat the subterranean network through the proper application of operational art in conjunction with airpower. The subterranean network threat requires a multi-service, integrated solution. Simply using grenades or air-dropped ordnance against subterranean networks is not enough. Effective use of operational art requires balancing basing, tempo, and risk while synchronizing efforts across time, space, and purpose. The Joint Warfighting Function of Command and Control (C2) provides the construct through which the US Army and other services, particularly the US Air Force, can leverage operational art to combat the subterranean threat.

Airpower has many dimensions that can directly partner with ground forces for a more integrated and effective approach to locating and defeating tunnel networks. Air to air combat is one role that airpower can provide, and it indirectly assists ground forces by removing aerial threats. Close air support (CAS) eliminates enemy targets on the ground, allowing ground forces

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[3] "Command Overview Brief," United States Army Asymmetric Warfare Group, last modified October 19, 2018, accessed March 20, 2019, https://www.awg.army.mil/.

[4] Matthew Cox, "The Army is Spending Half a Billion to Train Soldiers to Wage War Underground," *Task & Purpose,* June 25, 2018, accessed October 17, 2018, https://taskandpurpose.com/army-subterranean-warfare-training/.

to focus on locating the underground complexes. Dropping bombs on tunnel entrances and directly above known subterranean systems can destroy the enemy's underground complex. Airframes armed with sensor pods can detect possible location of subterranean structures, which helps save time by focusing search operations. Lastly, aircraft can rapidly transport troops to conduct search and destroy operations.

Methodology

The goal of this monograph is to highlight the use of operational art in a joint environment to combat subterranean networks. Two case studies highlight the effects subterranean operations have against the range of military operations. The first case study involves the Vietnam War. Several instances of operational disruption occurred both tactically and strategically because of the enemy's use of subterranean operations. Vietnam offers several examples across the country that highlight the positive impact of air and ground integration in countering the subterranean threat. The second case study examines operations in Afghanistan and analyzes the benefits the enemy garnered by leveraging subterranean operations against the US military. Each case study includes considerations of enemy doctrine, tactics, techniques, procedures, historical uses of subterranean operations, as well as geological, geographical, and social considerations. A side by side comparison examines the two wars and analyzes what elements are similar and how they influenced subterranean operations. Finally, examination of the evidence using C2 and three elements of operational art as criteria highlights deficiencies in the US military's implementation of operational art to account for the adversary's use of subterranean operations.

Examination of the two case studies reveals possible solutions to the subterranean threat. Integration with the air domain stands out as a key enabler, revealing potential roles for airpower in future subterranean operations. Viewing threats through the lens of the Army's doctrine, organization, material, leadership, personnel, facilities, and policy (DOTMLPF-P) framework helps generate solutions. The framework helps to identify possible areas of improvements to

address the shortcomings in combating subterranean networks. The analysis incorporates doctrine, unclassified standard operation procedures (SOP), and actions some military organizations have taken to address this doctrinal shortfall.

Commanders and staffs must consider how enemy forces can use subterranean operations to hinder US operational art. Operational art is defined by *Army Doctrine Reference Publication (ADRP) 3-0, Operations* as "the cognitive approach by commanders and staffs—supported by their skill, knowledge, experience, creativity, and judgment—to develop strategies, campaigns, and operations to organize and employ military forces by integrating ends, ways, and means."[5] As commanders develop their operations and incorporate operational art, the concepts of operational art provide a useful framework to assess the benefits of potential solutions, including the ways air power interacts with subterranean operations.

Basing, tempo, and risk, three of the ten elements of operational art, provide a useful lens to analyze the connectedness between the air domain and the subterranean domain and how one can influence the other. Basing refers to the establishment of bases, either permanent or nonpermanent. The definition of a base is "a locality from which operations are projected or supported."[6] Tempo is defined as "the relative speed and rhythm of military operations over time with respect to the enemy."[7] Finally, risk, which is inherent to any military operation, is defined as "the probability and severity of loss linked to hazards."[8] It is challenging to balance risk with reward or opportunity, but that decision ultimately rests with the commander.[9] The joint function of C2 serves as a fourth criteria of analysis. C2 allows a commander to exercise authority and

[5] United States Department of the Army, *Army Doctrine Reference Publication (ADRP) 3-0: Operations* (Washington, DC: Government Printing Office, 2017), 2-1.

[6] Ibid., 2-9.

[7] Ibid., 2-7.

[8] Ibid., 2-10.

[9] United States Department of the Army, *Field Manual (FM) 3-0: Operations* (Washington, DC: Government Printing Office, 2017), B-1.

direction to forces under his control, and to execute decisions more rapidly than the enemy.[10] Two case studies explore the interconnectedness of the three elements of operational art, C2, and air power with subterranean operations. Both case studies involve the United States Department of Defense and operations against a foreign aggressor.

Department of Defense personnel examine issues by considering solutions stemming from the separate categories of doctrine, organization, material, leadership, personnel, facilities, and policy. Doctrine examines the way the military fights, or the guidelines used in battle. Organizational changes refer to the organization of the units, either within a division or a brigade, to better handle subterranean operations. Training refers to the formal institutional training that should take place, as well as the types of joint and international exercises that should occur to better prepare for operations in the subterranean environment. Material consists of the clothing and equipment soldiers could use while operating in an underground environment. The personnel aspect merely refers to the number of individuals required to conduct operations. Facilities encompass the necessary training environment, both fabricated and natural, required to make a force capable of operating in the subterranean environment. Lastly, policies establish the rules of engagement while operating in subterranean environments.

Limitations

According to doctrine, subterranean operations do not take place in their own domain. They are a subset of urban operations, which take place in the land domain. Several military organizations and military contractors are developing training and equipment to overcome the unique challenges posed by this specialized environment. However, many of the standard operating procedure handbooks have handling instructions or possess a level of classification not

[10] United States Department of Defense, Joint Staff, *Joint Publication (JP) 3-0: Joint Operations* (Washington, DC: Government Printing Office, 2017), III-2.

authorized for publication within this research. The entirety of this research uses only unclassified information and resources, to include the analysis and DOTMLPF-P suggestions.

Subterranean Operations in Vietnam

The Socialist Republic of Vietnam became a country on September 2, 1945. Vietnam is situated on the eastern side of the Indochinese Peninsula with a coast line along the South China Sea roughly equivalent in length to the western coastline of the United States. Cambodia borders Vietnam to the southwest, Laos is to the northwest, and China is to the north. Vietnam is a country of tropical lowlands, yet is mostly hilly and densely forested. Vietnam's surface area is 40% mountainous and 20% level ground. The country struggles with flooding during the monsoon season from May to October. The climate and geo-positioning of Vietnam afford many lowlands and deltas where digging beneath the surface is easy because of the soil type. The large amount of rainfall and vegetation keeps the ground moist and workable, which enables easy digging and tunneling.[11] The complex interaction of the geographical, topographical, and climatological factors contribute to an environment that makes it acceptable and feasible to conduct subterranean operations.

The idea of using tunnels and caves for military operations during the Vietnam War did not originate at the onset of the war, but many years prior. Many of the tunnels were left over from the French Indochina War and were already in use as logistics bases before the start of the Vietnam War.[12] The Vietcong were the communist guerilla faction that fought in the southern part of the country. They inherited the tunnels from their previous inhabitants, the Viet Minh. The Viet Minh conducted guerrilla operations from the tunnels against the French years prior. Both

[11] Natural Resources and Environment Program, Thailand Development Research Institute Foundation, *Proceedings of the Regional Dialogue on Biodiversity and Natural Resources Management in Mainland Southeast Asian Economies, Kunming Institute of Botany, Yunnan, China, 21-24 February 1995* (Oakland, CA: Natural Resources and Environment Program, Thailand Development Research Institute Foundation, 1955), 56.

[12] Daphne Richemond-Barak, *Underground Warfare* (New York: Oxford University Press, 2018), xiv.

the North Vietnamese Army (NVA) and, more commonly, the Vietcong, employed subterranean operations in the existing underground tunnels as well as new tunnels that each organization constructed. The most notorious tunnels were the Củ Chi tunnels, which the Vietcong expanded into a complex network spanning nearly 40 square miles with almost 130 miles of interconnected passageways.[13]

Case Study I

Tunnels in Vietnam served as more than just attack positions. These underground facilities functioned in every capacity like that of their above ground counterparts. They served such functions as allowing for human smuggling, launching surprise attacks, storing and manufacturing ammunition, command-and-control centers, lines of communications, as well as training facilities and hospitals.[14] The digging of new tunnels, as well as the expansion of the existing ones, increased when the United States arrived in the country. Tunnel construction exploded after it became clear that the US Air Force and Navy would conduct heavy airstrike campaigns.[15]

From the onset of the war, the Vietcong's tunnels displayed similar uniform design features, dictated by terrain and tactical requirements. They were at least five feet deep to protect against bombing. They were generally three feet wide. The height ranged from three to six feet, although some tunnels were a little smaller. Many tunnels were constructed in a zigzag pattern to make detection and destruction harder, as well as to limit the effects of shrapnel. The entrances were meticulously camouflaged and often mined or booby-trapped. There were even secret entrances and passages within the tunnels themselves. The most challenging aspect of reducing

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[13] US Army Corps of Engineers, *Historical Vignette 062 – How the Army Engineers Cleared Viet Cong Tunnels*, (2003), accessed on October 29, 2018, https://www.usace.army.mil/About/History/Historical Vignettes/Military-Construction-Combat/062-Viet-Cong-Tunnels.aspx.

