The Case *for* Megacities

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ABSTRACT: We cannot know for certain what the future operating environment will be, but we must prepare for it. To date, the US military has not paid enough attention to the rise of megacities. This article argues the US Army must continue developing new concepts, capabilities, and ultimately solutions for achieving national security objectives within the current and future operational environments of the megacity.

The 2014 Army Operating Concept (AOC) defines the term complex as "an environment that is not only unknown, but unknowable and constantly changing."[1] It goes on to claim that "to win in a complex world, Army forces must provide the Joint Force with multiple options, integrate the efforts of multiple partners, operate across multiple domains, and present enemies and adversaries with multiple dilemmas."[2] Nowhere is this more crucial or difficult to accomplish than in the complex urban environment of a megacity. Such cities present the Army and joint force with a level of complexity for which they are not fully prepared. However, many opportunities exist for the Army and joint force to reinvigorate past research efforts, to consolidate learning, and to prepare the current and future force for operations in such environments.

Historical Context

Urban warfare is not a new phenomenon. For example, in the ancient Syrian city of Hamoukar, archeologists have discovered evidence of urban combat as early as 5,500 years ago.[3] Throughout the ages, urban conflicts have tended to be more the rule than the exception. Previous wars centered on the sieges and defense of urban centers of all sizes, while large battles have for centuries been the exception rather than the rule. Contemporary reminders of urban warfare and its inherent challenges include the battles of Stalingrad and Aachen during World War II, Hué during Vietnam, and Grozny in 1994-1995, and again 1999-2000. There is little reason to believe future conflicts will not also require some form of urban warfare. As such, the Army's capacity to engage, fight, and win major urban combat operations will determine the success of future operational and strategic endeavors.

The Battle of Hué during the Vietnam conflict reflected the tendency for urban combat operations to blend the levels of war, creating

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1   US Army Training and Doctrine Command, *The US Army Operating Concept: Win in A Complex World* (Fort Eustis: US Army Training and Doctrine Command, 2014), iii.

2   Ibid.

3   Owen Jarus, "Site of Earliest Known Urban Warfare Threatened by Syrian War," *LiveScience*, June 24, 2013, http://www.livescience.com/37672-ancient-urban-warfare-site-threatened.html.

the situation where tactical outcomes had significant strategic impli-
cations. Arguably, the bloodiest battle during the Tet Offensive took
place in Hué, Vietnam's third largest city, with significant operational,
cultural, and spiritual significance. The Battle for Hué involved 26 days
of intense street-to-street, house-to-house fighting against a determined
enemy established in a defense-in-depth. Major urban combat operations
occurred in the midst of a civilian population of around 140,000 people,
and against an initial enemy force estimated at 7,500 North Vietnamese
Army (NVA) and Viet Cong (VC) troops, later reinforced to a division-
sized element. Facing them were three US Marine battalions and 11
Army of the Republic of Vietnam (ARVN) battalions.[4] Although the
United States employed Army units from the 1st Cavalry Division and
101st Airborne Division during the Battle of Hué, these forces focused
on the outlying areas to prevent NVA reinforcement. The US Marines
and ARVN conducted the majority of fighting inside the city.

When the fight for Hué ended, US and ARVN forces retook the
city. The US military suffered 216 killed and 1,364 wounded, while
the ARVN lost 384 killed and 1,830 wounded. Civilian casualties were
around 5,800 people killed or executed by NVA/VC due to their politi-
cal allegiances. Estimated enemy casualties were 1,042 killed and 4,000
wounded.[5]

Despite the tactical gains from retaking the city and repelling enemy
forces across South Vietnam, the United States and Republic of Vietnam
faced the strategic repercussions of having laid in ruins an estimated 80
percent of the city, with over 116,000 persons left homeless. Moreover,
the Johnson administration lost the public's confidence, and South
Vietnamese confidence in its government declined further, worsening
existing political issues adversely impacting US policy. In essence, the
risk of winning the battle only to lose the war is significantly higher in
an urban fight.

