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MASTER OF MILITARY STUDIES

**TITLE:** Canvassing for Combat: Identifying and Leveraging Informal Networks in the Megacity

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## Executive Summary

**Title:** Canvassing for Combat: Identifying and Exploiting Informal Networks in the Megacity

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**Thesis:** The skeleton and sinew of a modern megacity is a combination of brick-and-mortar infrastructure and the informal social networks that support it. Using social media and smart phones, U.S. forces can create a map of both the physical infrastructure and the informal social networks supporting it before initial entry. These social networks, once identified, can be protected and supported at comparatively low cost in manpower and time with minimal impact on the civilian population.

**Discussion:** Connectivity is the defining characteristic of the modern megacity. Given their size and consequent demand signal, even third-world megacities are comparatively modern, teeming with wi-fi signals, smart phones and cell towers. In Nigeria, according to a 2014 Pew Research Center report, 78% of Nigerians own cell phones, but just 19% own smart phones. That 19% is clustered almost exclusively in Lagos, the country's lone megacity. Of those who go online, 83% are using social media<sup>1</sup>. As users post to sites like Facebook, Twitter and Instagram, they are geo-tagging themselves, posting their physical and temporal location. These posts allow analysts to plot pattern-of-life and can help commanders determine the best way to access and interact with the population, helping to quell any insurgency by focusing on protecting the populace rather than living in a state of constant friction.

**Conclusion:** Prior to the social media age, commanders receiving orders to a new country were limited to travel guides and the occasional memoir to learn about their destination. Today, online, open-source resources offer a wide range of articles written by all different types of travelers. More importantly, analysts can observe and interact with the population via social media and make some important determinations about pattern-of-life before ground troops reach the city.

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<sup>1</sup> “Emerging Nations Embrace Internet, Mobile Technology”, Pew Research Center, Washington, D.C. (February 13, 2014). <http://www.pewglobal.org/2014/02/13/emerging-nations-embrace-internet-mobile-technology/>

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## *Preface*

The proliferation of the smart phone and humanity's willingness to embrace it in order to feel connected has great implications for the modern military. Rather than using technology as a means of kinetically targeting an enemy, the smart phone can be used to identify “friendlies” and direct non-kinetic fires to protect the part of the population that might have been part of a silent majority before today.

I would like to express my thanks to my mentors both within and outside of the Advanced Studies Program at Marine Corps University, Dr. Benjamin Jensen, Dr. Joseph Ryan, Dr. Eric Shibuya, Prof. Michael Lewis, CDR Russ Evans, Lt. Col. Paul Melchior and Lt. Col. Carolyn Bird. Finally, the team, led by Dr. Andrew Crooks and Dr. Tony Stefanidis at George Mason University's Department of Computational Social Science and Center for Geospatial Intelligence in the Department of Geography and Geoinformation Science, respectively. Without their guidance, support and attention, this paper would not have been possible.

Finally, I would like to thank my wife, Annette, and son, Andrew, for providing the support necessary to complete this work. Semper Fi, Andrew!

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## **Introduction**

The megacity, defined as a city of more than 10,000,000 people, will be one of the military's most challenging operating environments yet. The majority of the inhabitants will be non-combatants. Neighborhoods will be divided by race, ethnicity, tribe, socio-economic status, religion, occupation and more. Coalition forces will not necessarily have an understanding of the city's social topography or even its physical geography. Using modern technology, particularly cell phones and social media, Coalition forces can generate a baseline ethnic map of the city prior to arrival and, using a list of pre-determined key infrastructure, quickly identify informal networks supporting each piece of infrastructure. Once identified, these informal networks can be supported and protected at minimal cost in manpower, time and with minimal impact on the civilian population.

### **Level of Command: Capitalizing on Existing Infrastructure and Leveraging Civilian Expertise**

The Marines have invested monetary and intellectual resources in the development of concepts to make the company the primary maneuver unit<sup>2</sup>. A company will not have the manpower, experience or strategic viewpoint to conduct the analysis advocated here. The company, however, is the primary customer and precise, detailed feedback from its commander would enhance operations. Due to the likely civilian support required, the initial analysis would be done by a team based in or near Washington, D.C. and the Marines' Center for Advanced Operational Culture and Learning (CAOCL)<sup>3</sup> has the ideal mix of Military Civil Affairs and civilian experts to form the core of the Operational Planning Team (OPT).

The OPT needs a mix of cultural experts, military personnel from the ground, aviation and logistics communities and civilian city planners with specialists familiar with water, sewage, power generation and food infrastructure. The primary benefits of hosting this capability at CAOCL is its

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<sup>2</sup> Headquarters, United States Marine Corps. *A Concept for Enhanced Company Operations* (Washington, DC: Headquarters, United States Marine Corps, 28 August 2008).

<sup>3</sup> Marine Corps Center for Advanced Cultural Operational Learning webpage, <https://www.mcu.usmc.mil/caocl/SitePages/About.aspx>

association with the brain trust at Marine Corps University (MCU) in Quantico and its proximity to Washington, D.C. The student body at MCU is composed of the most junior field-grade officers, Majors from the Army, Marines and Air Force and Lieutenant Commanders from the Navy and Coast Guard. It is a diverse group featuring officers from a wide range of military occupational specialties, including combat arms. All these officers are, in some capacity, planners-in-training and, over the course of their year in residency, will conduct exercises focused on operations in rural and urban environments, amphibious planning and counterinsurgency. This is a large body of mid-level managers, fresh from “the Fleet” who could be leveraged against any problem. Proximity to Washington, D.C. means access to international experts and several excellent universities which house departments dedicated to city planning and countries where the U.S. military may be required to operate.