[14] Richemond-Barak, *Underground Warfare*, 11.

[15] Logan Nye, "Why the Vietcong's Tunnels Were so Effective," We Are the Mighty, January 9, 2019, accessed March 31, 2019, https://www.wearethemighty.com/history/viet-cong-vietnam-war-tunnels.

tunnel complexes for US forces was locating tunnel entrances. They sometimes proved impossible to locate even if they knew one was in the immediate vicinity. Once discovered, it was equally challenging to explore the tunnels due to physical and psychological reasons. The passageway's design barely fit the body type of a Vietnamese adult, which made it too small for the average US Soldier or Marine.[16] The operational and tactical complexity of subterranean operations also posed a psychological challenge for US Soldiers. Tunnels trigger feelings of helplessness due to the claustrophobic nature of the environment. A lack of familiarity and spatial awareness relative to surface location can be disorienting. Underground warfare offers very little of the visibility normally afforded during aboveground operations. Limited communication, visibility restrictions, and the physical constriction of the tunnels caused fear and a strong desire to avoid tunnels.[17] The environment caused much anxiety among US forces; whereas, it posed less of a psychological problem for the Vietcong who had been using tunnels for over a decade.

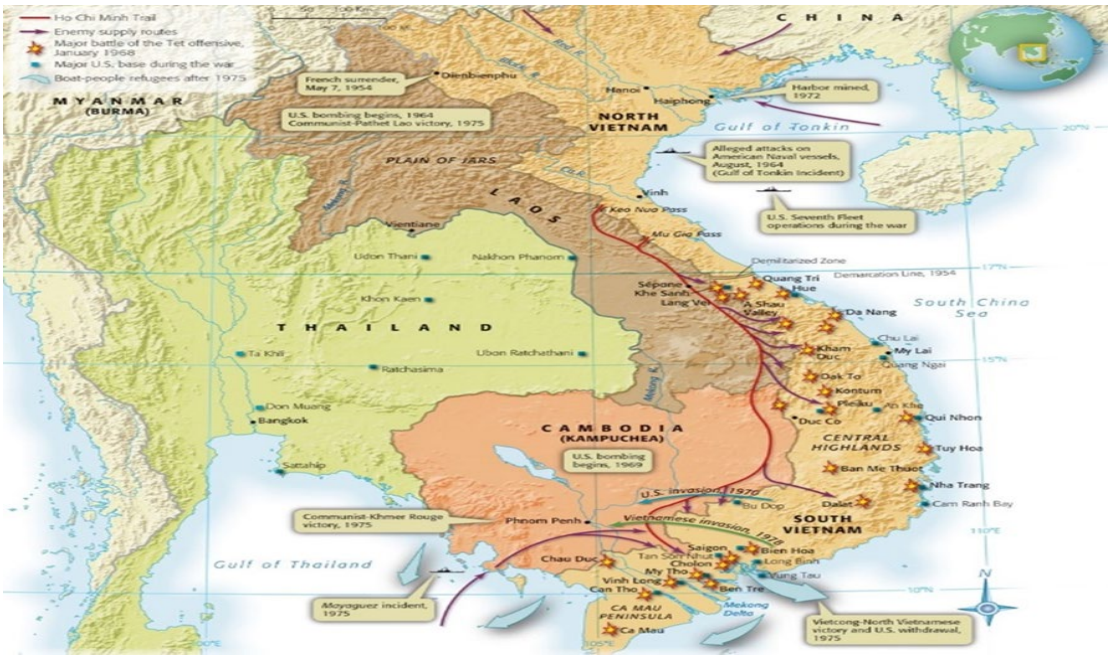

Figure 1. Map of Vietnam. Dr. Greggory Daddis, "A Problem of Language" (presentation, School of Advanced Military Studies, Fort Leavenworth, KS, October, 22, 2018).

[16] Richemond-Barak, *Underground Warfare*, 10.

[17] Ibid., 87.

The first ground combat troops from the United States landed in Vietnam in 1965. However, the United States conducted air raids against NVA bases as early as 1964 in response to the Tonkin Gulf incident.[18] By April 1968, the US military reached an apex of 543,000 personnel in theater. To secure the populace, the Military Assistance Command-Vietnam (MAC-V) sought to disperse these forces across the countryside. The US military often based near population centers in an effort to win the hearts and minds of the local population. Tunnel networks were often more prolific near population centers as this provided a safe area to hide war materials. The enemy simply blended in with the local populace during the day and waited until the United States left to exert influence over their territory and conduct operations from their tunnel systems. The Vietcong wore nondescript clothing allowing them to blend in with the local population. The preponderance of Vietcong operations took place in the south. The tunnel network facilitated the appearance of the Vietcong being everywhere. It also allowed them the ability to control the location of the front lines.

American strategists understood the advantages subterranean operations offered the Vietcong. The subterranean network negated the US military's conventional battlefield superiority and forced the United States into guerilla warfare.[19] Seeking to neutralize these subterranean advantages, in 1966 the US Army conducted two major tunnel clearing efforts, Operation Crimp and Operation Cedar Falls. During Operation Crimp, a seven-day American-Australian military venture, 8,000 troops conducted search and destroy missions in the Củ Chi district to destroy tunnel complexes. Employing B-52 airstrikes and artillery, the allies used

[18] David Gates, *Sky Wars: A History of Military Aerospace Power* (London: Reaktion Books Ltd, 2003), 112.

[19] Nelson Smithwick, "Down and Dirty: The Tunnel Rats of Vietnam," Saint Mary's University History Media, April 28, 2017, accessed March 30, 2019, https://www.stmuhistorymedia.org/down-and-dirty-the-tunnel-rats-of-vietnam/#marker-72756-2.

napalm and 15,000-pound 'Daisy Cutter' bombs to assist in finding the tunnels by leveling trees and removing the dense jungle foliage providing concealment for subterranean complexes.[20]

The superficial destruction achieved only nominal results. Despite the devastation wrought by the explosives, many tunnel entrances remained undiscovered. Troops infrequently searched the tunnels exposed by heavy bombing for fear of booby traps and the cave collapsing on them.[21] Utilizing a few grenades to crimp off the exposed tunnel openings proved only an inconvenience to the Vietcong as they quickly repaired the damage to the well-designed subterranean network.

The lessons learned during this operation, along with intelligence garnered from Australian sources, led units to develop tunnel rats to counter the subterranean threat. US personnel who volunteered to be a tunnel rat were generally smaller in stature so that they could fit into the narrow confines of many of the tunnels. The tunnel rats received additional training and employed compact equipment designed to mitigate the increased complications of operating in the confined spaces involved in tunnel search and clearance missions. Each unit also developed their own SOP regarding tunnel search and clearance operations.[22]

Almost one year after Operation Crimp, 30,000 troops and tunnel rats cleared underground mazes during Operation Cedar Falls. The operation achieved slightly more success than Operation Crimp, denying the Vietcong access to large stockpiles of supplies. The US military dominated the surface terrain and damaged 525 tunnels. Unfortunately, much of the destruction rarely went beyond the first fifty meters of the tunnel due to the solid design of the

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[20] Gates, *Sky Wars: A History of Military Aerospace Power*, 112.

[21] Peter Gorner, "Life of a Tunnel Rat: Fighting Fear in 'Nam," *Chicago Tribune*, June 28, 1985, accessed March 30, 2019, https://www.chicagotribune.com/news/ct-xpm-1985-06-28-8502110841-story.html.

[22] Smithwick, "Down and Dirty: The Tunnel Rats of Vietnam."

tunnel and the density of the soil composition.[23] The limited destruction made the damage easily repairable and had little effect on the supplies and personnel located below because they were hidden well beyond the impacted area of the tunnel entrance. The coalition forces never fully controlled the terrain where they conducted Operations Crimp and Cedar Falls. The subterranean caverns allowed the enemy to rapidly retake the terrain once coalition forces left the area.

