ENABLING MILITARY SECURITY COOPERATION THROUGH IMPROVED COMMERCIAL COMMUNICATIONS INFRASTRUCTURE IN CENTRAL AFRICA

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Communication systems play key roles in every military operation. Improved communication technologies and increased connectivity, down to the tactical level, expand interoperability in combined arms maneuvers. Military communications rely heavily on commercial infrastructures; improved commercial communications infrastructures will enable the success of the states in the Central African region through more than just military partnership. This paper will assess the implications of improved commercial infrastructures in remote locations in Central Africa with a view to determining whether this would improve military communications and operations in Central Africa.

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ABSTRACT

ENABLING MILITARY SECURITY COOPERATION THROUGH IMPROVED COMMERCIAL COMMUNICATIONS INFRASTRUCTURE IN CENTRAL AFRICA, by MAJ George Daniel Morrison, 110 pages.

Communication systems play key roles in every military operation. Improved communication technologies and increased connectivity, down to the tactical level, expand interoperability in combined arms maneuvers. Military communications rely heavily on commercial infrastructures; improved commercial communications infrastructures will enable the success of the states in the Central African region through more than just military partnership. This paper will assess the implications of improved commercial infrastructures in remote locations in Central Africa with a view to determining whether this would improve military communications and operations in Central Africa.

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TABLE OF CONTENTS

Page

ACRONYMS

AFRICOM	Africa Command
AOR	Area of Responsibility
AU	African Union
BPC	Building Partner Capacity
CAR	Central African Republic
CC	Combatant Commander
CCMD	Combatant Command
CGSC	Command and General Staff College
CIDG	Civilian Irregular Defense Group
COM	Chief of Mission
COP	Common Operational Picture
COTS	Commercial Off the Shelf
CT	Country Team; Counter Terrorism
DISA	Defense Information Systems Agency
DISAM	Defense Institute of Security Assistance Management
DOD	Department of Defense
DOS	Department of State
DRC	Democratic Republic of the Congo
ESF	Economic Support Fund
FDI	Foreign Direct Investment
FM	Field Manual
FMF	Foreign Military Financing
FMS	Foreign Military Sales

GWOT	Global War on Terrorism
ICT	Information Communication Technology
IDAD	Internal Defense and Development
IMET	International Military Engagement Training
ITU	International Telecommunications Union
JCET	Joint Combined Exchange Training
LOC	Line of Communication
MFC	Multinational Force Compatibility
MINUSCA	United Nations Multidimensional Integrated Stabilization Mission in the Central African Republic
MMAS	Master's of Military Arts and Science
MONUSCO	United Nations Organization Stabilization Mission in the Democratic Republic of the Congo
OEF-TS	Operation Enduring Freedom–Trans Sahel
PKO	Peacekeeping Operations
PREACT	Partnership for Regional East-African Counter Terrorism
RASCOM	The Regional African Satellite Communication Organization
ROU	Republic of Uganda
SA	Security Assistance; Situational Awareness
SAMS	School of Advanced Military Studies
SATCOM	Satellite Communication
SFA	Security Force Assistance
SOF	Special Operations Forces
SSD	South Sudan
SSR	Security Sector Reform

TCA	Traditional Commander's Activity
TSOC	Theater Special Operations Command
UNAMID	African Union/United Nations Hybrid operation in Darfur
UNISFA	United Nations Interim Security Force for Abyei
UNMISS	United Nations Mission in the Republic of South Sudan
VSO	Village Stability Operations
WBG	World Bank Group

ILLUSTRATIONS

Page

TABLES

Page

CHAPTER 1

INTRODUCTION

Introduction/Background

This paper will assess the implications of improved commercial infrastructures in remote locations in Central Africa with a view to determining whether this would improve U.S. military communications and operations in Central Africa. Communication systems play key roles in every military operation. Improved communication technologies and increased connectivity, down to the tactical level, expand interoperability in combined arms maneuvers. U.S. military communications rely heavily on commercial infrastructures[1]; improved commercial communications infrastructures will enable the success of the states in the Central African region through more than just military partnership.

