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14. ABSTRACT

It is increasingly likely that the future of warfare will involve operations in urban terrain, dense urban terrain, or megacities. Therefore, the future of operational art must consider all aspects of the urban environment and how they interact as a system. No single solution will be successful across the globe, so future coalitions must fully understand the operational environment in which they are placed. Different tactics, techniques, and procedures will be applied to each environment such as Fallujah in 2004, Sadr City in 2008, and Mosul in 2016-2017. Furthermore, the military will not be enough to properly influence the outcome of combat operations, and future battlefields will require close inter-organizational integration to synchronize the whole of government approach. Fighting through dense urban terrain and megacities will require the Department of State (DOS) and US Agency for International Development (USAID), among others, to increase their integration into the battlefield. These organizations must be closely coordinated and sequenced just behind the military advance to quickly restore stability. This proximity to combat will also require a decrease in risk aversion across the US government for the US and our allies to be successful on future battlefields.

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MASTER OF MILITARY STUDIES

COORDINATING CHAOS: INTEGRATING CAPABILITIES IN A FUTURE URBAN FIGHT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MILITARY STUDIES

MAJOR ROBERT D. BARBAREE, III, UNITED STATES MARINE CORPS

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EXECUTIVE SUMMARY

Title: Coordinating Chaos: Integrating Capabilities in a Future Urban Fight

Author: Major Robert D. Barbaree, III, United States Marine Corps

Thesis: The complexity of future urban combat will quickly outpace the capabilities and authorities of the US military. Close, interorganizational working relationships are paramount to influence operational and strategic outcomes by leveraging the organization that has the appropriate environmental knowledge, authorities, and access.

Discussion: With the rapid growth in global urbanization, it is increasingly likely, almost guaranteed, that future wars will include conflict in urban areas, dense urban terrain, or megacities. Each of these environments will bring its own challenges and military planners must understand the nature of the system in which they will operate. Understanding cities as systems will allow the US military to properly identify the current environment and then design operations to produce the desired future environment. Ultimately, cities are complex systems that are as unpredictable as war itself. Although cities operate in a relatively predictable manner during normalcy, predictability all but disappears once a city collides with another nonlinear system, warfare. Though there are consistent similarities across urban areas, recent examples in Fallujah, Sadr City, and Mosul, inform planners that no two urban areas are the same, and each requires a unique approach. Additionally, as size increases from urban area to megacity, complexity also increases. This complexity will require transitions and adaptations to meet the demands of a changing environment.

Conclusion: The US military must expand its consideration of urban areas, consolidate lessons learned, and synthesize new solutions to warfare in urban environments. Success in urban areas requires creativity and coordination, since no single government entity can effectively manage urban warfare. Interorganizational coordination is critical to ensure that operations leverage the right agency for each requirement. This practice will ensure proper information sharing and prevent task saturation of any single element. Planners must also consider the urban metabolism and whether or not it is even worth the risk of entering dense urban terrain and megacities.

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THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENT AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

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I. Introduction

Recent events in Operation INHERENT RESOLVE (OIR) in 2016 and 2017 have ignited a resurgence in the US military's analysis of urban warfare. While the idea of destroying a city to save it has become significantly less desirable when considering options for operations in dense urban terrain (DUT), the US military has few options apart from outright destruction.[1] Some past operations, such as Fallujah in 2004, successfully displaced the civilian population before moving into the city which allowed for a more aggressive and destructive operation. However, this technique was successful because the urban area was relatively small and number of civilians displaced was manageable. As a result, the reconstruction and reintegration costs were relatively low. Future urban battlefields will be in developed DUT or megacities that will have such large populations that they cannot be displaced, and will likely carry a more significant cost to rebuild. Therefore, strategists will need to develop a new theory of victory and refined operating concepts.[2] Rather than the destruction and total annihilation of enemy forces, the US military should explore ways to a surgically remove violent actors from otherwise benign areas, similar to Sadr City in 2008. A less destructive solution facilitates transferring control to civil authorities without significant reconstruction of critical infrastructure.

However, to address urban warfare from a purely military perspective is a mistake; the breadth of problems that US forces will encounter in future urban systems will quickly transcend conventional military capabilities. As a result, planners must properly analyze the system with which they will interact and include all interorganizational capabilities in a proactive review of strategic and operational concepts for conflict in major cities. The 2016-2017 counteroffensive against the Islamic State in Iraq and Syria (ISIS) in Mosul provides a potential model to explore for a future operational approach. Close working relationships are paramount to influence

operational and strategic outcomes by leveraging the organization that has the appropriate environmental knowledge, authorities, and access. Cross-talk between civil agencies and military commands is necessary at every level and can be accomplished by formalizing relationships or incorporating empowered liaison officers (LNO) and coordination cells to grow operational art beyond military considerations. This coordination is necessary to manage the complexity and congestion of urban warfare, while maintaining tempo and momentum through operational transitions and tactical adaptations to the actual battlefield conditions.

II. The City As a System

To begin, we must define exactly what an urban environment is to then understand how to interact with it. Characteristics of an urban environment are captured by *Joint Urban Operations* in the urban triad: complex man-made terrain, a population of significant size and density, and infrastructure. It is further described as a dynamic system in which the interplay of the triad components changes the environment and the triad components are easily changed by military operations therein.[3] Recent years have seen the proliferation of terms of reference and definitions of urban areas, built up urban areas, dense urban terrain, dense urban areas, cities, megacities, etc. The three that will be most helpful in understanding the environment, and used throughout this paper are urban area, dense urban terrain (DUT), and megacity. Demographia defines an urban area as "a continuously built up land mass of urban development that is *within* a labor market…contains no rural land," and "best thought of as the 'urban footprint' --- the lighted area ('city lights') that can be observed from an airplane (or satellite) on a clear night."[4] Though this definition makes it relatively easy for a military planner to visualize an urban area, it does little to aid in understanding its complexity.

In an article in the *Small Wars Journal*, Dr. Russell Glenn addresses some of these definitions to make them more useful to military application. He defines DUT as, "areas characterized by closely-packed manmade infrastructure and high population density."[5] This tends to align more with the urban triad above and adds the key component that is important to military planners - the population. However, he is also careful to warn the reader that seeking too specific a definition may limit our understanding of the environment. This concern is particularly true with regard to population size and density. Density can vary significantly between sections within an urban area and can be misleading when a holistic view is taken. For example, the standard in the West for an urban area is a population density of 400 persons per square kilometer. Demographia demonstrates that:

> "the population density of the Phoenix urban area is more than 60 percent higher than in the Boston-Providence urban area. Yet, the highest population densities of Boston-Providence are at least five times that of the highest density areas in Phoenix. Moreover, Boston-Providence has a far larger commercial core ('central business district' or 'downtown'). The difference is that the Phoenix suburbs are denser than the Boston-Providence suburbs."[6]

Dr. Glenn argues that assigning specific number values to an urban value is misleading and does little to understand the more conceptual intricacies of an urban area. Specifically with regard to megacities, defining them solely by population count - greater than ten million - misrepresents the complexities inherent in a megacity.[7] Dr. Glenn recommends a more complete definition: "a megacity is an urban area of extraordinary population size, geographic spread, complexity, and similarly exceptional characteristics, to include influence with at least national and regional scope."[8] This definition still respects the fact that a large population is a component, but does more to represent that megacity is interconnected to the rest of the world, at least the region, and its influence and importance is more than simply a number.