The Problem

Imagine if the US military had to conduct operations similar to Hué
in a megacity, a complex urban environment over 100 times larger and
with a population of nearly 10 million. Add in the challenges presented
by subterranean, cyber, and space environments against a determined
enemy, established in-depth, comprised of conventional and special
operations forces, paramilitaries, and terrorist and criminal elements
with access to a wide spectrum of advanced warfare capabilities. While
urban combat operations are not new, a megacity presents old challenges
at previously unimaginable scale and complexity.

Due to their increasing political, economic, and social significance,
megacities represent strategic key terrain interconnected to national and
even international centers of gravity. Megacities, due to their increasing
number, geographical locations, and crucial strategic importance, are
also the most likely environments where the US military will have to
execute its missions.

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4 Norman L. Cooling, "Hue City, 1968: Winning A Battle While Losing A War," *Marine Corps
Gazette*, July 2001, https://www.mca-marines.org/gazette/hue-city-1968-winning-battle-while-losing
-war.

5 Ibid.

Despite the crucial importance of megacities, the US military has not yet made a concerted effort to prepare for combat in these ultra-complex environments. The operational challenge is in plain view, but the Army and joint community have barely begun to climb the steep learning curve. A requirement for additional in-depth research to determine how US forces could operate in and around such environments remains in many areas. Discovering optimal organizational structures, what specialized materiel and munitions are necessary, and how to best adjust leader development and training programs, are just some of the megacity challenges the US military must continue to address.

The Army Chief of Staff's Strategic Studies Group recognized these shortcomings in its analysis of megacities conducted in 2013-2014, stating:

> …the Army is currently unprepared. Although the Army has a long history of urban fighting, it has never dealt with an environment so complex and beyond the scope of its resources. A decade of war in Iraq and Afghanistan has taught the Army that it must shape itself to the complex environment in which it is called to operate. This is a process that must begin now with megacities.[6]

To examine further what megacities represent in terms of military challenges and their implications for future military operations, this article addresses the following areas: the strategic context of megacities with regards to social trends; the characteristics of megacities; the operational challenges they present; and the current thinking is and what studies of megacities have revealed to date.

Strategic Context

Cities have long been the focus of culture, politics, economics, religion, and many other characteristics of civilization.[7] Not surprisingly, the emergence of megacities and their massive increase in scale, population, and capacity to impact global events have magnified the already significant role of cities. Furthermore, the pace at which megacities are developing and enlarging is changing the strategic landscape faster than strategists and policymakers are coping with them. As described in a McKinsey Global Institute article published in *Foreign Policy* magazine, "…over the next two decades, the world will see a burst of urban expansion at a speed and on a scale never before witnessed in human history."[8] Such a vast urbanization at an unprecedented rate will cause societal disruptions and put stress on the global economic system.

Additionally, the era when the US could hope to avoid getting pulled into an "infantry eating" urban fight has passed. In the future, the combat environment US forces will most likely find themselves engaged in is an urban one. Avoiding major urban areas is usually the desired course of action, but the desirable is not always possible.

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6   Chief of Staff of the Army, Strategic Studies Group, *Megacities and the United States Army: Preparing for an Uncertain Future* (Arlington, VA: Office of the Chief of Staff of the Army, Strategic Studies Group, 2014), 21.

7   Lou DiMarco, *Attacking the Heart and Guts: Urban Operations through the Ages* (Fort Leavenworth: US Army Command and General Staff College Press, 2014), 1.

8   Richard Dobbs, "Prime Numbers: Megacities," *Foreign Policy Magazine, McKinsey Global Institute,* October 2010, http://www.mckinsey.com/insights/mgi/in_the_news/prime_numbers_megacities.

In a recent National Intelligence Council study, *Global Trends 2030*, social scientists and analysts assessed that by 2030, the estimated urban population will grow by nearly 60 percent, or 4.9 billion people, from 50 percent today.[9] Urban centers already generate an estimated 80 percent of economic growth, a trend that will likely increase and continue to drive more social migration towards cities.[10] This social migration will likely drive increasing demands for housing, public infrastructure expansion, food, energy, water, and other basic natural resources.