The process of aggregating data can be done by computer experts and analysts assigned to the OPT, but the skill set is not something that will be found in the typical company's communications suite. Marine communicators' job is to establish secure communications, use voice nets and maintain Internet connectivity, not mine social media sites for data. This skill set is best practiced and maintained near Washington, D.C. with access to experts. Dr. Arie Croitoru and his team from George Mason described the methods used for data mining in their paper, “Linking Cyber and Physical Spaces Through Community Detection and Clustering in Social Media Feeds” in the 2014 edition of *Computers, Environment and Urban Systems*.

“The process begins with the collection of social media data according to user-defined search parameters, such as a set of keywords, a geographic region (e.g. a bounding box of an area), a temporal interval, user handles, or a combination of them. Based on these search parameters data is harvested from a social media service (e.g. Twitter) through a web API and processed accordingly.”

## Exploiting Social Networking Software to Map Informal Networks in the Megacity

One of the defining features of a megacity is its' "connectedness". Whether in a mature first world capital city like Berlin or a third world sprawl like Lagos, the modern cell phone and wi-fi network are prevalent. Each cell phone is reliant on the proximity of a tower for service and, given the density of cell phone towers in megacities, cell phones are frequently in contact with more than three towers at once, allowing anyone with appropriate access to triangulate the cell phone's signal. Cell phone locations can also be easily tracked or "geo-tagged" using social media, including Twitter, Flickr and Facebook. Unless specific features on the phone are disabled, each tweet, photo or Facebook post is tagged both spatially and temporally, to show a user's location at a specific time. Geo-tagging is neither new nor a limited technology. The tags must be manually disabled on most new cellphones and social media sites, to include Twitter, Facebook, Flickr, Instagram and others, all regularly geo-tag photos and posts. The U.S. Army and Air Force issued warnings to troops in 2010 to disable the feature to prevent the enemy from tracking troop movements.<sup>4</sup> Tweets, in particular, can be divided and categorized using language, in order to identify clusters of ethnic groups in a city<sup>5</sup>. Insertion of Civil Affairs teams to key pieces of infrastructure could collect specific data from employees to map the informal network associated with the infrastructure and, finally, identification of the networks, particularly routes used by employees moving to and from work and businesses frequented in transit could be exploited by friendly security forces to establish positive relationships with members of the informal network by timing patrols to coincide with routine network traffic. As relations between locals and the occupying force become more mature, the populace could even contribute using either a website dedicated to reporting attacks and security incidents or by using a hashtag to feed the Twitter database. All of this is possible using publicly available social media already widely used in both the

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<sup>4</sup> Joe Gould, "Geo-tags Can Show Enemies Your Location," *Armytimes.com*, December 20, 2010, <http://archive.armytimes.com/article/20101220/NEWS/12200309/Geo-tags-can-show-enemies-your-location>

<sup>5</sup> "Mapped: Twitter Languages in New York," Dr. James Cheshire, *Spatial.ly*, last updated February 20, 2013, <http://spatialanalysis.co.uk/?p=3978>

developed and developing world. Social media, cell phones and publicly available software will allow rapid mapping of formal and informal networks in a modern megacity.

### **Identifying Religious, Cultural and Ethnic Divides**

Analyzing tweets has already been used to produce language maps of New York City and London on the UK website Spatial Analysis: <http://spatialanalysis.co.uk/?p=3978>. The site's creator, Dr. James Cheshire of University College London, used publicly available software, R Software and ggplots 2, and a subscription to a Twitter trends analysis website, Trendshare, to plot more than 8.5 million tweets collected over a three-year period from January 2010 to February 2013. Dr. Cheshire used Google's publicly available translator function to identify the language used in the tweets. The results were notable not for the high clusters of international traffic at New York's respective airports or tourist sites, but for identifying both the size and location of specific ethnic communities, including the Russians in Brighton Beach, Spanish-speakers in the Bronx and Portuguese near Newark.<sup>6</sup> To do so, Cheshire geographically defined an area in Twitter and began downloading and cataloguing all tweets, using software to filter and plot each one. Given a city with a diverse ethnic population, intelligence analysts could, relatively quickly, create an ethnic map based solely on Twitter use using publicly available software. Facebook posts can be exploited similarly, because the posts are also often geo-tagged or have an element within the post that identifies the user's location. Determining the prevalence of social media in the target city will be key to any intelligence personnel assigned to the operation.

Rather than waiting for data delivered via the Internet, U.S. forces can also send teams of Civil Affairs Marines or soldiers to key pieces of infrastructure, be it a port, a sewage or water treatment facility or part of the power grid. A quick collection of cell phone numbers during the course of a normal work day would identify the bulk of employees that would comprise any informal network. Signals exploitation teams could use the data, tracking the different employees' routes to and from work over the course of a week, identifying neighborhoods where most employees live and coffeehouses,

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<sup>6</sup> *Ibid*

markets bars and restaurants they frequent before and after work. A preliminary sketch of the network could be completed after just a week and it could be plotted using a publicly available tool like Google maps, including key nodes and transit routes, to include times of peak activity. For example, if looking to exploit the port facility, a combination of “Geo-tagged” social media posts and an active Civil Affairs team conducting a transect of the port facility could gather enough cell phone data for analysis. Once the associated phone numbers had been turned over to a data exploitation team, U.S. forces would be able to plot the neighborhoods where most personnel in the port lived, their routes to and from work, key vendors associated with but perhaps not geographically co-located at the port, e.g. an ice vendor who supplies the fishermen, and businesses, whether directly related to trade in the port (the market where the fishermen sell their catch) or indirectly related to the people who work in the port (the bar where the fishermen congregate before going home for the evening). Armed with this information, U.S. commanders would be in an excellent position both to interact with the network and protect or exploit it. For example, security patrols could be timed to coincide with peak activity in specific coffee shops to ensure our patrols make face-to-face contact with network members and begin building rapport. Visible patrols would give network members a sense of security and encourage regular, positive interaction as both sides began to recognize familiar faces.

