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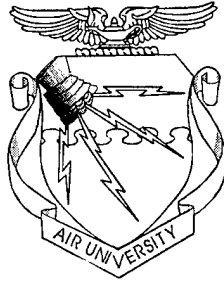
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The Role of Airpower in Urban Warfare

An Airman's Perspective

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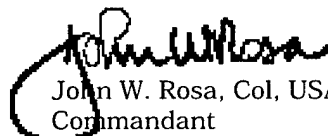
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Foreword

It is my great pleasure to present another of the *Wright Flyer Papers* series. In this series, Air Command and Staff College (ACSC) recognizes and publishes the "best of the best" student research projects from the prior academic year. The ACSC research program encourages our students to move beyond the school's core curriculum in their own professional development and in "advancing aerospace power." The series title reflects our desire to perpetuate the pioneering spirit embodied in earlier generations of airmen. Projects selected for publication combine solid research, innovative thought, and lucid presentation in exploring war at the operational level. With this broad perspective, the *Wright Flyer Papers* engage an eclectic range of doctrinal, technological, organizational, and operational questions. Some of these studies provide new solutions to familiar problems. Others encourage us to leave the familiar behind in pursuing new possibilities. By making these research studies available in the *Wright Flyer Papers*, ACSC hopes to encourage critical examination of the findings and to stimulate further research in these areas.



John W. Rosa, Col, USAF
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Preface

This research project addresses how I believe airpower should be employed in urban warfare to achieve operational and strategic results. I chose this topic because there is an apparent disconnection between how military planners and operators view urban combat and their awareness of airpower's unique and potentially decisive contributions in this environment. This disconnect could prove disastrous for military forces operating on urban terrain.

Urban warfare has been given considerable attention by the United States Army and Marine Corps. Although their concerns are soundly based on changes in the strategic environment, I believe their focus is misplaced at the tactical level of warfare. Airmen from all services need to reorient their thinking towards employing airpower to achieve "war-winning" operational and strategic results in this difficult environment. I sincerely hope this paper generates new thought and debate on how urban warfare should be planned and executed.

I wish to thank all of my Marine Corps, Army, Navy, and Air Force war-fighting peers attending the Air Command and Staff College who patiently listened to my ideas and graciously offered their suggestions. I especially want to thank Maj Ed "K-9" Kostelnik, one of the few Air Force officers who has seriously been involved in studying urban warfare, for his candid insight and arguments on the subject.

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Abstract

Increased emphasis on urban warfare creates an urgent need for airmen to focus serious thought toward what airpower's role should be in this difficult environment. Traditionally, military forces have viewed urban warfare as infantry action executed at the tactical level of battle. This emphasis on surface force employment stifles innovative thought as to how military forces can achieve operational and strategic effects by employing airpower as the *key* instrument of force in urban warfare.

Airpower plays a unique and decisive role in urban warfare by exploiting the very characteristics that limit surface forces on urban terrain—small operational units, close-range weaponry, presence of civilians and their property, defensive bias, and absorption of manpower. Understanding the role of airpower requires this study to examine first why military forces should consider urban warfare so important. Then, the study analyzes the urban environment to explain why these characteristics make airpower the key instrument of force. Airpower's contribution is weighed against those characteristics to show that only airpower can achieve battlespace dominance by matching targets, weapons, desired accuracy, and platforms in near-real-time operational-level actions that achieve operational and strategic effects. Finally, an airpower theory for urban warfare is proposed.

Airpower, via the integrated application of C4ISR and precision strike supported by other forces, is the only instrument of military force that can effectively prosecute urban warfare by shaping and controlling the battlespace through precise applications of lethal and nonlethal force that nearly simultaneously affect the tactical, operational, and strategic levels of urban combat.

The Role of Airpower in Urban Warfare An Airman's Perspective

The worst policy is to attack cities. Attack cities only when there is no alternative.

—Sun Tzu

Dilemma

Urban warfare is undesirable warfare. Warriors who have waged war in urban areas and planners who prepare for it agree that it is an environment to avoid. It is violent, resource intensive combat that consumes the lives of combatants and noncombatants with equal fervor. Historically producing levels of destruction unmatched in open field, maneuver warfare, urban combat yields shocking consequences and far too often, unmatched horror. Nevertheless, military forces, either by design or by inadvertent stumbling, continue to enter urban landscapes and seek military decisions that, hopefully, will support national political objectives.

The United States military is no exception. US forces have tasted urban combat's bitterness in the far flung cities of Palermo, Aachen, Manila, Hue, Beirut, Panama City, and, most recently, Mogadishu. This list is by no means inclusive and it obviously fails to account for other nations' experiences. Nonetheless, it clearly illustrates that the US military, albeit reluctantly in *some* cases, has aggressively engaged in both limited- and full-scale urban warfare and will continue to plan and prepare for it in the future. In fact, the 1997 *Joint Strategy Review (JSR)* states, "Increased urban terrain in 2010, especially in developing countries, will increase the probability of urban conflict. . . . US forces will likely be required to conduct military operations on urban terrain more frequently."¹

In recent years, the United States Marines Corps (USMC) and the Army stepped to the forefront of urban warfare thought and tactics development, while the Air Force quickly responded with studies and evaluations of urban close air support (CAS). Much of the Corps' efforts focus on Marine

specific operations (for example, the role of the Marine air-ground task force in tactical-level urban combat). Much of the Army's efforts focus on urban warfare between mobile, mechanized field armies fighting tactical engagements in cities against enemies that resemble former Warsaw Pact forces. Apparently, Air Force focus is on how to support these ground units with tactical-level close air support.

The common thread to all of these approaches, and one that accentuates the dilemma of urban warfare, is focus on the *tactical* level of battle. This focus is not surprising since the very nature of urban combat predisposes one to think at the tactical level. However, this predisposition perpetuates mindsets that stifle innovative thought as to how military forces can achieve operational and strategic effects. Specifically, this mode of thinking has stifled ideas about how armed forces should employ airpower in urban warfare to achieve not only tactical effects, but "war-winning" operational and strategic effects as well.