Characteristics of Megacities

What is a megacity? Aside from being significantly larger, what really distinguishes one urban area as a megacity? What makes Tokyo and Rio de Janeiro megacities, while Pittsburgh is not?

As a start point, the characteristics common to megacities and major urban areas are both physical (and virtual) across air, ground, sea, and subterranean domains. Physically, both possess buildings of varying size, age, and construction, complex networks of ground, air, and/or sea transportations, formal governance structures, and support infrastructures such as for power and water distribution. Both also have the virtual environments of cyber and space that affect information flow and informal governance structures, such as community activists and religious leaders. Additionally, both are likely to be globally interconnected to national and international economic centers of gravity.

Given these common traits, what then distinguishes megacities from major urban areas? The European Association of National Metrology Institutes (EURAMET) defined megacities as, "metropolitan agglomerations which concentrate more than 10 million inhabitants."[11] Other related studies conducted by RAND, McKinsey Global Institute, and the French Ministry of Defense's *Strategic Horizons 2040* further describe the characteristics of megacities in terms of two major inter-related factors: explosive population growth and potential volatility.

Whereas population growth in major urban areas like St. Petersburg, Russia, remains steady in the low percentiles and ranges in the thousands over the course of several years, population growth in megacities like Jakarta is extremely rapid, running in the millions within that same time span. Rapid population shifts often lead to situations where the demand for jobs, public services, and other resources exceeds the capacity of existing physical infrastructure, and far outstrips the ability of many states to add infrastructure at the pace of population growth.

Megacities promote economic growth for nations and regions, but also represent potential nightmares of poverty, widespread disease, as well as crime and other related tensions. The effects of an already existing wealth disparity amongst social classes can be further complicated by infrastructure deficits, which often lead to ungoverned areas of urban

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9 McKinsey Global Institute, "Urbanization," http://www.mckinsey.com/insights/mgi/research/ urbanization.

10 National Intelligence Council, *Global Trends 2030: Alternative Worlds* (Washington, DC: National Intelligence Council, 2012), 26.

11 European Association of National Metrology Institutes, *Mega Cities* (Braunschweig: EURAMET, 2013), 1.

decay (i.e. slums). These areas create opportunities for illicit activities, diseases, and economic dependence on governmental support.

Explosive population growth brings with it the potential for social unrest, and in a megacity is likely to have international repercussions. Megacities inherently contain the conditions for political unrest where populations split along ethnic or religious lines into "cities within cities." Ineffective and/or corrupt state governance often results in the creation of informal power structures and safe havens for illicit and threat networks. For example, a lack of basic policing by the state in the poorer regions of a megacity may result in a black market economy run by a shadow government of criminal and/or terrorist networks. Furthermore, threats can hide and operate more readily, and, unlike the rural countryside, they have easy access to technology to mobilize support and coordinate activities.

The 2011 uprising in Egypt as part of the Arab Spring led to the end of President Hosni Mubarak's 29-year regime in less than 30 days, and exemplified a situation where a megacity's potential volatility set off a chain of events. On January 17, 2011, the video of an Egyptian man setting himself on fire outside Cairo's parliament building after a dispute with local authorities over receiving his monthly coupons for subsidized bread went viral. The event proved to be tipping point of long-standing social grievances that galvanized protests in Cairo and Alexandria. Information technology access enabled the video's mass distribution and mobilization of a broad-based coalition of opposition groups (e.g. Muslim Brotherhood) that began and sustained a succession of large-scale protests.

Despite Mubarak's deployment of the military to restore his authority on January 30th, by February 6th the opposition leaders were holding talks with the Egyptian Vice President and on February 11, 2011, Mubarak resigned and surrendered his power to the military, ending his regime. In 2015, Egypt is still dealing with the political conflicts between Islamist and secular groups over government control, affecting regional stability in the Middle East and US foreign policy.[12] As evident in Egypt as part of the Arab Spring, the global reach afforded through technology and the sheer mass of resources available in megacities afford threats a greater potential to escalate social unrest with local, regional, and potentially international impact.