The rural area of Central Africa, occupying a space roughly the size of California and lying between four distinct sovereign states, is a key strategic region for security cooperation. This rustic area of Africa is home to multitudes of protected wildlife, millions of impoverished civilians, and various militant groups vying for control and exploitation of the vast resources and above-mentioned animals and people. The United States (U.S.) Military is partnered with the militaries of the Central African Republic (CAR), South Sudan (SSD), the Democratic Republic of the Congo (DRC), and the Republic of Uganda in this turbulent area. As part of shaping operations, U.S. Special Operations Forces (SOF) provide the steady state partnership with these host nations focusing on security cooperation. The U.S. Department of State (DOS) is the lead agency for peacetime-shaping operations; U.S. military affairs “occur within the diplomatic

frameworks and operating parameters set by the Department of State."[2] As part of this U.S. interagency partnership, the input that SOF provide to security cooperation are within the strategy set by the DOS and the Department of Defense (DOD).

Communications are an integral part of military operations. Within the U.S. Army's six war fighting functions, there exists one common thread: communication. With the world becoming more and more interdependent on communications infrastructures, it is a natural progression for national strategies to also become more dependent on communication infrastructures. As the U.S. Army moves towards the 2020 Operating Concept, the U.S. military is focusing heavily on partnered action in Africa "aim[ed] to build upon the aspirations of Africans."[3] These partnerships will require responsive and adaptive communication solutions that will depend on strong backbone communications infrastructure. This means that not only will the U.S. Military continue to require improved communication infrastructures, but so will the militaries of our partners.

Over the last 14 years of the Global War on Terrorism (GWOT), communications consistently played a vital role in the development of military operations. During this time, U.S. Military acquisitions models transformed where communication systems now rely primarily on "commercial off the shelf" (COTS) solutions vice government researched and developed solutions. While technology advanced at a rapid pace, dependence on communication infrastructure also increased. The U.S. Defense Information Systems Agency (DISA) increased leasing of commercial satellite support to meet demand. While different sources site a variety of ratios of DISA's balance of military and commercial satellite communication (SATCOM) infrastructures, a

consensus can be drawn that an increase in the reliance of DOD on commercial SATCOM has occurred since the start of the GWOT. According to the Government Accountability Office July 2015 report on Defense Satellite Communications between "2000 to 2011, DOD reported that its reliance on commercial SATCOM rose by over 800 percent."[4] Additionally, as U.S. reliance on communications increased, the tyranny of distance that so many strategists use to describe Africa, more appropriately now describes the challenges of satellite communications.

While satellites provide a highly reliable and effective means to communicate, the challenge in satellite communications is their inefficiency compared to terrestrial communication means due to the great distances at which they orbit the earth. Geosynchronous orbit is approximately 22,300 miles above the Earth's surface;[5] in comparison, the Earth's circumference is 24,901 miles measured at the equator (24,860 measured at the prime meridian).[6] The time it takes for data to pass between a satellite and a ground terminal is much higher than that of the data to pass between two terminals on the ground, simply from the distance traveled. The speed at which data travels through the electromagnetic spectrum (the medium used to transmit data between satellites and ground terminals) is virtually the same as the speed of light, which is the speed that data travels across a fiber-optic cable (the primary medium data travels between ground terminals). The amount of time it takes for a piece of data to travel between two points, is referred to in communication terms as latency, and is normally measured in milliseconds. The higher latency of satellite communications combined with increased costs for higher bandwidth use on satellite connections makes terrestrial communication infrastructure solutions more desirable.

Many problems exist in building terrestrial communication infrastructures in rural areas where there is already limited logistics, power, and communication infrastructure. The World Bank is an excellent resource for information on improving communications infrastructures in the geographic area at which this research study focuses. Numerous studies exist that show how improved infrastructure leads to prosperity and enlightenment. Many historical examples exist of infrastructure advancements in logistics such as road, rail and sea. Additionally, infrastructure improvements in the distribution of power supplies such as electricity and fossil fuels are extensive over the last two centuries. The communications infrastructure is no exception; advancements continue to accelerate as technology advances. The greatest improvements in communications infrastructures evolved over the last twenty years and are continuing to evolve today.

Research Questions

Primary Research Question

What are the key strategic challenges to the U.S. Military conducting security cooperation with the dearth of communication infrastructure in the 800-mile long, rural region of Central Africa (North-Western Uganda to North-Eastern Central African Republic)?

Secondary Research Questions

What are the implications, and potential solutions, from an increase to commercial communication infrastructure?