The coalition's rapid tempo through the region failed to give the military forces sufficient time to locate and uncover all the tunnel entrances in the region. This rapid tempo increased the risk to force and the risk to mission by giving the coalition a false sense of security. Coalition forces made assumptions that a particular area was clear because they did not locate any tunnels. The Vietcong continued to operate out of the subterranean tunnels because the tunnel entrance locations remained undiscovered. Overall, Operations Crimp and Operation Cedar Falls were only a temporary setback to the Vietcong, as this exact location in the Củ Chi region would later be used to plan and launch the infamous Tet Offensive.[24]

The Tet Offensive, a combined NVA and Vietcong military campaign, began on January 30, 1968 and continued until September 23, 1968. Over 80,000 North Vietnamese and Vietcong personnel conducted attacks all over the country, striking thirty-six of the forty-four provincial capitals and over 100 towns.[25] Many of these surprise attacks sprung from underground complexes. The United States quickly recovered much of the urban terrain lost during the surprise offensive. The Vietcong sustained heavy casualties and failed to spur local uprisings throughout the southern portion of the country. Despite the large tactical setbacks and heavy loss of forces, the Communists translated the whole operation into a strategic victory. The Tet Offensive showed

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[23] Kenneth R. Olson and Lois Wright Morton, "Why were the Soil Tunnels of Cu Chi and Iron Triangle in Vietnam so Resilient?" *Open Journal of Soil Science* 7, no. 2 (2017) 34, accessed October 30, 2018, https://www.scirp.org /Journal/PaperInformation.aspx?PaperID=74005.

[24] James R. Arnold, *Tet Offensive 1968: Turning Point in Vietnam* (London: Osprey Publishing Ltd, 1990), 12-13.

[25] Clark Dugan and Stephen Weiss, *The Vietnam Experience: Nineteen Sixty-Eight* (Boston: Boston Pub, 1983), 8.

there was plenty of fight left in the enemy and the United States did not have as firm a grasp on the situation as their leaders suggested.[26] Subterranean networks enabled the initial success of the Vietcong during the opening weeks of the Tet Offensive. They also provided a location to regroup and reorganize after the United States' counterattack.

The United States inadvertently enabled the Tet Offensive by taking unnecessary risk in their operational tempo and basing locations. US forces overlooked the inherent complexity of the tunnel networks. The oversight led to a more rapid operational tempo than was feasible. Locating and understanding the depth and complexity of tunnel networks took extensive amounts of time and energy. US forces were often not given sufficient time to properly clear an area. Sometimes the camouflage was so effective no one on the search team could locate the tunnel entrance. US forces struggled to locate both the entrance to a tunnel complex as well as all the underground rooms. Many of the room entrances within the tunnel networks were disguised and camouflaged just as well as the above ground entrances.[27]

US forces often failed to completely destroy the tunnel networks because they did not fully understand their complexity. The Vietcong rapidly repaired much of the tunnel damage inflicted by US forces, which posed a huge risk to US basing operations. Thinking a tunnel was destroyed gave a false sense of security to US forces. The Vietcong continued to easily harass the US military from nearby underground complexes. US soldiers often failed to adequately search and clear their immediate surroundings to the degree necessary to locate well-disguised tunnel entrances. If US forces had methodically located and destroyed the subterranean complexes near their bases, they would have likely lost fewer resources and denied the enemy convenient basing. It was not only the improper and haphazard tunnel clearance operations that negatively impacted

[26] "U.S. Involvement in the Vietnam War: The Tet Offensive, 1968," US Department of State, Office of the Historian, accessed October 30, 2018, https://history.state.gov/milestones /1961-1968/tet.

[27] Nye, "Why the Vietcong's Tunnels Were so Effective."

basing, but also the lack of the US military effectively neutralizing the subterranean domain once they cleared it.[28]

The United States employed canines to detect explosives and humans within tunnel complexes, but not every unit on patrol had a dog.[29] Unfortunately, the United States lost a significant number of canines in subterranean operations.[30] Since the dogs had no concept of booby-traps, they often died within the first couple meters of entering a booby-trapped tunnel. The increased loss of canine assets resulted in the search for a technological solution to help solve the subterranean threat. The only technology available at the time to detect tunnels was a magnetometer which measures the relative strength of magnetism over a given area. Abrupt changes in magnetism indicate possible tunnels. The portable 106-pound Differential Magnetometer deployed to Củ Chi was difficult to use. It was too heavy to carry in thick vegetation and exhausted whoever carried it, making them a liability.[31] Despite the difficulty in deploying the magnetometer, it did have limited success. Unfortunately, mission tempo limited the methodical deployment of canines and technology to properly clear sectors.

Airpower in Vietnam

The United States maintained air supremacy throughout the Vietnam War. The US Air Force alone flew over four million sorties.[32] The carrier-based planes were much closer than the Thailand based US Air Force, making naval airpower the preferred choice at the onset of the war. The US Navy and Air Force achieved more success against the northern regular army because "the North's regular forces were much more susceptible to aerial attack than their Vietcong

[28] Nye, "Why the Vietcong's Tunnels Were so Effective."

[29] Richard Cunningham, 2017, "The Dogs of the Vietnam War," *The New York Times*, October 3, 2017, accessed November 15, 2018, https://www.nytimes.com/2017/10/03/opinion/the-dogs-of-the-vietnam-war.html.

[30] Gorner, "Life of a Tunnel Rat: Fighting Fear in 'Nam."

[31] Richemond-Barak, *Underground Warfare*, 97.

[32] Phillip S. Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm* (Annapolis, MD: Naval Institute Press, 2017), 137.

comrades." The northern conventional army massed frequently and was easily distinguishable from the local population due to its uniforms.[33] The uniforms and large formations enabled US pilots to quickly identify enemy forces in the limited time they had to visually acquire targets while flying overhead. A regular army requires more resources, which results in the stock-piling of supplies. Large enemy storage facilities were easier to identify than the smaller subterranean underground facilities primarily used by the Vietcong, thus making them easier targets.

The United States initiated several air campaigns such as Flaming Dart (7 to 11 February 1965), Rolling Thunder (2 March 1965 to 31 October 1968), Linebacker I (9 May to 22 October 1972), and Linebacker II (18 to 29 December 1972) to name a few.[34] Target restraints and the use of non-precision munitions limited the success of these operations. The difficulty the pilot had in visually acquiring and confirming targets, coupled with the lack of ordnance accuracy, contributed to the death of some 52,000 civilians during operations Rolling Thunder alone.[35]

On March 30, 1972, a reinforced North Vietnamese Army Division engaged the 1st ARVN Division in what became known as the Easter Offensive. It lasted until October 22 of the same year. In response, the United States launched Operation Linebacker as a joint air campaign that targeted North Vietnam's transportation, storage, and air defense systems. Of the "18,000 combat sorties, 45% were by the US Air Force, 30% by the Navy and Marine Corps, and 25% by the South Vietnamese Air Force."[36] The massive employment of US airpower ultimately repulsed the NVA, despite the NVA's initial success. The fact that the NVA did not make extensive use of the subterranean domain strongly bolstered the United States' success. The long list of airpower's accomplishments against conventional forces hides the fact that airpower faired far worse against

[33] Gates, *Sky Wars: A History of Military Aerospace Power*, 113.

[34] Robing Hingham and Mark Parillo, *The Influence of Airpower Upon History* (Lexington, KY: The University Press of Kentucky, 2013), 219.

[35] Gates, *Sky Wars: A History of Military Aerospace Power*, 111.

[36] Hingham and Parillo, *The Influence of Airpower Upon History*, 222.

the subterranean threat. The US military knew how to leverage airpower against conventional forces, hence the reason so many of the air campaigns targeted the NVA. The US military struggled to effectively employ airpower against guerilla networks that operated from underground complexes.

Analysis

The dense jungles of Vietnam made it nearly impossible for pilots moving hundreds of miles an hour to visually acquire targets. The challenging terrain necessitated a "blind bombardment of map coordinates that were relayed by radio from spotters" on the surface, thereby incurring greater risk to the populace and reducing the chance of target reduction.[37] A near miss would fail to eliminate the tunnel, leaving it operational for the enemy. The employment method was highly ineffective if a target was moving due to the delay between coordinate reporting and ordnance release. The United States dropped increased amounts of ordnance to overcome the challenges of accuracy and increase the chance of destroying the target. Additionally, the lack of precision munitions hurt the United States' war effort both militarily, by not reducing the target, and politically, by causing material and civilian casualties. It is difficult to win the hearts and minds of the indigenous population when family and friends are being bombed from the sky.

