Heavy Matter

Urban Operations' Density of Challenges

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PREFACE

Urban operations are among the most complex challenges facing today's U.S. armed forces. Whereas there is no lack of confidence among tacticians when debating doctrine for fighting on open terrain, discussions of how to deal with missions in today's villages, towns, and cities inspire far less confidence, whether or not those missions entail combat operations. Modern cities dwarf any force that might be committed to their interiors. Even far smaller collections of man-made structures pose unfamiliar problems. There have been many recent examples of American forces operating in built-up areas, but none have involved anything resembling a major peer competitor. Most have consisted of limited-duration small unit actions. As a result, few active duty officers and noncommissioned officers have urban combat experience. Those watching other nations' forces confront such operations gain no comfort; several have stated what others also know: American forces too would be severely tested by a Grozny-like contingency. This publication proposes a new way of viewing the problem of urban operations, one that will perhaps aid in better understanding its multifaceted and complicated nature and help those responsible for preparing and conducting future undertakings.

Research in conjunction with this document was sponsored by the Joint Staff (J8 Urban Working Group) and conducted in the International Security and Defense Policy Center of RAND's National Defense Research Institute (NDRI) and in the Force Development and Technology Program of RAND Arroyo Center. Both NDRI and the Arroyo Center are federally funded research and development centers, the first sponsored by the Office of the Secretary of Defense,

the Joint Staff, the unified commands, and the defense agencies, and the second sponsored by the United States Army. This research is part of a larger RAND Arroyo Center effort to identify current U.S. force requirements in preparing for urban contingencies and to develop innovative approaches for such undertakings. This document will be of interest to individuals in government and commercial sectors whose responsibilities include doctrine, policy design, funding, planning, preparation, or the development of technologies in support of civil or military operations in urban environments.

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The best theory is intensely practical.

Mancur Olson
Power and Prosperity

The great urban battles of the twentieth century live on in military classrooms around the world. Stalingrad, Manila, Seoul, and others are well known to those in the armed forces who see the world's ever-increasing urbanization as a harbinger of more such challenges to come. Yet these historical examples are perhaps less relevant than they might at first glance appear. The cities of Manila and Seoul boasted populations of only a million or so when Americans fought for their liberation in 1945 and 1950 respectively; today both measure residents and workers at well over ten times that number. Concerns for loss of noncombatant life have generally characterized U.S. ground force operations, but political decisionmakers today seem far more influenced by such issues than they were during World War II or the Korean conflict. Likewise, there is a perception by these same political leaders that the public is far more sensitive to the loss of American military men's lives than it was a half-century ago.

The cover of this report helps demonstrate additional differences. With the book open and face down, Seoul as it was in 1953 can be seen on the left; the city and surrounding areas viewed from miles overhead in 1996 are on the right. Seoul was virtually an entity unto itself in the middle of the twentieth century, separated from neighboring small cities or towns by expanses of rice paddies and lightly occupied terrain. By the century's end, the city was awash in a much larger metropolitan area. Seoul and Inchon had seemingly merged.

Tentacles of urbanization joined the heart of the capital with once remote and far northern Munsan, Uijongbu, and Tongduchon. That the numbers of buildings, streets, vehicles, and people have increased is apparent in the comparison. The regional urban density has also increased. Whereas in 1953 built-up areas were the exception in the northwestern Republic of Korea, they are now predominant. Further, a city's components today are considerably more dense. More people now live and work in a square kilometer, a phenomenon made possible by ever-taller buildings and deeper subterranean structures. More vehicles pack the same downtown area; more offices, apartments, and commercial enterprises fill a unit of space than was the case in mid-century.

This study views modern built-up areas from the perspective of these many densities. For the military man or political leader attempting to address national interests, cities can be overwhelming in their scope and complexity. This straightforward and fundamental concept, urban density, can aid in making the problem less daunting. Doing so is one objective of this analysis; suggesting specific ways in which density can help the armed forces to better serve U.S. national interests during urban operations is another. After an overview of density's potential influence on military operations, five approaches to dealing with its challenges are proposed and discussed. They are:

- Match density with density
- Effectively reduce densities
- Maintain selected densities
- Address density asymmetrically
- Capitalize on urban densities.

The study concludes with an exemplary analysis of urban densities' implications for command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and information operations conducted in built-up areas.

Viewing urban operations in light of relevant densities, regardless of whether combat, stability, or support missions predominate, is a useful way to approach an otherwise most imposing puzzle. Doing so allows us to understand better how to conceptualize issues of per-

tinence, develop tasks and missions that will address those issues, and employ elements of national power in the service of strategic objectives.

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A number of individuals assisted in collecting data in support of this analysis. They include Dr. Robert Epstein from the U.S. Army's School of Advanced Military Studies and Charles R. Smith of the U.S. Marine Corps History and Museums Division. Appreciation is also due those who read and commented on early versions of this manuscript, including Dr. Kenneth Horn and Stephan DeSpiegeleire at RAND, and fellow members of the RAND Arroyo Center Urban Operations Team, Dr. Randall Steeb, Jamison Jo Medby, Scott Gerwehr, and LtCol Jay Bruder, USMC. LTC Louis Dimarco of the U.S. Army's Combined Arms Doctrine Directorate; Mr. Lester Grau, U.S. Army Foreign Military Studies Office; MAJ Kevin Born at Fort Lee; and BG Gideon Avidor (Israeli Defense Force, ret.) were also of considerable help in this regard. It would be remiss not to recognize the thorough and helpful reviews conducted by LtGen George R. Christmas, USMC (ret.) and LTC Robert Everson, USA. Finally, this

report relied greatly on Ms. Terri Perkins's diligent work in the technical preparation of the document.

ABBREVIATIONS

C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
COL	Colonel
DST	Decision Support Template
EPW	Enemy Prisoner of War
GPS	Global Positioning System
HUMINT	Human Intelligence
IPB	Intelligence Preparation of the Battlespace
J8	Joint Staff Directorate for Force Structure, Resources, and Assessment
LOS	Line of Sight
LTC	Lieutenant Colonel
MAJ	Major
MASINT	Measurement and Signature Intelligence
MOUT	Military Operations on Urbanized Terrain
NAI	Named Area of Interest
NDRI	National Defense Research Institute

NGO	Non-Governmental Organization
OICW	Objective Individual Combat Weapon
PVO	Private Voluntary Organization
ROE	Rules of Engagement
RPG	Rocket-Propelled Grenade
SIGINT	Signals Intelligence
SOP	Standing Operating Procedure
TAI	Target Area of Interest
TPFDL	Time Phased Force Deployment List
UAV	Unmanned Aerial Vehicle
USMC	United States Marine Corps
USN	United States Navy

Chapter One

INTRODUCTION

> The Army used to have all the time in the world and no money;
> now we've got all the money and no time.
>
> George C. Marshall
> January 1942

Whether it be from Namsan in Seoul, Victoria Peak in Hong Kong, or the Empire State Building in New York City, an observer gazing down on a modern metropolitan area cannot help but be awed by the seemingly endless ground cover of structures and unceasing hum of human activity. Awe can become bewilderment and dread, however, for a military leader whose mission it is to operate amidst the buildings of a major city. Whether his task is to support the local populace, help to stabilize a volatile situation, or openly combat an adversary, the vast sprawl of man-made terrain confounds the question of where to start. The chore is no less daunting for others writing the doctrine that will guide the men and women committed to some foreign or domestic metropolis, those seeking to equip them appropriately, or Americans and allies whose aircraft, ships, or vehicles will support their activities. Yet the current leadership of the U.S. armed forces is in one way fortunate. Unlike General Marshall a month after Pearl Harbor, it has time to ponder the challenges. Panama City, Mogadishu, Port au Prince, and Sarajevo remind us, however, that time is short.

Just as it can be difficult to see the forest for the trees, it can sometimes also be hard to comprehend the details in the whole. A city is such a case. At first glance it seems an overpowering whole capable of absorbing any force attempting in any way to influence the juggernaut of its daily life. Its parts are discernible, but determining how they interact and how one can identify the select few that drive

the whole may seem a Gordian knot without solution. This document is an effort to describe urban areas in a manner that will hopefully abet comprehension of both their totality and detail, and to stimulate thoughts on approaches that might be of value in conducting operations to come.

Our observer overlooking a city might first be impressed by the sheer magnitude of quantities. Hundreds, more likely thousands, tens of thousands, or even millions of buildings, vehicles, people, acreage, rooms, windows, streets, underground passageways, and much else make up the totality. Yet quantity alone insufficiently characterizes the whole. Open plains and forests, mountains and valleys, have many of the same components. Here too they number in the hundreds, thousands, or more. What distinguishes the urban area is the count of elements per unit of space and the quantity of activities per unit of time: density.[1] The number of structures, firing positions, avenues of approach, enemy, noncombatants, friendly force units, key terrain, and obstacles per cubic kilometer, or the number of small-unit engagements, troop movements, and interactions with noncombatants per minute within that space are far greater in cities than in any other environment. Some measure of the difference is evident from Table 1, which compares the densities of combatants on all types of terrain during several historical periods to those on urban terrain alone. At first glance, Table 1 may be surprising. For example, the density of fighters in antiquity's open terrain exceeded that in urban fighting. The tactics of the day explain the apparent inconsistency. The preferred method of fighting was a clash of tight formations on ground selected because it allowed a unit to move without destroying the cohesion of the group. Men were packed together side by side, shields and weapons seeking to form an impenetrable front. Urban terrain made such fighting virtually impossible. There, combatants had to line walls built for the protection of the built-up area; buildings and other structures disrupted mass formations when fighting devolved to a struggle in the streets. Engaging the adversary from a rooftop was not the norm; only those with projectile weapons (or very long stabbing implements) could attack others below. Soldiers with sword or pike would in general be relegated to the streets or the occasional building interior. The density of urban construction therefore acted to disperse the combatants, lowering the density of fighter per unit of space.