How will an increase to commercial communication infrastructure affect the U.S. Military's ability to partner with the militaries of Central African states?

Does the situation present any unique opportunities for U.S. Military or Diplomatic involvement?

Thesis

Communication is the common thread throughout all facets of military operations including security cooperation. Communication relies on robust infrastructure provisions; through improvements to communications infrastructures in remote, underdeveloped theaters, security cooperation will also improve.

Assumptions

Africa will continue to remain a focus area for U.S. security cooperation development.

African economic capabilities will continue to grow for the foreseeable future.

Africa's increased demands will require increased infrastructure to support expanding communication dependency.

A combination of State policies and foreign direct investment will accelerate future infrastructure growth.

Past Examples

Various case studies were used throughout the research project. Specific cases focusing on South Korea and China examined growth from strategies that focused on a framework for expansion of infrastructure into rural areas to connect with more modern areas for information sharing. A case study of Zimbabwe examined the potential of utilizing underutilized electromagnetic spectrum to expand communication links.

Limitations

Bias due to experience–The research author served in the U.S. African Theater Special Operations Command for three years and worked directly in the area of concern.

Location of focus area–area of concern is quite remote. Accessibility is limited.

Available data to reference–Data on area of concern is limited, comparisons will be made to similar rural areas.

Scope and Delimitations

This study will assess the use of communications systems in security cooperation in the area of concern and the feasibility of commercial infrastructure improvement. Research will examine the implications of improving infrastructure on communication systems capabilities and the potential impact to security cooperation. Any connections between the areas of examination will be determined.

Significance of Study

The study seeks to improve military effectiveness in security cooperation. Robust backbone infrastructure can provide high-speed broadband access to African and U.S. military partners, whereby significantly improving information sharing. Research will produce results to help understand the existing challenges and opportunities for strategy planning in the Central African region. The results will advance scholarship in military art by identifying key requirements for specific military necessities that can be affected through strategic adjustments. Other future locations may be analyzed utilizing the same process to assess the possibility of advancement in similar areas.

Secondary results of improving the infrastructures also increase the options for citizens to connect to information from the world outside their rural locations. Broadband access expands the capabilities of remote communities. Advances in education, health care, governance, social programs, and economic opportunities will accompany improved connectivity.

Summary and Conclusions

The focus of the research will cover identification of requirements and methods for improving the communications infrastructure in the area of concern, and the intended impact on security cooperation. Findings will recommend courses of action to begin improvement in the areas and the potential improvements to security cooperation operations. Research will study the impacts of infrastructure improvement to rural communities and the role of communications in security cooperation operations.

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[1] U.S. Government Accountability Office, GAO-15-459, *Report to the Committee on Armed Services, U.S. Senate, Defense Satellite Communications, DOD Needs Additional Information to Improve Procurements* (Washington, DC: Government Accountability Office, 2015), 2.

[2] Brian S. Petit, *Going Big by Getting Small: The Application of Operational Art by Special Operations in Phase Zero* (Denver, CO: Outskirts Press, 2013), 56.

[3] Barack Obama, *National Security Strategy* (Washington, DC: The White House, February 2015), 27.

[4] U.S. Government Accountability Office, 9.

[5] U.S. Army Command and General Staff College, *Space Reference Text 2016* (Fort Leavenworth, KS: Government Printing Office, 2016), 75-76.

[6] Tim Sharp, "How Big is Earth?," Space.com, last modified September 17, 2012, accessed December 20, 2015, http://www.space.com/17638-how-big-is-earth.html.

CHAPTER 2

LITERATURE REVIEW

In a review of available literature on this subject, there are multiple case studies of on-going telecommunication efforts throughout the global south, many produced by the World Bank. Literature researched also included multitudes of case studies and reports tying economic prosperity to improvements in communications infrastructures. Of particular use was a working paper from the World Bank that specifically outlines steps to take to increase telecommunication access in rural and low-income areas titled *Options to Increase Access to Telecommunications Services in Rural and Low-Income Areas*.[1] Within this paper, examples of communication infrastructures utilizing both satellite and terrestrial solutions are discussed. Another paper from the World Bank, *Information and Communications for Development 2009: Extending Reach and Increasing Impact*, discusses the advantages of extending telecommunication networks through broadband access; this paper uses a case study of the Republic of Korea (South Korea) to show benefits.[2]