The increased risk and cost of employing sorties to carpet bomb an area just to destroy one target proved inefficient at best. The United States needed precision guided munitions (PGMs). Unfortunately, PGMs did not appear until the later stages of the war. An iconic example of the failure of non-precision guided munitions is the mission to destroy the Thanh Hoa Bridge. Hundreds of sorties launched to reduce the key railway bridge. Several attempts to destroy the bridge using non-PGMs cost the United States eleven aircraft.[38] Shortly after those failed

[37] Gates, *Sky Wars: A History of Military Aerospace Power*, 117.

[38] Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm*, 171.

attempts, a single flight of F-4s armed with 3,000-pound PGMs succeeded in destroying a large span of the bridge, thereby cutting the NVA's southern rail logistics for several months.[39] This example shows how PGMs can be effective in destroying a target more efficiently by requiring less ordnance and fewer sorties to accomplish a task. PGMs also reduce the risk to aircraft, as well as the risks of collateral damage and civilian casualties.

US forces exercised extremely convoluted C2 of airpower in these campaigns. The complex employment of airpower resulted from the lack of a single individual exercising C2 over air operations. Vietnam itself fell under the purview of Pacific Command (PACOM), while the Military Assistance Command Vietnam (MAC-V) exercised command over combat operations. The White House selected military targets in North Vietnam during Tuesday lunches, which filtered down through PACOM. The targeting meetings rarely included airmen.[40] The typically aviator free MAC-V staff passed the targets to one of the four subordinate air components. The US Air Force had two tactical air units. One headquartered in Saigon (7AF) and the other in the Philippines (13AF). The aircraft in South Vietnam lacked authorization to strike targets in Laos, while the Thailand based contingent of the 13AF lacked permission to strike targets in South Vietnam. Strategic Air Command also controlled the 8AF from its forward headquarters at Offutt Air Force Base in Guam.[41] The issues of aircraft basing were not wholly unjustified because of the potential threat, but the lack of basing improvements, strike authorizations, and painfully slow C2 adjustments further reduced their effectiveness.

The lack of effective airpower coordination is evident in the resiliency of the Vietcong to continue the conflict. The number of bombs dropped on Vietnam by the United States was more than the amount dropped by the United States during WWII. The Pentagon could scarcely believe

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[39] Wayne Thompson, *To Hanoi and Back: The United States Air Force and North Vietnam 1966-1973* (Washington, DC: Air Force History and Museums Program, 2000), 235.

[40] Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm*, 137.

[41] Ibid., 140.

that any organization could survive this heavy of a bombardment.[42] Amazingly, because of the tunnels, the Vietcong survived more than six million US sorties, many of which targeted suspected tunnel networks. The Vietcong were able to continue the fight because they dispersed their personnel and equipment across the underground terrain to negate the effects of the aerial bombardments. Massive employment of airpower does not directly translate to effective employment of airpower when engaging an enemy who is heavily reliant upon subterranean operations, like the Vietcong.

The outcome of the Vietnam War is also a testament to the effectiveness of subterranean operations. The United States ultimately withdrew and Vietnam unified less than three years later. If the amount of airpower and ordnance deployed in Vietnam only delayed the inevitable for three years, then it is clear airpower was either ineffective or inefficiently used. Colin Gray notes that the United States "lacked suitably tailored doctrine and military posture" to effectively wage war in Vietnam.[43] Moreover, he argued that the lack of political and strategic integrity in the employment of US airpower negated the tactically impressive results.[44] He articulated that if the political narrative for military intervention is insufficient, it should follow that the military effort would be strategically disabled.[45] A short exchange between Colonel Harry G. Summers and North Vietnamese Colonel Tu summarizes the Vietnam experience. Summers remarked that the Vietnamese never defeated the United States on the battlefield. Tu replied, "That may be so. But it is also irrelevant."[46]

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[42] Gates, *Sky Wars: A History of Military Aerospace Power*, 112.

[43] Colin S. Gray, *Airpower for Strategic Effect* (Maxwell Airforce Base, AL: Air University Press, 2012), 194.

[44] Ibid., 194.

[45] Ibid., 196.

[46] Stephen Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, NJ: Princeton University Press, 2004), 41.

The lack of effective C2 in combating the subterranean network was also clear in this war. It took MAC-V General (GEN) Westmoreland until 1968 to establish a single air component commander. Even then, many contested the decision until the end of the war.[47] Efficient air to ground integration is imperative for reducing the risk in destroying subterranean networks. The inefficiencies in managing the air assets not only wasted resources and reduced operational tempo, but also hindered some political objectives due to excessive collateral damage. The incomplete clearing and destruction of the tunnel systems resulted in increased US casualties. Consolidating gains was difficult with large enemy elements and resources freely moving about in their area of operations. The US forces needed to slow their tempo and methodically clear their battlespace of tunnels. The methodical approach risks fewer lives and saves resources. It conserves tempo and energy by not devoting resources to clearing previously searched areas.

Subterranean Operations in Afghanistan

Afghanistan is a landlocked country situated in Central Asia. Eurasian tectonic plate movements gave rise to the Himalayan mountains in the northeast and east, which contain natural caves. Afghanistan borders seven countries: Turkmenistan, Uzbekistan, Tajikistan, and China to the north, Pakistan and India to the east, and Iran to the west. The climate in the highlands varies with elevation, but gets below freezing during the winter months.[48] The freezing of water also causes cracks and fissures in the rocks that Al Qaeda exploited and turned into underground caverns.

[47] Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm*, 141.

[48] "Political Map of Afghanistan," accessed October 30, 2018, https://www.nationsonline.org/oneworld/map/afghanistan_map.htm.

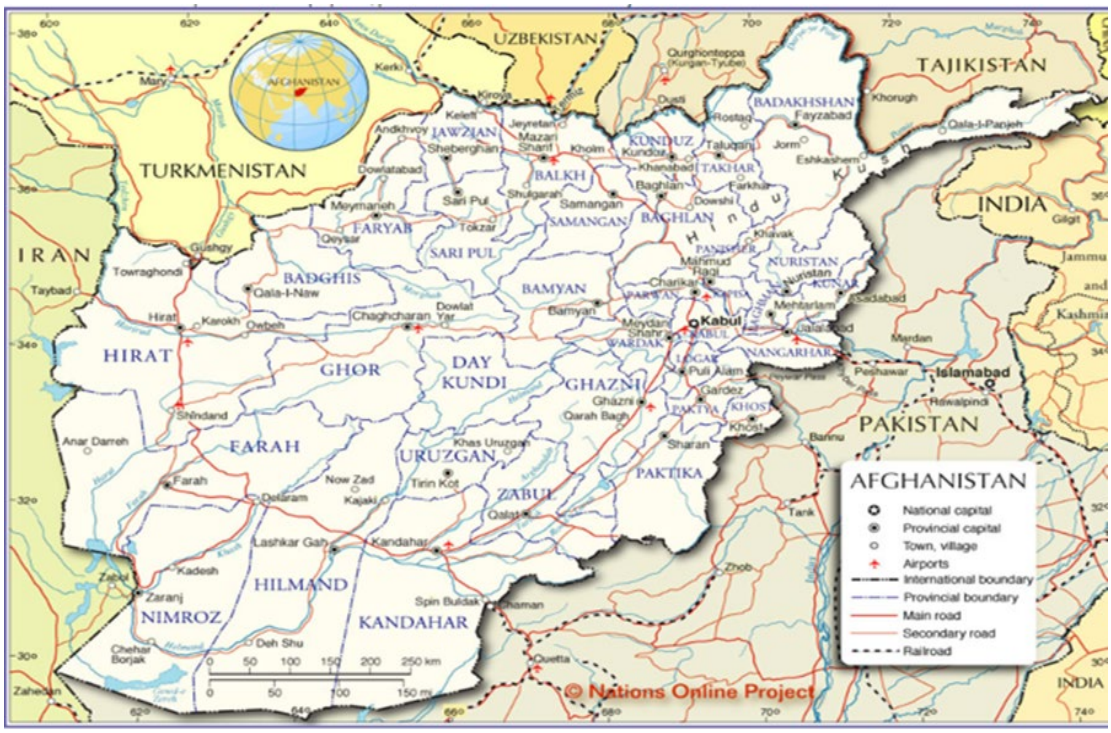

Figure 2. Map of Afghanistan. "Political Map of Afghanistan," *Nations Online,* accessed October 30, 2018, https://www.nationsonline.org/oneworld/map/afghanistan_map.htm.