Table 1

Battlefield Density Through the Ages[2]

Period, all terrain types	Antiquity	Napoleonic Wars	U.S. Civil War	World War II	October War
Urban terrain examples	*Plataea, New Tyre, New Carthage, Alesia*	*Jungingen, Aspern-Essling*	*Monterrey, Churubusco, Rorke's Drift*	*Stalingrad, Aachen, Manila, Nuremberg, Berlin*	*Beirut, 1982; Khorramshahr, Hue, Grozny, 1995; Suez City*
Men per square km	100,000	4,970	3,883	32	25
Urban examples	*16,300*	*46,400*	*11,600*	*1,300*	*1,100*
Square m per man	10	201	258	31,000	40,000
Urban examples	*61*	*22*	*86*	*769*	*909*

NOTE: Values for battlefield densities across all types of terrain are shown in Roman type; comparative urban examples and respective battlefield densities are in italics. Examples are from roughly the same period when sufficient examples were otherwise unavailable, e.g., in the case of the American Civil War.

With the advent of tactics influenced by longer-range and more accurate weapons, however, greater dispersion became necessary. Archers and javelin throwers generally had limited influence on the outcome of battles in ancient times. Ultimately it was the infantrymen at very close quarters, man stabbing man, phalanx grinding forward to destroy the adversary's cohesive ranks, that determined victor and vanquished. Gunpowder separated foes. Battle evolved to a fight between ranks of men who killed at musket or rifle range rather than arm's length. The new formations were less dense; men had to have room to reload and fire their weapons and to allow those in other ranks to pass forward. As weapons became more destructive, formations became more dispersed in efforts to preserve manpower by denying the adversary lucratively grouped targets. But dispersion was not always possible in urban environments. In the early years of firearms, commanders operating within a town or city attempted to fight just as they did in open areas. Disciplined ranks of

soldiers stood side by side and forced themselves into streets, alleys, courtyards, or whatever space let them attempt some semblance of the formations thought essential to massing firepower and maintaining control. Defenders either fought the same way or took positions within buildings, on rooftops, or behind walls, but proximity to other members of one's unit was still the order of the day. Whereas urban structures had forced apart the warriors of antiquity, they compressed the formations of early firearms days, with the result that densities for fighting in villages, towns, and cities do not differ greatly between the two periods (though in post-antiquity periods urban densities were far higher than those that characterized fighting on more open ground, for now structures tended to force men of an army together rather than apart).[3] The adoption of open order tactics significantly changed the situation. Soldiers sought to avoid bunching up. Massed forces attracted enemy fire, including that from larger-caliber weapons, which had extra effectiveness in cities through their secondary effects when they struck and shattered building surfaces. Though the densities of combatants in urban terrain followed the downward trend found in other environments, the many obstacles to vision, communications, and projectiles ensured that friend and foe remained more closely packed when combat took them into a built-up area. The density of fighters among buildings remained strikingly higher than the norm. In any given urban area, a commander was likely to encounter a far greater number of his own and the enemy's forces. This greater density meant that units had less distance to move before they dramatically altered a tactical situation. There was a reduction in the benefits otherwise offered by increased accuracy and firepower. Noise and physical exhaustion increased soldier stress, increasing the attrition of friendly force strength. This situation remains; today's leaders need more flexible plans and more responsive decisionmaking processes than are demanded for fighting elsewhere.

The nature of built-up areas themselves changes over time, altering the densities a force will confront during urban operations. Ancient urban structures only rarely exceeded one or two stories in height; modern engineering methods permit construction of buildings towering well above and burrowing far below ground. Thus while tactics promote dispersion on the battlefield, urban architecture allows stacking of capabilities such that it is far more appropriate to

consider densities in terms of three dimensions (e.g., cubic kilometers) rather than two. Other terrain changes relatively little over time. Cities grow exponentially, not only outward but also skyward, downward, and inward in the sense that today far more people can be accommodated in a given volume than was previously feasible. Military forces seeking urban operations preparedness must therefore continually adapt to these changing conditions.

The high density in urban space leads directly to a similarly magnified density in time. More infrastructure, people, and activity in less space mean that situations can change more rapidly. A greater number of events can occur in a given period. More decisions per unit of time are demanded of military leaders. As a result, the time available for a decision is dramatically reduced. Plans and alternative courses of action can be far shorter lived. The effect is one of time and space compression. Whether at the operational or tactical level, there is less time to analyze situations and alternatives, less time to properly position logistical support, and less time for forces to act to maintain the initiative.

Another way of expressing this challenge is in terms of tempo, "the rate of military action."[4] Army and Marine Corps doctrine notes that "all military operations alternate between action and pauses as opposing forces battle one another." Further, "controlling or altering" the rate of military action "is a necessary means to initiative."[5] Tempo should not be confused with speed of travel or velocity of advance. The rate of military action during urban operations is often very high, though it may appear more akin to vibration than the maneuver that often characterizes high-tempo operations in other environments. The grand sweeps of combat power across the Iraqi or Sinai deserts are not found here. It is the number of actions per unit of space and decisions per unit of time, that is exceptional. It may be instructive to think of the tempo of urban combat as akin to that found in the interior of a hive, where thousands of insects conduct activities at a frantic pace within their dense three-dimensional space. The activity need not be overt in character; soldiers may experience extraordinary mental anxiety due to what could be termed a high psychological tempo. The Israeli Defense Force's LTC Yaakov Hisdai found that members of his battalion, even those with prior urban combat experience from the 1967 fighting in Jerusalem, suffered debilitating stress injuries as they fought for hours at very

close range in Suez City during the 1973 Yom Kippur War.[6] The city quickens the heartbeat even in times of relative inactivity. A veteran comparing his months of duty in downtown Mogadishu with an earlier Persian Gulf War combat tour succinctly described the fundamental difference: "I was never bored in Mogadishu. I was bored in Southwest Asia."[7]

Notes to Chapter One

[1]While traditional definitions of density give primacy to quantity per unit volume, area, or length, a broader definition in which density represents quantity per other than spatial units is not new. See, for example, *Merriam-Webster's Collegiate Dictionary,* Tenth Edition, Springfield, MA: Merriam-Webster, 1997.

[2]*Sources for nonurban data.* Original table data derived from T.N. Dupuy, *Numbers, Predictions and War: Using History to Evaluate Combat Factors and Predict the Outcome of Battles,* Indianapolis, IN: Bobbs-Merrill, 1979, p. 28.

Sources for Antiquity. **New Carthage, 209 B.C.:** B.H. Liddell Hart, *Scipio Africanus: Greater Than Napoleon,* New York: Da Capo, 1994, p. 27; Livy, *The War With Hannibal*, New York: Penguin, 1987, p. 419; Polybius, *Polybius on Roman Imperialism: The Histories of Polybius Translated from the Text of F. Hultsch,* Evelyn S. Shuckburgh (trans.) Lake Bluff, IL: Regnery Gateway, 1987, pp. 254–256; and H.H. Scullard, *Scipio Africanus: Soldier and Politician,* Ithaca, NY: Cornell, 1970, p. 49. **Alesia, 52 B.C.:** Elmer C. May and Gerald P. Stadler, *Ancient and Medieval Warfare,* West Point, NY: Department of History, 1973, p. 89. **Plataea, 431 B.C.:** Donald Kagan, *The Archidamian War,* Ithaca, NY: Cornell University Press, 1992, p. 44; Paul Bentley Kern, *Ancient Siege Warfare,* Bloomington: University of Indiana Press, 1999, pp. 100, 103. **New Tyre, 332 B.C.:** Arrian, *The Campaigns of Alexander,* New York: Barnes & Noble, 1993, pp. 142, 147n; J.F.C. Fuller, *The Generalship of Alexander the Great,* New York: Da Capo, 1989, pp. 200–201, 208, 217–218; May and Stadler, *Ancient and Medieval Warfare,* op. cit., p. 42.

Sources for Napoleonic War period. **Jungingen, 1805:** Scott Bowden, "Battlefield Domination: Napoleon's New Grand Armee Thrashes the Austrians at Haslach-Jungingen During the Ulm Campaign of 1805," *Napoleon,* September 1996, pp. 12, 14–15, and 23. **Aspern-Essling, 1809:** Scotty Bowden and Charlie Tarbox, *Armies on the Danube, 1809,* Arlington, TX: Empire Games Press, 1980, pp, 86, 90–91, 93.

Sources for U.S. Civil War period. **Monterrey:** Vincent J. Esposito (ed.), *The West Point Atlas of American Wars, Volume 1: 1689–1900,* New York: Frederick A. Praeger, 1967, Map 14b; Robert Selph Henry, *The Story of the Mexican War,* New York: Bobbs-Merrill, 1950, pp. 140, 142, 146; Oliver Otis Howard, *General Taylor,* New York: D. Appleton, 1892, p. 154 and map following p. 172; John S.D. Eisenhower, *So Far From God: The U.S. War with Mexico,* New York: Doubleday, 1990, p. 129. **Churubusco:** Esposito, *The West Point Atlas of American Wars,* op. cit., Map 16c; Eisenhower, *So Far From God,* op. cit., p. 326. **Rorke's Drift** (density includes British forces only; area is only that of British defensive laager due to difficulty of establishing area occupied by Zulu forces): T.H.E. Foulkes, "'Black as Hell and Thick as Grass'—Reflections on Rorke's Drift and Isandhlwana," *The Royal Engineers Journal,* Vol. 110, December 1996, pp. 217, 218.

Sources for World War II. **Stalingrad:** John Erickson, *The Road to Stalingrad: Stalin's War with Germany, Volume 1,* New York: Harper & Row, 1975, p. 387. **Nuremburg:** C.M. Broadwater, *CSI Battlebook 13-D: The Battle of Nuremburg,* Fort Leavenworth, KS: Combat Studies Institute, 1984, pp. 10, 19, 20, and 25. **Aachen:** Price, et al., *CSI Battlebook 13-C: The Battle of Aachen,* Fort Leavenworth, KS: Combat Studies Institute, 1984, pp. 43, 63, 88–89; Charles B. MacDonald, *United States Army in World War II: The European Theater of Operations: The Siegfried Line Campaign,* Washington, D.C.: Center of Military History, 1990, p. 282 and map III; and R.D. McLaurin, Paul A. Jureidini, and David S. McDonald, *Modern Experience in City Combat,* Aberdeen Proving Ground, MD: U.S. Army Human Engineering Laboratory, 1987, p. 50; Shelby L. Stanton, *World War II Order of Battle,* New York: Galahad, 1991, p. 13. **Berlin:** McLaurin, et al., *Modern Experience in City Combat,* op. cit., pp. 61–63 and 65. **Manila:** McLaurin, et al., *Modern Experience in City Combat,* op. cit., p. 72; Robert Ross Smith, *U.S. Army in World War II: The War in the Pacific: Triumph in the Philippines,* Washington, D.C.: Center of Military History, 1991, pp. 237, 264, 274; Stanton, *World War II Order of Battle,* op. cit. pp. 13, 23, 258.