### **The Utility of VGI**

Voluntary Geographic Information (VGI) is information contributed willingly by a population, normally to promote collective security. For example, the non-governmental organization (NGO), Invisible Children + Resolve developed the website LRA Crisis Tracker (<http://lra-crisistracker.com/>) in response to atrocities committed by the Lord's Resistance Army (LRA) in northern Uganda, the Central African Republic (CAR), Democratic Republic of Congo (DRC) and South Sudan.<sup>7</sup> From 1986-2006, the United Nations estimated the LRA abducted more than 30,000 children and further believes fear of the LRA has resulted in displacement of more than 465,000, a substantial impact given the U.S. State

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<sup>7</sup> “Lord's Resistance Army Crisis Tracker,” *LRA Crisis Tracker*, last modified April 18, 2015, <http://lra-crisistracker.com/>

Department webpage puts LRA membership at approximately 250-300 members<sup>8</sup>. To shed light on the LRA's atrocities, Invisible Children + Resolve created its website to allow locals to contribute information on LRA attacks and broadcast warnings to other endangered villages. Small communities in remote areas of Uganda and the DRC have received long-range radios and will call in using radios to report attacks. A central station adds the attacks to the map on the LRA Crisis Tracker website and sends alerts via the website, e-mail and a mobile app. Similar citizen-based crime reporting websites exist in Monterrey, Mexico, developed by local businessmen to make citizens aware of cartel-related violence<sup>9</sup>, and in Washington, D.C. Specific events can also be tracked using Twitter hashtags. When the University of Kentucky won the 2012 NCAA basketball championship, riots broke out throughout the city of Lexington, Kentucky. Observers were able to piece together a timeline of the evening's events when Twitter users, admittedly a higher-than-normal percentage of the population in an American college town, began tagging every post related to the riots with the hashtag #LexingtonPoliceScanner.<sup>10</sup> These websites, while they will not necessarily contribute to the problem of mapping a network, will encourage local participation in collective security and establish a pattern of data contribution.

Proliferation of cell phones and the use of social media have made mapping informal networks in a megacity easier. While citizens in a developing nation's rural areas may struggle for a wireless or cell phone signal, the connectivity demands of a megacity mean a thick constellation of cell phone towers to track cell phones and ensure social media posts, including Twitter and Facebook, are spatially and temporally tagged. Using publicly accessible software, including R software, ggplots2 and Trendsmap, civilians are already able to isolate social media posts geographically and then mine down to individual cell phones or electronic devices and identify discreet population clusters in a diverse

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<sup>8</sup> U.S. Department of State, *The Lord's Resistance Army – Fact Sheet* (Washington, DC: Office of the Spokesperson, March 23, 2012). <http://www.state.gov/r/pa/prs/ps/2012/03/186734.htm>

<sup>9</sup> Centro de Integración Ciudadana, *CIC Beta*, last modified January 11, 2015, <http://www.cic.mx/tehuan-beta/>

<sup>10</sup> Jeremy Crampton, et al., "Beyond the Geo-tag? De-constructing "Big Data" and Leveraging the Potential of the Geo-Web." University of Kentucky, 2013.

landscape. A Civil Affairs team can conduct a transect at a specific piece of infrastructure, gather cell phone data and, within a week, build a rough sketch of the informal network associated with the infrastructure and present it to a commander for exploitation or protection.

### **Integrating the Social and Physical Map of the Megacity**

The megacity has no collective identity. It is a series of networks, some confined to a single building, others sprawling over miles. If tasked with fighting in a megacity, the U.S. military will have to identify the power brokers for each of these enclaves. They will include the police, criminals, businessmen, religious figures and educators. At the very least, these figures will have to be rendered neutral. Each of these networks will have centers of gravity that must be mapped and presented to commanders. The problem of creating an integrated physical and social map of the megacity can be broken down into three areas: physical terrain mapping, social terrain mapping and integration and display of results and centers of gravity. Each of these challenges has been addressed individually, but, no one has attempted to construct a physical and social map of a megacity for the purposes of fighting within its confines. The best means of topographical mapping will include modern surveillance technology including LANDSAT satellites, Synthetic Aperture Radar and drones. Social mapping will incorporate the principals of the geographic “transect”, walking the city and interacting with its people to best learn its identity. To date, no comprehensive technology has emerged for integrating the social and physical map of a megacity, though there are proposals for integrating open source media and voluntary input from the city's citizenry as well as a nascent attempt by Los Angeles county to leverage citizens' input in metro construction. Identification and mapping of human networks and leveraging their respective centers of gravity will be the defining challenge of war in the megacity environment.

### **Solving the Topo Problem**

High-quality topographical maps are essential to every military operation, but megacities represent a challenging problem set. Megacities have not been a traditional area-of-operations (AO) for U.S. forces and their geography frequently changes as people flood into the city, erect temporary

housing, occupy arable land and bring livestock with them. Topographical mapping is the subject of two articles featured in *Remote Sensing of Environment*. The first, by authors Junichi Susaki, Muneyoshi Kajimoto and Masaaki Kishimoto, focuses on identifying population density centers. In “Urban Density Mapping of Global Megacities from Polarimetric SAR Images”, the authors use Synthetic Aperture Radar (SAR) to map concentrations of population in Dhaka, Bangladesh<sup>11</sup>. Patrick Griffiths, writing four years earlier, mapped the systematic growth of Dhaka from 1990 to 2010 using both SAR and LANDSAT satellite imagery. Specifically, Griffiths noted the expansion of the city as immigrants moved onto arable land at the city's outskirts. New residents, most coming from rural areas, would settle on arable land and then set up small subsistence farms to ensure a stable food supply while they adjusted to life in their new environs<sup>12</sup>. Identification of arable land at a city's outskirts could help U.S. commanders identify likely points of new settlement. LANDSAT and SAR imagery could be supported with drones to create an up-to-date topographical map of the mega-city. An influx of livestock, even on the city's outskirts, will present another challenge to American commanders as livestock often promotes the spread of disease through poorer segments of the populace.