Case studies on three different countries were used to compare the region in question with other areas in the global south that enjoyed improvements in economic prosperity through improvements to their communications infrastructure. The first case study, *Capacity Development Initiatives for Grass Roots Communities: Two Cases*, by Hakikur Rahman discusses the process South Korea underwent to improve the communication infrastructure throughout the South Korean Peninsula.[3] Two case studies from the World Bank titled *Information and Communications in the Chinese Countryside*[4] and *Rural Informatization in China*[5] focus on China's development of

communication infrastructure in rural areas and provide an abundance of examples for comparison. A case study focused on Zimbabwe titled *Wireless Regional Access Networks: A Wise Choice for Internet Connectivity to Rural Areas of Zimbabwe* simulates the use of underutilized electromagnetic spectrum apportioned for television to propagate broadband access to rural areas utilizing cognitive radio technologies.[6]

Three more pieces of literature also provided insight to the development of infrastructure in the developing parts of the world. *ICT Development Strategies* by Thi Luc Hoa Pham provided a comparison between developing and developed countries in the Asian region of the world and outlined policy recommendations for strategies to improve the communication infrastructures in similar regions of the world.[7] Another work titled *Making Telecoms Work* by Geoff Varrall covered the full range of the various technologies involved in delivering communication and information throughout the world.[8] From this work, research focused on Part III, Network Hardware, for specific insights into the main technologies used to deliver information across wire transmission through copper and fiber-optic cables or radio transmission through microwave, cellular, and satellite. Finally, a work by the World Bank titled *Information and Communications for Development 2012: Maximizing Mobile* focused on mobile telephony use in promoting development worldwide.[9] The work provided economic and sector data sets of mobile telephony technology used in 152 different world economies. The data sets include comparisons for each economy with itself and the world regions that it falls in using data from 2005 and 2010. Most importantly, this work provided an overview of trends in mobile telephony, covering a wide range of services from mobile technologies.

Specifically, chapter 7 focused on policies promoting the expansion of wireless broadband networks and services.

Research included access of various maps of communications lines from the International Telecommunications Union,[10] AT&T,[11] and MTN South Sudan.[12] Also included in research were statistical data from the World Bank. In the conclusion of the research project, the postulated way ahead for infrastructure development in the area of concern is compared in relation to a strategy outlined by the World Bank. The World Bank Working Paper Number 51 titled *Connecting Sub-Saharan Africa: A World Bank Group Strategy for Information and Communication Technology Sector Development* outlines a framework that is used as a reference for how communication infrastructure should be grown in the region of concern.[13]

Research literature reviewed included multiple Command and General Staff College (CGSC) Master's of Military Arts and Science (MMAS) thesis papers, School of Advanced Military Studies (SAMS) monographs, and works from other recognized University's such as the University of Westminster and the Canadian Forces College. Many of these papers play a dual role of identifying challenges in the area of concern as well as identifying further sources for research. Works researched of this type focused on security cooperation primarily rather than telecommunication infrastructure improvements.

Literature regarding the importance of shaping operations to security cooperation is also vast. One could look as far back as Virgil's *Aeneid* for an example of the impact of Special Operations on warfare.[14] Still today, Special Operations Forces play the most distinct role in Phase Zero Shaping Operations. One particularly detailed book examining

the role of communications in Phase Zero Operations is *Going Big by Getting Small*: *The Application of Operational Art by Special Operations in Phase Zero* by Colonel Brian Petit. In this book, Colonel Petit uses three vignettes and one case study from Yemen, Indonesia, Thailand and Columbia to discuss the interaction of Special Operations Forces (SOF) with multinational and interagency partnerships in Phase Zero Shaping Operations.[15]