Case Study II

The United States fought the Soviets, via proxies, in these mountains from 1979 to 1989. The United States armed the local mujahideen, who carried out guerrilla style warfare against the larger Soviet conventional forces. The defeated Soviets departed in 1989 after a decade of fighting. Part of the reason the mujahideen were so successful was due to the excavation and expansion of the naturally occurring caves scattered throughout Afghanistan. Al Qaeda inherited these exact tunnel networks dug by the mujahedeen and used them to conduct attacks against US forces during Operation Enduring Freedom.[49] The United States never grasped the full extent of the tunnel networks it helped create by funding proxies in the 1980s, leading to operational delays and increased troop losses in the 2000s.

[49] Richemond-Barak, *Underground Warfare*, 15.

A notable cave complex exists in the region of Tora Bora, a 9.5 by 10-kilometer valley situated 15 kilometers from the Pakistan border. Osama Bin Laden used those tunnel networks to elude capture.[50] During the anti-Soviet jihad in 1987, Bin Laden spent six months using bull dozers to build a road through the region. He was very well acquainted with this area of Afghanistan. When US Special Forces and Afghan Soldiers went into the region in early December, 2001, they called in airstrikes against al-Qaeda forces for over 56 hours straight. Fortunately, this engagement used precision guided munitions as several of the targets were close to friendly forces. The increased precision and timeliness enabled deadly results, no collateral damage, and resulted in zero friendly casualties.

After several days of heavy fighting, al-Qaeda negotiated a cease-fire with the local Afghan militia commander, who gave them time to surrender their weapons.[51] However, many believe this negotiation for a cease-fire was a ruse because it allowed Osama Bin Laden, other al-Qaeda leaders, and about 800 to 1,500 of his followers to escape into Pakistan through tunnel networks. Initial estimates calculate anywhere between 2,500 to 3,000 enemy combatants were in the region prior to the opening engagements of Operation Anaconda. There were approximately 1,100 enemy either killed, wounded, or captured as enemy prisoners of war.[52] Those are staggeringly good ratios for the US coalition especially considering there were no American or British losses during the battle.

Regrettably, al Qaeda leadership and a significant contingent of fighters escaped the region and engaged the United States again in three months in the Shahi-Kot Valley.[53] Some US

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[50] Peter Bergen, "The Account of How We nearly Caught Osama bin Laden in 2001," *The New Republic*, December 29, 2009, accessed October 31, 2018, https://newrepublic.com/article/72086/the-battle-tora-bora.

[51] Dalton Fury, *Kill bin Laden* (New York: First St. Martin's Press, 2009), 233.

[52] Donald P. Wright, *A Different Kind of War* (Fort Leavenworth, KS: Combat Studies Institute Press, 2010), 119.

[53] Tommy Franks, *American Soldier* (New York: Regan Books, 2004), 377.

officials requested an additional 800 Army Rangers to secure the potential rear exits of the cave complex, but those forces never materialized. The United States required a rapid operational tempo, but the precision air strikes did not have the requisite follow up by a temporary influx of soldiers needed to clear the remaining pockets of resistance. Part of the hesitancy on the part of US military leaders was due to the risk of an accidental engagement with Pakistani soldiers stationed near the eastern Afghan border. The subterranean facilities located near an international border proved too great a risk to commit large amounts of US forces, despite information that the United States' most wanted man was in the region. US forces also lost tempo due to the obligatory Muslim observance of the holy month of Ramadan because the Afghan partners left the battlefield in the evening to go eat (after fasting all day), thereby surrendering ground back to the enemy. The coalition, leveraging airstrikes, retook terrain again the next day, but the delay in tempo helped enable Bin Laden's escape.[54]

Near the region of Tora Bora is a lesser known tunnel complex located in Zhawar Kili, along the Pakistan border. The size of the complex easily surpassed the initial intelligence provided to US Navy SEALs who ultimately secured the compound.[55] Coalition forces initially planned only one day to clear the complex, but it wound up taking nine days to search all the caverns. US forces brought in vehicles to survey the tunnels more quickly. The underground warehouse was a treasure trove of information, and US forces were able to destroy millions of pounds of explosives, rifles, machines guns, and even a tank.[56] The resources staged in this complex enabled al-Qaeda and its allies to maintain control of the Zhawar Kili region prior to the US incursion. It also supported operations at Tora Bora by housing fighters who supported the battle and provided a fall back point during the retreat from Tora Bora. If the additional 800 US

[54] Wright, *A Different Kind of War*, 117.

[55] Richemond-Barak, *Underground Warfare*, 16.

[56] Ibid., 16.

troops had been present at Tora Bora, a more rapid and thorough search could have been conducted and the operational tempo maintained to keep the pressure on fleeing al-Qaeda forces.

Ironically, the CIA's success during the Afghan-Soviet War proved a hindrance for US military operations in 2001 because of the subterranean networks developed with US funds during the 1980s. The decade long war, followed by the Afghanistan civil war, ravaged the landscape, and limited the local government's ability to invest in road and rail infrastructure.[57] Movement into Afghanistan took place via air from the closest base the United States could initially secure in Uzbekistan, located along Afghanistan's northern border. Though a lack of local basing did not paralyze US operations, it certainly slowed the tempo due to the need to traverse the almost 400-mile distance by air.

Operations including the search, clearance, and denial of cave and subterranean structures continued to challenge military forces for years to come. In 2003, Operation Valiant Strike, Operation Desert Lion, Operation Carpathian Mountains, and Operation Mongoose saw a host of countries engaged in valley and cave clearing.[58] There were no shortages of caves and subterranean structures to search. There was, however, a rag tag, non-standardized approach across the coalition for conducting search and clearance operations throughout the caves. A lack of standardization or synchronization slowed operational tempo and repeatedly committed resources to the same region because there was no thorough initial search.

Airpower in Afghanistan

The United States' use of airpower in Afghanistan placed a heavy emphasis on bombing and combat support, but it conducted additional missions as well. US aircraft also conducted psychological air operations, humanitarian aid, logistics, provided air mobility, and resupply.[59]

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[57] Wright, *A Different Kind of War*, 58.

[58] Eric Micheletti, *Special Forces: War on Terrorism in Afghanistan* (Paris: Histoire & Collections, 2004), 13.

[59] Ibid., 9.

The use of airframes for air mobility circumvented the high risk of attack stemming from enemy ground fighters assaulting from subterranean compounds. In the first six months of Operation Enduring Freedom, the coalition conducted over 36,000 sorties and dropped over 21,000 munitions of varying size.[60] By the end of March 2002, al Qaeda shifted tactics from a large force employment concept to a more guerilla style of warfare. The airpower technology employed by the coalition offered al Qaeda no other choice but to change tactics or embrace annihilation.[61]

While many air missions consisted of bombing surface targets and providing combat support, there were also significant contributions made to tunnel location and destruction stemming from the use of technology, specifically sensor pods. Several air platforms can be configured with different types of sensor pods. Sensor pods enable the aircraft to rapidly search large areas of land in a relatively short amount of time.[62] Suspicious activity is communicated to ground units to enable search and clearance missions more effectively. Sometimes known cave entrances were also included in pre-planned strikes, even though they had not been searched or cleared.[63] A successful example leveraging the intelligence garnered from a sensor pod occurred in March of 2002 when a pair of F-16s with sensor pods located a secret bunker hidden on the mountain of Takur Ghar and destroyed it with a 500-pound laser guided munition.[64]

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[60] Eric Micheletti, *Special Forces: War on Terrorism in Afghanistan* (Paris: Histoire & Collections, 2004), 13.

[61] Wright, *A Different Kind of War*, 173.

[62] "Sniper Pod," US Air Force, September 22, 2015, accessed April 2, 2019, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104527/sniper-pod/.

[63] "Operation Anaconda: An Air Power Perspective," Headquarters United States Air Force, Office of Air Force Lessons Learned, February 7, 2005, accessed October 30, 2018, http://www.au.af.mil/au/awc/awcgate/af/anaconda_unclassified.pdf.

[64] Dodge Billingsley and Lester W. Grau, *Operation Anaconda: America's First Major Battle in Afghanistan* (Lawrence, KS: University Press. 2011), 294. This particular ammunition dump was constructed during the Soviet-Afghan War and was the largest remaining ammunition dump under al-Qaeda control in Afghanistan. The US destroyed the heavily defended bunker. There was so much ammunition that secondary explosions echoed for hours and it burned for days. For more detail, see page 295.