Airpower plays a unique and decisive role in the successful prosecution of urban warfare. Airpower's potential is so significant, commander in chief (CINC) and joint task force (JTF) planners should consider airpower the key component in a joint urban warfare operation. To understand this, we must examine why the consideration of urban warfare is so important and why the Marines and Army invest so much time and effort studying it. We must examine the nature and characteristics of the urban environment to ascertain what characteristics drive airpower to be the key component. This understanding will flow from analyzing how urban terrain affects the movement and employment of surface forces at the tactical level. In order to move from merely thinking on the tactical level to thinking on the operational and strategic levels, we must examine why all the services have failed to define airpower's role in urban warfare apart from CAS. Has this failure negated rational thinking and planning from an operational or strategic perspective? If so, what should we consider airpower's role to be in the urban environment? Such analysis will lead us to contemplate seriously whether or not any of the services are willing to realistically acknowledge the high costs of urban warfare. Finally, we must determine if there

is an airpower theory that will match the unique contribution airpower can make to the complex and violent arena of urban warfare.

Why?

Yea though I walk through the valley of the shadow of death, I will fear no evil.

—Psalm 23:4

If urban warfare is so difficult and costly, then why fight the urban battle? The Army's capstone urban warfare manual, Field Manual (FM) 90-10, *Military Operations on Urbanized Terrain (MOUT)*, clearly stresses that urban combat operations are conducted only when required and that built-up areas are usually isolated and bypassed rather than risking a costly, time-consuming operation in this difficult environment.² Army rationale is soundly based on experience. Unfamiliarity with the environment, large numbers of noncombatants, a high political profile, short engagement ranges, devastating casualty rates, a dense battlefield (Southeast Asian jungles and Germany's Huertgen Forest cannot match the three-dimensional complexity of a city), and rapid consumption of ammunition stores: these are but a sampling of urban warfare's historical offerings.³ Given these characteristics, it comes as no surprise that commanders generally have little desire to expose their forces to the potential ravages offered by the world's cities. If this is true, why are the Army and Marine Corps focusing so much on urban warfare? The answer lies in unprecedented demographic changes in the strategic environment due to population growth and urbanization.

Increasing global urbanization is a predominant post-World War II (WWII) trend. In 1920 the United Kingdom was the only nation with more than 50 percent of its population in cities or towns of more than 20,000. By 1960, however, one in every four people lived in urban areas. Ten years later, 12 percent of the world lived in cities with populations over five hundred thousand.⁴ The trend continues as the global population will likely exceed seven billion by 2010, an increase of 25 percent over 1996, with the greatest increase occurring in developing coun-

tries. Littoral regions will experience the greatest population growth, a condition not overlooked by the USMC. In fact, by 2010, persons living within 500 kilometers of the sea could very well comprise around two-thirds of the world's population.⁵

People in developing countries, seeking an improved quality of life, will migrate increasingly to urban areas. Urbanization and population growth will seriously strain fragile societies and weaken infrastructures in some developing states. In overcrowded urban areas, the negative impact of man-made and natural disasters could be magnified exponentially. Any or all of these conditions could foster political radicalization of populations, and this radicalization in conjunction with increased urban terrain in 2010, especially in developing countries, will increase the probability of urban conflict.⁶

The 1997 JSR states that military forces must be prepared to conduct combat, humanitarian, civil relief, and law enforcement operations simultaneously in urban environments. It further states that any significant military activity on urban terrain will place great demands on the resources of all services, and while most military technology enhancements are advantageous in urban operations, the requirement for manpower to control such terrain and its populations is nevertheless great. As a result, joint doctrine for all military tasks across the full range of military operations must accept the likelihood of operating on urban terrain as routine.⁷

These predictions with associated guidance provide insight as to why the Marines and Army have increased their emphasis on urban combat despite doctrinal inclinations to avoid it. The JSR clearly and most emphatically prescribes increased emphasis on urban combat. JSR emphasis on littoral regions provides justification for an extended Marine Corps role; its reference to using manpower-intensive surface forces to control urban terrain certainly provides the Army with a long-term role. Responding with "911" urgency, USMC Fleet Marine Force Manual (FMFM) 1-2, *The Role of the Marine Corps in the National Defense*, states, "The increasingly probable terrain for political reinforcement tasks under unanticipated, time-sensitive cir-

cumstances is urban."⁸ The rationale for this statement resides in the fact that US embassies and legations are located in cities where host-country political and economic leadership is concentrated and where US nationals tend to seek economic opportunities. This rationale, combined with the fact that the Marines, historically, have evacuated US nationals from urban areas, drives the USMC toward an urban warfare mindset, a mindset not necessarily unique to the Marines. Of particular interest to the Navy is the fact that some 60 percent of politically significant urban areas (those whose political or economic activity have warranted establishment of a US embassy, legation, or other government agency) outside allied or former Warsaw Pact territory are located along or within 25 miles of a coastline; 75 percent are within 150 miles of the sea; 87 percent within 300 miles; 95 percent within 600 miles; and all within 800 miles.⁹

What all these statistics point to is that each of the services recognizes a variety of reasons why a military may fight in a city. The city may be a vital port with access to critical lines of communications; it may be located between two natural obstacles denying a maneuvering army the possibility to bypass. On the other hand, it may be the only place the enemy is actually located. There may be overwhelming political considerations that dominate the military decision, or in the case of operations other than war, the entire mission and focus may center on a city.¹⁰ Finally, above all else, one must consider that the populations of all nations are urbanizing. It is highly unlikely that a military can fight in the future without conducting some or all of its combat in cities. In fact, it is highly probable that the majority of future combat will take place in and around urban areas.¹¹

Therefore, the answer to the question "why" is, The military instrument of power as an instrument of national policy must be able to engage any threat, in any environment, at any time. As long as our National Security Strategy states, "We must be prepared and willing to use all appropriate instruments of national power to influence the actions of other states and non-state actors . . . we must demonstrate the will and capabilities to exert global lead-

ership and remain the preferred security partner for the community of states that share our interests. . . . American leadership and engagement are vital for our security, and the world is a safer place as a result."¹² And our National Military Strategy states, "Engagement serves to demonstrate our commitment; improve interoperability; reassure allies, friends and coalition partners; promote transparency; convey democratic ideals; deter aggression; and help relieve sources of instability before they can become military crises."¹³ Then, military forces must prepare to enter urban environments and defeat any adversary in operations ranging from operations other than war to high-intensity combat.

Consequently, "why" is not the question. Rather, "how" and "with what" require careful consideration. If military forces are employed in urban warfare operations, how should they be committed and what assets will be most appropriate for achieving strategic and operational objectives? Pre-disposed thinking that focuses on achieving tactical-level objectives using surface combatants as the predominant instrument of force stifles thinking at the operational and strategic levels. To understand why the nature of urban warfare can quickly drive thought to the tactical level, we must examine the characteristics of the urban environment and analyze how forces, historically, have approached the urban problem. This examination will show that airpower should be the preferred instrument for achieving operational and strategic objectives because airpower can exploit those very characteristics that constrain and drive surface combatants to piecemeal, tactical-level operations.