Understanding a city as a system and how it responds to inputs is an important step to develop our future techniques for combat in this environment. Dr. David Kilcullen and the US Army's Urban Warfare Project, among others, are contributing to this discussion to analyze how increased urbanization and connectedness will create a system of systems that amplifies the complexity of warfare.[9] Dr. Glenn also describes this complexity and unpredictability by using a pool table analogy in his discussion with the Modern War Institute. He compares urban operations to "having seven racks of the colored balls on the table and you strike the cue ball, and you have no idea what the ultimate consequences are going to be when they all start to impact each other."[10] Ultimately, cities are complex systems that are as unpredictable as war itself. Although cities operate in a relatively predictable manner during normalcy, predictability all but disappears once a city collides with another nonlinear system, warfare. In her literature review of urban metabolism, Elizabeth Rapoport recognizes that recent urban studies frequently apply "complex systems theory, which conceives of systems as open, non-linear, hierarchically organized entities consisting of a number of agents interacting amongst themselves and with their environment."[11] Each part of this description aptly represents what we encounter in an urban environment.

Open systems are those that fluidly exchange feedback with their external environment, have porous boundaries, and exhibit equifinality: more than one way to achieve the same or similar results.[12] Next, nonlinear systems are "those that disobey proportionality or additivity" and become unpredictable as a result.[13] The principle of proportionality supposes that an input to a system will result in a proportional output. As a linear concept, proportionality provides a direct connection between input and output that doesn't exist in a complex system. Additivity reduces a system into smaller components with the idea that solving component problems will

eventually add to solving the entire problem.[14] Warfare in urban environments certainly disobeys both of these principles. Finally, hierarchical organization has multiple applications, but in this case urban hierarchy refers to three levels: inhabitants, the city itself, and how the city integrates into the overall system of cities in a region.[15] Interaction at each of these levels will produce different results that may or may not support overall operational objectives. The characteristics of open, non-linear, and hierarchical organization allow planners to understand how to interact with the city, and how to anticipate potential consequences of various inputs.

Additionally, Robert Jervis explains in his study of interactions that: "We are dealing with a system when (a) a set of units or elements is interconnected so that changes in some elements or their relations produce changes in other parts of the system and (b) the entire system exhibits properties and behaviors that are different from those of the parts."[16] Jervis also discusses the cyclic nature of the interaction of an actor and its environment. An actor does not just change the system or the environment by making inputs. As the system frequently adapts, the change in the environment and feedback to the actor subsequently change the actor itself. This idea is relatively intuitive for the Marine Corps to apply since it ties directly to the single battle concept as defined in the Marine Corps Planning Process: "operations or events in one part of the battlespace often have profound and consequent effects on other areas and events; therefore, a commander must always view the battlespace as an indivisible entity."[17] In recognizing a city as a system, Marx's urban metabolism idea has resurfaced in the last fifty years to understand how it actually functions. Marx supposes that cities, just like an ecosystem or a human body, consume inputs and create waste concurrent with the activity of the entire system.[18] If the city is unable to metabolize all of the inputs, it can quickly become overwhelmed and increased toxicity in the system will result in a destabilized environment. A significant

analysis of the way an urban system metabolizes inputs from its environment is imperative for future combat operations in these environments to be successful.[19]

In considering this complex environment, studies in scientific revolutions and systems theory consider similar properties that the US will encounter in addressing the future of warfare, especially in urban environments. In *The Structure of Scientific Revolutions*, Thomas Kuhn highlighted the difference between "normal" and "revolutionary" phases of science. A normal phase occurs when the scientific research adheres to a status quo and largely follows the paradigmatic model with few anomalies. A revolutionary phase emerges when the anomalies or outliers increase, and the existing paradigm can no longer solve problems so scientists must develop a new model. In the struggle to find solutions, the revolutionary model does not necessarily maintain all of the tenets of the previous paradigm but must maintain an equal or greater problem-solving power to be relevant.[20] Also, especially when considering military doctrine, development trends toward punctuated equilibrium of long periods of consistency marked by short periods of dynamic change.[21] In response to a revolutionary period driven by increased urbanization, progress in urban operational art will require understanding the nature of the system in which we operate. War is a nonlinear, or complex, system that is unpredictable because repeated actions infrequently lead to repeated results as human psychology and conflicting problem-solving cycles compete. This discussion of scientific theories assists understanding the difficulty in developing future operational art, particularly when considering the urban environment, and will allow the US to proactively impose a revolutionary approach to operations in DUT before this normal period is punctuated by our adversaries and we are forced to react in a complex system.

III. Modern Case Studies

Events of 9/11, Operation ENDURING FREEDOM (OEF), and Operation IRAQI FREEDOM (OIF) marked an end to equilibrium in a normal period of military science. Immediately the world was thrown into a punctuated and revolutionary period as global terrorism and warfare in Iraq and Afghanistan forced militaries to address new and different adversaries. Not only were the enemies diverse in capability, but also in the environment that they occupied. The US military's old paradigm - designed on conventional Cold War assumptions and success in DESERT STORM - could no longer address the anomalies associated with an irregular global threat.[22] Adversaries will no longer seek a conventional fight with the US military and will turn more often to irregular and unrestricted methods.[23] As Russian General Valery Gerasimov noted in 2013, "[t]he very 'rules of war' have changed. The role of nonmilitary means of achieving political and strategic goals has grown, and, in many cases, they have exceeded the power of force of weapons in their effectiveness."[24] This idea is particularly true with regard to counterinsurgency and urban operations where precision firepower alone is not as effective as in an open, conventional fight.

The US military had seemingly forgotten the lessons of the Vietnam War, and began to revisit the past searching for similarities to develop capabilities and doctrine to meet this new threat. With regard to urban operations, fighting in Fallujah and Sadr City during OIF provided a laboratory for experimentation with novel solutions to the new realities of urban warfare. Concluding OIF, it would appear that the US reverted back to a normal period of equilibrium. But urbanization is growing rapidly and future operations in DUT and megacities will present new challenges for the US military. Continued extraction of the lessons from OIF, and more recently OIR, is necessary to anticipate future requirements. The cases demonstrate that

complexity in DUT require thoughtful analysis to develop solutions specific to each environment while managing the congestion, both civil and military, in urban areas. As urban areas continue to grow, reviewing these operations will highlight some options available to inform future urban warfare concept development.