Sources for October War period. **Beirut, 1982:** McLaurin, et al., *Modern Experience in City Combat,* op. cit., pp. 13–14, 19–20, 22; Richard A. Gabriel, *Operation Peace for Galilee: The Israeli-POL War in Lebanon,* New York: Hill and Wang, 1984, p. 139. **Khorramshahr:** McLaurin, et al., *Modern Experience in City Combat,* op. cit., pp. 70–71; Anthony H. Cordesman and Abraham R. Wagner, *The Lessons of Modern War, Volume II: The Iran-Iraq War,* Boulder, CO: Westview, 1990, p. 93; R.D. McLaurin, *Military Operations in the Gulf War: The Battle of Khorramshahr,* Aberdeen Proving Ground, MD, U.S. Army Human Engineering Laboratory, 1982, p. 5. **Hue:** Email from Charles R. Smith, Headquarters, USMC, History and Museums Division, to author, February 7, 2000; Jack Shulimson, et al., *U.S. Marines in Vietnam: The Defining Year, 1968,* Washington, D.C.: Headquarters, USMC, 1997, pp. 165, 174, 192, 210, 745; McLaurin, et al., *Modern Experience in City Combat,* op. cit., p. 67; Curtis A. Lapham, *Colossus on Main Street: Tactical Considerations of Heavy Armor and Future MOUT Doctrine,* Fort Leavenworth, KS:, School of Advanced Military Studies, p. 30.

[3]Though the density of combatant per unit space seems considerably higher during the Napoleonic period than for either antiquity or the mid-19th century, these values are all within an order of magnitude of each other; sample size may explain the differences. Alternatively, efforts to maintain a semblance of ranks during fighting in Jungingen, Aspern, and Essling may have inflated the density values as narrow city streets compressed formations. Taylor's ranks of Americans attacking in Monterrey, and those of the Mexican defenders, were often not maintained during that battle.

[4]Field Manual 101-5-1/MCRP 5-2.2 (DRAG Edition), *Operational Terms and Graphics* (Washington, D.C.: Headquarters, Department of the Army and Headquarters, U.S. Marine Corps, July 31, 1996), p. I-285.

[5]Ibid.

[6]Author interview with COL Yaakov Hisdai (IDF, ret.), Israeli Armor Museum, Latrun, Israel, April 9, 2000.

[7]Author interview with LTC John Allison (USMC, ret.), Quantico Marine Base, January 19, 2000.

Chapter Two

THE INFLUENCES OF DENSITY ON MILITARY OPERATIONS: A MORE DETAILED LOOK

Find out afterward how that particular muddle occurred
and, if possible, don't let it happen again.

Sir A.P. Wavell
February 1933

Military commanders at any level must have sufficient control to allow coordination of the many actions undertaken by subordinate units; they must be able to modify plans rapidly and effectively so as to retain the initiative. That is difficult during any high-tempo operation; it is an even greater challenge when the density of high-tempo operations is such that it can overwhelm traditional decisionmaking processes and other command and control procedures. Greater densities make urban areas the ultimate military challenge, whether for the individual fighter or his commander many echelons removed. Figure 1 presents a sample of factors and the relative difficulties they pose in three distinct environments. The extraordinary difficulties posed by urban operations are due in considerable part to the synergistic effects of densities such as those seen along the bottom of the figure. A segment of open ground can at most offer firing positions to a handful of enemy; if that ground houses subterranean structures or skyscrapers, it may harbor thousands. Ground that might support a single avenue of approach in grasslands might have several in a city—some underground, others on the surface, yet others through the upper floors of building interiors—all potential routes for movement or maneuver. The rifleman is therefore confronted with seemingly innumerable positions from which an enemy might fire. At the same time, the density of obstacles means that traditional tactical operations may be impossible: the high density of buildings,

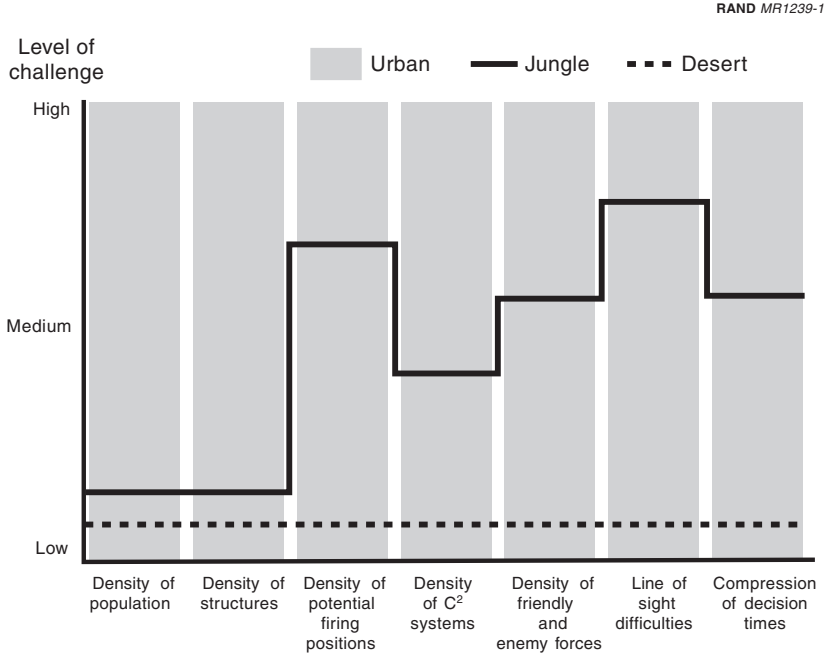

Figure 1—The Challenge of Military Operations in Urban Areas

vehicles, and the like has reduced the space available for maneuver.[1] The high civilian population density, moreover, means that an individual suddenly dashing from a doorway or alley could be an innocent noncombatant seeking safety, or an armed adversary. The density of structures and other vision-blocking obstacles compounds the problem, for the potential target often appears suddenly and at very close range. The warrior has only an instant to detect the target; orient his weapon; determine whether the potential target is enemy, friendly, or innocent; and decide whether or not to fire. Density has overloaded his ability to monitor the situation, complicated his target identification, and reduced his engagement to an almost instantaneous act. Indirect fire, aviation, and air support must meet similar demands for speed and hyperaccuracy. The fleeting nature of targets and their frequent proximity to friendly forces or noncombatants means that the cycle of target identification, call for fire, and

engagement must be far tighter than in most other situations. Artillery units may find it very difficult to provide effective fire support in an environment where intelligence accuracy is fleeting and potential targets move in and out of cover in a matter of seconds. Such problems are compounded by highly restrictive rules of engagement (ROE) precipitated by high densities of noncombatants, civil infrastructure, and cultural landmarks.

Separately, densities present problems enough; their cumulative negative effects can create a scenario of sensory and capability overload. This density of potential threats also accelerates both mental and physical exhaustion, which is further fed by the excessive sound levels reflecting off the numerous hard surfaces. The multiplicity of threats demands larger numbers of infantrymen to maintain satisfactory force protection levels. Further, the proliferation of below-ground and elevated firing positions presents problems for armored vehicles, many of which have main gun depression and elevation limits that make them vulnerable to short-range bottom or top attack. These difficulties challenge all opposing commanders. They can overwhelm . . . or they can offer advantage. Subterranean passageways, for instance, may threaten a passive force with underground envelopment. But they are prospective routes for movement, even perhaps for maneuver, for the savvy and situationally aware. Similarly, at the company or battalion level, an advancing unit continuously exposes itself to threats from an enemy that could be concealed in any of hundreds of subterranean, ground level, or elevated hides, or one moving rapidly and unseen along parallel passageways and through nearby structures. But that density of possible enemy actions may be matched by the equally many ways the friendly unit's reserve could move to relieve a beleaguered ally, or by the quantity of obstacles that could block that movement.

Density similarly complicates activities at the operational and strategic levels. A single urban area can become a "resource magnet" that demands seemingly more than its fair share of manpower and other assets. The operational-level commander therefore has to decide how much of his limited combat power to dedicate to built-up areas within his theater, locations where his forces are more concentrated and therefore potentially more vulnerable to rapid destruction. The closer proximity of enemy to friendly forces means that a sudden movement by the adversary could threaten even

strategic objectives. Such volatile conditions demand extraordinary flexibility. A larger reserve is one way of meeting this requirement; by keeping more forces in or near built-up areas, the commander can react more rapidly should the unexpected occur. However, this dedication of combat power to urban conglomerations means that less is available to perform other tasks, such as isolating the city. Steps taken to counter the higher densities found in the city may therefore degrade operational flexibility outside the metropolis. In addition, the requisite force concentrations and the higher tempo of operations mean that foodstuffs, water, and ammunition are consumed more rapidly than they would be elsewhere. Plans must include consideration of these high consumption rates during development of Time-Phased Force Deployment Lists (TPFDL), airlift, and sealift planning. That virtually no doctrine or compilation of historical usage rates exists for urban contingencies magnifies the need for further study, simulation, and extrapolation from quality exercises.

The density of targets in built-up areas combines with concentrations of friendly forces and civilians to put a premium on the accuracy and controllable effects of munitions. Precision weapons are the most effective means currently available for solving the dilemma of minimizing friendly losses on one hand and abiding by stringent ROE designed to similarly minimize noncombatant loss and infrastructure damage on the other. While not a zero-sum situation, strict ground force ROE have historically precipitated higher friendly force casualties. Precision munitions provide a way to engage targets from a distance, thereby mitigating the need for ground forces to close with an entrenched enemy. But such capabilities, while helpful, are not a universal solution. Not all targets can be identified and eliminated using long-range fires. As in operations in Kosovo in 1999, tactical targets will be numerous. They will often be small, well concealed in their urban setting, and deliberately positioned near hospitals, religious structures, noncombatant concentrations, or other ROE-proscribed features. The density of urban targets means that stockpiles of precision weapons will likely be exhausted well before all are addressed. Further, precision weapons are expensive; barring a dramatic reduction in their price, it will simply be too costly to engage each target with these systems.