The Abyss

To him was given the key to the bottomless pit. He opened the bottomless pit, and smoke arose out of the pit like the smoke of a great furnace . . . the sun and the air were darkened because of the smoke of the pit.

—Revelation 9:1-2

The most important, fundamental characteristics of urban warfare stem directly from the nature of the urban environment. Extreme three-dimensional density and het-

erogeneity characterize this environment. Subterranean and multiple-story structures provide numerous locations for ground forces to fight below, on, and above the earth's surface. This situation, combined with narrow streets and a large noncombatant population that doesn't necessarily know when or how to get out of the way, means military forces face an environment that by its very nature thwarts the advantages of speed, maneuver, superior firepower, command and control, and leadership. This conclusion is clarified by analyzing urban characteristics under five categories that combine to present unique and complex challenges to military forces: small operational units, close-range weaponry, civilian presence (lives and property), defensive bias, and absorption of manpower.

Historically, when surface forces enter urban landscapes, the streets and buildings of that environment fragment warfare into conflict between squad- and platoon-size units. Generally, insufficient space exists for the deployment and maneuver of larger units. Complexes of buildings become (or can be relatively easily converted into) defensive positions, and battles rapidly disintegrate into series of more or less separate and isolated conflicts around "mini-fortresses."¹⁴

A consequence of this fragmentation is a loss of control by commanders and resulting devolution of responsibility to small group leaders and individuals, which accounts in part for the distrust of a professional officer corps in committing forces to a battle over whose progress it has minimal control.¹⁵ Minimal control situations emphasize individual motivation, reliability, and initiative and the quality of junior leadership, rather than the wider regulatory disciplines and esprit de corps upon which most professional armies are based. These conditions create potential asymmetric relationships between forces that can produce unexpected results. For example, fragmentation of control may favor individually motivated guerillas over technically competent, well-organized professionals; fragmentation may favor the personal skills and self-reliance of such "regular irregulars" as paratroops, commandos, Green Berets, and the like, rather than units trained for more conventional warfare.¹⁶

Units with these special characteristics generally have fought the most fiercely contested urban battles. For instance, Stalingrad pitted a Wehrmacht, which paid particular attention to the quality of small-unit leadership, against a Red Army, which stressed the importance of individual motivation.¹⁷ Stalingrad highlights the important fact that when military forces engage in urban conflict, the force that is clearly superior in open terrain must reassess the hazards of attempting to pursue that success into the streets and alleys of cities. German failure to reassess following a brilliant offensive through western Russia led to defeat at Stalingrad. Learning from Wehrmacht mistakes, Soviet commanders emphasized the necessity of isolating and encircling a city if speed and surprise could not be employed to achieve an immediate, overwhelming victory. The Soviets also emphasized the use of "assault detachments" composed of infantry, combat engineers, and flame thrower troops supported by tanks and self-propelled artillery in combined-arms operations.¹⁸ This combination of force at the small unit level produced victory from Stalingrad to Berlin at an incredible cost in Soviet lives and resources. Just over 50 years later in Chechnya, it appears the Russians either forgot those lessons or the lessons no longer apply. Despite tremendous urban warfare experience gained from fighting the Germans, the Russians could not translate that experience into victory against Chechen rebels in Grozny partially because they failed to consider that the high costs of WWII tactics might no longer be acceptable.¹⁹

Another fundamental feature of the urban environment is that buildings limit visibility. The most important consequence of this simple condition is that the employment ranges of surface force weaponry are necessarily short. Ranges are too short for the safe operation of much heavy weaponry and confine the bulk of urban fighting to hand-held or hand-thrown infantry weapons. This is a historical by-product of a tactical mindset that emphasizes the use of infantry in urban warfare and also suggests that most supporting artillery, armor, and air or sea forces are generally unable to sight targets.²⁰ In addition, this mindset suggests that heavier weaponry can be counterproductive

because any attempt to hit targets in a city creates collateral damage over a wide area surrounding the target. Collateral damage, in turn, likely reduces accessibility, visibility, and recognition by blocking roads as well as by creating infantry positions among the rubble. Undeniably, the cumulative effects render the coordination of combined-arms action through speed, maneuver, and firepower largely ineffective.²¹

Allied experience in Aachen, Germany, during WWII illustrates this condition quite well. "The shock effect of the superior [Allied] firepower, especially the 155-mm guns, had a psychological effect on the defenders allowing U.S. forces to capture the inner city. It also created extensive rubble that impeded movement and provided the German defenders with excellent defensive positions. Glass and other litter punctured tires forcing medics to rely on tracked vehicles for evacuation of wounded."²² The difficulties of visibility and recognition, exacerbated by damage to buildings and streets, frequently result quite simply in units becoming lost in a maze of unfamiliar terrain. Consequently, however advanced their communication systems and fire support, small units become dependent upon their own resources and fight individual battles without secure flanks or secure rear areas and without reference to the wider battle context.²³

What we find then is that the density of urban terrain is a major determinant in the selection of tactics and fire support for a military operation that emphasizes the use of surface forces for three reasons. First, urban terrain will never allow the same potential for conventional maneuver as open terrain and may render certain firepower systems (i.e., armor, artillery) inappropriate for their traditional roles. Second, if combatants seek to minimize collateral damage, noncombatant casualties, and loss of public support, urban terrain density will limit the firepower support surface combatants have traditionally enjoyed. Third, density of the urban terrain will force the meeting engagement to occur at such close ranges (25 to 100 meters) that supporting arms must be ultra-precise and yield controlled.²⁴ Consequently, insufficient clear fields of fire and arming distances will generally limit the use of such weapons as

ground-based, wire-guided missiles. Typical buildings include thick walls that will require penetrating weapons with minimum explosive content to prevent excessive rubble. Limited explosive yields will also factor heavily in trying to minimize noncombatant casualties. Additionally, urban terrain will limit line-of-sight communications and favor combatant use of ambush techniques. Any combination of these conditions can lead to great confusion for ground combat units and their fire support assets.²⁵