Two MMAS papers and a SAMS monograph were also used to research the U.S. role in security cooperation with a focus on Phase Zero Operations in Central Africa. The SAMS monograph titled "Partners of Choice and Necessity: Special Operations Forces and the National Security Imperatives of Building Partner Capacity" focused on the gaps in partner force advising in Phase Zero Operations.[16] "Village Stability Operations in the Democratic Republic of the Congo: A Special Operations Approach" examined historical examples of Civilian Irregular Defense Group (CIDG) operations in Vietnam and Village Stability Operations (VSO) in Afghanistan. The security situation in the Democratic Republic of the Congo (DRC) was then examined and compared with the CIDG and VSO operations of Vietnam and Afghanistan to identify potential future efforts in the DRC.[17] "The Transition to an Independent Southern Sudan: How should the U.S. Military Posture to Influence and Deter Factors that may cause Regional Instability" evaluated the options available to the U.S. military instrument of power as part of the stabilizing force in South Sudan.[18] Finally, research regarding security cooperation included reviews of the U.S. National Security Strategy (NSS),[19] the 2015 U.S. Africa Command (AFRICOM) Posture Statement,[20] four policy studies by the RAND Corporation,[21] and U.S. Army Field Manual (FM) 3-22, Army Support to Security Cooperation.[22] A study

by the U.S. Congressional Research Service[23] and the "Greenbook,"[24] officially titled *The Management of Security Cooperation* produced by the Defense Institute of Security Assistance Management, provided reviews of current security cooperation programs and potential available programs to be utilized.

Finally, the last area of literature reviewed during research concentrated on a comparative analysis of logistic infrastructure with communications infrastructure. The goal with this portion of the research was to identify the significance of infrastructure in regards to the prosperity of the local economies and the success of security cooperation in those areas. Research in this area included an MMAS case study in Ethiopia on the effects of dramatic improvements of infrastructures in an underdeveloped area titled "The Road to Success in Africa is paved in asphalt: Transportation infrastructure development in emerging economies as a way to achieve National Strategic Policy objectives."[25] Also a book by Mahnaz Z. Ispahani titled *Roads and Rivals* is a case study of the importance of roads and routes to developing nation-states especially along their borderlands. The author used the historical example of the Pakistani province of Baluchistan along with the other regional actors of South, Central and West Asia.[26] These two works provided a source for comparison for communication infrastructure researched in the thesis and balance the overall understanding of the impact of infrastructure on security cooperation.

In conclusion, three main areas made up the focus of the literature reviewed for this research. First, the impact of communication infrastructures in rural areas emphasized much of the literature throughout all aspects of the research. Second, the challenges of security cooperation, the methods in which communication support these missions and the strategies employed to effect these undertakings supplied a large focus

of research. Third, the research examined the development of infrastructures in underdeveloped areas and its impact on the environment in which they exist. The books, theses, and papers provided a solid basis of understanding and good examples of the importance of infrastructure to security cooperation.

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[1] Arturo Kunigami and Juan Navas-Sabater. *World Bank Working Papers: Options to Increase Access to Telecommunications Services in Rural and Low-Income Areas* (Herndon, VA: World Bank Publications, 2009).

[2] World Bank, *Information and Communications for Development 2009: Extending Reach and Increasing Impact* (Herndon, VA: World Bank Publications, 2009).

[3] Hakikur Rahman, "Capacity Development Initiatives for Grass Root Communities: Two Cases" in *Cases on Progressions and Challenges in ICT Utilization for Citizen-Centric Governance*, ed. Hakikur Rahman (Hershey, PA: IGI Global, 2012), 69-104.

[4] Natasha Beschorner, Michael Minges, and Kaoru Kimura, *Information and Communications in the Chinese Countryside: A Study of Three Provinces* (Herndon, VA: World Bank Publications, 2014).

[5] Christine Zhen-Wei Qiang et al., *Rural Informatization in China* (Washington, DC: World Bank, 2009).

[6] Mardeni Roslee and Rasty Last Chimheno, "Wireless Regional Access Networks: A Wise Choice for Internet Connectivity to Rural Areas of Zimbabwe," *Modern Applied Science* 7, no. 7 (2013): 29-41.

[7] Thi Luc Hoa Pham, *ICT Development Strategies* (Hamburg, DEU: Anchor Academic Publishing, 2014).

[8] Geoff Varrall, *Making Telecoms Work: From Technical Innovation to Commercial Success* (Hoboken, NJ: John Wiley and Sons, 2011).

[9] World Bank, *Information and Communications for Development 2012: Maximizing Mobile* (Herndon, VA: World Bank Publications, 2012).

[10] International Telecommunication Union (ITU), "ITU Interactive Transmission Map Public Version," accessed February 9, 2016, https://www.itu.int/itu-d/tnd-map-public/.