Fallujah, 2004

In April of 2004, after four American Blackwater contractors in Fallujah, Iraq were killed and hung from a bridge crossing the Euphrates River, Combined Joint Task Force-7 (CJTF-7) ordered 1st Marine Expeditionary Force (I MEF) to attack the city. Despite initial protests to the order, I MEF attacked in Operation Vigilant Resolve.[25] The operation was quickly organized and started with only two Marine Corps infantry battalions, with two more joining the fight later. Marine commanders received minimal guidance addressing their objectives, faced stiff resistance from imbedded insurgents in the city, and were ill-prepared for the complexity of the operations. This lack of preparedness stifled momentum and the initial battle lasted only five days from 4-9 April, followed by sporadic fighting through the rest of the month. As the insurgency exploited negative press against the US and the Government of Iraq (GOI) the operation ended on 1 May before the coalition could reach tangible results. What Vigilant Resolve did accomplish, was to attract additional insurgent fighters and illicit activity to the area. As enemy activity increased, CJTF leadership attempted to form an ISF Fallujah Brigade to keep order while US forces remained on the outskirts of the city in support. As the Fallujah Brigade disintegrated and many defected to the insurgency, it became increasingly clear that US forces would have to re-enter the city and gain control. The emboldened Islamists insurgents were brutal in their control of the city and executed several western hostages in highly publicized murders. The resultant coalition

response was a much more deliberate planning effort for Operation Phantom Fury, otherwise known as Fallujah II.[26]

I MEF learned from Vigilant Resolve and took significant steps to ensure that planners adapted Phantom Fury based on their experience in April. Shortly after planning began in July 2004, so did information operations (IO) to influence the civilian population to leave Fallujah. As a recurring theme in urban combat, the threat of civilian casualties informed by the recent experience of Vigilant Resolve made the coalition wary of re-entry concurrent with a significant civilian presence. In conjunction with limited raids and coordinated air strikes, US forces successfully used the IO campaign to encourage civilians to depart. On the eve of the battle, few civilians remained and the coalition had a good understanding of the enemy disposition in the city.[27] This time, the clearing force would not be underwhelming. Four Marine infantry battalions, an Army armored brigade, and nine Iraqi battalions congested the battlefield for a coordinated, mutually supporting clearance from north to south while supporting elements blocked to the south and east. The overall concept was to coordinate the employment of armor and infantry: armored Army units would rapidly push through the city to secure key objectives, while Marine light infantry would clear the city in detail.[28] It would be hard fighting, but overwhelming mass would ensure no sanctuary for the enemy.

On 7 November, 2004, coalition forces secured the initial objectives of Phantom Fury and set the stage for the main assault to begin the next day. Difficulty breaching the berm north of Fallujah, and fierce resistance in the city made progress slow for the Marine light infantry, but they aggressively progressed nonetheless. The armored forces, however, rapidly advanced and seized their assigned objectives. As events stabilized in the northern half of the city, coalition forces continued south where the insurgents had thoroughly prepared the defensive positions due

to their erroneous assessment that the coalition attack would come from the south. By November 12th, all coalition forces had reached their objectives, however not all were fully secured. In the process, they had found house-borne IEDs, a significant tunnel network, and heavily fortified positions that showed the enemy's preparedness. The continued clearance of all of the city blocks was a significant challenge due to the enemy's resolve to stand and fight, support from foreign fighter networks, and illicit drug use for endurance and courage. It was clear that the insurgents were determined to fight and take as many American lives as possible. Therefore, clearing the city house by house and room by room became a particularly difficult option. The success of the IO campaign in removing the vast majority of civilians availed another tactical adaptation to coalition forces. Rather than go into a heavily fortified house and suffer casualties, coalition forces could now confirm enemy locations, back away, and then use any fire support means available to catastrophically destroy the building: a return to the idea of destroying a city to save it. Coalition forces still had to clear every building, but conforming to the actual battlefield conditions made the effort much safer by killing most of the remaining fighters, or scaring them off of the battlefield.

By mid-November coalition forces began to transition to reconstruction in mid-November while still fighting through the city.[29] Clearly there had been a shift in mindset of how best to conduct operations in this type of urban environment. With Fallujah's relatively small size, it was realistic to conduct and IO campaign to get civilians to leave before the battle. As the fight progressed, within three days the transition to using "firepower, and not primarily muscle power to clear buildings of enemy fighters" became ever more pervasive.[30] The amount of casualties the coalition forces, especially Marines, experienced while clearing buildings had been unacceptable relative to the mission gain. To properly manage risk, Marines relied on fire

support from artillery and aviation, but they quickly adapted to coordinate closer with their armor and engineer counterparts so that they would have direct fire support and demolition available at a moment's notice.[31] This infantry-armor coordination was critical to ensure the safety of both. If an attack was led by armor, it typically reduced the enemy threat before exposing light infantry. If the infantry initiated the next attack, insurgents were lured into complacency or over-aggression due to the distant sound of armor. In this situation, they would expose themselves to get a clear shot at the tanks, but light infantry would already be in a position to attack and protect the armor. This mutual support, coupled with the overwhelming use of supporting fires, directly reduced the human toll required to clear the rest of Fallujah. Even though armor was not always available to the Marines, and many still had to fight house by house with only light infantry, the adaptation to closely integrate armor and overwhelming fire power to destroy vice clear buildings is a hallmark of Fallujah II.

Overall, the difference between the two Fallujah battles demonstrates the effectiveness of adaptation in urban warfare. Fallujah I featured extremely difficult fighting in unfavorable conditions made worse by civilian presence. The insurgents capitalized on the media effect by broadcasting civilian casualties to influence world opinion. Coalition forces learned from this and reduced the scope of the problem in Fallujah II by evacuating the vast majority of civilians before combat began. The desire to reduce coalition casualty rates in Fallujah also allowed the light infantry to capitalize on this civilian vacancy. Fallujah II witnessed the transition from stacks of light infantry pouring into heavily defended buildings to using stand-off and employing armor, firepower, and demolition to reduce heavily fortified enemy positions. Ultimately, a determined enemy who has established fighting positions in urban terrain will require the attacking force to enter the city and fight and there will be significant destruction and a high

number of casualties on both sides. The coalition adapted to make urban operations more survivable for light infantry by effectively teaming with armor formations to maximize tempo and firepower to devastate enemy forces. In Fallujah, the coalition had to destroy the city to save it.

Sadr City, 2008

In 2008, the Battle for Sadr City reaffirmed the nonlinearity of urban combat, and highlighted the ingenuity required to reduce an adversary in this environment. Sadr City is on the northeast edge of the Baghdad urban sprawl and had an estimated population of 2.4 million at the time of the battle.[32] For comparison, Manhattan, which is twice the geographic size of Sadr City, had a population of 1.6 million in 2008.[33] This population density and the total control that the coalition adversaries, Moqtada al-Sadr and Jaish Al-Mahdi (JAM), had on the population presented a significant challenge to coalition forces. However, the coalition's understanding of JAM's character and the purpose of the operation were critical in identifying the best method to achieve the desired endstate. JAM forces had been harassing the international zone of Baghdad with rocket fire and preceded major coalition operations in Basra with another significant rocket attack and disruption operations throughout Baghdad. Events in Sadr City threatened the success of the impending Basra mission, so US forces were tasked to stop JAM activity, and return control of the city to the GOI.[34] Because of the size and density of the city, coalition forces required an approach that did not involve clearing it in detail.