This confusion can be magnified further by urban heterogeneity, which presents attackers and defenders with numerous engagement conditions. Line of sight in urban areas varies from a few feet to several thousands of meters. Target acquisition and engagement are far more likely to be at the lower end of this spectrum: only 5 percent of the targets in urban operations appear at more than 100-meter range; 90 percent are confronted at ranges of 50 meters or less. Human targets are generally acquired at 35 meters or less.²⁶ Soldiers, therefore, often have limited time to acquire and engage before being engaged themselves. Targets rarely present themselves for more than a few seconds, and frequently, in that few seconds, only a small part of an individual or vehicle is exposed.²⁷

Weapon characteristics can be decisive in these short-range engagements. A weapon may have a minimum arming distance too great for close targets. Some systems also have "dead space" within which an operator cannot engage a target because of the elevation or depression limits of the weapon's barrel. Height and proximity of buildings cause further dead-space problems; targets may be difficult or impossible to engage with supporting artillery systems because rounds are unable to clear obstacles and reach targets without striking other edifices. These terrain characteristics not only tend to neutralize firepower advantages but also to increase the probability of inadvertent noncombatant casualties due to munition impacts on other-than-intended targets.²⁸

All of the above interacts with the third fundamental characteristic of urban terrain, the presence of civilians and their property. The need to limit noncombatant casualties and minimize collateral damage may impose restric-

tions on movement, fields of fire, targeting, weapon choice, and many other military options. Of course, attitudes toward the city's civilian inhabitants, and thus the severity of the constraints upon the military, depend upon political or humanitarian considerations. For example, during the Allied advance through western Europe in 1944-45, the liberation of cities inhabited by friendly civilians (in France and the Low Countries) imposed more limitations upon the opposing armies than did the cities of Germany.²⁹

Whether such limitations are imposed or not, a diversion of manpower and resources may be required for the care of civilians. Even if this care is unnecessary, civilians will nevertheless impose some constraints upon military action in protection of their lives and property, or by just being in the way. This coincidental presence and accidental involvement of civilians in the conflict is exacerbated by some of the other characteristics of the urban environment. For instance, the short ranges involved, and thus fast reaction times, make it difficult to identify targets correctly which, in turn, could increase civilian casualties. Similarly, regular forces will be aware that urban terrain is ideally suited to the concealment, ambush, and withdrawal techniques of partisans, creating a predisposition to regard civilians with suspicion. Thus, the presence of civilians on the battlefield at best imposes constraints on the conduct of battles and at worst leads to a breakdown in the military/civilian distinction, increasing both the hardships suffered by civilians and the difficulties faced by the military.³⁰

Although the circumstances described above apply to both attacking and defending forces, there is reason to argue for an in-built bias in favor of the defense. This bias stems in part from the characteristics of the battlefield environment—the density of buildings and rubble that provide opportunities for ambush, mining, booby-trapping, and the like, all of which are essentially defensive. Such characteristics offer easily adapted and camouflaged positions for defending infantry, while limiting visibility for advancing armored vehicles, hindering their mobility, and forcing them to approach within range of antitank projectiles. Not only do cities favor infantry, which is more likely to be used in defense, over armor, which is more likely to spear-

head an attack, but, more generally, cities present a circumstance in which troops who are inferior in equipment, training, or morale can be pitted against superior forces on more even terms.³¹

The implications are quite clear for US military forces. Conventional US surface forces translate superior firepower, mobility, and logistics on an open battlefield into offensive actions that seize the initiative and dictate the tempo of operations. Conversely, urban environments impose limits on mobility and firepower, allowing the defender to control the tempo of surface operations. By forcing a fight on urban terrain, our opponents' weaker forces could level the playing field. They could level the playing field not only by negating the superior firepower, speed, and mobility of US surface forces but also by exploiting America's lust for mythical, clean wars that produce few casualties and cause little collateral damage.³²

Urban battles fought in Beirut, Mogadishu, and Grozny attest to the fact that urban terrain provides the defender with a force multiplier. Given the doctrinal aversion to urban combat of most technologically sophisticated military forces, a competent defender will do everything in his power to draw the fight into the city. Ramzan Maltsegov, a Chechen fighter in Grozny, stated, "We were very happy they [the Russians] came into the city, because we cannot fight them in an open field."³³ Maltsegov fully understood that in urban terrain, the defender has a much better opportunity to control the tempo of operations by creating an operational and moral dilemma for the attacking force in terms of attrition, delay, discrimination of combatants versus noncombatants, proportionality of weapons effects, and negative media coverage.³⁴ Typically, such urban defenders use mutually supporting strong points throughout a defense in depth. They attempt to break up the attacking unit's cohesion, deny mutual support, and isolate individual elements for annihilation.³⁵

Absorption of manpower is the last of the five characteristics of urban warfare and is largely a resultant of the operation of those already mentioned, but it remains the most important military consideration governing the choice of cities as battlefields. Quite simply, the amount of re-

sources (especially human resources) needed to conduct urban warfare using surface forces in a combined-arms action is extremely high in relation to the area of the battlefield.³⁶ The urban environment creates a physically structured, but fragmented series of compartmentalized battlefields that can absorb large quantities of personnel—who, once committed, are difficult to extricate, regroup, or reinforce. Whether casualties will be heavier (as a percentage of the committed manpower, rather than in terms of space won or lost) is arguable, but the tying down of large numbers of troops for long periods, and thus the delaying of other operations for limited spatial objectives, is not. Similarly, the type of battle dictated by the urban environment imposes particularly severe strains on those subjected to it. The continuous high level of alertness demanded by close actions, the physical discomfort, and the insecurity of isolated small unit operations without fixed lines, secure flanks, or protected rear—all contribute to the rapid onset of battle fatigue within hours rather than days.³⁷

By analyzing small operational units, close-range weaponry, civilian presence, defensive bias, and absorption of manpower, this section has tied together some of the critical characteristics of the urban environment and explained how that environment constrains and limits surface combatant employment. The compartmentalized, three-dimensional world of urban warfare forces surface combatants to employ in small units. These small units have limited firepower support and can be easily cut off and annihilated by enemy forces. Firepower is limited to handheld, direct-fire weaponry because of range limitations and the desire to limit collateral damage. Leadership and command and control are driven to the lowest level, making operational coordination virtually impossible. Rubble presents obstacles to maneuver while buildings present obstacles to maneuver and communication. Combat occurs at extremely close ranges due to line-of-sight and target-acquisition problems. Civilians get in the way and get killed, negatively affecting the war fighter and the politicians who sponsor the fight. Tactics succumb to two-dimensional thinking in a three-dimensional world. Manpower is absorbed at a rate much faster than in open, maneuver warfare. The cumulative

effects of these factors create severe limitations, making urban combat extremely risky for surface combatants.