[11] AT&T, “International Wireless Voice Coverage,” accessed February 9, 2016, https://www.att.com/maps/wireless-coverage.html?q=Central%252520 African%252520Republic.

[12] MTN, “MTN Coverage,” accessed February 9, 2016, http://mtn-ssd.com/ coverageLanding.html.

[13] Pierre Guislain et al., *Connecting Sub-Saharan Africa: A World Bank Group Strategy for Information and Communication Technology Sector Development* (Washington, DC: World Bank, 2005).

[14] Petit, 32.

[15] Ibid., 10.

[16] Stephan R. Bolton, “Partners of Choice and Necessity: Special Operations Forces and the National Security Imperatives of Building Partner Capacity” (Monograph, School of Advanced Military Studies, Ft. Leavenworth, KS, 2015).

[17] Chad Lewis, “Village Stability Operations in the Democratic Republic of the Congo: A Special Operations Approach” (Master’s thesis, Command and General Staff College, Ft Leavenworth, KS, 2014).

[18] Grant A. Fish, “The Transition to an Independent Southern Sudan: How should the U.S. Military Posture to Influence and Deter Factors that may cause Regional Instability” (Master’s thesis, Command and General Staff College, Ft Leavenworth, KS, 2011).

[19] Obama.

[20] David Rodriguez, “United States Africa Command 2016 Posture Statement,” Africom.mil, last modified March 8, 2016, accessed April 20, 2015, http://www.africom. mil/NewsByCategory/document/28035/2016-posture-statement.

[21] Jefferson P Marquis, Jennifer D. P. Moroney, and Justin Beck, *Developing an Army Strategy for Building Partner Capacity for Stability Operations* (Santa Monica, CA: RAND Corporation, 2010); Jennifer D. P. Moroney, Adam R. Grissom, and Jefferson P. Marquis, *A Capabilities-Based Strategy for Army Security Cooperation* (Santa Monica, CA: RAND Corporation, 2007); Jennifer D. P. Moroney, David E. Thaler and Joe Hogler, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity* (Santa Monica, CA: RAND Corporation, 2013); Stephen Watts, *Identifying and Mitigating Risks in Security Sector Assistance for Africa's Fragile States* (Santa Monica, CA: RAND Corporation, 2015).

[22] Department of the Army, Field Manual 3-22, *Army Support to Security Cooperation* (Washington, DC: Department of the Army, 2013).

[23] Ted Dagne, *Africa: U.S. Foreign Assistance Issues* (Washington, DC: Congressional Research Service, 2010).

[24] Defense Institute of Security Assistance Management (DISAM), *The Management of Security Cooperation* (Wright-Patterson Air Force Base, OH: Government Printing Office, 2016).

[25] Brendan John McEvoy, "The Road to Success in Africa is Paved in Asphalt: Transportation Infrastructure Development in Emerging Economies as a Way to Achieve National Strategic Policy Objectives" (Master's thesis, Command and General Staff College, Ft Leavenworth, KS, 2014).

[26] Mahnaz Z. Ispahani, *Roads and Rivals: The Political Uses of Access in the Borderlands of Asia* (Ithaca, NY: Cornell University Press, 1989).

CHAPTER 3

RESEARCH METHODOLOGY

The research methodology used for this thesis consists of qualitative research through a review of literature and analysis of case studies coupled with a comparison of analyzed data from the World Bank. Subjects researched include a focus in U.S. Military Phase Zero Shaping Operations, with sources specializing in strategy for U.S. Security Cooperation, and also has focused on sources specializing in the impact of communications in rural areas. A theoretical view of how communication infrastructure of the information age, like the road and rail infrastructures of the industrial age can provide a path to success has been provided. Case studies were used to compare the situation in Central Africa to other similar circumstances due to a lack of previous research on this specific subject in this specific location. Specifically, case studies of South Korea, China, and Zimbabwe were used for research for the similarity of communication infrastructure shortcomings and the methods they employed for improvement.

The case study on South Korea was selected due to a similar lack of infrastructure in South Korea like Central Africa prior to the implementation of a strategic communications infrastructure plan. This case study depicted a strategy to advance communications infrastructure through government coordination with a free market. The South Korean public-private partnership demonstrated the best results achieved by a strategy. The case studies on China were informative to our study of Central Africa as China, too, had a similar lack of communications infrastructure prior to a strategic plan implementation. These case studies illustrated a strategy solely relying on government

implementation and control. The Chinese examples demonstrated limited effects resulting from disjointed coordination. The case study of Zimbabwe was selected to illustrate a country that had a functioning urban communications infrastructure that functioned well, but lacked any rural communications infrastructure. The Zimbabwe case study described a potential strategy to increase communications infrastructure in rural areas under similar circumstances as some of the countries like Uganda or South Sudan.