Social migration trends indicate the movement from rural areas to cities will likely continue; life in urban areas, even in slums, is still better than rural poverty where there are no opportunities for economic advancement. Additionally, as inefficient as a poorly run megacity's economic system may be, typically enough food arrives to feed populations of 10 million people or more versus the rural areas where such resources are unavailable. Likewise, even in slums there are economic systems that maintain at least minimal degrees of order, and minimally sufficient sanitation to avoid the entire area from becoming a giant cesspool.

Clearly, not all megacities are equal in this regard. Each possesses unique physical, political, and social characteristics. Shenzhen is not like Delhi, nor like Mumbai or São Paulo. Even cities within the same nation

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12   Kelsey Jane Clark, et. al., "Timeline: Revolution in Egypt," *Los Angeles Times*, June 19, 2012, http://timelines.latimes.com/egypt/.

demonstrate numerous crucial differences; consider Los Angeles and New York City.

What distinguishes well-run megacities from poorly-run ones are their capacities for maintaining economic systems, effective governance, and resilience. The people of New York City demonstrated such resilience through their public resolve and emergency response operations following the 9/11 attack on the World Trade Center in 2001, and Superstorm Sandy in 2012. In both instances, there was sufficient leadership and emergency response capacity to keep the city running and commerce flowing. The people of Tokyo demonstrated similar resilience in the wake of the 2011 Tōhoku earthquake and tsunami that devastated key infrastructure and displaced hundreds of thousands of people. By contrast, a natural disaster in a megacity like Lagos, challenged by its own ethnic tensions and internal governance struggles, might plunge the Nigerian government into chaos due to the scale of death, disease, and ensuing reconstruction costs, resulting in regional and international economic consequences.

Operational Challenges Presented by Megacities

Megacities can be best described as systems of systems, comparable to a living organism. They are dynamic environments that change not only block by block, but day to day. While this is not a new idea, the magnitude of the challenge to gain situational understanding is significantly greater due to the complexity, density, and scale of the physical and human terrain. Future intervention within these unique environments will likely be brought about by their vulnerability to humanitarian crises and suitability as safe havens for threats to the United States and its allies.

Because of their interrelationship within a nation or region's centers of gravity, megacities will likely have greater strategic value beyond material military advantage. The following complex challenges require close coordination between tactical actions and strategic objectives:

• Regional and international interconnectedness and centers of gravity

• Extended urban infrastructures supporting dense, diverse populations

• Formal and informal sources of power

• Congested and constraining terrain

• Interconnected, embedded threats across super-surface, surface, sub-surface, and cyber/space

Mission execution in one megacity would be tough; working in several across the range of military operations at the same time might be horrendous. The US military could be conducting combat operations in and around a megacity overseas while simultaneously, a natural disaster affects one in the United States, requiring extensive humanitarian aid and disaster relief operations, analogous to Hurricane Katrina and Operation Iraqi Freedom that coincided in 2005, but on a significantly larger scale. At a minimum, mission planning in and around such environments involves the following considerations.

Strategically, leaders and planners must consider the rest of the country and region when examining megacities. Regardless of the type

of military operation, a primary objective is to provide safe and secure environments to facilitate effective governance. US military forces will likely support broader efforts directed by the US government or other entities whose priorities may limit freedom of action (e.g. limiting collateral damage). Many of the problems associated with megacities are not isolated, and are likely interconnected with national or regional problems. Such planning considerations are comparable to maintaining the health of a whole body versus treating symptoms (i.e. megacity slums). As an example, efforts to improve megacities will likely increase urban migration, setting conditions for problems to recur. Planning efforts may have to include options to improve conditions throughout the rest of the country as part of a whole-of-government approach.

Additionally, megacities possess critical vulnerabilities that favor an attacker due to the magnitude of resources needed to "keep them running." The effective disruption or denial of energy, water, and/or food supply through isolation of key infrastructure nodes could affect millions within the span of a few days. These vulnerabilities will be areas for the US military to exploit or mitigate, depending on its role as the attacker, defender, or occupier.