What are the Marines and Army doing about it? They are looking for technologies that will enhance tactical-level operations. They are focusing on the infantry soldier as the primary instrument of force projection; this emphasis will not get the results they desire. What we need is new thinking about airpower as the three-dimensional force to drive three-dimensional urban warfare operations. We need new thinking about battlespace management and what it takes to achieve operational and strategic effects in urban warfare in any theater of operations. This thinking must make airpower the *key* instrument of military force for conducting urban warfare at the operational level.

Airpower

Of what use is decisive victory in battle if we bleed to death as a result of it?

—Sir Winston Churchill

Airpower is the only instrument of military force that can transform urban warfare from tactical-level, infantry-oriented, attrition warfare favoring the defender to operationally focused, offensive-centered combat orchestrated to achieve strategic objectives. Airpower is the only instrument of military force that can eclipse the limitations of small operational units, close-range weaponry, presence of civilian lives and property, defensive bias, and absorption of manpower. Yet none of the services address any serious role for airpower outside the mission of close air support. This mindset perpetuates the dilemma: the only way to conquer the abyss in the *traditional* manner is to feed it exorbitant quantities of resources in small servings over a long period of time so that, in the end, victory doesn't look much different than defeat. There is a better way!

Given the traditional emphasis on small unit operations in urban combat, it is easy to understand why war fighters, airmen and soldiers alike, view CAS as airpower's premier role in urban warfare. An earlier section explained how traditional, supporting arms such as mortars and artillery are virtually impossible to employ because urban

terrain presents too many obstacles to successful target engagement. The Germans discovered this in WWII and relied heavily on CAS to support urban infantry. Hans Ulrich Rudel, in *Stuka Pilot*, writes,

This is the thought which occupies our minds as we fly sortie after sortie against the Red fortress [Stalingrad]. The section of the city held by the Soviets borders immediately on the west bank of the Volga, and every night the Russians drag everything needed by the Red Guardsmen across the Volga. Bitter fighting rages for a block of houses, for a single cellar, for a bit of factory wall. We have to drop our bombs with painstaking accuracy because our own soldiers are only a few yards away in another cellar behind debris of another wall. We fly in, map in hand, and it is forbidden to release a bomb before we have made sure of the target and the exact position of our own troops.³⁸

As significant as Rudel's experience with providing CAS in Stalingrad were the tactics the Soviets employed to counter the Stuka pilots. The Soviets implemented new urban ground-combat tactics that forced meeting engagements to occur at extremely close ranges. Although these close-range engagements cost the Soviets heavy casualties, the tactics denied the Germans the use of attack aviation out of fear that Stukas would engage their own troops.³⁹ Gen Vasil I. Chuikov, the Soviet commander in Stalingrad stated, "I came to the conclusion that the best method of fighting the Germans would be close battle, applied day and night in different forms. We should get as close to the enemy as possible so that his air force could not bomb our forward units. . . . it seemed to me that it was precisely here, in the fighting for the city, that it was possible to force the enemy into close fighting and deprive him of his trump card—his air force."⁴⁰

There is little reason to doubt that future enemies in urban settings would apply the same tactics to eliminate the US airpower trump, especially if CAS is the only way that trump card is configured. Yet today's Air Force planners and operators continue to focus on CAS. Maj Edward A. Kostelnik, A-10 pilot, states in a 1996 *Urban Close Air Support Tactics Development and Evaluation Test Plan*, "Conceivably, U.S. or Allied Forces, involved in military operations on urban terrain (MOUT), may require CAS that prevents or limits collateral damage to urban structures and noncombatants. Correct and precise targeting with

improved and very accurate weapons delivery platforms using precision-guided munitions, may provide a method for such CAS."⁴¹

Granted, CAS is an important mission that significantly enhances the firepower of the combined-arms team in any environment, including urban. However, focusing solely on tactical-level CAS puts the United States in a position to make the same critical mistakes the Luftwaffe made during the battle for Stalingrad. "The fundamental tactical error was compounded by the Luftwaffe effort being dispersed against a wide variety of targets. If, instead of dropping thousands of tons of bombs on the sea of rubble that was Stalingrad, the bombers had been employed with single-minded persistence in an interdiction role against the Volga [river] traffic, enough of the ferrying craft might have been destroyed to starve the defense into submission."⁴² Had the Luftwaffe not been so focused on relegating airpower to a tactical arm of surface forces, it might have realized the significance of interdicting resupply traffic on the Volga. Certainly, shifting focus to interdiction would have created a more operationally oriented perspective in scope and depth that might have provided the Germans the chance to stave off defeat. However, the Luftwaffe could not achieve this perspective because urban warfare was viewed as a surface combatant problem, no matter how excessive the casualties.

With the ascendancy of airpower, what should airpower's role be in urban warfare? Should airpower be relegated to a tactical arm of surface forces to be squandered in the piecemeal, tactical application described above? Should it be the great equalizer when leaders become frustrated about excessive casualties? Consider the German approach in the battle of Brest-Litovsk. "It was obvious that a more systematic and less bloody method was now needed to dig the surviving Reds out. Throughout the day 'sudden' concentrations of fire and propaganda broadcasts by loudspeakers tried to induce the encircled Russians to surrender. . . . On 29 June all hell broke loose as Air Field-Marshal Kesselring committed an entire Stuka wing of over 90 aircraft to pulverize the Eastern Fort. Both 1000 and 4000 pound bombs were used. The massive battering finally proved too

much and, in the late afternoon, over 600 troops and many civilians surrendered."⁴³ Consider the USMC approach during the battle for Hue City in Vietnam. "But the heavy casualties suffered by the Marines and the tenacity of the Vietcong prompted the lifting of most sanctions [restrictive use of firepower]. Fire support from naval gunfire, artillery, air strikes, and napalm contributed to the devastation the Vietcong wreaked on the city and left it in shambles."⁴⁴

Logically, airpower's role is defined along the entire continuum of operations from piecemeal application to full application that could lead to total annihilation of the urban area. To realize airpower's full potential, it is important to think beyond CAS. And it is important to think beyond total annihilation. Airpower must be considered as a full complement of resources, both manpower and material, that will provide integrated C4ISR, psychological operations (PSYOP), and force projection to influence the urban environment at the tactical, operational, and strategic levels of warfare near simultaneously.