Marine Corps Civil Affairs (CA) is postured to contribute to the mapping function, particularly on the social side, though not yet on the scale required by the megacity. Capstone exercises at the Marine Corps Civil-Military Operations School (MCCMOS) aimed at preparing Marines for operations in cities focus on a smaller city on the island of Mindanao in the Philippines<sup>13</sup>. CA troops will use open source material, namely Google and CIA Factbook, to identify key locations in a city. These key locations will often include markets, public squares and churches and may be analogous to social centers of gravity. Once these major points of interest are mapped, Civil Affairs Marines will conduct

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<sup>11</sup> Junichi Susaki, Muneyoshi Kajimoto and Masaaki Kishimoto, “Urban Density Mapping of Global Megacities from Polarimetric SAR Images.” *Remote Sensing of Environment* 155, December 2014, pp. 334-348.  
<http://search.ebscohost.com/>

<sup>12</sup> Patrick Griffiths, “Mapping Megacity Growth with Multi-Sensor Data.” *Remote Sensing of Environment* 114, February 2010, pp. 426-439.

<sup>13</sup> Capt. Michael Pevehouse (Operations Officer, Marine Corps Civil-Military Operations School), interview by LCDR Jared W. Samuelson, November 13, 2014.

visits in conjunction with an infantry unit and begin to question the population, using a Tactical Conflict Survey, a 4-question battery, designed to identify a local, informal power structure or network. Unfortunately, the MCCMOS was only established in 2011<sup>14</sup> and the Marines have been busier withdrawing from contested areas as part of a pullback of U.S. Forces from Iraq and Afghanistan than operationally testing the principles practiced in the schoolhouse.

Los Angeles County represents one of the first attempts at integrating physical and social maps of a megacity. A city of more than 10,000,000 people is typically not geographically confined. It sprawls for miles. The LA metroplex, for example, extends for almost 100 miles towards Death Valley. Almost every large city in America has a Chinatown, but Los Angeles also has Koreatown, Little Ethiopia, Baldwin Park, known to LA residents as “the black Beverly Hills”, actual Beverly Hills, Filipinotown, hundreds of homogeneous communities and dozens of smaller groupings of immigrants, mostly from Pacific Rim countries. Each of these communities has, in turn, dozens of its own subdivisions based on tribal and religious associations from the countries of origin. Were the U.S. Military called to fight in Los Angeles, there is no logical geographic boundary containing the city. If U.S. Forces were to establish a base outside the “city”, they might find themselves 50 miles from the downtown area. Although it does not “map” Angeleno society, the Geosocial Interactive Mapping System (GIMS) does provide an excellent framework for the U.S. Military to examine a potential future interface with the population of a megacity. The GIMS, developed by the Civil Resource Group (CRG), is initially being used to inform Los Angeles residents about impacts of planned Metro rail projects and solicit input from the citizenry. The CRG developed the interactive map for the County of Los Angeles to improve communications across the county's 1,433 square mile service area<sup>15</sup>. The site's initial model is still in beta testing, but is based on open data and is compatible with both Android and Apple devices. No comprehensive study of GIMS' impact has been completed, but it holds promise for

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<sup>14</sup> Marine Corps Civil-Military Operations School webpage, Training and Education Command.  
<http://www.tecom.marines.mil/mccmos/UnitHome.aspx>

<sup>15</sup> “Metro Geo-Social Interactive Mapping System,” <http://www.civicresource.com/CaseStudy/geosocial>

incorporating voluntary information into a map of a large cityscape. GIMS represents a first step in the type of local participation in assembly of geographic data identified as critical to mapping a megacity by Mohammed Bakillah and his co-authors in his article, “Semantic Interoperability of Sensor Data with Volunteered Geographic Information: A Unified Model.” What will make GIMS and any future integrated modeling software successful is timely, accurate input from the populace of the megacity.<sup>16</sup> Ultimately, this will require a positive relationship between residents of the megacity and American commanders.

### **Transecting the Megacity**

The concept of the “transect” dates from the late 19<sup>th</sup> century and was pioneered by explorer-biologists like Alexander von Humboldt. During a transect, the biologist in question would walk across a defined territory, recording his observations and speaking with locals along the way. More recently, American biologist J. Michael Fay spent almost two years mapping the vegetation in the Congo River basin. National Geographic touted Fay's project, which included walking more than 3,200 miles, as a “Megatransect”. Today, the Urbanphoto blog is applying Fay's methodology, for the first time, to a megacity<sup>17</sup>. Thus far, megatransects have been completed in London, Mexico City and Mumbai. British correspondent for The Geography Collective Daniel Raven-Ellis walked each of the cities, taking a photograph approximately every eight steps and splicing the photographs into Youtube films. When reviewed, the videos of London, Mumbai and Mexico City lack for context. Raven-Ellis has completed an impressive journey across the city but, thus far, he has only a photographic record of his travel. To flesh out a transect, in the manner of von Humboldt, he will need to incorporate interviews with the people who live in the neighborhoods along the route he traversed. This project would take years to complete and it is unlikely the funding will support the self-titled “Guerilla Geographers.” Raven-

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<sup>16</sup> Bakillah, Mohammed, Liang, Steve H.L., Zipf, Alexander and Arsanjani, Jamal Jokar, “Semantic Interoperability of Sensor Data with Volunteered Geographic Information: A Unified Model.” *ISPRS International Journal of Geo-Information* 2 (2013): 766-796, <http://www.mdpi.com/2220-9964/2/3/766>.