Research in this paper covers the effectiveness of these case studies and those of other infrastructure developments in rural areas. "Case studies allow a researcher to achieve high levels of conceptual validity or to identify and measure the indicators that best represent the theoretical concepts the researcher intends to measure."[1] Due to the lack of academic research in the area of concern, and the inaccessibility of the area, case studies are a useful method with which to analyze the problem in Central Africa. Case studies allow for research to examine a problem from multiple viewpoints to identify which approaches or theories impact a problem in different ways. The different perspectives offered by the case studies allows for examination of the best practices and concepts with respect to development of communications infrastructure.

The significance of communications in U.S. Security Cooperation partnership was investigated, specifically the roles communications play in Phase Zero Shaping operations. The current conditions of the area in question, as well as the potential for the improvements identified, was also addressed in the research. The research compares the findings from the security cooperation literature with the current U.S. National Security Strategy and the Theater guidance from the AFRICOM Posture statement and proposes steps to take in future operations. These studies of security cooperation efforts

demonstrate the full range of methods in which security cooperation occurs. Through this analysis, conclusions were drawn, focused on requirements for improved communication infrastructure to support the increasing demand of security cooperation activities and a lack of emphasis or any focus on infrastructure strategy, which support the argument for inclusion into future strategy development.

The geographic area on which the research focuses stretches from Northern Uganda near Gulu, the Murchison Falls National Park and Lake Albert, and extends northwest to the disputed Kafia Kingi region of South Sudan and Sudan and the Bamingui-Bangoran and Vakaga prefectures of the Central African Republic. This region covers an area approximately 300 miles wide by 800 miles long and roughly the same size as California, nearly 200,000 square miles. Three separate UN Missions operate in this region: MONUSCO, MINUSCA, and UNMISS, with two more UN missions operating within another 300 miles: UNISFA and UNAMID. The area contains the pole of inaccessibility for Africa, which is defined by the Royal Scottish Geographical Society as "the location [of a landmass] that is furthest from a particular coastline."[2] The inaccessibility of this previously defined area causes great difficulty.

With regard to Phase Zero Shaping Operations, a review of literature specifically focusing on these types of operations was examined and compared to security cooperation policy and strategy. To gain an adequate assessment of the conditions of current communication infrastructure in the region, literature and reports from intergovernmental, non-governmental, and multinational corporations were reviewed. With regard to comparing the strategy for security cooperation and improvements to the region, a review of current strategy documents was made. Through comprehensive

research of these three main areas, analysis was conducted to support recommendations on the way ahead for enabling security cooperation in the region through improved commercial infrastructures.

The research paper combines several comparative methods to examine the research questions. By examining case studies of countries with similar communications infrastructure challenges, the review of security cooperation literature and the analysis of World Bank data, provided the author the ability to analyze the communication infrastructure situation in Central Africa. This analysis informed the concepts identified in the research questions.

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[1] Alexander L. George and Andrew Bennett, *Case Studies and Theory Development in the Social Sciences* (Cambridge, MA: MIT Press, 2005), 19.

[2] Daniel Garcia-Castellanos and Umberto Lombardo, "Poles of Inaccessibility: A Calculation Algorithm for the Remotest Places on Earth," *Scottish Geographical Journal* 123, no. 3 (2007): 227-233.

CHAPTER 4

ANALYSIS

The purpose of this research paper is to assess the implications of improved commercial infrastructures in remote locations in Central Africa with a view to determining whether this would improve military communications and operations in Central Africa. To accomplish this purpose, the paper focuses on addressing four research questions: What are the key strategic challenges to the U.S. Military conducting security cooperation with the dearth of communication infrastructure in the 800 mile long, rural region of Central Africa (North-Western Uganda to North-Eastern Central African Republic)? What are the implications, and potential solutions, from an increase to commercial communication infrastructure? How will an increase to commercial communication infrastructure affect the U.S. Military's ability to partner with the militaries of Central African states? Does the situation present any unique opportunities for U.S. Military or Diplomatic involvement?