The very characteristics of small operational units, close-range weaponry, the presence of civilians and their proximity, defensive bias, and absorption of manpower make airpower the key component to conduct urban warfare successfully. Think of it this way: In urban warfare, military leaders have objectives derived from politically motivated guidance; that political guidance is certain to be restrictive in nature and forces what one senior leader during Operation Urgent Fury (1983 seizure of Grenada) describes as a mindset of "wage war, but don't hurt anyone or break anything." The dense nature of the urban environment (dense in structure and population) requires the precise implementation of a strategy that makes full use of precise lethal and nonlethal force. To implement that strategy, command and control is essential. To enable command and control, communications become critical. Operational efforts by the forces involved must concentrate combat power by achieving synergistic application of resources to achieve persistent effects that balance risk with operational necessity to achieve the strategic and political objectives of our national leadership. From this analysis, four key facets stand out: concentration, persistence, syn-

ergy, and balance. Airpower is the instrument of military force that can effectively create the effects desired by applying all four of these facets. It can do that by shaping the battlespace and directing the correct force, both lethal and nonlethal, to precise locations on the urban terrain.

To prevent urban warfare from fragmenting into tactical conflicts between small units that have no reference to the wider battle context and the subsequent loss of command and control associated with this phenomena, a robust command, control, communications, computers, and intelligence (C4I) system is required to manage the variables that stem from the complexity of the urban environment. An airman who also has access to information, surveillance, and reconnaissance assets that will facilitate the transfer of near-real-time information to airborne platforms best manages this C4I system. Current and evolving C4ISR technologies promise a capability to match targets, weapons, desired accuracy, and platforms in near real time in an iterative fashion that connects and controls sensor-to-shooter architectures and facilitates the effective, efficient employment of joint air and space assets.⁴⁵ The implications for urban warfare are compelling. Rather than viewing the urban environment as a fragmented collection of built-up areas, airmen, from a three-dimensional perspective, can view the environment as an integrated battlespace that can be exploited through operational and strategic effects. Consequently, rather than employing surface forces in fragmented engagements, airpower can exploit the third dimension and operate across the entire urban environment shaping the battlespace and fragmenting enemy forces so that they can be precisely targeted and defeated "in detail."

Precision strike by airborne platforms can solve many of the problems associated with short-range weaponry, the presence of civilians and their property, and absorption of manpower. Precision strike allows airpower to shape the battlespace from a distance—to significantly influence the adversary's area of operation from outside that area and beyond the enemy's reach—thereby minimizing the placement of friendly forces in harm's way. The fewer US forces at risk, the more credible US commitments and the more

effective operational employment.⁴⁶ During Operation Desert Storm, few scenes were as vivid on television as the picture of a precision-guided bomb going through a ventilation shaft in an Iraqi office building. In fact, the strikes that inflicted the bulk of the physical damage to Iraqi leadership and command, control, and communications targets involved precision munitions, carried out principally by F-117s. Given the hardness, small size, and location in urban areas of many of the targets involved, primary reliance on the F-117 and precision-guided munitions made considerable sense, both for certainty of destruction and limitation of collateral damage.⁴⁷

Precision strikes produce massed effects without the need to mass forces. The ability of one pass or mission to achieve one or many kills not only provides efficiency but also frees other airpower assets to cover more targets, thereby permitting either breadth of coverage or intensity of firepower as needed.⁴⁸ The operational possibilities for this capability in urban warfare are endless. Airpower could effectively isolate the urban terrain by cutting main lines of communication, by destroying enemy supply networks, and by targeting precise locations of enemy resistance. Even more importantly, airpower permits the simultaneous execution of these actions throughout the entire urban battlespace. Additionally, precision-strike capabilities increase the probability and predictability of success and decrease the prospects of civilian casualties and collateral damage.⁴⁹

Thus airpower could actually reduce the disparity between limited destruction/limited casualty rules of engagement (ROE) and the military necessity to apply violence and destruction to achieve maximum effects. In war, pressure for quick victory is exerted for a variety of reasons: weather considerations, consolidation of gains prior to outside interference, minimization of casualties and collateral damage, and maintenance of public support. Urban conflict seems to magnify many of these concerns, resulting in extreme pressure for quick results that are hard to achieve when surface forces are the principal instruments of force. This vicious "Catch-22" tends to escalate the conflict even further in the bid for quick success despite the fact that

rules of engagement are frequently tightened in an effort to preserve civilian life and minimize collateral damage.⁵⁰ Most nations attempt to use minimal force and restrict the ROE *until* the costs of the restrictions in lives or time become prohibitive. Rules of engagement are then relaxed to speed the battle or break the deadlock to minimize further loss of friendly forces.⁵¹

If casualties and collateral damage are to be minimized, airpower is the instrument of force the military needs to get the job done. Modern airpower strike assets provide the means to deliver both lethal and nonlethal force to a precise location with a precise yield under ROE that impose constraints where the prospect of collateral damage exists. Honoring the constraints does not diminish airpower's effect, because airpower produces physical and psychological shock by dominating the fourth dimension—time.⁵² The level of destruction wrought on an enemy in the urban environment may not be as important as the precision and tempo with which the force is applied. The timing and tempo of force application could provide a means for imposing control over the enemy's behavior. This, in and of itself, could evolve into a form of psychological warfare that progressively shapes enemy actions by denying his response options and paralyzing his capacity to organize effective military operations, further reducing the level of violence imposed on the urban landscape. All this is gained with minimum destruction and loss of civilian lives or other collateral damage.

In contrast, historical examples of surface force employment (as in Hue City, Mogadishu, and Stalingrad) demonstrate that once surface forces become heavily engaged, the constraining characteristics of the urban environment actually escalate the violence and destruction until there is disengagement. Consider the USMC experience in Hue City:

Reflecting on the engagement in an interview after the war, Harrington (commanding officer of 1st Battalion, 5th Marines) evoked a phrase coined elsewhere in South Vietnam during the Tet Offensive. "Did we have to destroy the town in order to save it? Well, I don't think that the North Vietnamese and Vietcong were about to give up even if we'd surrounded Hue and tried to starve them out. . . . But we didn't go in there simply to show how great our weapons were, how much destructive power we possessed. We

did our best to avoid malicious damage. Yet when we had to destroy a house, we destroyed it."⁵³

In fact, the heavy casualties suffered by the Marines and the tenacity of the Vietcong in set-piece tactical engagements prompted the maximum application of force from both direct and indirect fire assets. Maximum application of force contributed to the devastation the Vietcong wreaked on the city and left it in shambles.⁵⁴