<sup>17</sup> Christopher Szabla, “Mega(city)transect,” *URBANPHOTO* (blog), May 1, 2011, <http://www.urbanphoto.net/blog/2011/05/01/megacitytransect/>.

Ellis's work, when played in slow-motion, looks like a version of Google's street view. This could be valuable to infantry commanders looking to familiarize soldiers and Marines with their surroundings prior to entry into the city. Again, this type of recording will require acquiescence from the populace.

## **Conclusion**

The megacity presents a challenging environment, made more challenging by the difficulty in understanding its many neighborhoods, informal networks and topography. Before infantry and armor units can be expected to operate inside the city, comprehensive topographical mapping is necessary. Once inside, all efforts should be exhausted to determine the location of population clusters and informal networks in order to identify individual centers of gravity. Once identified, commanders can assess how best to leverage those centers of gravity to root out an insurgency or pacify a restive population. Topographic mapping can be accomplished using LANDSAT satellite, SAR, reconnaissance aircraft and drones. Social mapping will remain the domain of Civil Affairs Marines and soldiers and their counterparts in the infantry. The biggest challenge will be successfully integrating a physical and social map. Use of open media sources will be necessary to integrate input from ground forces as well as incorporate civilian input, both of the American and local variety. The ability to successfully show senior commanders the social and topographical terrain they are operating in will be the defining challenge of the battle in the megacity.

## **The Human Terrain Map Operational Concept**

### **Introduction**

Social media, cell phones and publicly available software will allow rapid mapping of formal and informal networks in the modern megacity. The megacity, defined as a city of more than 10,000,000 people, will be one of the U.S. military's most challenging operating environments. The majority of the inhabitants will be non-combatants. Neighborhoods will be divided by race, ethnicity, tribe, socio-economic status, religion, occupation and more. Coalition forces will not necessarily have an understanding of the city's social topography or even its physical geography. Using modern technology, particularly cell phones and social media, Coalition forces can generate a baseline ethnic map of the city prior to arrival and, using a list of pre-determined key infrastructure, quickly identify informal networks supporting each piece of infrastructure. Once identified, these informal networks can be supported and protected at minimal cost in manpower, time and with minimal impact on the civilian population.

This operational concept is based on and organized according to the Defense Adaptive Red Team (DART) guide for developing and writing operational concepts written by John F. Schmitt<sup>18</sup> and Joint Publication 5-0, Joint Operation Planning. The diagram below is from JP 5-0 and shows the progression of phases. Non-kinetic use of this capability will be used primarily in Phases 0-II and IV-V. There is a means of using cell and social media networks to target enemy forces. That would primarily be used by the Coalition in Phase III and then turned over to the Host Nation in Phases IV-V.

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<sup>18</sup> John F. Schmitt, "A Practical Guide for Developing and Writing Military Concepts," Defense Adaptive Red Team Working Papers #02-4, December 2002.