To address the threat posed by JAM, Major General Hammond (USA) chose an operational approach to "isolate Sadr City, influence its population, then employ [ISF] to stabilize the district."[35] Isolation seemed the only viable option since US forces didn't have the forces necessary to clear the area without pulling from Basra, and they were forbidden entry into

the city proper by GOI due to negative outcomes of previous missions.[36] The coalition achieved isolation by using concrete t-walls to protect marketplaces and prevent JAM access to critical economic resources while simultaneously manning combined security checkpoints to disrupt freedom of movement. Targeted raids destabilized JAM command and control (C2) while minimizing long duration missions that would result in disadvantageous and drawn-out fighting. The first struggle to influence the population was developing an accurate understanding of the environment. As a deeply imbedded and influential adversary, JAM essentially denied coalition forces' ability to generate a significant human intelligence (HUMINT) network. Furthermore, SOF were unable to operate effectively in this environment because of the threat of rapid isolation by an overwhelming enemy force.[37] This difficulty was the result of al-Sadr's clear control of the city to the point that residents credited his presence with any improvements to their quality of life.[38] However, despite the historical reliance on al-Sadr and JAM to provide security and essential services, their brutality in subjugating the people created a seam for coalition forces to exploit and influence the residents by providing them a better option for governance

Finally, with regard to employing ISF, using t-walls to isolate key markets and control JAM freedom of movement had another unintended consequence. JAM fighters understood the value of the access they lost, and shifted to open battle in an attempt to maintain control of the area. In doing so, they exposed themselves to coalition targeting which allowed coalition and ISF to achieve a significant advantage.[39] As US forces and ISF attrited JAM resistance, they gained significant access to a wealth of intelligence. US forces were still prohibited from going into Sadr City proper, so ISF took the lead in developing intelligence throughout the city to help weed out the remaining JAM leaders and operational elements. [40] This role supported the overall effort, but also served to legitimize ISF and show their value to the local populace. Further, ISF's

role in the overall targeting apparatus grew. Some of their targets remained theirs to engage, some were handed off to US Army, and others were given to SOF for action. This ability to fully integrate the partner force into operations is critical in areas where they have the best access and need the credibility gained from their involvement. It took significantly more effort for US forces to convince GOI that conditions existed to provide security and essential services. But, once they did, conditions dramatically improved. ISF welcomed Iraqi Police into the area to assist in providing law and order, GOI began collecting trash off of the streets, and citizens began to feel as though they had a stake in their future and no longer had to react to JAM brutality.

Sadr City is a good example of finding novel solutions to complex problems in an urban environment. Rather than destruction and annihilation, US forces found less devastating methods to achieve their objectives. This is not to say that there was not significant fighting in and around Sadr City, there certainly was. However, coalition forces focused on denying JAM's critical requirements - freedom of movement and access to critical resources - and forced the insurgents to come out and fight. In doing so, US forces and ISF did not have to destroy the city to save it. More importantly, the coalition main effort in Basra was able to continue mission without being diverted due problems in Sadr City. Reconstruction efforts and infrastructure that remained intact quickly increased the credibility of ISF and GOI. General Hammond's operational approach showed the applicability of creative thought in urban warfare. Though Sadr City only represents a fraction of what future combat in DUT or a megacity will entail, its lessons provide insight into what methods might be useful to avoid protracted war in extremely difficult urban terrain.

Operation Inherent Resolve - Mosul

In 2016, while I was assigned to Special Operations Task Force (SOTF) - North in Erbil, CJTF-OIR began its overwhelming push up the Tigris River Valley (TRV) toward Mosul to

drive ISIS out of Iraq. As the coalition continued north, preparations began for extremely difficult fight against a committed enemy that had been fortifying its defenses for two years.[41] Mosul represented a different challenge than Fallujah and Sadr City had previously, but maintained that militaries must adapt their approach to the environment. The geographic size, population density, demographic diversity, and geopolitical controversy all made Mosul a labyrinth of regional actors trying to sort their way to victory. The sheer size of the city made it impossible to evacuate all civilians, and ISIS entrenchment and control guaranteed that there would not be a simple way to surgically remove them from the city. Furthermore, the fight would also entail the transition from open terrain to urban, and simultaneously a shift from regular to irregular warfare against an enemy prepared for that transition. The fight for Mosul represents of the increased complexity and congestion that will exist in future DUT, and the necessary anticipation to transition from conventional to unconventional warfare and adapt to actual conditions in such a large city.

As Operation Eagle Strike proceeded out of Baghdad and up the TRV, Mosul loomed in the distance as a future problem. In the process, Iraqi SOF units, the Counter Terrorism Service (CTS) achieved significant success as the most capable combat unit in the Iraqi Army (IA). The smaller urban areas that they cleared on the advance north - Balad, Tikrit, and Bayji - represented a relatively simple problem that required less detailed planning and coordination. Approaching Qayyarah, the situation began to change. The previous offensives were small enough and less critical to ISIS because of their ability to retreat to Mosul. Now, the advance was threatening the ISIS capital in Iraq, the largest city that they held, and there were no longer options for retreat.[42] ISIS was determined to fight, and the coalition would have to face a dedicated enemy in the most complex terrain yet.

The advance up the TRV also meant the convergence of military units and ethnic identities that historically do not work well together. On the east side of the Tigris, the IA and CTS units were moving into close proximity with Kurdish Peshmerga and Zerevani forces. It was evident that Iraqi-Kurdish cooperation would be necessary because the Kurds controlled the avenues of approach surrounding Mosul to the north, east and southeast. However, it was difficult to determine the exact role for each force as the planning began. Not only on the Iraqi side, but US partnership and battlespace boundaries began colliding as well. SOTF West and its advise, assist, accompany, and enable (A3E) SEAL task elements were based in Baghdad typically received support from Combined Joint Operations Center (CJOC) - Baghdad while operating along the Euphrates River Valley. As they moved north, they maintained their CTS partnerships, and progressed into CJOC - Erbil and Kurdish Security Forces (KSF) battlespace where SOTF North was conducting operations throughout the Kurdistan Region of Iraq (KRI). This collision course required coordination and relationships that the coalition had not yet established. On the west side of the river, the Iraqi Federal Police (FEDPOL) Emergency Response Divisions (ERD) were slowly moving north toward Mosul with Italian SOF advisors in hope of a combined assault from the east and south, on both sides of the river. This movement proved too costly and was eventually diverted east of the Tigris to regain momentum.

Not only were military units complicating the battlespace, but geopolitical tension grew as the coalition prepared for the assault because of Mosul's diverse ethnic composition. It is estimated that in 2014 the population was 1.3 million in only 140 square kilometers with a "majority Arab Sunni population (around 80 per cent of the population if not more), followed by Kurds, Christians, Turkomans, Shabak, and Yazidis."[43] This population diversity is coupled with the strong geographic ties to Iraq, Kurdistan, Turkey, Iran, Syria, and other Gulf states with each

state having its own interest in Mosul's future and lacking consensus. It also led to discussions about which force, Iraqi or Kurdish, would be the primary to lead the assault. Friction grew between the Kurdistan Regional Government (KRG) and GOI since both had strong ethnic connections to the city and a significant desire to participate in the operation that dismantled ISIS in Iraq. However, it ultimately rested on the Iraqi Constitution: Mosul was not part of the agreed upon Kurdistan Region of Iraq, so the KRG did not have a much of a claim to enter the city proper. The final plan settled on the Kurds advancing the Kurdish defensive line around Mosul to allow the CTS and IA to execute a forward passage of lines (FPOL) into Mosul.

To support this effort, prior to commencing the formal counteroffensive in October 2016 there was a myriad of units and organizations swarming through the area. US CFs were represented by elements of the 101st Airborne Division and 82d Airborne Division participating in security force assistance (SFA) with US Air Force joint terminal attack controller support, as well as coalition forces that were supporting SFA in a training capacity. Army Civil Affairs and US Department of State officials were conducting interorganizational and intergovernmental coordination to synchronize efforts through a delicate interstate division between the GOI and KRG, while simultaneously managing the Iraq Train and Equip Fund (ITEF). US Agency for International Development (USAID) and non-government organizations (NGO) were involved in the humanitarian crisis and managing the resumption of essential services as well as multiple camps of internally displaced persons (IDP). As the units with the most permissive authorities, coalition SOF from seven different nations were supporting foreign internal defense (FID) and conducting A3E operations with Iraqi and Kurdish Security Forces (KSF) throughout Kurdistan and eventually in Mosul. Even within US SOF, there was another division between Marine Special Operations Teams (MSOT) and Naval Special Warfare Task Elements (NSWTE). While

not nearly a comprehensive list of organizations and activities, it does highlight the congestion in the operating environment. Taken a step further, most of these agencies did not have formal command relationships at the tactical and operational levels to guarantee coordination.