This type of urban fighting accentuates the "defensive-bias" mindset characteristic of surface force engagements; airpower shatters that mindset. Airpower is primarily an offensive weapon. The combination of a robust C4ISR system and precision-strike capability gives airpower the information superiority and offensive punch to seize the initiative in urban warfare. This integration of offensive capability enables sustaining a high tempo of operations, which, when combined with responsive, adaptive forces (surface forces), will allow US forces to anticipate the enemy's decision and action cycles. These real-time, mutually supporting, adaptive capabilities will create unexpected opportunities because the opponent will never quite be in step. Therefore, the opportunity to initiate operations with a minimum of deliberate planning or preparation means that US forces can exploit opportunities created in this complex battlespace.⁵⁵ In this concept, as opposed to the more traditional views of air and space power as the supporting force, air and space power can be the principal offensive, supported instrument of force in urban warfare. Further, this concept would maximize the ability of airpower to be devastatingly lethal against massed forces by combining air and space assets with ground maneuver elements that compel the opponent to concentrate or be defeated in detail by the integrated force.⁵⁶

It is important to emphasize here that surface forces will still play an extremely important role in orchestrating operational synergies in urban warfare. However, surface forces must accept a paradigm shift from being the *supported* instrument of force to being a *supporting* instrument. Airpower's ability to shape and control the battlespace in and around the urban environment uniquely positions airmen to orchestrate all facets of urban warfare operations. Continuous air and space operations, instead of episodic ap-

pearances in the battlespace, would allow airpower to create an "air overwatch" to dominate all tactical operations beneath.⁵⁷ Airmen, using robust C4ISR assets, will be able to precisely insert surface force tactical-level firepower, fully supported by tactical-level airpower (close air support), where it can achieve the greatest tactical success to support operational and strategic objectives. Such a situation does not mean that airmen would command and control surface forces once on the ground. It simply ensures that surface forces fully integrate into the operational game plan and that they do not fall prey to piecemeal, tactical engagements that are divorced from the overall operational strategy. It also balances the tactical necessity of the action with operational requirements and the associated risks of introducing surface combatants into the formidable urban environment. This should alleviate a large part of the "absorption of manpower" characteristic that has historically made urban terrain warfare's deadliest landscape.

Negating the absorption of manpower characteristic also requires a fully integrated complement of airpower assets. Creating a robust C4ISR system requires space-based, air-breathing, and land-based airpower assets integrated into a mutually supporting architecture. This system will paint an accurate picture of the urban terrain, enemy order of battle, and friendly order of battle. This picture will permit commanders not only to shape the battlespace but also to control the battlespace to ensure attainment of strategic and operational objectives. To this end, unmanned aerial vehicles offer tremendous possibilities for reconnaissance and information gathering that could directly complement the efforts of such platforms as the TR-1, EC-130, and joint surveillance target attack radar system. Precision strikes with cruise missiles complement precision strikes delivered by fixed- and rotary-wing aircraft. Munitions must be designed to meet a variety of requirements ranging from total destruction to controlled neutralization of targets using both lethal and nonlethal effects. Airborne PSYOP must complement the activities of special operations forces to affect the decision cycle of enemy forces. Airpower brings all of these assets to the urban fight, and when properly orchestrated, airpower transforms the nature of urban com-

bat from manpower intensive, tactically focused, defensive actions to offensive actions that influence urban warfare on an operational and strategic scale.

This influence may go beyond merely applying force within the urban environment. Assuming that the urban terrain in question is only one aspect of an overall theaterwide effort, airpower could make isolating and bypassing the urban terrain a lucrative possibility. It probably can be said that in the past all or most urban warfare was conducted because it had to be conducted; that is, the belligerents, both attackers and defenders, had to fight on urban terrain in the pursuit of their strategic designs. The reason, as every military leader from Hannibal to Eisenhower saw it, was that the key to all warfare was the conquest and retention of enemy territory. Generally, the cities in such territory were strategic prizes, related to the actual physical war-making ability and the psychological reserves of the belligerents.⁵⁸ However, WWII changed that, when for the first time air forces began to play an important role in reducing the strategic value of various types of territory including cities.

Airpower had become a new dimension of mobile warfare that made the conquest of some urban areas strategically much less significant than mastery of the skies. Even the value of urban areas as obstacles declined. Airpower and the increased speed and maneuverability of armored forces made it possible to destroy them (e.g., Rotterdam, Coventry, and Dresden) or at least render them largely uninhabitable and paralyzed.⁵⁹ Today, airpower's increased range, speed, and ability to mass devastating effects with fewer resources has magnified this condition exponentially. Those same C4ISR and precision-strike assets that make airpower the premier force to use in the urban environment could also provide the strategic and operational situational awareness to avoid a potentially costly urban engagement. Airpower then becomes even more valuable not only because of what it can do but also because of what it might prevent.

Highly mechanized, technologically sophisticated militaries must leverage new capabilities to move away from the serial application of tactical combat power to parallel

applications that produce operational and strategic effects. Airpower provides the capabilities to achieve this shift. Airpower is the key instrument of military force that provides CINC and JTF planners the wherewithal to develop war-winning strategies to execute urban warfare in a manner that will produce victory that in no way resembles defeat. Whether engaging the enemy on urban terrain or establishing the conditions for bypassing urban areas, airpower is the key instrument of force that points to a better way!

Victory

Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.

—Douhet

If the United States military wants victory in urban warfare to be more than a casualty-ridden misnomer, then it must seriously consider airpower's ability to achieve operational and strategic effects in this environment. Gone are the days when planners and operators can merely think of urban warfare as infantry actions that must be supported by the tactical application of airpower. Stalingrad refutes the traditional premise; Hue City echoes the dangers of this outdated thinking; and, more recently, Mogadishu and Grozny provide all too vivid reminders that the urban environment can quickly become an abyss that consumes the lives of combatants and noncombatants with equal disregard.

All of the services appreciate the complexities and the dangers of urban warfare. All document its pitfalls and limitations in doctrine and operations manuals. However, none of the services, including the Air Force, have seriously considered airpower's ability to transform this environment into an offensively oriented, fully integrated battlespace that employs forces that negate many of the pitfalls associated with small unit operations, close-range weaponry, the presence of civilians and their property, defensive bias, and absorption of manpower. If the predictions and associated guidance provided by the *Joint Strategy*

Review are indeed accurate (i.e., military forces will be expected to fight more frequently on urban terrain), is there an airpower theory that will match airpower's unique capabilities to the complex, violent environment of urban warfare? The answer is yes.