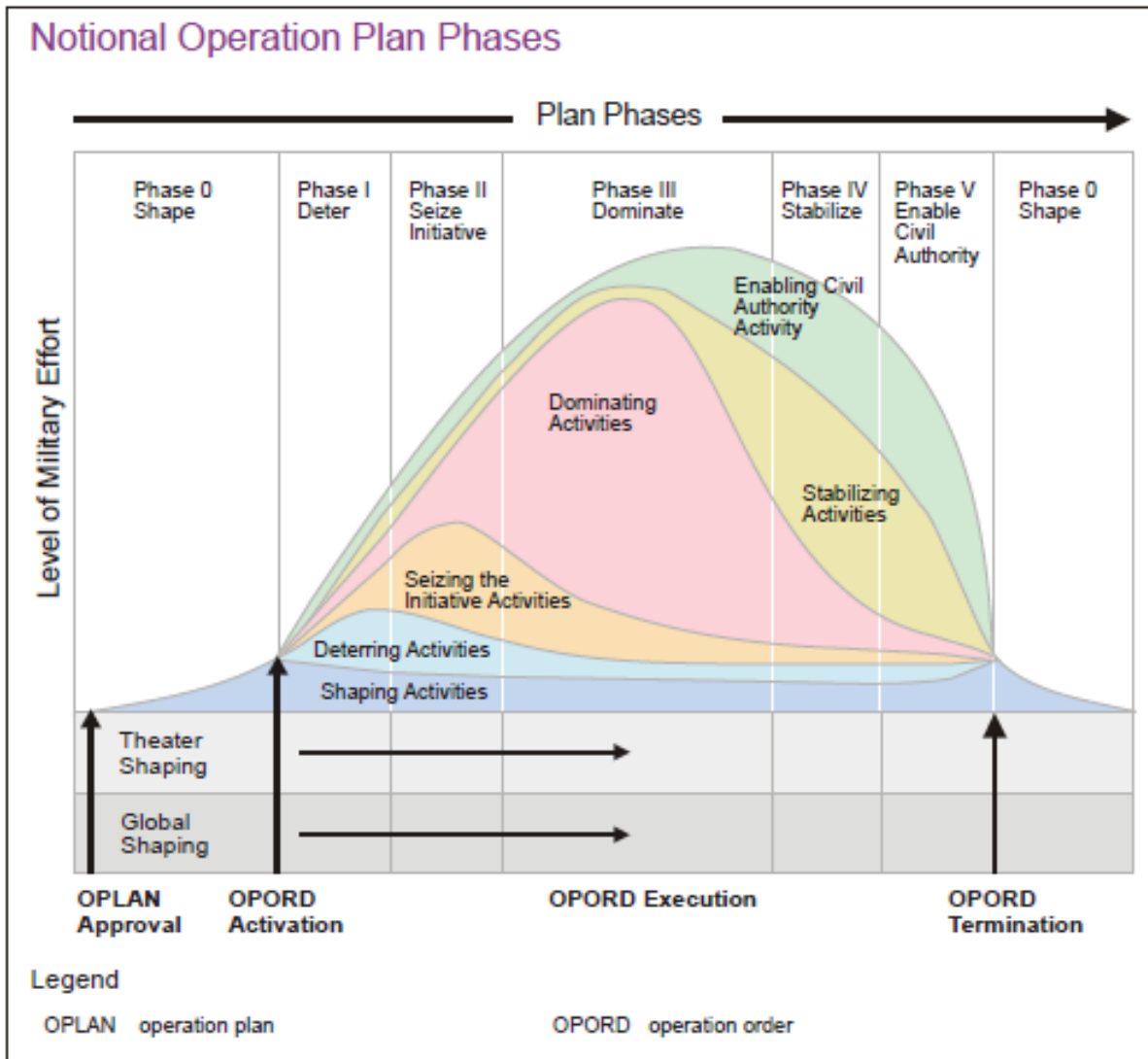


Figure III-16. Notional Operation Plan Phases

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### Purpose of the Concept

The purpose of the canvassing for combat concept is to develop a means of assessing critical infrastructure in a megacity, both in the traditional, brick-and-mortar sense, and the underlying, informal social networks related to the structure that enable its continued operation. Once identified, the physical buildings and social networks will become the “key terrain” required to keep the city functioning as Coalition forces move into it.

<sup>19</sup> JP 5-0, Joint Operation Planning, August 11, 2011, III-39.

## **Phase 0 Operations**

Choice of the megacity as a battleground will be dictated by the National Command Authority. Intelligence analysts can begin experimenting with social media as a mapping tool, now, though. This type of analysis already exists in Dr. James Cheshire's Twitter Map NYC and Twitter Map London. Intelligence staff can set a geographic boundary around a megacity and use all Tweets geo-tagged within for analysis. Establishment of the boundary should not be arbitrary. Rather, it should be discussed with both military planners and civilian experts, to include those most familiar with the city in question. Experts in the languages, religions and ethnic groups common to the region should be part of the planning team. This prevents establishment of a boundary based on a feature that, while it appears imposing on a topographical map, is no impediment to movement for the local populace or that bisects a population cluster.

Once boundaries are established, using Dr. Cheshire's established model, Tweets and other posts can be plotted on a map using a color code to designate the language used. The resultant map will give a preliminary picture of population distribution and, in particular, clusters of ethnic groups. This "Human Terrain Map" would be roughly analogous to the Marine Corps' Modified Combined Obstacle Overlay (MCOO). In Dr. Cheshire's NYC and London maps, he used Google's translation service. It is unclear what limitation the Google service might have in discerning differences between African tribal dialects or different variants of Chinese, for example.

During Phase 0, a separate cell of city planners should be established, preferably from both American megacities and megacities in the region where Coalition forces will be operating. The task of the city planners should be to identify infrastructure, first common to any megacity and second specific to the city in question. These would include facilities for a port, water treatment, power generation, sewage, markets, transportation hubs, including central bus depots and major train stations, major universities, high schools or elementary schools and hospitals. This list is not comprehensive, but provides a good starting point. Once a list of general infrastructure typically found in a city has been

identified, regional experts and any Americans previously stationed in the city should be available to identify specific points in the city identified as key to daily life. The list should be prioritized using a combination of Maslow's Hierarchy of Needs and local knowledge. Just as the Joint Forces Air Component Commander (JFACC) is responsible for aggregating the kinetic target lists of all services, the Ground Forces Component Commander (GFCC) or a representative team dedicated to preparing for Phase 4 Operations should be tasked with generating a non-kinetic target list based on the Human Terrain Map.

Pairing a social map of the city with a topographical map with identified critical infrastructure will create an effective map for commanders planning operations into the city. All the information regarding key social groups will be valuable to commanders doing problem-framing as well. An overlay showing where different groups compete for resources or share boundaries is valuable for defining the grievances preventing a lasting peace.

### **Phase I, II and III Operations**

Due to the density of the modern megacity, it is unlikely Coalition forces will want to initially establish a base inside the city. The prevalence of artificial “high ground” as a result of modern architecture as well as how closely buildings are packed together means the modern megacity is inherently unsafe for outside forces.

**1. Conduct a Transect.** The transect, meaning “to cut across” is a term from geography wherein a team of cartographers or geographers would walk across an unexplored area to explore and map it. Once the planning group has identified key infrastructure and operational commanders have made the decision to enter the city, units should be designated to “transect” the area immediately around each location. During that transect, the focus should be on positive interactions and gathering as much cell data as possible. Armed with the Civil Affairs 4-question Tactical Questionnaire, even moderately trained infantry units focused on force protection could gather the data necessary for future exploitation.

**2. Exploitation and Interpretation.** As part of a transect of each piece of infrastructure, infantry units will need to collect cell phone data from all civilians present. Aggregation of cellular data into a spreadsheet allows a set of cell phones to provide a temporal and spatial map of the pattern-of-life associated with each piece of infrastructure. A week's worth of data would normally be enough to determine when people come to and from work, where they live, where they congregate when not at work, which businesses they frequent in connection with their job. The resultant map should be turned over expeditiously to the local infantry unit to begin encouraging seemingly coincident contact between his security patrols and locals to encourage positive relationships.

### **Phase IV and V Operations**

As Coalition Force presence becomes normal in the megacity, security patrols will be timed to provide the most benefit to the populace, protecting people moving to and from work, protecting children moving to and from school and focused on safeguarding the infrastructure necessary to make the megacity livable. If the population sees the benefits of the stability brought by Coalition forces, they should be encouraged to begin providing Voluntary Geographic Information (VGI), reporting attacks in real-time so first Coalition and then government forces can respond. If smart phones are prevalent, the reporting mechanism can be as simple as an app that can be downloaded. As Coalition troops begin to turn control of the city back over to government troops or municipal police, either of those organizations can be taught how to monitor the VGI system and respond.