Coalition forces and interagency involvement complicated matters due to the number of competing equities; however, the primary combatants were Iraqi and Kurdish Security Forces (ISF and KSF). Their interaction and coordination added yet another layer of difficulty and saturation. Units operating in the battlespace for ISF consisted of conventional Iraqi Army (IA) units, Iraqi SOF CTS, FEDPOL, ERD, Iraqi Air Force, and popular mobilization forces (PMF). The KRG initially supported with Peshmerga, Zerevani, and Asayish forces, among others, as they provided critical security around Mosul, and the initial thrust to begin the counteroffensive. As the operation began in October of 2016, there were over 50,000 ISF and KSF soldiers participating in the operation to clear approximately 6,000 ISIS fighters. This total for ISF and KSF would grow to over 90,000 by the time the operation was complete.[44] Additionally, local government and tribal officials became involved and empowered as control of areas surrounding, and in Mosul were reclaimed. The tension between Kurdish and Iraqi elements and leadership led to significant friction at times and highlighted the need for an intermediary to manage the relationship and operations.

The coalition in this situation was fortunate to have had several smaller-scale operations that occurred throughout the TRV that facilitated trial and error since 2014, but it still took deliberate coordination to ensure unity of effort. Co-location was the critical factor that enabled a common operating picture and rapid decision-making. The Kurdish leadership maintained the Kurdistan Regional Support Center (KRSC) that worked directly with CF and SOF LNOs to share KSF disposition and operational information. The KRSC also coordinated access and

movement through regional sectors to ensure force protection and logistics. All coalition SOF units provided representatives to planning cells and a combined joint operations center (CJOC) to rapidly process, prioritize, and coordinate all operations and strike requests. This SOF CJOC was also co-located with the CF JOC so that the JOC director could quickly get accurate information about current battlefield conditions from forward SOF teams. All warfighting functions co-located to the maximum extent possible, and coordination meetings occurred daily or weekly, at the key players' availability, to discuss progress and shortfalls. The Consul General conducted a bi-weekly meeting to synchronize civil-military operations and remain aware of the reality of the situation. Once again, more coordination occurred than listed, but the takeaway is that coordination at all levels and across all domains and functions was happening continuously, but informally. In the future, we will probably not have several small-scale events that serve as dress rehearsals to build informal relationships and structure as combat operations progress. These considerations need to be taken into account before deployment to the theater and incorporated as much as possible into the joint manning document so that personnel requirements can correlate to actual line numbers.

With the complexity of the urban environment and the congestion also came a critical transition: from rural terrain, to suburban, and then into dense urban.[45] The rural outskirts of Mosul are sparsely populated and gave ISIS little protection from observation and attack by coalition forces. Based on the overwhelming numbers of KSF and ISF commencing the operation, this meant that a significant defense in the rural areas was untenable. Instead, ISIS chose to conduct an active defense in these areas using vehicle-borne improvised explosive devices (VBIED), prepared fighting positions, an extensive tunnel network, and pre-registered defensive targets for their mortars to delay and disrupt the coalition advance. VBIEDs were their

primary bid for success as they tried to over-saturate KSF and coalition observation and fire support to get as many VBIEDs through to a successful attack as possible. Some of the small villages became ISIS strongpoints where they would dedicate significant effort to delaying the advance. However, with coalition MSOTs and NSWTEs embedded to advise and assist C2, accompany their partners into combat, and enable responsive fire support, the KSF successfully expanded the security area to allow the ISF FPOL into the outer urban areas.[46]

This transition - from a KSF led operation to ISF led - was the first of many to come and surprisingly successful as the KRG and GOI worked well together and with their coalition partners to coordinate its execution. It also entailed a transition in terrain and the initial phases of the shift from more conventional means to unconventional. At this point, "the Islamic State clearly had an accurate appreciation of the vectors from which the assault on Mosul were most likely to come (and subsequently did)."[47] ISIS deftly prepared the defensive crust in the urban sprawl by using mouse-holes, holes knocked out of walls in buildings to permit unobserved, rapid movement between rooms or buildings. This technique allowed ISIS to move through neighborhoods unobserved, and coupled with a tunnel network, also allowed them to reoccupy positions that had been cleared previously. Though ISIS obstacle belts were relatively ineffective at slowing the ISF advance, their anti-tank defenses were effective at slowing the predictable, tank-led ISF formations as they moved through the rural areas approaching the city. ISIS constructed ambush zones supported by anti-tank guided munitions and successfully disrupted the infantry-tank coordination, somewhat negating the successful tactics of Fallujah II. As noted by Knights and Mello, "the Islamic State achieved an important goal for much of the east Mosul battle: to separate enemy tanks and infantry from cooperating in the street-to-street fighting."[48]

The lead ISF units through the FPOL were CTS. Pushing into the urban sprawl, they defaulted to the tactics that had been successful all the way up the TRV - use speed to penetrate deep into the city, then backclear to hold territory. In previous Eagle Strike operations, the CTS could penetrate all the way through a town and successfully backclear in just a few days. However, Mosul would be different and the CTS would quickly outpace themselves and the other axes of advance. This problem became apparent as the CTS advanced into the DUT and the IA axes on their north and south slowed to a stop. As CTS continued their advance to penetrate into Mosul, their flanks became exposed and their forces stretched too thin to adequately manage the threat in such a large city. The CTS hard fought gains were even more difficult to retain. This transition from rural to urban also bore the need for several adaptations: adequate forces to hold and stabilize cleared areas, SOF A3E teams to energize the north and south axes, and updated rules of engagement (ROE) to maintain tempo and force protection.

To generate the necessary hold forces, SOTF North energized a tribal force training program that had been progressing slowly until summer of 2016. The idea behind this portion of the Sunni popular mobilization forces (PMF) was that they would eventually be able to move into areas that their tribe had historically occupied. Their presence would permit ethnic continuity and security as internally displaced persons moved out of camps and back into their neighborhoods. It would also allow CTS, IA, and FEDPOL units to maintain momentum without significantly reducing combat power due to casualties and the need to leave forces behind to secure and hold cleared areas. In preparation for Mosul, SOTF North increased the number of training camps for properly vetted Sunni PMF, and significantly increased the total number of trained forces available to retain the valuable gains made by ISF in Mosul's DUT.[49] In November of 2016, all PMF were formalized by law into the national ISF hierarchy and began

receiving funding through the Iraqi Train and Equip Fund (ITEF).[50] This increased stream of funding allowed coalition SOF to rapidly build the forces necessary to support operations in Mosul. More than just funding, the law provided the critical means to command and control the PMF and integrate them into the broader ISF strategy and operation. With the surge in Sunni PMF capability, ISF now had viable hold forces that allowed them to maintain offensive momentum, while simultaneously providing a more welcoming temporary police force to Sunni Moslawis. The Sunni PMF program was an adaptation and solution to a critical friction point that allowed the local population to solve local problems while federal forces continued to progress.[51]