Operationally, a key consideration is the adversaries' ability to attack and exploit United States and Allied military vulnerabilities from megacities due to the resources available and ability to hide and operate within the population. Adversaries will continue to employ both advanced and simple technologies to avoid US strengths, emulate US capabilities, disrupt US technological advantages, and to expand operations to the US homeland.[13] US and Allied vulnerabilities also might include dependency on improved ports or intermediate staging bases to deploy and employ forces, as well as an inability to secure lines of communication through extended urban areas. Population congestion and/or a persistent threat environment may also prohibit basing, movement, and maneuver within urban areas. In addition to the physical urban terrain that would favor a defending conventional force, unregulated cities with poor social services also provide havens for other threats such as terrorists. While this is true of urban areas in general, the scale of a megacity will likely exceed military capacity to execute operations effectively.

Tactically, civil and environmental considerations will likely strain governance and law enforcement:

- Physical land constraints
- Energy, water, and sanitation demands
- Vehicular congestion
- Aging infrastructure
- Entrenched criminal networks
- Political corruption/gridlock

Modern-day buildings and dense shanty-towns provide ample cover and concealment for threats to maneuver, hide, and operate. Essentially,

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13   US Army Training and Doctrine Command, *The US Army Operating Concept: Win in A Complex World*, 10.

megacities have the potential to be developed by defenders into hundreds, if not thousands, of individual mutually supporting fortresses and obstacles.[14]

Urban terrain significantly favors defense through streets, buildings, etc., that canalize maneuver and inhibit an attacker's ability to mass effects. As a result, small-scale attacks are more likely to impact a significantly larger and more technologically advanced force. A few dozen landmines and some concertina wire employed as minefields in the desert would likely have minimal impact on a mechanized battalion's ability to maneuver. However, in an urban environment those same obstacles would likely block units in a column formation, making them ripe for attack. While bypass opportunities will likely exist due to the number of side streets available or since a megacity's scale exceeds a defender's capacity, gaining situational understanding to employ multiple avenues of approach will be a challenge.

In addition to major combat operations, the planning considerations to execute and resource missions such as humanitarian aid and disaster relief are equally formidable. As a reference point, Hurricane Katrina in late August 2005 displaced upwards of one million people across multiple states in the US Gulf Region. The search-and-rescue and relief effort required the mobilization and employment of over 72,000 soldiers, sailors, and airmen across the Active, Reserve, and National Guard forces in conjunction with federal, state, and local agencies. US military forces supporting Joint Task Force Katrina helped distribute and manage the delivery of over 1.7 million gallons of water, 3.6 million meals, and 11.5 million pounds of ice, in addition to providing evacuation and emergency medical care for thousands of people.[15] The logistics to execute disaster relief operations was equally substantial, requiring the following resources just to sustain the Active component forces:

- 815,000 cases of Meals Ready to Eat (MREs)

- 215,000 lbs of ice

- 837,000 bottles of water

- 1.3 million gallons of fuel

- 142,000 gallons of potable water [16]

A natural disaster in a megacity overseas, potentially impacting millions, would create a demand far exceeding both host nation support capacity and the distribution capability of any realistic initial US military response. Other considerations involve priorities of effort: would it be more advantageous to move international aid or focus on the host nation's capacity? To what degree should US forces utilize non-state entities and organizations (e.g. tribal militias) that are more effective in providing security and essential services than the host nation? There are no easy answers to those questions.

For example, the initial US military response will likely not have the capacity to execute a humanitarian aid/disaster relief operation in

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14   DiMarco, *Attacking the Heart and Guts: Urban Operations through the Ages,* 21.

15   James A. Wombell, *Army Support to the Hurricane Katrina Disaster* (Fort Leavenworth: Combat Studies Institute Press, 2009), 173.

16   Ibid., 174.

a megacity unilaterally and require host nation interaction. However, a corrupt or ineffective host nation regime would likely hoard or skim off US humanitarian aid for distribution to its ruling elites, driving existing social tensions further towards violence or worse yet, increase the risk of loss of life due to privation and disease as experienced in Haiti 2010 from corrupt police and government officials.[17] Conversely, US military utilization of an effective but ethnic minority runs the risk of the host nation interpreting the action as an endorsement of a political threat and strain US relations with the country.