Airpower, the integrated application of C4ISR and precision strike supported by other air and surface forces that impact the aerospace medium, is the only instrument of military force that can effectively prosecute urban warfare by shaping and controlling the battlespace through precise applications of lethal and nonlethal force that affect the tactical, operational, and strategic levels near simultaneously. This theory encompasses every major aspect of this study and drives home the premise that airpower is the key to success in urban combat.

It is absolutely critical for airpower thinkers, planners, and operators from all the services to give airpower's role in urban warfare much more serious consideration. The Marine Corps and Army are forging new vistas using outdated paradigms that could potentially minimize critical airpower contributions. Within the Air Force, airmen appear content to remain focused on tactical applications rather than expanding their thoughts to more operationally oriented applications that could yield strategic effects. Airmen, soldiers, sailors, and marines owe it to each other as joint war fighters to reflect on operational capabilities that will achieve operational and strategic objectives in urban warfare. Settling for piecemeal tactical applications may only feed the urban warfare abyss exorbitant quantities of the services' most important resources, the men and women who will bear our nation's arms in this difficult environment. Airpower is the better way!

Notes

1. Chairman, Joint Chiefs of Staff, *Joint Strategy Review* (U), Washington, D.C., 1997, 4. (Secret) Information extracted is unclassified.
2. Department of the Army, Field Manual 90-10, *Military Operations on Urbanized Terrain (MOUT)*, 15 August 1979, 1-1.
3. Russell W. Glenn, *Combat in Hell, A Consideration of Constrained Urban Warfare*, RAND Report MR-780-A/DARPA (Santa Monica, Calif.: RAND, 1996), 2.
4. *Ibid.*, 2-3.

5. *Joint Strategy Review* (U), 29. (Secret) Information extracted is unclassified.
6. Ibid.
7. Ibid.
8. US Marine Corps Fleet Marine Field Manual (FMFM) 1-2, *The Role of the Marine Corps in the National Defense*, June 1991, 3-13.
9. Ibid., 1-2, 3-13.
10. Lt Col T. R. Milton Jr., USA, "Urban Operations: Future War," *Military Review*, February 1994, 38.
11. Ibid.
12. The White House, *A National Security Strategy for a New Century*, (Washington, D.C.: Government Printing Office, May 1997), 2.
13. Chairman, Joint Chiefs of Staff, *National Military Strategy of the United States of America*, Washington, D.C., 1997, 7.
14. G. J. Ashworth, *War and the City* (New York: Routledge, Chapman and Hall, 1991), 117.
15. Ibid.
16. Ibid., 118.
17. Ibid., 119.
18. Lt Comdr James W. O'Connell, USN, *Is the United States Prepared to Conduct Military Operations on Urbanized Terrain?* Research Report no. 92-12753 (Newport, R.I.: Naval War College, 1992), 10.
19. Timothy L. Thomas, "The Russian Armed Forces Confront Chechnya: The Battle for Grozny, 1-26 January 1995 (Part I)," *Low Intensity Conflict & Law Enforcement* 5, no. 3 (Winter 1996): 409-33. Mr. Thomas's article provides an in-depth account of how the Russian military disregarded the need for isolation and encirclement of Grozny when it was apparent that speed and surprise would not lead to an overwhelming defeat of the rebels. It also explains why the Russians were unable to mount an effective combined-arms operation of the scope and magnitude used in WW II. From this article we see the dangerous evolution of tactical thinking applied to operational problems that require more than just piecemeal blundering at the small unit level. Highly mechanized, technologically sophisticated militaries must leverage new capabilities to move away from the serial application of tactical combat power to parallel applications that produce operational and strategic effects.
20. Ashworth, 119.
21. Ibid.
22. Maj Charles A. Preysler, *Going Down Town: The Need for Precision MOUT* (Fort Leavenworth, Kans.: School of Advanced Military Studies, US Army Command and General Staff College, 1995), 10.
23. Ashworth, 119.
24. Maj Jon M. Davis, *Urban Offensive Air Support: Is the United States Military Prepared and Equipped?* Research Report no. 97-178 (Quantico, Va.: US Marine Corps Command and Staff College, Marine Corps University, April 1995), 7.
25. Ibid., 8.
26. Glenn, 10.
27. Ibid.
28. Ibid., 11.

29. Ashworth, 121.
30. Ibid.
31. Ibid., 120.
32. Davis, 4-5.
33. Ibid., 14.
34. Ibid.
35. Ibid., 15.
36. Ashworth, 121.
37. Ibid.
38. Hans Ulrich Rudel, *Stuka Pilot* (London: Vale and Oakley, 1952), 62.
39. Vasil I. Chuikov, *The Battle for Stalingrad* (New York: Holt, Rinehart, and Winston, 1964), 72.
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41. Maj Edward A. Kostelnik, USAF, *Urban Close Air Support Tactics Development and Evaluation Test Plan*, ACC Project no. 96-561FR (Nellis AFB, Nev.: Air Combat Command, Air Warfare Center, August 1996), 1-1.
42. V. E. Tarrant, *Stalingrad, Anatomy of Agony* (London: Pen and Sword Books, 1992), 77.
43. Lt Comdr James W. Chattin, USN, *Battles for Cities on the Eastern Front During World War II*, Student Study Project (Fort Leavenworth, Kans.: Army Command and General Staff College, 1981), 15-18.
44. O'Connell, 14.
45. Daniel Gouré and Christopher M. Szara, *Air and Space Power in the New Millennium* (Washington, D.C.: The Center for Strategic and International Studies, 1997), 112.
46. Ibid., 15.
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48. Gouré and Szara, 14.
49. Ibid., 17.
50. O'Connell, 10.
51. Ibid., 13.
52. Col Phillip S. Meilinger, USAF, *10 Propositions Regarding Air Power* (Washington, D.C.: Air Force History and Museums Program, 1995), 28.
53. O'Connell, 15.
54. Ibid., 12.
55. Gouré and Szara, 31-32.
56. Ibid., 32.
57. Ibid.
58. Lilita I. Dzirkals, Konrad Kellen, and Horst Mendershausen, *Military Operations in Built-Up Areas: Essays on Some Past, Present, and Future Aspects*, RAND Report R-1871-ARPA (Santa Monica, Calif.: RAND, June 1976), 85.
59. Ibid., 82.

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