Though the Sunni PMF program allowed CTS to continue forward and manage any ISIS attempts to infiltrate and attack in cleared areas, the other axes of advance, the 9th IA on the south and 16th IA on the north, were still stalled. As mentioned above, the fact that these axes were not moving complicated the problem for CTS to protect its ever expanding front. A key difference between these CTS and IA units was that CTS had US SOF A3E attached and forward with them to provide responsive fire support and C2 advice. IA units did not have this luxury and worked through a slower and more deliberate process at a lower priority for support than CTS. However, another opportunity to adapt now presented itself. As the Peshmerga advance to expand the Kurdish Defensive Line (KDL) and set the perimeter had been completed, their forces were more than capable to defend their line and the no longer required the same amount of SOF presence as when the operation began. SOTF North analyzed the situation, and made the recommendation to reallocate forces to the 9th and 16th IA to provide the same level of attached assistance that CTS received. Due to national caveats, coalition SOF maintained tasking with the Kurds along the KDL, and US SOF in the form of MSOTs and NSWTEs pushed forward into Mosul to accompany the halted IA units. As 9th IA encountered significant difficulty at the al

Salam hospital, FEDPOL ERD moved to the east side of the Tigris to assume the lead on the southern axis and continue to advance through east Mosul. Even though the 9th IA initial effort failed due to a devastating counterattack at the hospital, it was evident that ISIS could not manage a multi-axis attack and that if the coalition executed the operation as planned, it would succeed. With US SOF teams forward at the point of friction on every axis, this critical adaptation enabled the coordinated assault relieved the pressure on CTS, and now presented too big a challenge for ISIS to manage.

Concurrent with these adaptations, a change to the ROE was moving through the CJTF-OIR staff. Up to this point, target engagement authority had been very centralized and could not keep up with the pace of urban warfare. Though acceptable while coalition forces were operating in rural, open terrain and reaction time was not as critical, the transition through urban sprawl and into urban terrain demonstrated that ISIS would outpace coalition efforts if the ROE remained the same. Reduced threat reaction time in the canalizing DUT enabled ISIS to expertly employ VBIED and small unmanned aerial systems (SUAS) teams against ISF. The shift in ROE allowed frontline commanders much more authority to defend themselves and ISF, especially in time sensitive situations. The VBIED capability ISIS had developed in east Mosul was an impressive an extremely difficult threat for ISF to counter. Not only did the shift in ROE enable the coalition to regain tempo, but it also restored confidence to ISF that they would be protected from the most capable weapon that ISIS employed. With these two advantages combined, the initiative shifted back to the coalition's favor and ISF were able to effectively synchronize their operations across three axes to effectively recover east Mosul.

Operation Eagle Strike and the coordinated effort to reclaim Mosul demonstrated that an organized coalition can overcome complexity, congestion, transitions, and adapt to meet the

requirements of combat in DUT. By slowing down and coordinating each axis of advance into the city, ISF and coalition forces effectively managed the complexity of urban terrain to systematically break apart ISIS defenses. ISIS simply could not manage the breadth of the operation once the ISF effort became coordinated. Next congestion in the battlespace will be an inhibitor if not thoroughly planned and coordinated as multiple nations, units, organizations, and interests collide. Though Mosul is certainly DUT, it is still nowhere near the problem that a megacity will be in the future. The coalition standardized coordination between civil, military, and multinational organizations by establishing combined operations centers, coordination cells, and synchronization meetings. Informal, relationship-based coordination was extremely effective in ensuring unity of effort and information sharing.

Managing the transition from regular warfare in open terrain, to irregular warfare in DUT required changing tactics, techniques and procedures (TTPs) and equipment requirements to meet new challenges. Not only the transition in terrain, but the transition in partnership from a KSF-led to an ISF-led operations presented challenges that were well considered and planned to make the ISF FPOL successful. Additionally, by generating, employing, and empowering local Sunni PMF hold forces with intimate knowledge of the people and terrain, the coalition managed yet another transition as combat operations continued while the Sunni PMF began stability operations in its wake. This allowed the right people to welcome IDPs back to their neighborhoods and homes with familiar forces providing security rather than leaving a foreign occupation force behind. The coalition frequently adapted to conditions as it approached and entered Mosul to develop the Sunni PMF hold forces, shift SOF teams to protect critical vulnerabilities, and adjust ROE to enabled ISF and the coalition to gain and maintain the initiative against a well prepared enemy. Although this is not a comprehensive list of lessons

from Mosul, these considerations will help inform how to conduct future operations in DUT and megacities.

Future Considerations

Unified action by a broad organization of dissimilar agencies with a varied understanding of their counterparts is challenging. James McArthur rightly addresses the need for each organization to "clearly articulate its needs, resources, abilities, authorities, and, most importantly, its constraints."[52] However, Joint Publication 3-08 *Interorganizational Cooperation* (JP 3-08) recognizes that "one difficulty of coordinating operations among USG departments and agencies is determining appropriate counterparts."[53] A proactive approach from mission leadership is necessary to identify the appropriate counterparts early, and connect these individuals at operational and tactical levels that are close to the problem. Brokering this relationship will enable honest dialogue between planners to fully understand the capabilities, authorities, and limitations of each contributor. SOF may have the relationships, access to key leaders, and authorities to execute specific activities. CF may have the preponderance of fire support, aviation, and logistics (to include medical support). USAID may have the resources to handle infrastructure challenges; other government agencies (OGA) the necessary intelligence; while approval authority for any activity may reside with the host nation via the Country Team. In this type of situation, very similar to Mosul in 2016, planners must have detailed knowledge of who is operating in the battlespace, how they can best be employed to support the operational objectives, and how inputs into the system may result in disproportionate results for the other participants. Open sharing of information and co-locating will be necessary to ensure information quickly makes it to the individual who it impacts the most or has the authority and ability to take action. Integrated planning between these organizations will add depth to problem

framing and help identify key shortfalls across agencies before they materialize on the battlefield. Current, ad hoc relationships are yielding positive effects in the operating environment, but agencies should formalize relationships early enough to allow personnel to develop working relationships and a shared vision.

Formal mechanisms to coordinate this activity are currently lagging behind the operational concepts, but Joint Publication 3-08 and Field Manual 6-05 provide useful insight into how to manage this integration. Effectively coordinating efforts in the future will require exchanging LNOs with adjacent organizations operating in the battlespace. FM 6-05 recognizes that, "LNOs are critical to a command's ability to coordinate, integrate, and deconflict CF and SOF operations."[54] Though this publication specifically addresses military integration, these principles need to be carried over to the whole of government framework: especially when considering operations in DUT. JP 3-08 carries the idea further by recommending the joint staffs request LNOs and open dialogue with other agencies, or providing LNOs due to the limited manpower available to other agencies.[55] These LNOs need to be carefully selected individuals who have the credibility to speak and authority to act on their organization's behalf during critical times of battlefield friction when waiting for a decision from leadership will close a window of opportunity. In a complicated combat environment, the difficulty becomes selecting a solid performer to leave the primary staff to serve as an LNO. However, selecting strong performers is critical to ensure operational and strategic success, while encouraging interorganizational relationships based on mutual competence.