The Search for Ideas

Studying the challenges that megacities present in order to turn new ideas into concepts capable of addressing urban operations is not new to the Army. In fact, megacities were the basis of Unified Quest in 2004. Prompted by dynamic changes in the operational environment, in particular the impact of technological advances and their global proliferation during the past 10 years, as well as enduring operational problems related to complex urban environments, the Future Warfare Division of the Army Capabilities Integration Center (ARCIC) once again focused on megacities for Unified Quest 2014. Over 300 subject matter experts from across the military, government, academic, and scientific community participated in a series of studies and seminar wargames over the course of the year to reveal the following insights, operational approach ideas, and their implications for consideration:

Planning operations in and around the megacity must incorporate the capabilities of all unified action partners, requiring the Army to re-evaluate and modify current information sharing and communications interoperability procedures and regulations such as AR 380-5, *Department of the Army Information Security Program* and AR 380-10, *Foreign Disclosure and Contacts with Foreign Representatives*.[18] Current trends indicate the United States will likely not unilaterally respond to an international crisis without support and authority from the international community. Some partners will remain traditional, such as government agencies, allied military forces, and the host nation. However, examining the megacity environment revealed the need for the Army to consider non-traditional partners as potential sources of support and not just opposition, even if some have an aversion to working with the military (e.g. non-governmental aid organizations) and some that US government may be averse to engaging (e.g. shadow governments, tribal militias). While many potential partners will be influential, they will also be the most difficult to understand. Timely, comprehensive coordination and information sharing to gain and maintain understanding and dialogue with these of types of partners will be vital, but likely remain contested under current policies and procedures such as the vetting process for releasing information that can take several weeks or even months.

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17   Jonathan Strong, "Haitian Corruption and Graft Delay Earthquake Relief Efforts, Punishes Destitute Refugees," *The Daily Caller*, April 21, 2010, http://dailycaller.com/2010/04/21/haitian-corruption-and-graft-delay-earthquake-relief-efforts-punishes-destitute-refugees; and Patricia Zengerle, "Will Endemic Corruption Suck Away Aid to Haiti?" *Reuters*, January 26, 2010.

18 US Department of the Army, *Department of the Army Information Security Program*, Army Regulation 380-5 (Washington, DC: US Department of the Army, 2000); and US Department of the Army, *Foreign Disclosure and Contacts with Foreign Representatives*, Army Regulation 380-10 (Washington, DC: US Department of the Army, 2013).

Additionally, future land forces require the capability and capacity to gain and maintain situational understanding of the incredibly complex environment (physical, human, information, etc.) of megacities. The Army must therefore reconsider the units and capabilities allocated for its Regionally Aligned Forces to enable more persistent engagement and civilian-to-military planning in that region, in particular that region's megacities, with intelligence collection capabilities adapted to the complex urban terrain. Mass collection and big data analysis will be critical to handle the volume of information, in addition to enhancing human intelligence capabilities, with an emphasis on developing social networks. The Army should consider either developing this big data/human intelligence analysis capability internally within its intelligence and cyber communities, or resourcing it through contracts supporting Department of Defense agencies.

Maneuvering in megacities involves crossing multiple physical and virtual domains simultaneously, requiring the Army, as part of the joint community, to re-evaluate current policy on offensive tactical level cyber towards developing that capability. Currently, the employment of offensive cyber is under US Code Title 50, *War and National Defense*, not US Code Title 10, *Armed Forces*. Granted, while having great potential, offensive cyber at the tactical and operational level also possesses several potential repercussions and unintended consequences if employed (e.g. cyber-attack affecting both enemy and friendly systems) and methods to accurately conduct battlefield damage assessment from a cyber-attack still need to be developed. Nevertheless, it remains highly likely adversary threats will continue developing and employing offensive cyber, and defensive cyber countermeasures will likely not be enough in the future.