The United States' overwhelming air superiority in Afghanistan left zero air-based options for al Qaeda. While in the past, al Qaeda was able to steal military equipment from the Afghan government to sustain themselves, there were no airframes for al Qaeda to steal to try to compete with the coalition in the skies. If al Qaeda did obtain aircraft, then they would require basing, maintenance, and weapons to effectively employ them. Even if it were available, the US military could easily locate and destroy any aerial basing the enemy attempted to employ. The only airpower available to al Qaeda resided in the Afghanistan military in the form of a few poorly maintained Soviet legacy Mi-24 Hind and Mi-17 Hipp helicopters.[65] Prior to the start of the war, the Pakistani Air Force maintained and flew aircraft for al Qaeda associates. Due to the international complications and severe overmatch by the United States, Pakistan officially stopped supporting al Qaeda with helicopter operations.[66]

Analysis

The US Department of Defense considered al Qaeda and the Taliban defeated as an organized military force by the end of 2002. From October 2001 to the end of 2002, the US Air Force and Navy flew 90% of all sorties in Afghanistan, with coalition partners flying the remaining 10%.[67] The distribution of effort was not an equality consideration, but a capability and needs based consideration. Differing platforms can provide similar effects, but basing was also a consideration due to the time it took to get an effect on target. For example, the US Air Force only flew 25% of the strike sorties, but dropped over 70% of both non-precision and precision guided munitions. The US Navy claimed an 84% accuracy to target and munition

[65] M. Chris Mason, *The Strategic Lessons Unlearned from Vietnam, Iraq, and Afghanistan: Why the Afghan National Security Forces will not hold, and the implications for the U.S. Army in Afghanistan* (Carlisle Barracks, PA: United States Army War College Press, 2015), 22.

[66] Ibid., 25.

[67] Anthony H. Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, and Force Transition* (Washington, DC: Center for Strategic and International Studies, 2002), 4.

accuracies within 10 meters were the norm.[68] The high accuracy rate ensured that if a strike was called in on an underground tunnel, it was more likely to be destroyed. Compared to Vietnam, the increased efficiency reduced the risk to force by reducing the chance of striking friendly units and minimizing collateral damage.

The United States had near complete air supremacy early on because al Qaeda could not make effective use of its limited surface to air missile units. Air supremacy enabled not only effective strike missions, but mostly uncontested air transport and logistics throughout northern Afghanistan. Despite the freedom of navigation that the United States possessed in the skies, it lacked sufficient transport capability to fully capitalize on that opportunity.[69] The intelligence provided from aerial assets could not be capitalized on quickly enough. There were simply not enough helicopters to rapidly shift forces throughout the region at the rate desired. If airpower is to properly support ground forces, then the airlift capacity must exist to maintain the operational tempo to adequately consolidate gains. Otherwise, the enemy can gain the initiative and disperse underground to attack or defend at a place of their choosing.

The US military, particularly the US Navy, assumed great risk to mission by conducting many sorties with limited ground forces present. The US Navy, basing from aircraft carriers, incurred a combat mission length twice that of normal peacetime training and previous combat missions.[70] The increased mission duration placed additional mental and physical strain on the pilots, resulting in unnecessary fixed wing and rotary crashes. The AH-64 Apache and United States Marine Corps (USMC) Super Cobras incurred additional risk because, although they could provide the proper firepower when available, they could not optimally employ their weapons because of the extreme altitude in the mountains. The altitude limited their ability to loiter,

[68] Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, and Force Transition*, 8-9.

[69] Billingsley and Grau, *Operation Anaconda: America's First Major Battle in Afghanistan*, x.

[70] Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, and Force Transition*, 20.

negatively affected their targeting, and decreased their accuracy.[71] This meant limited aerial coverage during tunnel clearing missions in higher altitudes. Additionally, there were not enough attack helicopters to adequately support the ground troops.[72] While the risk of fewer attack helicopters was mitigated by either limiting missions or only undertaking relatively low risk operations without aerial support, tempo was lost by not being able to rapidly consolidate gains from previous missions. The inability to rapidly exploit intelligence led to many of al Qaeda's top leadership escaping into Pakistan and prolonging the conflict.

The design of the airframes for some platforms did not account for the possibility of conducting close air support (CAS) missions, thereby incurring additional risk to the force. The Apache helicopter design focused on long range tank destruction, but the aircrews were relatively quick to adapt to the technique of running gunfire. The USMC Super Cobra is a highly capable asset, but is unable climb to as high an altitude as the Apache due to its design and was therefore somewhat restricted in the type of support that it could provide to ground forces.[73]

While the use of airpower during Operation Anaconda was necessary, it also highlighted inherent shortcomings in the capabilities of light ground forces. The lack of artillery capabilities is particularly notable. Artillery provides a more sustained, rapid response to calls for fire than airpower does. While the infantry did have limited mortar capabilities, the logistical requirements of hefting such a heavy system through a mountainous region was quite challenging.[74] Adequate ground basing, were it available during this period, could have provided a much more rapid and economical solution to destroying enemy targets in the mountainous region.

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[71] Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, and Force Transition*, 66-67.

[72] Billingsley and Grau, *Operation Anaconda: America's First Major Battle in Afghanistan*, x.

[73] Ibid., 347.

[74] Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, and Force Transition*, 67.

Tora Bora and Operation Anaconda, despite mostly successful implementation at the tactical level, failed to achieve either operational or strategic success. Al Qaeda was able to disperse throughout over 200 caves and tunnels and continue to attack US troops. Additionally, despite evidence of top al Qaeda leadership being present in subterranean networks in early 2001 and 2002, the United States failed to destroy al Qaeda's top leadership early in the war.[75]

The United States recognized the threat posed by adversaries using subterranean operations to thwart US operations. An attempt to doctrinally mitigate the subterranean threat emerged in 2006 when the US Army and US Marine Corps jointly published *Army Field Manual 3-24*, *Counterinsurgency,* and *Marine Corps Warfighting Publication 3-33.5*, *Counterinsurgency Field Manual.* However, a troubling aspect of the publications was the almost complete lack of appreciation of the multidimensional value of airpower.[76] Ground forces could conduct subterranean operations unilaterally, but the risk would be high. Air forces could never properly conduct subterranean operations by the very nature of their character, although they could be partially successful if they committed significant resources. The best solution synergizes both air and ground forces, in the right proportion, for the situation.

Military planners failed to accurately account for the threat posed by the subterranean aspects of Afghanistan. Military operations began before a true objective for the military campaign was formulated.[77] This incurred incredible risk in operational planning as basing rights could not be easily secured in Afghanistan's neighboring countries if the State Department or United States Central Command could not clearly articulate the nature of military operations.[78] The lack of strategy formulation reduced the operational tempo of US forces in Afghanistan and

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[75] Wright, *A Different Kind of War*, 119.

[76] Gray, *Airpower for Strategic Effect*, 197.

[77] Frederick W. Kagan, *Finding the Target: The Transformation of American Military Policy* (NY: Encounter Books, 2006), 289.

[78] Ibid., 293.

provided al Qaeda additional time to prepare for the pending invasion. Once conventional forces began to flow into Afghanistan, coalition forces had limited control over the situation on the ground due to both basing issues and local agreement procedures of who would lead specific operations.[79] The challenge in understanding and accounting for the slower speed of Afghan led missions directly reduced operational tempo and increased risk.

Some US Air Force common practices also resulted in greater risk while operating in Afghanistan. US Air Force Tactical Air Control Party (TACP) specialists supported conventional ground forces in the Shar-I Kot valley during Operation Anaconda. Prior to working together during Operation Anaconda, the US Army and Air Force verbally acknowledged the necessity of training together. However, neither party committed to a plan of action that developed the requisite interoperability. As a result, they were ill prepared to coordinate together under combat conditions.[80] Understandably, US Air Force leaders wanted combat experience for their airmen. Rotating personnel through positions seemed a viable solution to spread the knowledge of lethality throughout the force. While there is conventional wisdom in desiring as much of the force to have combat experience, exchanging key personnel in the middle of battle is rarely a sound decision. Due to positive leader intervention, the US Air Force ultimately elected not to rotate TACPs in the middle of operations.

If the TACP replacement concept were implemented, it would have been doubly problematic in that not only was it a replacement to a member of the joint team, the replacement also came from outside the Army and was a foreigner to the established culture.[81] The crucible of combat helped solidify the effectiveness of joint operations being an effective solution against subterranean networks. Mutual trust between the US Army and Air Force is essential for successful operations. Even as far back as 1956, Field Marshal Slim recounted that "quick and

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[79] Kagan, *Finding the Target: The Transformation of American Military Policy*, 294.

[80] Billingsley and Grau, *Operation Anaconda: America's First Major Battle in Afghanistan*, 346.

[81] Ibid., 306.

accurate co-operation of this sort did not come in a day; it grew with the airmen's and soldier's mutual confidence … and pride in one another's achievements."[82] The bonds between airmen and soldiers forged during the initial days of combat reduced operational risk because of the trust and competency developed in combat as they worked to defeat the subterranean networks.