Conclusion

Through OEF, OIF, and OIR, interagency, joint SOF, joint CF, coalition forces, and non-government organizations increasingly operated in the same battlespace. As future military

operations continue to move into DUT, this level of congested activity is only going to increase as each agency is required to leverage their capabilities to support the operational objective. An article by James McArthur et al. published in the Joint Forces Quarterly highlights this need as it addresses the differences in interorganizational purpose, process, and people. He notes that when this "coordination is absent, DOD activities may lead local groups to develop unrealistic goals for future governmental interactions, leading to disappointment, resentment, and possible anger to the United States."[56] The requirement to rapidly identify which agency is the most capable to solve difficult problems is growing, and lower echelons at the operational and tactical level must embrace this coordination. Unity of effort is critical at these levels and is more difficult to achieve when enduring relationships between organizations do not exist.

Moreover, the US military must expand its consideration of urban areas, consolidate lessons learned, and synthesize new solutions to warfare in urban environments. Success in urban areas requires creativity and coordination to properly manage the complexity inherent in an urban system. Additionally, future urban operations will likely include a transition from rural, open terrain into the urban area. This transition will be a critical friction point as TTPs, and equipment all change to meet the new terrain. Not only will there be a tactical transition, but due to the unpredictability of the environment, the US military will have to anticipate requirements to adapt to the reality of the situation. Fallujah, Sadr City, and Mosul all demonstrate these characteristics and requirements. These cases help inform future planners who must consider the urban metabolism and whether or not it is even worth the risk of entering dense urban terrain and megacities. Ultimately, the US military must train and prepare for the enduring characteristics of complexity, congestion, transition, and adaptation in urban warfare.

Notes

[1] John Spencer, "Why America Is Destroying Iraqi Cities to Save Them," *National Interest*, August 23, 2017.
[2] Benjamin M. Jensen, *Forging the Sword: Doctrinal Change in the U.S. Army* (Stanford, CA: Stanford University Press, 2016), 16-17.
[3] US Department of Defense, *Joint Urban Operations*, JP 3-06 (Washington, DC: US Department of Defense, November 20, 2013), I-2.
[4] *Demographia World Urban Areas*, 11th edition, 2015, 2, http://www.demographia.com/db-worldua.pdf (accessed April 11, 2018), 3-4.
[5] Russell W. Glenn, "Ten Million is Not Enough: Coming to Grips with Megacities' Challenges and Opportunities," *Small Wars Journal* (accessed April 10, 2018). http://smallwarsjournal.com/jrnl/art/ten-million-is-not-enough-coming-to-grips-with-megacities%E2%80%99-challenges-and-opportunities.
[6] *Demographia*, 5.
[7] *The Oxford English Dictionary Online*, s.v. "megacity," accessed April 15, 2018, https://en.oxforddictionaries.com/definition/megacity.
[8] Glenn, "Ten Million is Not Enough."
[9] David Kilcullen, "The City as a System: Future Conflict and Urban Resilience," *The Fletcher Forum of World Affairs*, Vol 36:2 (Summer, 2012), 21-25; https://mwi.usma.edu/urban-warfare-project/.
[10] Russell Glenn, "The Future Urban Battlefield," Modern War Institute, podcast audio, August 16, 2017. https://mwi.usma.edu/mwi-podcast-future-urban-battlefield-dr-russell-glenn/
[11] Elizabeth Rapoport, "Interdisciplinary Perspectives on Urban Metabolism: A review on the literature," (London: University College London, October 27, 2011), 8.
[12] Fremont E. Kast and James E. Rozenweig, "General Systems Theory: Application for Organization and Management," *Academy of Management Journal* (December, 1972), 450.
[13] Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security*,Winter 1992/93, 62.
[14] Ibid.
[15] Denise Pumain, "Alternative Explanations of Hierarchical Differentiation in Urban Systems," *Hierarchy in Natural and Social Sciences*, Methodos series (Netherlands: Springer, 2006), 171-172.
[16] Robert Jervis, "From Complex Systems: The Role of Interactions," *Coping With the Bounds: Speculations on Nonlinearity in Military Affairs*, 235.
[17] Headquarters US Marine Corps, *Marine Corps Planning Process*, MCWP 5-10 (Washington, DC: US Marine Corps, May 2, 2016), 1-6.
[18] David Kilcullen, *Out of the Mountains: The Coming Age of the Urban Guerilla* (New York: Oxford University Press, 2013), 41-45; Rapoport 6-8.
[19] Kilcullen, *Out of the Mountains*, 42-43.
[20] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 50th Anniversary Edition (Chicago: University of Chicago Press, 2012), 62-65, 144-158, 169.
[21] Stephen Jay Gould, *Punctuated Equilibrium* (London: Belknap Press of Harvard University Press, 2007), 39-40, 295.
[22] Kilcullen, "City as a System," 20.

[23] Qiao Liang and Wang Xiangsui, *Unrestricted Warfare*, (Beijing: PLA Literature and Arts Publishing House, February 1999), 4-7.
[24] Valery Gerasimov, "The Value of Science is in the Foresight: New Challenges Demand Rethinking the Forms and Methods of Carrying out Combat Operations," [Russian] trans. Robert Coalson, *Military Review* (January-February 2016), 24.
[25] Gian Gentile, David E. Johnson, Lisa Saum-Manning, Raphael S. Cohen, Shara Williams, Carrie Lee, Michael Shurkin, Brenna Allen, Sarah Soliman, and James L. Doty III, *Reimagining the Character of Urban Operations for the U.S. Army: How the Past Can Inform the Present and Future* (Santa Monica, CA: Rand Corporation, 2017), 69.
[26] Ibid., 69-71.
[27] Ibid., 72.
[28] Ibid., 75.
[29] Ibid., 76-83.
[30] Ibid., 93.
[31] Ibid., 94-95.
[32] David E. Johnson, M. Wade Markel, and Brian Shannon, *The 2008 Battle of Sadr City: Reimagining Urban Combat* (Santa Monica, CA: Rand Corporation, 2013), xv.
[33] https://www1.nyc.gov/assets/planning/download/pdf/data-maps/nyc-population/acs/demo_tables_2008_2012_nyc_acs.pdf.
[34] Johnson et al, *The 2008 Battle of Sadr City*, 39.
[35] Ibid., 10.
[36] Ibid., 100.
[37] Ibid., 12.
[38] Ibid., 26.
[39] Ibid., 74-75.
[40] Ibid., 84.
[41] Zana Gulmohamad, "Unseating the Caliphate: Contrasting the Challenges of Liberating Fallujah and Mosul," *CTC Sentinel*, Volume 9, Issue 10, October 2016, 19.
[42] Ibid., 18; Michael Knights and Alexander Mello. "Defeat by Annihilation: Mobility and Attrition in the Islamic State's Defense of Mosul," *CTC Sentinel*, Volume 10, Issue 4, April, 2017, 1.
[43] United Nations Human Settlements Programme in Iraq (UN-Habitat), "City Profile of Mosul, Iraq: Multi-sector Assessment of a City Under Siege" (New York: UN-Habitat, 2016), 21.
[44] Knights and Mello, "Defeat by Annihilation," 5; Gulmohmad, "Unseating the Caliphate," 21.
[45] Paul Torpey, Pablo Gutierrez, and Paul Scuton, "The Battle for Mosul in Maps," *The Guardian*, June 26, 2017, https://www.theguardian.com/world/2016/nov/04/battle-for-mosul-maps-visual-guide-fighting-iraq-isis.
[46] Knights and Mello, "Defeat by Annihilation," 1-2.
[47] Ibid., 2.
[48] Ibid., 3.
[49] Erica Gaston, *Sunni Tribal Forces* (Berlin: Global Public Policy Institute, August 30, 2017), http://www.gppi.net/publications/sunni-tribal-forces/.
[50] Government of Iraq, House of Representatives, *Law of the Popular Crowd* [Arabic], Session No. 32 (November 26, 2016), http://ar.parliament.iq/2016/11/26/.
[51] Gaston, *Sunni Tribal Forces*.