Urban densities ensure that forces conducting sustainment operations will meet many of the same difficulties confronted by maneu-

ver units. Modern cities have thousands, often tens or hundreds of thousands, of their population packed into a few square kilometers (though "cubic kilometers" is the more appropriate measure, given the skyscrapers that house or provide work for much of an urban area's citizenry and the webs of underground activities that characterize many modern metropolises). Problems can be complicated by urban dwellers' higher expectations about their quality of life as compared to the populations of often less-privileged rural areas. Those acclimatized to urban living may have different diets, lesser tolerance to temperature extremes and exposure, and a greater susceptibility to disease than those found in the countryside. To ignore the dissimilarities is to invite sickness and unrest. The situation could be further complicated if operations are conducted during winter months or when urban water and power distribution are not functioning. The simple task of descending stairs and climbing back to a high-story apartment with sustenance may be beyond the physical capabilities of the sick or elderly.

The city puts these noncombatants at center stage. When a unit moves across open terrain, through the foliage of close jungle vegetation, or along a mountain path, the unexpected appearance of another human being generally means discovery of the enemy. Friendly forces are on the whole more dispersed and therefore have fewer opportunities to accidentally confront one another; noncombatants are at times a concern, but their sudden appearance is either generally at longer ranges, in fewer numbers, or more predictable than is the case in a city. Leaders during the 1968 fighting in Hue had considerable difficulties with the large numbers of South Vietnamese civilians seeking the protection of their American allies, yet the numbers concentrated in any one place during that event were small in comparison with those that could confront tomorrow's commander in a modern megalopolis. A city with shortages of food, water, medicines, or other essentials, still populated by residents and perhaps refugees from the surrounding countryside, poses a logistical problem that might well overwhelm even the most effective military support system.

Control of refugees attempting to leave built-up areas will quickly overtask military police forces that must also perform their doctrinal traffic control, prisoner of war, and other responsibilities. Allocating enemy prisoner of war (EPW) and noncombatant control to infantry

or other units only deprives a commander of resources probably already in short supply. Medical personnel, always tasked to provide care to friendly force and coalition member combatant casualties, may find large numbers of civilians in need of assistance. The political repercussions of a failure to treat civilian suffering would at a minimum cast a pall of neglect over other military operations, successful or otherwise. As was the case with Allied forces as they swept across the French, Dutch, and Belgian landscapes in 1944, the United States and its coalition partners may find themselves simultaneously tasked to support both high-tempo operations and needy civilians.

Communicating with, directing, and controlling the movement of noncombatants to preclude their unnecessary exposure to danger and disease, or to guide them to resource distribution points, will demand a significant dedication of assets. Again drawing on the example of Hue, such movements of groups will inevitably include hostile force members attempting to infiltrate friendly lines or cause disruption of rear area operations. The high density of noncombatants in cities could result in a force confronted by enemy to the front and instability in its rear. Greater consideration of the psychological, civil affairs, and nonlethal implications of this challenge is called for.

Other potential problems are similarly packed into single buildings or a few blocks. The bunching of buildings provides fuel for fires, which can spread to consume major portions of a city and endanger both friend and noncombatant. Flame and its accompanying smoke interfere with observation, target designation, aviation operations, and the use of night vision systems. Water might not be available for extinguishing these conflagrations. Even given the availability of water, firefighters and their equipment may be either unavailable or unable to reach burning structures.

Variability in structure types and the occasional presence of open areas alter environmental densities (e.g., the number of potential attack axes, the number of noncombatants in an area). These fluctuations complicate planning for operational and tactical level commanders alike. Manpower requirements and unit frontages can change dramatically within a very short distance. An organization able to defend hundreds or even thousands of meters of frontage in a large park may be able to defend a sector consisting of only a single building after an advance or withdrawal of a few hundred meters,

making force allocation estimates difficult. Further, the tempo of operations, the ability to communicate, and the suitability of particular weapons systems can all change suddenly. The most difficult battlefield transition for a force may well be the one it must undergo as it moves from open ground (whether inside or outside a built-up area) to the dense environs of a city.

Offensive operations further task leaders. When launching an attack at the line of departure, a commander would logically seek to have sufficient manpower to cover every possible enemy firing position.[2] As the assault moves forward, the inevitable requirements to clear buildings of enemy combatants, secure them against further enemy infiltration, and evacuate the ubiquitous noncombatants, bring about the severe physical and mental exhaustion that characterizes urban combat. These and other factors quickly drain a force of numbers even in the absence of combat losses. (See Figure 2.) The three-dimensional quality of urban terrain, each level dense with challenges, requires repetition of offensive or defensive tasks on layer after layer above, at, and below ground level. A single building can consume battalions. Lacking very large numbers of soldiers or marines, a leader could quickly find himself unable to meet his combat power requirements. Reinforcement helps, but it can only delay the inevitable; the constant high density of challenges consumes a force operating in a city. Joint, multinational, and interagency coordination further add to the complexity of operations.

It is true that the density of streets and other means of transporting people and material is far higher in cities than elsewhere. The greater density offers little solace for military transporters, however; cities are infamous for traffic that makes it difficult for their populations to move about effectively. Add a military force's oversized vehicles driven by individuals unfamiliar with the area, and the congestion could precipitate a standstill. If residents are fleeing an enemy, the same gridlock that plagues daily life within an urban area can clog roadways exiting a city, the very roadways that may be essential to moving friendly force personnel and materiel forward.

Sustaining displaced urban residents is no less daunting an undertaking than having to support them were they to stay in the built-up area. Saudi Arabia south of Khafji was able to absorb that city's

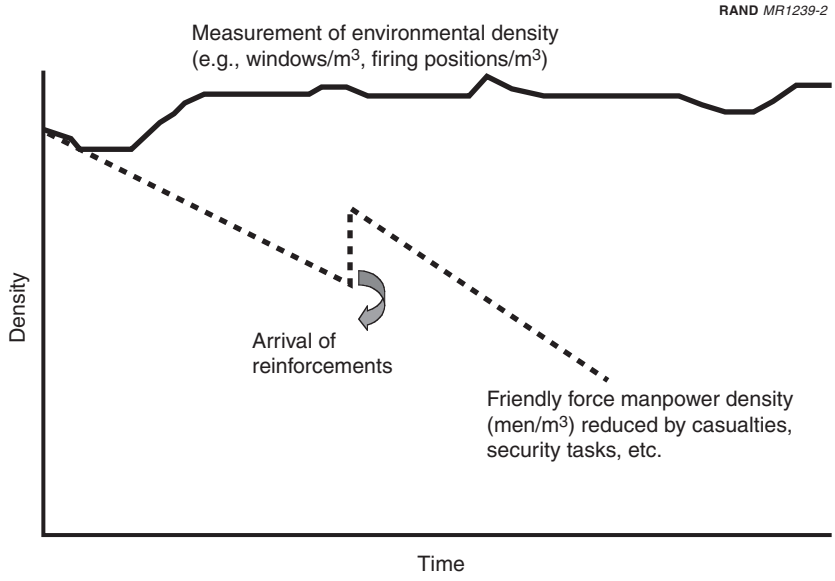

Figure 2—Environmental Density Versus Friendly Force Manpower

population when it was evacuated prior to the 1991 Operation Desert Storm. Had Iraqi forces continued south along the Persian Gulf coast, the country may have been less able to similarly handle the tens of thousands evacuating Al Jubayl, Ad Dammam, and Dhahran while also sustaining security forces along the Kuwaiti border and receiving incoming American units. Supporting the displaced would have been difficult even with extensive assistance from international nongovernmental and private voluntary organizations (NGO and PVO). This was dramatically demonstrated in Kosovo and Albania later in the decade. In addition to having to juggle these many demands during ongoing operations, leaders during future urban contingencies will also be expected to accurately predict manpower and logistics needs for the recovery operations that will follow combat. They will have to do so both in support of combat operations and in a manner that minimizes the difficulties in transitioning from combat to recovery tasks. It promises to be an intellectual puzzle of notable proportions.

This overview of problems inherent in any major urban undertaking is far from exhaustive. The subject matter literature provides a more comprehensive set of examples that reflect both the scope and character of pertinent issues. Urban densities underlie many of them.

Notes to Chapter Two

[1]The author thanks BG Gideon Avidor (IDF, ret.) for this observation.

[2]COL Gary Anderson, Chief of Staff for the Marine Corps Warfighting Lab, Quantico, Virginia, provided an example that led to the conceptualization of this approach. He noted that ongoing experiments during the Marine Corps's Project Metropolis reflected that, at least at the line of departure, a unit should have sufficient manpower to cover every window that an enemy might use as a firing position. Author interview with COL Anderson, November 30, 1999, Quantico, Virginia.

Chapter Three

ATTACKING THE CHALLENGE

When you see a rattlesnake poised to strike,
you do not wait until he has struck.

Franklin Delano Roosevelt

Understanding urban density is the first step toward overcoming its challenges and using it to advantage. Solutions to urban operations problems at the operational and higher tactical levels will most likely include elements from one or more of the approaches described below.

MATCH DENSITY WITH DENSITY

Confronted with high urban densities, a commander can attempt to neutralize their effects by increasing the size of the force or other resources dedicated to the mission. Given sufficient manpower, for example, an attacking unit can augment its strength so as to have sufficient men to cover every possible enemy firing position and approach route while assigning others responsibility for handling possible noncombatant and EPW contingencies. Command Sergeant Major (CSM) Michael T. Hall and Sergeant First Class (SFC) Michael T. Kennedy of the 75th Ranger Regiment articulated this succinctly. They noted that there may be instances during urban combat in which "a whole company, and perhaps a battalion, will be concentrating on nothing more than getting one squad across a street." This is in part because "the urban fight is 360 degrees and forces must be allocated against this."[1] A defender would similarly mass sufficient combat power to defeat an attacker that threatens to approach from one or more of many ground and air routes.

EFFECTIVELY REDUCE DENSITIES

Personnel constraints and physical topography will often deny a leader the option of matching an urban environment's densities. An alternative is to effectively reduce them. The number of enemy firing positions that could threaten a friendly force can be reduced by maximizing underground and building-to-building movement, by employing booby traps, chemicals, foam, or other lethal and nonlethal munitions to deny the adversary use of buildings, or via thorough planning that avoids particularly dense concentrations of windows, doorways, and the like. Emerging robotic capabilities offer considerable promise in this regard. Systems able to install barriers, provide early warning, or even themselves engage an enemy force will help reduce densities to manageable levels.