The Army, in conjunction with the joint community, needs to develop more operational approaches to conduct missions in and around megacities to give commanders and their staffs more options. Current doctrinal models for conducting major combat operations in urban terrain apply methods consistent with a siege where the attacking forces isolate the city to "starve the defenders out" or attrition-based warfare where attacking forces seize control through street-to-street fighting against the defending force. While the Army has several capabilities suitable for urban operations, the Army needs options beyond either siege or attrition based approaches or bypassing because the scale of requirements presents a capacity challenge for future forces. The Army will likely not have enough force to seize an entire megacity and will have to focus on a specific mission area and apply different approaches for access and maneuver. Congestion in all domains will significantly impede traditional forms of movement and maneuver that may not even involve armed enemy threats; anti-access and area denial of a seaport or airfield could be achieved through sheer mass of humanity from displaced persons and refugees.

As an example, the following six proposed operational approaches for joint urban operations by the team supporting the Joint Advanced Warfighting Program at the Institute of Defense Analyses may warrant further examination towards concept development:

• *Precision Strike* involves the employment of highly accurate attacks through remotely delivered smart munitions, special operations direct

action, and/or ground attack by fire to destroy, fix, and suppress detected adversary capabilities from stand-off distance to isolate them from resupply and reinforcement sources without occupying ground.[19]

- *Nodal Capture* involves the control of critical nexus points (structural and non-structural) in the city to deny adversary sources of support and freedom of movement, and prevent contact between adversary forces.[20]

- *Nodal Capture and Expansion* builds on the Nodal Capture approach through leveraging control of the critical nexus points to facilitate capture of the entire city.

- *Soft Point Capture and Expansion* employs seizure of undefended areas of the city and uses them as bridgeheads for decisive, multiple attacks.

- *Segment and Capture* employs counter-mobility to fix adversary forces to the extent that they lose the ability to mass for offensive or defensive purposes and can be defeated piecemeal.

- *Nodal Isolation* is the approach to psychologically and/or physically seal off critical nexus points (structural or non-structural) from adversary forces to deny them sources of support and freedom of movement, and prevent contact between adversary forces.[21]

The search for ideas and their development into viable concepts, capabilities, and ultimately, solutions should be an ongoing process requiring extensive study, engagement, dialogue, wargaming and experimentation cross the military, government, scientific, and academic communities. While not an easy task to accomplish, the operational necessity to prepare the future force outweighs the institutional challenges associated with collaborative learning efforts.

The Way Ahead

The operational challenges inherent in megacities are significant, and given strategic trends, somewhat predictable. The Army must conduct additional research to determine how US forces can and will operate in and around such environments and develop the means to execute as part of a comprehensive improvement of the current and future force. Essentially, megacities epitomize complexity through physical and virtual environments that are dynamic, interconnected, and congested while spanning multi-dimensions in a scale that exceeds military capacity. For consideration are the following proposed actions:

Reflect and Assess

As this article argues, the study of urban terrain is clearly not a new endeavor, nor is the idea of megacities. The Army has the responsibility to reflect on work of the past (JFCOM, and others partners), assess lessons learned, and carry that understanding forward through the development of running estimates of past learning. For instance, Unified Quest assessed its own internal work in 2004 before reinvigorating its efforts addressing megacities in 2014. This approach ensures the

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19   Alec Wahlman, Mark Bean, et al., *Exploring New Concepts for Joint Urban Operations* (Arlington: Institute for Defense Analyses, 2003), S-2.
20   Ibid., S-3.
21   Ibid., S-4.

Army does not relearn in areas where there are volumes of data, and use resources wisely to focus learning into the future.

Learn and Test

Wargaming and experimentation remain critical virtual components in the Army's modernization strategy: Force 2025 and Beyond Maneuvers is the Army's Campaign of Learning.[22] As described, numerous wargaming efforts of the past (Unified Quest 2004, 2014) have addressed megacities from a strategic and operational context, supporting concept development. The next step is to drive experimentation which, at the operational, down to tactical and entity-based level, can further expand capabilities development in the critical areas necessary to win in this multi-domain environment (surface, sub-surface, maritime, air, cyber, and space).