### **A maritime application?**

The community policing model is no longer just a phenomenon for ground forces. The Navy and Coast Guard have increased their respective efforts to monitor pattern-of-life in the Arabian Gulf, forward-deploying 10 Cyclone-class Patrol Coastal (PCs) and 5 Island-class Weapons Patrol Boats (WPBs) to Bahrain. Those vessels spend most of their patrols conducting visits to fishing dhows through the Gulf, handing over leather gloves and first aid kits, while querying the fishermen about

piracy<sup>20</sup>.

A commercial fishing fleet is an important piece of floating infrastructure for a littoral city. The day's catch feeds the populace, employs vendors in markets and provides local restaurants with product. The ability to locate and protect that fleet is vital to winning goodwill from the population. When initially permanently deployed to the Arabian Gulf, PC crews struggled identify probable fishing locations. It took several patrols to realize most fishermen preferred to cluster around easily located navigational aids and the shallows the aids identified. Knowing probable locations cut down unnecessary time spent conducting a grid search in assigned patrol boxes, allowing crews to more efficiently plan the days' events. The coast of Africa, however, has comparatively few navigation aids and the habits of its fishermen are largely unknown. One way to track the fishing fleets at sea would be the deployment of cell towers on a trio of Littoral Combat Ships (LCSs), anchored to fix their positions geographically, and triangulate the fishermens' position based on signal, allowing a Coalition fleet to move to that location and provide a visible deterrent to criminals and pirates.

## **Conclusion**

The megacity's size presents an intimidating obstacle, but its size also contributes to a modernity and connectivity that, even in the developing world, will allow a modern military to mine, manipulate and exploit data the city's citizens will provide without a heavy-handed presence. Careful planning in Phase 0 by teams of military, civilian and social planners will allow military forces to develop a non-kinetic target list equivalent to the target list in use by the JFACC, plan a methodical advance into a city, identify key infrastructure and note existing social and ethnic divisions. During Phases 1, 2 and 3, initial patrols will visit the infrastructure on the non-kinetic target list, gather cell data for exploitation and turn it over to teams from the intelligence community to build pattern-of-life models for each site. Follow-on patrols will be timed to protect and positively interact with the

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<sup>20</sup> Eric Schmitt, "Eyes on Iran, Navy in the Gulf Stays at the Ready," *The New York Times*, December 8, 2013, [http://www.nytimes.com/2013/12/09/world/middleeast/eyes-on-iran-navy-in-gulf-stays-at-ready.html?\\_r=0](http://www.nytimes.com/2013/12/09/world/middleeast/eyes-on-iran-navy-in-gulf-stays-at-ready.html?_r=0)

informal networks identified. As Coalition forces' presence becomes accepted, locals can be encouraged to report incidents using a VGI application, initially on the Internet, later on an application available for download to the types of smart phones prevalent in the city. Monitoring of the application and response will gradually be turned over to local government military and law enforcement as Coalition forces plan to withdraw.

### **The Lagos Hypothetical: Protecting the Fishmongers from Boko Haram**

Situation: In late 2015, the Boko Haram insurgency, unable to successfully fund itself in the agrarian north, moves en masse into the city of Lagos, blending into the civilian population and conducting strikes against the military, government and police while trying to replicate ISIS' means of funding by plundering the banking industry. The Nigerian government requests American assistance and the U.S. agrees to respond to support the Nigerian government.

#### **Assumptions:**

1. Boko Haram is able to successfully move a significant force from the Nigerian interior to Lagos and blend into the population sufficiently to threaten the Nigerian government's continued control of Lagos.
2. The Nigerian government is willing to offer U.S. forces complete support, including access to cell phone companies and records.
3. Government agencies specifically mentioned are willing to support a whole-of-government approach.
4. A team to conduct analysis of geo-spatial intelligence has been established at the Marines' Center for Advanced Operational Cultural Learning in Quantico, VA. This team is composed of cultural and linguistics experts as well as Marine communications specialists who regularly work with the team at George Mason University's Center for Geospatial Intelligence in the Department of Geography and Geoinformation Science.

## Phase 0

1. The Marines establish an Operational Planning Team based at the Center for Advanced Operational Cultural Learning in Quantico, VA, including subject matter experts (SMEs) on Nigeria, the city of Lagos, SMEs specifically to address the religious and tribal groups present in the city of Lagos, State Department representatives familiar with Boko Haram, city planners from New York, Los Angeles and Chicago, as well as representatives of the Lagos State Water Corporation (clean water infrastructure)<sup>21</sup>, Lagos State Electricity Board (electrical production)<sup>22</sup>,

2. The OPT develops an initial list of vital infrastructure within the city of Lagos that the U.S. military will be directly involved with protecting. The list includes, but is not limited to the following:

a. The food supply for Lagos, represented by the fishing grounds, transit corridors to and from the favored fishing grounds, the fish markets in the city, the neighborhoods where both the fishmongers and fishermen live, the routes fishermen and fishmongers use to move to and from work and establishments frequented en route.

b. Power production facilities, the neighborhoods where industry workers live, routes along which fuel for the facilities travels, routes to and from work for both plant workers and fuel truck drivers.

c. Water production facilities, the neighborhoods where industry workers live, routes to and from work and subordinate pumping stations.

d. The Lagos Port Authority Facilities, including fishing piers, oil terminals, the coal terminal, the flour terminal and the remainder of the government run facilities along Apapa Road, Creek Road and at Tin Can Island, the neighborhoods where the majority of the workers in these facilities reside, the bus routes servicing the waterfront and a series of businesses which support the waterfront's continued operation.