Less than lethal means may be of value in attacking or defending against an enemy; they will undoubtedly have application in efforts to protect, control, and influence noncombatant behavior. So too can psychological operations and civil affairs actions be used in conjunction with NGO and PVO activities to motivate noncombatant movement away from areas of greatest risk. Actions that reduce the density of innocent civilians in selected areas can deny the enemy access to forced labor and bystanders he might employ as screens for his forces.

MAINTAIN SELECTED DENSITIES

Isolation of the battlefield is perhaps the most often violated tenet of urban combat. Denying an enemy reinforcements and resupply has often foretold the beginning of his end. Failure to do so can allow a combatant to continue resistance almost indefinitely. Victory during urban contingencies has often followed a prolonged but eventually successful attempt to cut off a force in a built-up area. Zhukov defeated Manstein's efforts to maintain substantial contact with Stalingrad; only then did Paulus surrender his Sixth Army. In 1968, the 1st Cavalry Division *de facto* isolated Hue's communist defenders by overrunning the headquarters supervising the operation (despite that headquarters not being located within the city); U.S. Marine Corps and Army of the Republic of Vietnam forces then completed their retaking of the ancient capital. Russian difficulties in isolating

Grozny's Chechen defenders are well known to those who followed the 1994–1995 and 1999–2000 campaigns, as are the consequences of failing to do so. Successful isolation means that an enemy can at best temporarily maintain his combat capabilities. Casualties, starvation, ammunition shortages, and other weakening factors eventually diminish his numbers and reduce critical densities to a point that allows the isolator to gain the upper hand.

ADDRESS DENSITY ASYMMETRICALLY

Urban combat is justifiably seen as an equalizer. The superior combat power of U.S. armed forces is in many ways effectively neutralized on city streets, especially when restrictive ROE are in effect. That does not mean that their competitive edge should be considered lost during such contingencies. Superior discipline, training, combined arms and joint cooperation, and leadership will continue to be influential, if not decisive. That a small and isolated force of Americans was not overwhelmed during the October 3–4, 1993, fighting in Mogadishu lends credence to this observation. Some technological advantages are effectively neutralized; others are not or may suffer only conditional shortfalls. Though buildings and other obstacles will shield targets on occasion, much urban sprawl consists of structures that are well dispersed and suffer limited if any shielding by adjacent obstacles.[2] Indirect, aviation, or fixed-wing air fire support is in many cases feasible (though the accuracy of such support and the vulnerability of aircraft will be influenced by the sophistication of the adversary's air defense capabilities). Urban densities may complicate the employment of such support, but proper planning, map analysis, visual reconnaissance, and training can ensure that friendly force fire support superiority is not unnecessarily diminished. In a similar manner, counterfire radar, radio, and global positioning systems (GPS) degradation can be minimized through aggressive, informed planning. Selection of key terrain such as taller man-made and natural features for use as relay, radar, or air defense sites will assist in maintaining an edge.

Future weapons, intelligence acquisition, and targeting systems enhancements will help a force maintain an asymmetric advantage. The Objective Individual Combat Weapon (OICW), for example, will have a laser range finder and air-bursting munitions that will allow

U.S. infantrymen to engage targets positioned behind cover. Innovative uses of robot-delivered sensors and micro-UAVs will assist in friendly force detection of enemy locations, thereby reducing the adversary's opportunities for successful ambush. Several such systems should be available within the next decade.

Asymmetric approaches need not be limited to employment of purely military forces. The density of friendly force and noncombatant casualties during urban actions could easily overwhelm military medical resources. NGO, PVO, or indigenous medical capabilities may compete for facilities close to active combat operations. They will similarly compete for evacuation routes, medical materials, other supplies, and transportation. Incorporating these resources into a medical support plan can turn competitors into allies that complement military capabilities and reduce the burden of caring for the sick and wounded. Gaining the cooperation of PVOs and NGOs can relieve units of noncombatant support tasks that detract from combat operations. More active pre-operation coordination with these organizations, such as inviting them to participate in training exercises and simulations, would better prepare both military and civilian agencies for operational contingencies. Such contacts would also provide a forum for working out issues of relationships during eventual deployments. These organizations have much to offer in relieving the suffering that often accompanies modern conflicts; their assumption of relief responsibilities could greatly ease the burdens (fiscal as well as manpower and transportation) that would otherwise have to be assumed by military aid providers. It could also give friendly forces a decided advantage in winning support from a citizenry well served by the coordinated efforts of civilian and military support organizations. From the reverse perspective, PVOs and NGOs will at times require assistance with security, communications, and transport. There are significant symbiotic returns for military, PVO, and NGO organizations willing to cooperate. Early establishment of a Civil-Military Operations Center (CMOC) that does not interfere with Tactical Operations Centers (TOCs) facilitates coordination with these entities and overall operational management by dividing responsibilities for various densities among the force.

CAPITALIZE ON URBAN DENSITIES

Turning disadvantage to advantage is a signature characteristic of the best military artists. This is no less true during urban operations. The same factors that disrupt friendly force undertakings can overwhelm the enemy. The density of activity in a city is a natural cloak for surreptitious actions. Changes in routine are less likely to be noticed, as urban routine is itself often in constant flux. Density can provide the innovative commander with flexibility; a force moving along a street can divide to go in three directions at an intersection, puzzling an enemy attempting to determine intent, only to use many other routes to reconsolidate at a designated time and location. Similarly, the high volume of electronic signatures, human and vehicle movement, and other activities can be used to either mask intentions or overload an adversary's analysis capabilities. The defending commander who recognizes that his opponent can be overwhelmed by the multitude of possible firing positions his force could occupy can capitalize on the situation. Large numbers of fake positions, for example, could confuse attackers and draw their fire away from actual sites. Dummy positions may consist of little more than pieces of pipe and paper silhouettes; they need only to be good enough to attract attention for the moment it takes defenders to engage the unwitting enemy. At higher echelons, a defending commander could leave a series of streets free of obstacles while apparently blocking others to give a false impression regarding counterattack plans. The attacker, otherwise confronted with the many possible avenues of approach that could threaten his flanks and rear, may be only too ready to accept the ruse as legitimate. Whether attacking or defending, logistics units can take advantage of urban densities to augment their capabilities. Vehicles, civilian manpower, covered and concealed facilities, fuel points, and building supplies are a small sample of resources more readily available during many urban contingencies because of their increased density in that environment.[3]

SUMMARY

Whether used individually or in a complementary manner to maximize their joint effects, these approaches offer one way to conceptualize urban challenges and determine operationally viable solu-

tions. The approaches themselves are not mutually exclusive. On the contrary, they tend to overlap and can offer synergistic benefits when properly employed in the service of mission accomplishment. So also can actions taken in support of one approach evolve into results akin to another. For instance, isolating a force so as to *maintain* existing densities will inevitably have the eventual effect of *reducing* enemy force densities as the adversary loses the ability to reinforce or resupply. Considering urban missions from the perspective of a built-up area's densities will not provide solutions for every problem. It is, however, one step toward better understanding and overcoming a very complex set of issues.

Notes to Chapter Three

[1]CSM Michael T. Hall and SFC Michael T. Kennedy, "Applying the Lessons Learned—Take 2," briefing given at the RAND—Marine Corps Warfighting Lab—U.S. Army Training and Doctrine Command—Office of the Secretary of Defense urban operations conference, Santa Monica, CA, March 23, 2000. This and other briefings given at this conference will appear in Russell W. Glenn (ed.), *Capital Preservation: Preparing for Urban Operations in the Twenty-First Century,* to be published by RAND in 2001.

[2]Alan Vick, et al., *Aerospace Operations in Urban Environments: Exploring New Concepts,* Santa Monica, CA: RAND, 2000, pp. 72–74, 93–110.

[3]The author thanks MAJ Kevin Born for his observation in this regard. Email to author dated May 24, 2000.

Chapter Four

TURNING DENSITY TO ADVANTAGE: C4ISR AND INFORMATION OPERATIONS AS EXAMPLES

When so much was uncertain, the need
to recover the initiative glared forth.

Winston Churchill
Their Finest Hour

Applications of the five approaches described in Chapter Three are infinite. The following discussion considers how they might be employed in support of command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) and information operations. Information operations are defined as "actions taken to affect adversary information and information systems while defending one's own information and information systems."[1] This, the U.S. military's joint definition, is perhaps too narrow in its scope. Activities involving information and related systems are often crucial to mission success during missions in which there may be no adversary. Even in contingencies involving an opponent, information operations planning and execution should include noncombatant considerations that may have nothing to do with affecting the enemy's activities or defending friendly force capabilities. In today's conflict environment the impact of information operations is seldom limited to two opposing sides. Second- and higher-order effects will most likely influence all parties in opposition, impact various and varied noncombatant groups, and be interpreted in different ways by members of the media and audiences worldwide. This same multitude of effects will very possibly be felt within a single urban area due to the density of different interested parties found in virtually any major modern megalopolis.

COMMAND, CONTROL, AND COMBAT REACTION

Quick decisions are unsafe decisions.

Sophocles
Oedipus Tyrannus

The god of war hates those who hesitate.

Euripides
Heraclidae

The ancients may provide conflicting advice, but any rifleman knows that he who hesitates could be lost. A Vietnam veteran once recounted how his unit regularly practiced quick reaction drills during periods in base camp. A noncommissioned officer would have a soldier armed with a M16 face away while he stepped behind him to rearrange a set of cans, some black, some green, others gray. On the command of "Green cans, fire," the soldier would rapidly face about and engage only those cans of the color designated.[2] The objective was to integrate accuracy and mental quickness into a decisively destructive event for any future enemy confronted during a meeting engagement. It is a talent any urban fighter needs.

The "snap drill" involving firing at cans sought to enhance performance. Through such training the infantryman seeks to introduce an asymmetric overmatch into a meeting engagement with the enemy, an imbalance in training that gives him the upper hand. Such preparation has counterparts at every echelon and across all military functions. Keys to gaining the upper hand on the urban battlefield include decentralized decisionmaking, good leadership, regular rehearsals, well-conceived drills, and quality training. Proficient units are able to task organize rapidly to adjust to changing mission requirements, an ability that can help them match environmental density more ably than a less prepared force. If they are to be effective in combat, task organized units must have trained together before the lethal event. This translates into a more frequent linkage of armor, infantry fighting vehicle, light infantry, and aviation units at urban training sites. Urban operations tasks, conditions, and standards are needed for combinations of these elements (and those from engineer, medical, air defense, artillery, and other organizations) at every echelon from squad to battalion task force. At this

most fundamental level, units that train together communicate better, function better as a team, and trust each other. An urban component in Expert Infantryman and Expert Medic Badge evaluations is advisable as another step toward operational success.