Build

The Army lacks appropriate live-training areas that properly replicate the scale required to train at both the operational and tactical levels, platoon and above, in a megacity. The Joint Readiness Center's Shughart-Gordon complex is useful for squad and below training, but lacks the multi-dimensional requirements for training in a megacity. As part of the physical component of *Force 2025 and Beyond Maneuvers*, the Army must build a live training environment to support the operational force as new concepts and capabilities develop into doctrine, training and material and other Doctrine, Organization, Training, Materiel, Leadership, & Personnel (DOTMLP) solutions requiring appropriate "F" - facilities to insure units are prepared. US Forces Command is developing options but the effort is understandably challenging given the fiscal environment. It is also understandable that Congress, with tough budget decisions ahead, will choose to support more current issues rather than to fund more mid and far-term projects. Thus, the Army should consider funding through other means, such as public-private ventures or federal-state options that can create value not only for the military, but for the public and private service sector as well. Overall, this kind of investment has the potential to pay great dividends and will move the Army forward more quickly in this endeavor.

Collaborate

The Army is connected with many academic institutions and government organizations thinking hard about the challenges of dense urban spaces. The Army Capabilities Integration Center (ARCIC), Chief of Staff of the Army (CSA) Strategic Studies Group (SSG), Research, Development and Engineering Command (RDECOM), and the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) are all working to link concept and capability development. However, the Army needs to create an even greater collaborative research network to increase overall urban research capacity. This will allow for quicker identification of the critical needs of the Army today and in the future. Learning and collaboration can also be increased more rapidly through relations with our Allies and partners.

22 Army Capabilities Integration Center, "Force 2025 and Beyond," http://www.arcic.army.mil/Initiatives/force-2025-beyond.aspx.

One example of a major opportunity for increased learning in this space is via collaboration with the Singaporean Army, and its access to the Urban Redevelopment Center in Singapore. This center includes advanced urban development ideas and an extensive terrain model of the entire country, which is an example of the kind of terrain model extremely useful for the Army's table-top wargames, needed to develop and assess new operational approaches to this emerging strategic trend. Collaborative research networks can assist the Army in moving forward more quickly with insights to help develop concepts and capabilities necessary to operate in megacities of the future.

Establish

The Army must establish a Megacities Center for Advanced Research and Collaboration, composed of strategists, concept and capability developers, academics, scientists, and international partners, as part of either the core component of this center, or as part of an advisory panel uniquely focused on this challenge. While megacities are unique environments, and centers are normally organized around functions, this challenge is so significant it requires focused effort. This center would help develop operational theories and approaches, test them, and track academic progress at all institutions within the Army's collaborative network. It would also work closely with operational commanders to educate them on the possibilities for satisfying their unique, geographically specific urban challenges through the integration of learning across the Army's functional Centers of Excellence (Maneuvers, Fires, etc.). The center will also educate leaders and support their development, and increase focused learning through wargaming and experimentation. It could also establish professor and student exchanges with other partners and interorganizational labs and centers to create more engagement, thinking and solution development for the unique, challenging operational environment of the megacity.

Sustain

Finally, sustaining collaboration, learning and testing is important to ensure the Army is constantly assessing current assumptions and identifying new challenges within the operational environment, and new opportunities from the science and technology community. There are many tools to accomplish this task. Arguably, one of the most useful tools is Army Warfighting Challenges (AWFCs). AWFCs are enduring first order problems, the solutions to which improve the combat capability of the current and future force. This tool is proving very effective today in creating unity of effort around solution strategies within the Army's Campaign of Learning. AWFCs will ensure sustained collaboration and drive unity of effort in support of concept and capability development for dealing with the challenges of the megacity.

Conclusion

Although efforts such as Unified Quest and studies by the Institute of Defense Analyses and other related organizations examined the challenges of urbanization and megacities over the years, the problems they identified were far from solved and still require extensive work. Megacities represent the most likely and most dangerous aspects of the

current and future operational environments, requiring the Army, as part of the Joint force, to develop new approaches, concepts, and, capabilities, and ultimately, solutions.

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