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<sup>21</sup> "Lagos Water Corporation," *Lagos State Water Corporation*, last modified March 16, 2015, <http://www.lagoswater.org/>

<sup>22</sup> "Lagos State Electricity Board," *Lagos State Electricity Board*, last modified April 10, 2015, <http://www.lseb.gov.ng/>

3. Over the course of planning, the OPT identifies the continued operation of the ports of Lagos, as critical for the government's continued operation due to its 6 oil terminals and 4 tank farms along Creek Road as well as the container terminal at Tin Can Island<sup>23</sup>. It is also critical for the population because of the four berths for fisheries and the Ijora Coal Wharf. Related to the port facility (included in the informal network) are the fish markets in Iddo, Makoko, Epe, the Liverpool Fish Market located within the Tin Can Port facility and the market under the Falomo Bridge on Victoria Island, the Bus Rapid Transit (BRT) routes servicing the port facilities were included as well.

4. The fish markets are identified by intelligence analysts as a likely Boko Haram target. In response to the Nigerian government's imprisonment of known Boko Haram's leaders' wives in 2012, Abubakar Shakau issued a threat to kidnap the wives of prominent government officials, marking a turn towards gender-based violence (GBV)<sup>24</sup>. Since 2013, the group has abducted hundreds of women, including 270 girls from the town of Chibok in April 2014. Nigerian fish markets are predominantly run by women and somewhere between 80-90% of all fish vendors are women<sup>25</sup>.

5. The Marines' Geospatial intelligence team, working with their counterparts at George Mason University, begin using Twitter analytics to find tweets geo-tagged within the port facilities in an effort to identify users who regularly visit the port during the course of a work week. Users thus identified are then analyzed, looking specifically for tweets related to their homes and transit routes to and from work.

### **Phases I-III**

1. The Marine staff picks a landing location/location for a Forward Operating Base in the vicinity of Mutala Mohammed International Airport. Use of the port facilities allows the Marines to

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<sup>23</sup> "Lagos Jetties," *Lagos Port Complex*, last modified August 30, 2012, <http://www.nigerianports.org/dynamicdata/lagosjetties.aspx?Pid=176>

<sup>24</sup> Jacob Zenn and Elizabeth Pearson, "Women, Gender and the Evolving Tactics of Boko Haram," *The Centre for the Study of Terrorism and Political Violence, Journal of Terrorism Research*. Volume 5, Issue 1(2014): <http://ojs.st-andrews.ac.uk/index.php/jtr/article/view/828/707>

<sup>25</sup> C.I. Ayo-Olalusi, et. al. "The Liverpool fish market in Lagos State, Nigeria," *International Journal of Agribusiness and Resource Economics* Vol. 1 (2), 37-41, February 2014.

bring heavy equipment ashore and one runway is dedicated to Marine aviation, allowing a continuous stream of supplies from the Amphibious Readiness Group (ARG).

2. Once established, infantry platoons visit each of the aforementioned fish markets, taking translators to interview the leadership council and vendors. The platoons gather a list of cell phone numbers and aggregate the data in Excel spread sheets, turning the data over to a team of NGA and NSA personnel. This team, with the assistance of the Nigerian government, accesses the Nigerian cell network and begins diagramming pattern-of-life associated with the fish markets, to include the fishermen whose catch is used to support the market.

3. Three LCSs associated with the naval task force are outfitted with cell tower antennas and anchor off the coast, capturing the cell signals of the fishermen and triangulating the popular fishing locations along the coast. Once these locations are identified, the LCSs move to the locations, providing a visible deterrent to pirates and criminals, allowing the fishermen to continue their work in peace.

4. Analysts use cell phone data to determine the following pattern-of-life: the women who run the respective fish markets live primarily in four different neighborhoods. The women take a similar route to work, often arriving around 4:30 a.m. to help offload the previous day's catch from the fishing boats and put the products on display. These women routinely stop at an ice vendor located in the vicinity of the their respective markets. There are popular restaurants that sell both coffee and food near each market frequented by market leadership and vendors.

5. Nigerian government troops, with Marines as advisors, are assigned to start running security patrols with first, the fishermen, whose morning commute begins earlier than the fishmongers. The same troops then conduct patrols coincident with the fishmongers' morning commute. Emphasis is on friendly contact multiple times during the day between government troops, the Marines and the fishermen and fishmongers.

6. As the government troops and Marines begin to establish a relationship, the Nigerian

government debuts a reporting application to allow its citizens to report Boko Haram attacks online. This serves the purpose of both warning citizens to avoid areas when an attack is in-progress as well as allowing government troops to respond. The application is established by an NGO working in coordination with the Nigerian government.

#### **Phases IV-V**

1. Nigerian troops, now without Marine advisors, continue their patrols, using the pattern-of-life information to monitor the flow of people to and from the fish markets and wharves and timing security patrols to maximize the contact between government forces and the people critical to the fish markets' continued operation.

2. The Nigerian government takes over operation of the Boko Haram attack-reporting application, developing a Quick-Reaction Force (QRF) specifically to respond to reports of attacks via helicopter, allowing Marine units to leave the city.

#### **Conclusion**

The megacity's size presents an intimidating obstacle, but its size also contributes to a modernity and connectivity that, even in the developing world, will allow a modern military to mine, manipulate and exploit data the city's citizens will readily provide without a heavy-handed presence. Careful planning in Phase 0 by teams of military, civilian and social planners will allow military forces to develop a non-kinetic target list equivalent to the target list in use by the JFACC, plan a methodical advance into a city, identify key infrastructure and note existing social and ethnic divisions. During Phases I, II and III, initial patrols will visit the infrastructure on the non-kinetic target list, gather cell data for exploitation and turn it over to teams from the intelligence community to build pattern-of-life models for each site. Follow-on patrols will be timed to protect and positively interact with the informal networks identified. As Coalition forces' presence becomes accepted, locals can be encouraged to report incidents using a VGI application, initially on the Internet, later on an application available for download to the types of smart phones prevalent in the city. Monitoring of the application

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