The ability to react quickly is not only needed by those directly in contact with the foe. The tempo of urban operations can render contingency plans and decision support templates (DSTs) moot in a matter of hours or minutes.[3] In the immediate term, there are several straightforward training initiatives that leaders can take to address this problem by improving staff performance. They can conduct urban map exercises for their subordinates and themselves. Urban "terrain walks" through local towns and cities would bring map exercises to life and demonstrate challenges first hand. Alternatively, commanders with units going through Military Operations on Urbanized Terrain (MOUT) training sites can bring their staffs and incorporate actions in "the box" into larger tactical exercises with more numerous notional enemy and noncombatant participation spread over a far larger area. As it is for the machine gunner clearing a jam or the tank crew in the attack, "drill, drill, and more drill" will tighten the decision cycle. Training that drills staffs and commanders in their decisionmaking processes makes them better able to execute. It also helps them to learn how to adapt their processes when time constraints demand trimming. It effectively reduces urban densities as the staffs learn to handle more actions per unit of time. Staff tempo quickens both absolutely and relative to the urban operational tempo. Training gives the staff an asymmetric advantage in the urban environment. Quality training is essential; exercises that fail to replicate the information overload that an actual urban operation can present will not adequately prepare commanders and staffs for action in the field.

Yet performance enhancement may be insufficient. MOUT facilities at installations such as Fort Polk, Camp Lejeune, and Fort Knox are too small and lack the large numbers of enemy and noncombatants needed to present the realistic battery of contingencies that urban densities place before a commander and his staff. These and other sites fail to replicate virtually every aspect of urban density, both densities of structures and other elements per cubic kilometer and densities of apartments, rooms, passageways, furniture, and other concerns within structures. The doctrinal mission analysis, com-

mand estimate, or intelligence preparation of the battlespace (IPB) processes may be inherently too cumbersome for urban contingencies under actual conditions. Even the best-trained staffs may be unable to adapt them to maintain pace. Current urban operations exercises fail to replicate these challenges.

Two modifications of current decisionmaking processes offer initial assistance toward better urban operations readiness. In the first instance, the help comes from Carl von Clausewitz's masterpiece of military theory *On War* and the concepts of centers of gravity and decisive points. Whether formulating a campaign plan or operations order, the sheer number of operationally relevant elements packed into a metropolitan area can be overwhelming. By identifying and addressing centers of gravity—"those characteristics, capabilities, or localities from which a military force derives its freedom of action, physical strength, or will to fight" or "which, by their movement and direction, govern the rest"—one can begin to separate the urban wheat from the chaff.[4] Influencing these centers of gravity via the decisive points is a further step toward managing the otherwise overwhelming whole. Knowing its objectives, missions, or tasks, a force can identify especially critical nodes (centers of gravity and decisive points) that must play a role in the design of successful operations. For a force providing humanitarian relief after a natural disaster, such nodes could include sources of fresh water (within or outside the urban area), supporting purification and distribution systems, and marketplaces that serve as traditional gathering places. For armed forces attempting to hold critical parts of an urban area pending a friendly counterattack, such centers of gravity and decisive points might be enemy reserves, tall buildings critical to communications relays, an airfield essential to force arrival operations, or selected bridges. Given densities may themselves be centers of gravity or decisive points. Population density in a given urban conglomeration, for example, may be too great for the infrastructure and could thus be overly conducive to outbreaks of cholera or other diseases. Recognition of the situation could spur steps to lower densities via movement of individuals out of the most congested areas to reduce critical concentrations and establish conditions for mission success. A further difficulty more frequently confronted in urban than in other environments is the second-, third-, and higher-order effects that density precipitates. The same bridges destroyed to deny

enemies access to a given area may carry the power lines that supply civilian hospitals in the friendly force sector; severing them shifts the burden of medical support from indigenous to military assets. Many such effects are more subtle and thus harder to fathom. Urban concentrations of different demographic groups are particularly troublesome in this regard, for understanding the reactions of groups with cultural, social, and other characteristics different from those of the planner complicates the process.[5]

A second change addresses the IPB process. IPB is a thorough, deliberate, and potentially very helpful decisionmaking aid. It is flexible; steps can be trimmed or reduced altogether. However, the current doctrine detailing IPB insufficiently addresses the densities inherent in urban operations and the consequent need for greater speed in decisionmaking. Additions and modifications to the process that emphasize the need for consideration of second- and higher-order effects and the many demographic factors a force must incorporate into its plans are needed. Automation or other means of rapidly deleting defunct courses of action and replacing them with new ones at a pace that matches or exceeds the tempo of urban contingencies is also essential.[6]

Center of gravity, decisive point, and improved IPB analysis are initial steps toward increased capabilities to handle urban contingencies. Taking the products from these efforts, a commander can then identify and prioritize zones of interest within the area of interest—zones that deserve special intelligence collection, processing, and dissemination. Collection assets would focus on those named areas of interest (NAIs) in zones with higher priorities. Enemy units or other nodes of notable concern would also receive greater attention from signals, human, or measurement and signature intelligence (SIGINT, HUMINT, and MASINT respectively) collection assets. A difficulty, given current technological limitations, is that subterranean and through-building movements are hard to detect. Though intention to move and initial routes might be discerned, continuous monitoring will be difficult until the introduction of more capable sensors and non-line-of-sight (NLOS) transmitters. Monitoring a specific target as it passes through other units or masses of civilians will be a challenge even after these capabilities become available.

As with drills, insightful modification of decision processes effectively reduces urban densities by increasing friendly force efficiency. However, passing the fruits of this enhancement on to lower levels is hindered by line-of-sight (LOS) problems and the difficulty higher-level commands have in maintaining an accurate tactical picture. The LOS issue is a surprisingly difficult one to overcome. Small "walkie-talkie" type squad radios offer a fix at the lowest level, but these systems are unable to communicate with many radios at higher echelons and are vulnerable to direction finding and communications intelligence exploitation. Equally as important, neither the squad radios nor the few systems with which they are compatible allow communications with many fire support systems. Even if leaders were able to communicate directly with all subordinate units several levels under them, compiling, analyzing, and determining how to react to the high density of messages coming in during active operations would impede unit agility needed to operate within the enemy's decision cycle. Better conceptualization of communications needs, to include taking a systems perspective, is essential to properly provisioning the urban warriors of tomorrow. Perhaps there is a call for systems that pass selected information directly to pertinent users. Few would disagree that direct links between UAVs that locate enemy air defense sites and pilots about to overfly those enemy positions are desirable. Similarly, direct links between a sensor that detects an adversary and the units that are about to enter an urban ambush are preferable to a network that first relays the information through higher headquarters. The unit, forewarned of what lies ahead, has its density of challenges significantly reduced. Instead of scanning every opening, its soldiers can register their attention on the ambush site, thus dramatically reducing the number of firing positions with which they must concern themselves.

INTELLIGENCE OPERATIONS

Annihilation is the fundamental principle of war.
It is intimately connected with the principle of surprise.

General Waldemar Erfurth
Surprise

The quantity of information available in an urban area is like the water behind a large dam. Advances in collection technologies threaten to open the sluice gates and send a torrent raging through the valley. The volume of flow and the inability of potential users along its banks to reach any but small portions threaten to make this release an obstacle to rather than a vehicle of progress. Control is needed, a means of dividing the flood into many smaller streams that flow where needed, join with other courses when desirable, and can be rerouted when circumstances dictate.

Responsive intelligence is fundamental to success in an environment in which rapid decisions are crucial. As has been noted, an effective collection, analysis, and distribution system can dramatically reduce the effects of urban density by narrowing a force's attention to areas where threat presence has been confirmed or where other activities of interest have been identified and can be monitored. Currently, however, inefficient intelligence, surveillance, and reconnaissance (ISR) processes and incompatible software and hardware handicap this desirable result. The current dispersion of ISR products over various incompatible hardware systems hamstrings both operational efficiency and effectiveness. Rather than an analyst being able to go to a single station to access a synthesis of all needed intelligence, several soldiers, marines, sailors, or airmen must piece together the intelligence picture via the "sneaker net."[7] The time consumed, and the opportunity for introducing error during the process, can make even the world's best military an underdog against a more flexible and responsive adversary. Aside from constraints due to hardware and software incompatibilities, security concerns often act as a further brake on timely processing and dissemination. The need to deny selected users access to portions of a message can and has precluded the timely release of decisive intelligence.[8] Without resolu-

tion these issues will tend to turn density to the foe's advantage rather than our own. There is an obvious need to streamline intelligence processes (perhaps through posting the materials on user-friendly classified web sites) so that all pertinent materials are readily available to cleared users. Classification issues can be overcome with development of "tear line" filtering software that automatically removes material not releasable to given addressees. Only with such methods of compressing current intelligence processing times can ISR activities hope to adequately serve the people who are developing and executing plans.

Standing Operating Procedures (SOP) and Rules of Engagement (ROE)

> What is necessary to be performed in the heat of action
> should constantly be practiced in the leisure of peace.
>
> Vegetius
> *De Re Militari*

Despite the greater burden that a denser environment requires during initial ISR actions, subsequent monitoring can reduce the load through a policy of reporting only by exception. This focusing on significant changes will act to effectively reduce urban densities.

Initial detection and monitoring of enemy and relevant noncombatant movement within an urban area can be difficult; the problem defies easy solution. The density of hide locations, many of them large, means that an adversary can have one or several undetected forces quite close to friendly units, close enough that reaction times to an enemy attack would be very limited. Further, short distance movements can make prospective targets unassailable; they may position themselves within "danger close" range of friendly units or noncombatants or become masked by tall structures that either disrupt line of sight or require engagement at an angle impossible for available friendly systems. Engagement guidance designed for other environments can unnecessarily cripple operations. Determination of what comprises "danger close" for munitions in built-up areas is overdue. Some rounds may have little effect against given types of structures, thus allowing engagement of targets closer to friendly

forces than under other conditions. Alternatively, other munitions effects could be magnified by spalling or building collapse, necessitating an increase of danger close distances. The effects on pertinent regulations, SOPs, and ROE could significantly influence operations. Conducting such evaluations before the commitment of forces to future urban contingencies will better allow them to use the densities of built-up areas to coalition advantage.