The effective joint partnership between the US Army and Air Force took time to develop. A prime example of the challenges faced early in the war is readily visible in the command and control challenges presented throughout Operation Anaconda. Effective air to ground integration is essential when operating in a mountainous region trying to destroy subterranean complexes. The US Air Force's EC-130E Airborne Battlefield Command and Control Center aircraft was the primary coordinating system for tactical air support to ground forces. However, the US Air Force had other operational considerations, and was in the process of transitioning toward an upgraded variant of the EC-130. The previously mentioned considerations caused US ground forces extreme difficulty in communicating with air platforms to destroy tunnel complexes. The US Air Force's Airborne Warning and Control System attempted to bridge the gap and coordinate air assets, but they could not talk to the forces on the ground, nor were they trained for such a role. An ad hoc system formed whereby a US Air Force Joint Surveillance Target Attack Radar System air platform relayed the information to the ground forces from the air, but could not actually confirm any of the information sent because of the lack of proper sensor systems. Other services provided close air support, in addition to French aircraft, making terminology and language another hurdle in trying to conduct CAS.[83] Two of the main tasks of C2 are to communicate across the command and manage risk, neither of which could be done effectively when the units on the ground cannot directly communicate with the unit providing support.

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[82] William Joseph Slim, *Defeat into Victory: Battling Japan in Burma and India, 1941-1945* (London: Papermac, 1987), 544.

[83] Billingsley and Grau, *Operation Anaconda: America's First Major Battle in Afghanistan*, 346.

Another challenge to effectively combat subterranean networks was higher echelons making decisions independent of the conditions on the ground. On many occasions, the Combined Air Operations Center (CAOC), located almost 1,500 miles away, denied CAS strikes. This makes little sense considering it was either a US Air Force TACP or a Combat Controller who requested the mission. The US Air Force trained those individuals and the US Army authorized them to coordinate strikes if they had eyes on the target. The CAOC's desire to exert control over any and all air activity resulted in enemy forces escaping via a tunnel network and living to fight another day.[84] Additionally, no one person commanded all US forces on the ground. It took weeks before General Franklin L. Hagenbeck had authorization over all special operations and conventional forces. Strangely, the US Air Force remained an independent entity that required lateral coordination instead of simply executing. The lateral coordination between the US Air Force and Army, in place of being directly under the command of a single individual, did not constitute a huge delay, but in wartime, minutes matter and can be the difference between life and death.

Case Study Comparison

The two case studies highlight the need for joint operations in effectively locating and defeating enemy subterranean networks. While there were definite shortcomings in each instance, there were also positive examples of correctly leveraging command and control to properly balance the three tenets of operational art in combating subterranean networks. It is possible ground forces could combat the underground threat unilaterally, but it would increase the risk and time required to do so. Airpower cannot defeat all the underground networks by itself, however, it can have devasting effects on the subterranean network.

Basing considerations in each instance were unique. Vietnam had some US air assets positioned close to provide a more rapid response, yet were not authorized to support certain

[84] Billingsley and Grau, *Operation Anaconda: America's First Major Battle in Afghanistan*, 347.

regions. In this instance the basing was not terribly inhibitive, but the C2 structure prevented the most effective use of air assets.[85] A more clearly defined C2 architecture would have streamlined the air assets for a more efficient and effective use. A better C2 plan would also maintain tempo. One aspect of tempo is the concept of it taking place over time, and not just for a short duration. A better C2 structure would reduce the risk to force and the risk to mission over time.

Both wars involved instances of US ground forces basing near the local indigenous population in an effort to win the hearts, minds, and support of the locals, as well as gather intelligence. However, winning the hearts and minds of the local populace, locating and disarming improvised explosive devices, locating underground facilities, and eliminating nonuniformed enemy combatants hiding among the civilian populations are frequent challenges where airpower finds itself lacking. The previously mentioned tasks show airpower's dependency upon the ground forces. Basing for US ground forces should be near local populations and expected areas of operations. Basing for air transport could be prepositioned in the same location if the risk is low enough.

Basing for fixed wing aircraft need not be at the same location as ground troops. Aircraft basing should be close enough for long loiter times to provide the maximum amount of coverage as possible for the longest duration possible. Other benefits that arise from closer base proximity is the ability to more rapidly exploit intelligence and the ability to respond more quickly in the event of an emergency. There are risks associated with aircraft being based closer to the area of operations. It is the commander's decision to effectively balance the risk to the aircraft with the risk to the force and mission when considering basing requirements. Initial basing in Afghanistan had few options. "Aircraft Carriers, owing to their mobility, could be positioned much closer to remote targets and were therefore the force of choice when distances and fuel consumption were

[85] Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm*, 140.

major considerations. Similarly, initial unavailability of land bases in Afghanistan made aircraft carriers the only viable source of requisite airpower."[86] Basing was evaluated and adjusted to meet the operational needs of the force. The US military mitigated basing risks allowing for a more rapid response to ground forces in their tunnel clearance missions.

Airpower can provide the necessary standoff to reduce the risk of casualties, yet still inflict damage on the enemy. However, standoff can sometimes be detrimental to the operation because of the increased potential for collateral damage. Air missions in Vietnam caused more collateral damage than air missions conducted in Afghanistan. There were two main contributing and overlapping factors. One factor was population density and the other factor was the use of precision guided munitions. The population density of Vietnam in 1965 was over 3.5 times greater than the population density of Afghanistan in 2001.[87] US forces in Vietnam also lacked PGMs until the end of war. The use of precision guided munitions greatly reduces possible casualty rates compared to non-precision guided munitions. The chance for civilian casualties is higher when non-precision guided munitions dropped in an area with a higher population density, such as in Vietnam.

Improperly managed airpower can damage the United States' image and garner support for the opposing organization. During Vietnam, the lack of precision guided munitions required increased ordnance drops to reduce subterranean targets. The result destroyed the surrounding terrain and infrastructure, making the area difficult to use by the local populace.[88] The same was true in Afghanistan. Despite the remoteness of the terrain and the use of precision guided munitions, there were still civilian casualties that brought the ire of the local populace against the United States. In both wars, the enemy was able to leverage the shortcomings of airpower,

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[86] Hingham and Parillo, *The Influence of Airpower Upon History*, 233.

[87] "Afghanistan is about 2 times bigger than Vietnam," My Life Elsewhere, accessed April 3, 2019, https://www. mylifeelsewhere.com/country-size-comparison/afghanistan/vietnam.

[88] Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm*, 2.

predominantly the civilian casualty count, against the United States. They used it as a recruiting tool and as a means to deny the United States popular support among locals.[89] If the locals are receptive of a US presence, the intelligence they provide can increase tempo and provide more optimum basing opportunities to US operations than traditional intelligence, surveillance, and reconnaissance capabilities alone can provide. If locals are not receptive to a US presence, they can frustrate US efforts and hinder operations and tempo.

Air transport drastically increased the tempo of US operations. Ground troops could quickly traverse across the terrain and avoid the many dangers posed by subterranean operations. Alternatively, the subterranean network offered increased flexibility to both the Vietcong and al Qaeda. They could disperse their assets and personnel, and conduct guerilla operations from undisclosed locations. The subterranean complex allowed the enemy to be flexible in their tempo.

Risk is always present when considering basing and tempo. Balancing the risks of proximity of aircraft basing with the opportunities it presents is never an easy decision. The same is true for tempo. A rapid tempo of US military operations keeps the enemy off balance, and prevents them from properly consolidating their gains.

One of the main risks highlighted in both case studies is that the enemy leveraged whatever it could to counter US technology and that often included using subterranean compounds. Al Qaeda in Afghanistan and the Vietcong in Vietnam both showed flexibility in battle when they shifted their tactics after suffering significant defeats.[90] When they adjusted tactics, the results were considerable. The United States suffered defeat in Vietnam and is still conducting operations in Afghanistan today against an enemy who can hold out, in part, because of a subterranean network.

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[89] Wright, *A Different Kind of War*, 64.

[90] Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, and Force Transition*, 22.