[52] James C. McArthur, William D. Betts, Nelson R. Bregon, Faith M. Chamberlain, George E. Katsos, Mark C. Kelly, E. Craig Levy, Matthew L. Lim, Kimberly K. Mickus, and Paul N. Stockton, "Interorganizational Cooperation Part I of III: the Interagency Perspective," *Joint Forces Quarterly* 79 (4th Quarter, 2015), 110.
[53] US Department of Defense, *Interorganizational Cooperation*, JP 3-08 (Washington, DC: US Department of Defense, June 24, 2011), I-12.
[54] Headquarters US Marine Corps, *Multi-Service Tactics, Techniques, and Procedures for Conventional Forces and Special Operations Forces Integration, Interoperability, and Interdependence*, MCWP 3-36.1 (Washington, DC: Headquarters US Marine Corps, March 2014), 14.
[55] JP 3-08, II-10.
[56] McArthur et al, "Interorganizational Cooperation Part I of III," 108.

Bibliography

Beyerchen, Alan. "Clausewitz, Nonlinearity, and the Unpredictability of War." *International Security.*Winter 1992/93.

Demographia. *Demographia World Urban Areas*, 11th edition, 2015, 2, http://www.demographia.com/db-worldua.pdf (accessed April 11, 2018).

Duri-Agri, Jessa Rose, Omer Kassim, and Patrick Martin. *Iraqi Security Forces and Popular Mobilization Forces: Orders of Battle*. Washington, DC: Institute for the Study of War, 2017.

Fine, Glenn A. *Operation Inherent Resolve: Report to the United States Congress*. Lead Inspector General Report to the US Congress (July 1, 2016 - September 30, 2016).

Fine, Glenn A. *Operation Inherent Resolve: Report to the United States Congress*. Lead Inspector General Report to the US Congress (January 21, 2017 - March 31, 2017).

Gaston, Erica. *Sunni Tribal Forces.* Berlin: Global Public Policy Institute, August 30, 2017. http://www.gppi.net/publications/sunni-tribal-forces/.

Gentile, Gian, David E. Johnson, Lisa Saum-Manning, Raphael S. Cohen, Shara Williams, Carrie Lee, Michael Shurkin, Brenna Allen, Sarah Soliman, and James L. Doty III. *Reimagining the Character of Urban Operations for the U.S. Army: How the Past Can Inform the Present and Future.* Santa Monica, CA: Rand Corporation, 2017.

Gerasimov, Valery. "The Value of Science is in the Foresight: New Challenges Demand Rethinking the Forms and Methods of Carrying out Combat Operations [Russian]." Translated by Robert Coalson. *Military Review* (January-February 2016): 23-29.

Glenn, Russell W. "Ten Million is Not Enough: Coming to Grips with Megacities' Challenges and Opportunities." *Small Wars Journal* (accessed April 10, 2018). http://smallwarsjournal.com/jrnl/art/ten-million-is-not-enough-coming-to-grips-with-megacities%E2%80%99-challenges-and-opportunities

Gould, Stephen Jay. *Punctuated Equilibrium.* London: Belknap Press of Harvard University Press, 2007.

Government of Iraq. House of Representatives. *Law of the Popular Crowd* [Arabic]. Session No. 32, November 26, 2016. http://ar.parliament.iq/2016/11/26/.

Gulmohamad, Zana. "Unseating the Caliphate: Contrasting the Challenges of Liberating Fallujah and Mosul." *CTC Sentinel*. Volume 9. Issue 10. October 2016.

Headquarters US Marine Corps. *Marine Corps Planning Process.* MCWP 5-10. Washington, DC: US Marine Corps. May 2, 2016.

Headquarters US Marine Corps. *Multi-Service Tactics, Techniques, and Procedures for Conventional Forces and Special Operations Forces Integration, Interoperability, and Interdependence*. MCWP 3-36.1. Washington, DC: Headquarters US Marine Corps, March 2014.

Jensen, Benjamin M. *Forging the Sword: Doctrinal Change in the U.S. Army*. Stanford, CA: Stanford University Press, 2016.

Jervis, Robert. "From Complex Systems: The Role of Interactions." *Coping With the Bounds: Speculations on Nonlinearity in Military Affairs*. http://www.clausewitz.com/readings/Czerwinski_Coping.pdf

Johnson, David E., M. Wade Markel, and Brian Shannon. *The 2008 Battle of Sadr City: Reimagining Urban Combat*. Santa Monica, CA: Rand Corporation, 2013.

Kast, Fremont E. and James E. Rozenweig. "General Systems Theory: Application for Organization and Management." *Academy of Management Journal*. December, 1972.

Kilcullen, David. *Out of the Mountains: The Coming Age of the Urban Guerilla*. New York: Oxford University Press, 2013.

Kilcullen, David. "The City as a System: Future Conflict and Urban Resilience." *The Fletcher Forum of World Affairs*, Vol 36:2. Summer, 2012.

Knights, Michael and Alexander Mello. "Defeat by Annihilation: Mobility and Attrition in the Islamic State's Defense of Mosul." *CTC Sentinel*. Volume 10. Issue 4. April, 2017.

Kuhn, Thomas S. *The Structure of Scientific Revolutions*. 50th Anniversary Edition. Chicago: University of Chicago Press, 2012.

McArthur, James C., William D. Betts, Nelson R. Bregon, Faith M. Chamberlain, George E. Katsos, Mark C. Kelly, E. Craig Levy, Matthew L. Lim, Kimberly K. Mickus, and Paul N. Stockton. "Interorganizational Cooperation Part I of III: the Interagency Perspective." *Joint Forces Quarterly* 79. 4th Quarter, 2015.

Liang, Qiao and Wang Xiangsui. *Unrestricted Warfare*. Beijing: PLA Literature and Arts Publishing House, February 1999.

Pumain, Denise. "Alternative Explanations of Hierarchical Differentiation in Urban Systems." *Hierarchy in Natural and Social Sciences.* Methodos series. Netherlands: Springer, 2006.

Rapoport, Elizabeth. "Interdisciplinary Perspectives on Urban Metabolism: A review on the literature." London: University College London, October 27, 2011.

Spencer, John. “Why America Is Destroying Iraqi Cities to Save Them,” *National Interest*, August 23, 2017.

United Nations Human Settlements Programme in Iraq (UN-Habitat). “City Profile of Mosul, Iraq: Multi-sector Assessment of a City Under Siege.” New York: UN-Habitat, 2016.

US Department of Defense. *Interorganizational Cooperation*. JP 3-08. Washington, DC: US Department of Defense, June 24, 2011.

US Department of Defense. *Joint Urban Operations*. JP 3-06. Washington, DC: US Department of Defense, November 20, 2013.