Offensive Information Operations

> We must as far as possible make the enemy blind and deaf by sealing his eyes and ears, and drive his commanders to distraction by creating confusion in their minds.
>
> Mao Tse-tung
> *On Protracted War*

The urban environment can also be used to considerable advantage during the conduct of offensive information operations. In addition to the fertile ground for deception that the urban environment provides, its density of man-made physical features and human activity makes it lucrative as a catalyst for overloading an enemy's decision-making processes. The high tempo and heterogeneous nature of activities are conducive to hiding actions or drawing attention to them. High densities and larger quantities mean that the insightful tactical or operational artist can disguise his force's activities through emulation of those naturally found in the daily routine. On the other hand, deliberately breaking that routine or taking steps to make an event more noticeable in the constant hum of continuous vibration allows the artist to attract undue attention to either confuse the enemy or keep him from detecting another activity. This combination of natural and deliberately staged actions by itself promotes the adversary's misreading of reality. Add planned disruptions such as targeting of his command and control nodes (that may or may not be located within the built-up area itself, as the aforementioned example of Hue during Tet 1968 fighting demonstrated), jamming of communications, loss of power, and other attacks against operational stability, and the likelihood of decision error climbs steeply.

The targets of influence need not be enemy. Many of the same distracters and other characteristics that favor disruption of an adversary's command and control can also support psychological operations (PSYOP) and civil affairs (CA) activities directed at a local populace.[9] In 1991, coalition forces warned Iraqi soldiers that they would be bombed in the near future; they then consummated the threat. In a similar manner, demonstrating that friendly forces can control such essentials as electrical, water, food, or other supplies while the enemy cannot might have significant benefits in the service of U.S. and allied objectives. Similarly, demonstrating a friendly force aversion to unnecessary noncombatant casualties could likewise win latent if not overt support. The coordination of deception, PSYOP, CA, and other military actions is crucial in any environment. Urban contingencies will have a tendency to magnify the benefits resulting from such coordination and the penalties for failing to do so. As has been noted, accounting for second- and higher-order effects of such initiatives will be essential though difficult; cultural differences and the complexity of the environment will have consequences very hard to foresee. The burden on planners and those executing will be considerable.

Notes to Chapter Four

[1]Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms,* Washington, D.C.: Office of the Chairman, The Joint Chiefs of Staff, March 23, 1994, as amended through June 14, 2000, p. 221.

[2]This example is from Russell W. Glenn, *Reading Athena's Dance Card: Men Against Fire in Vietnam,* Annapolis, MD: Naval Institute Press, 2000.

[3]For a detailed investigation of the IPB process as applied during urban operations, see Jamison Jo Medby, *Street Smart: Employing the Intelligence Preparation of the Battlefield Process During Urban Operations,* Santa Monica, CA: RAND, forthcoming.

[4]The first definition of "center of gravity" is from Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms,* Washington, D.C.: The Joint Chiefs of Staff, March 23, 1994, as amended through June 14, 2000, p. 72. The second is from Carl von Clausewitz, *On War,* Michael Howard and Peter Paret (eds.), Princeton, NJ: Princeton University Press, 1976, p. 486.

[5]David Hackett Fischer does an excellent job of describing the difficulties and common errors involved in considering groups other than one's own in his book *Historians' Fallacies: Toward a Logic of Historical Thought,* New York: Harper, 1970, pp. 216–242. He writes for an audience of historians, but his observations are easily extrapolated to military operations.

[6]These and other IPB issues are addressed in Medby, *Street Smart* (forthcoming), op. cit.

[7]"Sneaker net" refers to situations in which those processing information must go from system to system extracting needed information and passing it to users by reentering pertinent data into completely different systems.

[8]For a far more extensive discussion of C4ISR interoperability problems, see Russell W. Glenn et al., *Getting the Musicians of Mars on the Same Sheet of Music: Army-Joint, Multinational, and Interagency C4ISR Interoperability,* Santa Monica, CA: RAND, 2000.

[9]This comment applies only to operations in which the targets would be other than U.S. personnel. U.S. forces are proscribed from using PSYOP against American citizens.

Chapter Five

CONCLUSION

Man, his wits, and his will are still the key
to war and peace, victory and defeat.

Admiral George W. Anderson, USN
U.S. Naval Institute *Proceedings,* 1964

The past is an able guide for the professional who desires to prepare himself for future conflicts. The wise student learns from both the successes and failures of others. Adaptation of history's lessons is always necessary; only a fool attempts to overlay events from one age directly on those in another. Though all eras of military history have lessons of usefulness, those from more recent periods generally hold more of relevant value. The infantryman is likely to find greater utility in studying the events of the Second World War, Vietnam, or Panama than from a reading of Scipio Africanus' Carthaginian campaigns. Unfortunately, for the leader attempting to derive lessons from urban operations even those of the past several decades are at times of questionable value. Key cities are much larger and denser than the ones confronted during World War II and Korea. Concerns about friendly force casualties, noncombatant losses, and infrastructure damage have greater influence than they have in the past. There are lessons to be drawn from the past several decades, but much is demanded of the student attempting to make them relevant to coming actions. This in no way diminishes the professional's responsibility to adapt those lessons that are pertinent to the requirements of today and coming years. Development of weapons, communications, and support systems must include consideration of urban density and other factors related to operations in built-up areas. Insights on these subjects can be extracted from the previ-

ously hard-learned lessons of others. Here too wisdom in application will be essential.

A modern U.S. force possessing extraordinary maneuverability and firepower that is unable to fight and win in the city is of dubious value. Systems tuned to peak performance in the deserts of southwest Asia or the valleys of Korea, but unable to function effectively in streets, subways, or within buildings, will not go unnoticed by ever-watching adversaries. Authors Eliot Cohen and John Gooch determined that a military's ability to learn, anticipate, and adapt was crucial to its success in war.[1] It is more difficult to learn, however, when a soldier has been preconditioned to fight in a manner different from what the next conflict may call for. Learning is harder yet when what must be learned has long been an operational pariah. The guidance with regard to urban operations has been unambiguous for thousands of years. Sun Tzu declared that "the rule is not to besiege walled cities if it can possibly be avoided"; many nations' current doctrines similarly advise modern commanders.[2] Anticipation is harder when experiences still over the horizon may be very different from previous ones—as is the case with urban operations, for the anticipation requires intellectual leaps over unfamiliar conceptual chasms. Wars are unforgiving if adaptations ultimately prove themselves inadequate or misguided, as the French of 1940 could attest. Bureaucratic judgment can be no less harsh on the leader whose recommendations do not prove themselves immediately valuable.

These are but some reasons that insights into the character of the urban contingencies are not only desirable but essential. When the problem is one of seemingly insurmountable complexity, men fear to approach it because the opportunities for failure too greatly exceed the chances of success. This brief offering has been an effort to provide a means of reducing the complexity somewhat so that knowing what we must learn, how to anticipate, and what capabilities to adapt might be somewhat more obvious. It has done little more than propose a means of simplifying conceptualization and perhaps give a hint or two on how one might proceed toward future readiness. Much more thinking, discussion, and analysis is needed. Employment during planning and exercises is necessary to perfect and gain proficiency in applying the concepts discussed herein. Fortunately, unlike the situation in which George Marshall and the U.S. armed

forces found themselves in January 1942, there is a little time to do so. But only a little.

Notes to Chapter Five

[1]Eliot A. Cohen and John Gooch, *Military Misfortunes: The Anatomy of Failure in War,* New York: Free Press, 1990, pp. 26–28.

[2]Sun Tzu, *The Art of War,* Lionel Giles (trans.), London: Luzac & Co, 1910, p. 18.

BIBLIOGRAPHY

Books

Adcock, F.E. *The Greek and Macedonian Art of War*. Berkeley: University of California Press, 1957.

Beevor, Antony. *Stalingrad: The Fateful Siege: 1942–1943*. New York: Viking, 1998.

Bosworth, A.B. *Conquest and Empire: The Reign of Alexander the Great*. New York: Cambridge, 1993.

Bowden, Scotty, and Charlie Tarbox. *Armies on the Danube, 1809*. Arlington, TX: Empire Games Press, 1980.

Caesar, Julius. *Caesar's War Commentaries*. John Warrington (trans.). London: J.M. Dent & Sons, 1955.

Chandler, David. *The Campaigns of Napoleon: The Mind and Method of History's Greatest Soldier*. New York: Macmillan, 1966.

———. *Dictionary of the Napoleonic Wars*. New York: Simon & Schuster, 1993.

———. *Napoleon's Marshals*. New York: Macmillan, 1987.

von Clausewitz, Carl. *On War*. Michael Howard and Peter Paret (eds.). Princeton, NJ: Princeton University Press, 1976.

Cohen, Eliot A., and John Gooch. *Military Misfortunes: The Anatomy of Failure in War*. New York: Free Press, 1990.

Connaughton, Richard, John Pimlott, and Duncan Anderson. *The Battle for Manila: The Most Devastating Untold Story of World War II*. Novato, CA: Presidio, 1995.

Cordesman, Anthony H., and Abraham R. Wagner. *The Lessons of Modern War, Volume II: The Iran-Iraq War*. Boulder, CO: Westview, 1990.

Costello, John. *The Pacific War*. New York: Rawson, Wade, 1981.

Craig, William. *Enemy at the Gates: The Battle for Stalingrad*. New York: Reader's Digest Press, 1973.

Dear, I.C.B., and M.R.D. Foot (eds.). *The Oxford Companion to World War II*. New York: Oxford, 1997.

Dewar, Michael. *War in the Streets: The Story of Urban Combat from Calais to Khafji*. Newton Abbot, Devon: David & Charles, 1992.

Dodge, Theodore Ayrault. *Alexander*. New York: Da Capo, 1996.

Donnelly, Thomas, Margaret Roth, and Caleb Baker. *Operation Just Cause: The Storming of Panama*. New York: Lexington, 1991.

Dupuy, Trevor N. *The Evolution of Weapons and Warfare*. New York: Da Capo, 1984.

Eisenhower, John S.D. *Agent of Destiny: The Life and Times of General Winfield Scott*. New York: Free Press, 1997.

———. *So Far from God: The U.S. War with Mexico*. New York: Doubleday, 1990.