The United States' emphasis on technology in warfare is becoming predictable.[91] Forcing the enemy into the subterranean environment where we have little codified doctrine for handling such a threat poses a unique challenge. In both Vietnam and Afghanistan, the United States did not standardize its subterranean clearing operations across the force. Despite knowing that caves and tunnel complexes were present in both theaters of war, little was done to codify the search and clearance procedures. Carl von Clausewitz's fog and friction found in normal operations are compounded in subterranean networks due to decreased visibility and increased psychological challenges.[92] The recently released Army *Training Circular 3-21.50: Small Unit Training in Subterranean Environments* emerged in 2017 as a recognition of the challenges posed by operating underground. Its publication provided urgently needed guidance to begin planning and executing training in subterranean environments.[93]

Vietnam and Afghanistan show the value and importance of airlift and long-range strike capability. Despite the many advantages of airpower, poor C2 reduces effectiveness and tempo while increasing the risk to personnel and assets. Airpower can deliver an effect to a specific area, but not have the potentially negative consequences of appearing to be an occupying force. During the Vietnam War, President Lyndon B. Johnson initially favored limited air strikes in late 1964 to avoid escalating the conflict through the use of ground forces. President Johnson intentionally chose airpower because it was less provocative than ground forces occupying terrain.[94]

Stephen Biddle, a Senior Fellow in Defense Policy at the Council on Foreign Relations, argues force employment is more important than technological or numerical preponderances.

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[91] Patrick Tucker "Pentagon Launches New Push for Tunnel-Warfare Tech." Defense One, December 21, 2017, accessed August 15, 2018. https://www.defenseone.com/technology/2017/12/pentagon-launches-new-push-tunnel-warfare-tech/144748/.

[92] Carl von Clausewitz, *On War, Indexed Edition,* ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989) 120.

[93] United States Department of the Army Training Circular 3-21.50: *Small Unit Training in Subterranean Environments* (Washington, DC: Government Printing Office), 2017.

[94] Hingham and Parillo, *The Influence of Airpower Upon History*, 196.

Biddle defines force employment as "the doctrine and tactics by which armies use their material in the field."[95] There are certainly occasions when technology or numerical superiority overwhelms advantageous force employment. Military theorists and historians have long recognized that non-material factors matter and too heavy an emphasis has been placed on quantifiable statistics because they are easy to measure. That deductive reasoning to resort to measurable factors can provide a false catharsis, a sense that things are well accounted for when in actuality they are not. The challenge is there is not a modern accepted model for properly identifying and accounting for nonmaterial factors, such as force employment. An assumption is that states use their material in an optimum fashion, hence the rational that only accounting for the material itself is important.[96]

Biddle's assessments are manifest in the outcomes of the two cases discussed in this monograph. Al Qaeda was able to escape a technologically superior opponent by use of proper force employment throughout the subterranean environment. Additionally, the Vietcong were able to logistically supply and effectively employ their forces against the technologically superior United States. The North Vietnamese were not materially impressive on paper, but when properly employed and handled, the result was victory.[97]

Recommendations

Many potential solutions exist, but not all will prove economically feasible. The following recommendations do not account for monetary restrictions. The recommendations cover multiple aspects of the DOTMLPF-P structure, while some overlap more than one specific consideration.

[95] Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle*, 2.

[96] Ibid., 2 - 3.

[97] Ibid., 3.

Training in a subterranean environment is the best possible solution to getting better at locating and defeating enemy subterranean operations. Doctrine should better reflect the subterranean domain so it can more effectively drive the subterranean training considerations. Training facilities in the United States and abroad provide excellent training and testing grounds for new technology. There are six locations in the United States that feature significant subterranean facilities.[98] These facilities give the US military the practice to understand what it takes to fight in subterranean environments. They also allow individuals the time to work on overcoming the psychological challenges of maneuvering underground while in a safe environment. Admittedly, it is a logistical challenge to transport units to those underground training facilities. Nevertheless, it is well worth the cost given the current and potential deployment environments.[99] For US forces staged overseas, partnering with other nations and conducting research and training is one possible avenue that has already furnished positive results.[100]

Training should also take place at the division level and higher on how to rapidly form and leverage command and control responsibilities in combating subterranean networks. At the most senior level during Vietnam, more trouble arose from doctrinal unpreparedness than from technological unpreparedness as the latter is quite frequently dependent upon the former being established to best implement the available technology.[101] Westmoreland suffered from interservice rivals during Vietnam. The United States also suffered from interservice colloquialisms during the initial phases of Afghanistan. Adhering to joint doctrine and quickly

[98] Cox, "The Army is Spending Half a Billion to Train Soldiers to Wage War Underground."

[99] Ibid.

[100] Benjamin Runkle, "Preparing for Warfare's Subterranean Future," War on the Rocks, last modified April 16, 2015, accessed August 28, 2018, https://warontherocks.com/2015/ 04/preparing-for-warfares-subterranean-future/.

[101] Donald J. Mrozek, *Air Power and the Ground War in Vietnam: Ideas and Actions* (Maxwell Airforce Base, AL: Air University Press, 1988), 45.

falling in line on a preordained command structure reduces inefficiencies. Allowing commanders to understand the threat posed by subterranean operations enables them to better visualize operations in time, space, and purpose. Incorporating lines of operation that include locating and defeating enemy subterranean networks directly supports the line of effort of defeating enemy forces.[102]

The United States should deploy enough airframes to rapidly move the amount of ground forces required to search, clear, and destroy tunnels. In Afghanistan, Task Force Rakkasans could have captured the villages in the Shar-I Kot valley much more quickly than what transpired, but that mission was reserved for the Afghan forces.[103] Understanding that a loss of tempo incurs additional risk, steps should be taken to mitigate or reduce those risks. The additional 800 troops that were requested, but never materialized, would have mitigated the risks from tempo reduction.[104] Working out which nation leads a mission is not as big a concern as having the proper amount of forces on location to support it.

Materials should be developed to better enable the warfighter to operate in subterranean conditions. Lighter and more compact versions of current ballistic protection is an obvious benefit that is currently in development.[105] Refining the design and employment of tactical lights will enhance visibility and lethality in confined spaces.

The use of canines for tunnel exploration in Vietnam saved human lives, but it was often at the expense of the dog. Specialized dog training and increased proliferation across the force can reduce the risk to soldiers and canines alike. Specific robots engineered to operate and map underground complexes would prove incredibly useful to understanding the complexity of a

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[102] United States Department of Defense, Joint Staff, *Joint Publication (JP) 5-0: Joint Planning* (Washington, DC: Government Printing Office, 2017), III-7.

[103] Billingsley and Grau, *Operation Anaconda: America's First Major Battle in Afghanistan*, 359.

[104] Wright, *A Different Kind of War*, 117.

[105] Cordesman, *The Lessons of Afghanistan: Warfighting, Intelligence, and Force Transition*, 71.

tunnel network. Partnering existing robotic frames with echolocation technology can help the robot navigate underground while also providing a template for the unexplored spaces ahead. A unique feature of subterranean networks is acoustics. Technology could leverage these acoustic properties in the form of mapping underground networks or creating a nonlethal acoustic weapon to temporarily disable enemy combatants.[106]

The military should develop infrared reflective ropes and cords for tethering and guiding forces underground. The infrared nature makes it so only soldiers with specialized gear can see it. Thermal goggles are currently in development for the subterranean environment, but it will take a while to equip and train the force on leveraging this technology. A special type of foam grenade should be developed to rapidly create a flexible seal of particular tunnel branches. This allows forces underground to know which areas have already been cleared and provides a temporary form of concealment from enemy threats.[107]

Leveraging commercial industries' ground penetrating radar would provide ground forces the ability to map the shallower subterranean networks without having to enter them. Understanding the environment is essential in defeating the enemy forces within it. It could enable surface laden explosives to effectively reduce the threat from below without the risk of exposure to enemy fire.

Conclusion

The expansive list of shortcomings and challenges of subterranean networks in Vietnam and Afghanistan are strikingly similar, despite being decades and miles apart. However, the lessons learned are no less important regardless of what battlefield they come from. The US military must adapt if it desires a result different from that of Vietnam or Afghanistan.

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[106] John Spencer, "My Underground Warfare Wish List," Modern War Institute at West Point, February 19, 2019, accessed April 1, 2019, https://mwi.usma.edu/underground-warfare-wish-list/.

[107] Ibid.

Phillip S. Meilinger's book, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm,* closes with a sentence that synthesizes the focus of this monograph. He states, "The high cost in transporting and sustaining large ground forces in such operations is a major deterrent to action – to say nothing of the potentially high cost in blood. Light ground forces, especially special operations forces, working in tandem with indigenous forces and the requisite airpower to provide transport, intelligence and dissemination, and precision strike, seem far more efficient and effective."[108] A limited, yet well supported ground force that is operationally enabled by a clear command and control structure that properly balances risk, basing, and tempo within the context of the environment is the best organization for tackling the subterranean threat. It must be flexible and mobile using sufficient air lift to capitalize on intelligence. Many state and non-state actors are unable to exploit all their resources effectively via a modern force employment.[109] If adequately leveraged through proper force employment, the United States will have a different outcome when conducting subterranean operations than it had during the wars in Vietnam and Afghanistan.

[108] Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm*, 29.

[109] Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle*, 48.

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