Engels, Donald W. *Alexander the Great and the Logistics of the Macedonian Army*. Berkeley: University of California Press, 1978.

Erickson, John. *The Road to Stalingrad: Stalin's War with Germany, Volume 1*. New York: Harper & Row, 1975.

Esposito, Vincent J. (ed.). *A Military History and Atlas of the Napoleonic Wars*. New York: Frederick A. Praeger, 1968.

———, *The West Point Atlas of American Wars, Volume 1: 1689–1900*. New York: Frederick A. Praeger, 1967.

Fischer, David Hackett. *Historians' Fallacies: Toward a Logic of Historical Thought*. New York: Harper, 1970.

Fox, Robin Lane. *Alexander the Great*. London: Futura, 1975.

Gabriel, Richard A. *Operation Peace for Galilee: The Israeli-POL War in Lebanon*. New York: Hill and Wang, 1984.

Gall, Carlotta, and Thomas de Waal. *Chechnya: Calamity in the Caucasus*. New York: New York University Press, 1998.

Gill, John H. *With Eagles to Glory: Napoleon and His German Allies in the 1809 Campaign*. Novato, CA: Presidio, 1992.

Glenn, Russell W. *Reading Athena's Dance Card: Men Against Fire in Vietnam*. Annapolis, MD: Naval Institute Press, 2000.

Hammel, Eric. *Fire in the Streets: The Battle for Hue, Tet 1968*. New York: Dell, 1991.

Heinl, Robert Debs. *Dictionary of Military and Naval Quotations*. Annapolis, MD: Naval Institute Press, 1985.

Henry, Robert Selph. *The Story of the Mexican War*. New York: Bobbs-Merrill, 1950.

Howard, Oliver Otis. *General Taylor*. New York: D. Appleton, 1892.

Infantry in Battle. Washington, D.C.: The Infantry Journal Incorporated, 1939.

Jansen, Michael. *The Battle of Beirut: Why Israel Invaded Lebanon*. Boston: South End Press, 1983.

Kerr, Walter. *The Secret of Stalingrad*. Garden City, NY: Doubleday, 1968.

Kirkham, Ralph W. *The Mexican War Journal and Letters of Ralph W. Kirkham*. Robert Ryal Miller (ed.). College Station, TX: Texas A&M, 1993.

Liddell Hart, B.H. *Scipio Africanus: Greater Than Napoleon*. New York: Da Capo, 1994.

Lieven, Anatol. *Chechnya: Tombstone of Russian Power*. New Haven, CT: Yale, 1998.

Livy. *The War With Hannibal*. New York: Penguin, 1987.

von Manstein, Erich. *Lost Victories*. Novato, CA: Presidio, 1986.

MacDonald, Charles B. *United States Army in World War II: The European Theater of Operations: The Siegfried Line Campaign*. Washington, D.C.: Center of Military History, 1990.

Matloff, Maurice (ed.). *American Military History*. Washington, D.C.: Center of Military History, 1973.

McConnell, Malcolm. *Just Cause: The Real Story of America's High-Tech Invasion of Panama*. New York: St. Martin's Press, 1991.

O'Ballance, Edgar. *No Victor, No Vanquished: The Yom Kippur War*. Novato, CA: Presidio, 1991.

Parker, Harold T. *Three Napoleonic Battles*. Durham, NC: Duke, 1983.

Petre, F. Loraine. *Napoleon and Archduke Charles: A History of the Franco-Austrian Campaign in the Valley of the Danube in 1809*. Novato, CA: Presidio, 1991.

———. *Napoleon's Campaign in Poland, 1806–1807*. Novato, CA: Presidio, 1989.

Plutarch. *The Age of Alexander*. Ian Scott-Kilvert (trans.). London: Penguin, 1973.

Polybius. *Polybius on Roman Imperialism: The Histories of Polybius Translated from the Text of F. Hultsch*. Evelyn S. Shuckburgh (trans.). Lake Bluff, IL: Regnery Gateway, 1987.

Rotundo, Louis C. *Battle for Stalingrad: The 1943 Soviet General Staff Study*. Washington, D.C.: Pergamon-Brassey's, 1989.

Ryan, Cornelius. *The Last Battle*. New York: Simon and Schuster, 1966.

Scullard, H.H. *Scipio Africanus: Soldier and Politician*. Ithaca, NY: Cornell, 1970.

Shafritz, Jay M. *Words on War: Military Quotations from Ancient Times to the Present*. New York: Simon & Schuster, 1990.

Stanton, Shelby L. *World War II Order of Battle*. New York: Galahad, 1991.

Shtemenko, S.M. *The Soviet General Staff at War, 1941–1945, Book One*. Trans. Robert Daglish. Moscow: Progress, 1985.

———. *The Soviet General Staff at War, 1941–1945, Book Two*. Trans. Robert Daglish. Moscow: Progress, 1986.

Shulimson, Jack, et al. *U.S. Marines in Vietnam: The Defining Year, 1968*. Washington, D.C.: Headquarters, USMC, 1997,

Smith, Robert Ross. *U.S. Army in World War II: The War in the Pacific: Triumph in the Philippines*. Washington, D.C.: Center of Military History, 1991.

Sun Tzu. *The Art of War*. Lionel Giles (trans.). London: Luzac & Co, 1910.

Thucydides. *History of the Peloponnesian War*. Rex Warner (trans.). New York: Penguin, 1972.

———. *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War*. Robert B. Strassler (ed.). New York: Free Press, 1996.

Toland, John. *The Last 100 Days*. New York: Random House, 1966.

Zhukov, Georgi K. *Marshal Zhukov's Greatest Battles*. New York: Harper & Row, 1969.

Zhukov, Georgi K. *Reminiscences and Reflections, Volume 2*. Moscow: Progress, 1985.

Articles

Arnold, James R. "Flirting With Disaster: Exclusive Excerpt from James R. Arnold's Napoleon Conquers Austria." *Napoleon* (May 1996): 4–22.

Bowden, Scott. "Battlefield Domination: Napoleon's New Grand Armee Thrashes the Austrians at Haslach-Jungingen During the Ulm Campaign of 1805." *Napoleon* (September 1996): 5–18+.

Foulkes, T.H.E. "'Black as Hell and Thick as Grass'—Reflections on Rorke's Drift and Isandhlwana." *The Royal Engineers Journal,* Vol. 110 (December 1996): 216–218.

Thomas, Timothy L. "The Caucasus Conflict and Russian Security: The Russian Armed Forces Confront Chechnya III. The Battle for Grozny, 1–16 January 1995." *The Journal of Slavic Military Studies,* Vol. 10 (March 1997): 50–108.

Reports

Gerwehr, Scott, and Russell W. Glenn. *The Art of Darkness: Deception and Urban Operations.* Santa Monica, CA.: RAND, 2000.

Glenn, Russell W. *Combat in Hell: A Consideration of Constrained Urban Warfare*. Santa Monica, CA.: RAND, 1996.

Glenn, Russell W., et al. *Denying the Widow-Maker: Summary of Proceedings, RAND-DBBL Conference on Military Operations on Urbanized Terrain*. Santa Monica, CA.: RAND, 1999.

Glenn, Russell W., et al. *Getting the Musicians of Mars on the Same Sheet of Music: Army-Joint, Multinational, and Interagency C4ISR Interoperability*. Santa Monica, CA.: RAND, 2000.

Glenn, Russell W. *Marching Under Darkening Skies: The American Military and the Impending Urban Operations Threat*. Santa Monica, CA: RAND, 1998.

McLaurin, R.D. *Military Operations in the Gulf War: The Battle of Khorramshahr*. Prepared for the U.S. Army Human Engineering Laboratory, Aberdeen Proving Ground, MD, 1982.

McLaurin, R.D., Paul A. Jureidini, and David S. McDonald. *Modern Experience in City Combat*. Prepared for the U.S. Army Human Engineering Laboratory, Aberdeen Proving Ground, MD, 1987.

Medby, Jamison Jo. *Street Smart: Employing the Intelligence Preparation of the Battlefield Process During Urban Operations*. Santa Monica, CA: RAND, forthcoming.

Vick, Alan, et. al., *Aerospace Operations in Urban Environments: Exploring New Concepts*. Santa Monica, CA: RAND, 2000.

Wilson, Peter A. *Defense of Hue and Quangtri City: The 1972 NVN Invasion of MR-1*. Alexandria, VA: Center for Naval Analyses, May 1974.

Government Documents

Field Manual 101-5-1/MCRP 5-2.2 (DRAG Edition), *Operational Terms and Graphics*. Washington, D.C.: Headquarters, Department of the Army and Headquarters, U.S. Marine Corps, July 31, 1996.

Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms*. Washington, D.C.: The Joint Chiefs of Staff, March 23, 1994 as amended through June 14, 2000.

Interviews/Email correspondence

Anderson, Col Gary, Chief of Staff for the Marine Corps Warfighting Lab, Quantico, Virginia, Russell W. Glenn interview, November 30, 1999.

Smidt, MAJ Michael L., Professor, International Law, U.S. Army Judge Advocate General School, Charlottesville, Virginia, telephone interview with Russell W. Glenn, January 27, 2000.

Smith, LTC Jeffrey D., Chief of Military Law Office, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, telephone interview with Russell W. Glenn, January 27, 2000.

Smith, Charles R., Headquarters, USMC, History and Museums Division, email to author, February 7, 2000.

Internet

de Marbot, Baron Marcellis. *The Memoirs of Baron de Marbot [Volume I, Chapter XXXII]*, London: Longmans, Green, and Company, 1892.

"Napoleonic Literature," John Schneider (ed.), URL http://napoleonic-literature.simplenet.com/Book_2/V1C32.html, April 2000.

Unpublished materials

Broadwater, C.M. "CSI Battlebook 13-D: The Battle of Nuremberg." Combat Studies Institute, Fort Leavenworth, KS, 1984.

Lapham, Curtis A. "Colossus on Main Street: Tactical Considerations of Heavy Armor and Future MOUT Doctrine." Monograph, School of Advanced Military Studies, Fort Leavenworth, KS.

Price, et al., "CSI Battlebook 13-C: The Battle of Aachen." Combat Studies Institute, Fort Leavenworth, KS, 1984.

McEwery, Kevin T. "The XIV Corps Battle for Manila, February 1945." Thesis, Command and General Staff College, Fort Leavenworth, KS, 1993.