These questions are addressed through reviewing security cooperation doctrine and examining security cooperation strategies. The key points from this part of the study are then examined in context with the joint military shaping operations known as Phase Zero. Next, case studies of strategies used for communication infrastructure support for Information Communication Technology (ICT) development in South Korea, China, and Zimbabwe are examined. Then, the countries examined in the case studies and compared with the four Central African countries in the area of concern of this study using World Bank data for Internet usage, mobile cell subscription, and fixed broadband subscription.

Lastly, several strategies for continued development and improvements in the ICT field are explored.

The first step in the research analysis is to understand what the challenges are that must be overcome. Specifically, the primary research question asks "What are the key strategic challenges to the U.S. Military conducting security cooperation with the dearth of communication infrastructure in the 800 mile long, rural region of Central Africa (North-Western Uganda to North-Eastern Central African Republic)?" The root of this question is broadly focused on "the challenges"; to identify these challenges we must analyze the problem from three specific perspectives: Security Cooperation, Communication Infrastructure, and State Strategy.

To help answer this question along the first perspective of interest, security cooperation, a series of studies by the Rand Corporation as well as current U.S. Army Doctrine for security cooperation were examined. Additionally, master's graduate degree theses focusing on the region in question were used to ascertain context for the environment along with the USAFRICOM 2016 Posture Statement. A study from the Congressional Research Service and the Greenbook from the Defense Institute of Security Assistance Management were used to identify programs available to support emerging requirements. The National Security Strategy (NSS) was utilized to pull together the framework examined in security cooperation by the DOD with the supporting efforts of the DOS. Each one of these organizations plays a critical role in the security cooperation program in all of the countries in the area of concern. DOD and DOS work closely in each country although their operations are often separated by

hundreds of miles. Likewise, all of the countries in this region are linked to one another through geography, economy, and history.

The four countries in the area of concern do not always agree on the subjects of politics or economics. However, their connection with each other and cooperation with one another is essential for prosperity in each of their individual countries. The U.S. DOD and DOS partner with each of the four African Nations in this region to promote peace and stability. Strategic guidance for security cooperation for DOD programs originates from the senior military commander of the Africa Command (AFRICOM) Theater, General David Rodriguez. Strategic guidance for security cooperation for the DOS originates from the Chief of Mission (COM) for each individual U.S. Embassy, which is typically the Ambassador for each country. Strategies of each department must be nested within the NSS provided by the President of the United States (POTUS).

DOD partnership programs include enduring "Advise and Assist" missions by Special Operations Forces Soldiers and the military of each of the partner countries. These highly trained Soldiers live side by side with their African partners and work to train and develop their militaries through daily engagement. These Soldiers are the subject matter experts when it comes to security cooperation with foreign partners. They work with African partners on a daily basis, they know the challenges our partners face and they work with them to make the best out of their situations. While there are a variety of improvements that each of the African partner militaries may benefit from such as organizational changes, equipment upgrades, or even civil infrastructure developments, this study is focused on the communication habits, abilities and technologies of our African partners.

The role of the DOS in security cooperation programs is not at the level of execution, the DOD is responsible for actually conducting the operations. The DOS is key to the overall security cooperation strategy. The DOS typically partners with the Ministry of the Interior or another equally responsible governmental department of each partner nation. The DOS is responsible for ensuring that security cooperation programs receive appropriate attention and adequate funding from the governments of each partner country. At times, the DOS also plays a key role in recommending approvals to congress for funding of U.S. sponsored security cooperation programs such as the Counter Terrorism Partnership Fund (CTPF). DOS and DOD personnel in each African partner nation must coordinate regularly to synchronize their efforts and support each other's needs as best as possible. Security Cooperation efforts are ongoing routine activities that fall along the conflict continuum between peace and war as part of the range of military operations (ROMO). These efforts generally fall outside of normal contingency operations and major operations and campaigns. Below, figure 1 from JP 3-0 displays the U.S. DOD ROMO, note that Security Cooperation efforts occupy a position in the bottom of the figure closer to the peace side of the conflict continuum. This position in the ROMO is an important aspect of security cooperation efforts that influence the strategies examined in this analysis and will be recalled during the final recommendations of this paper.

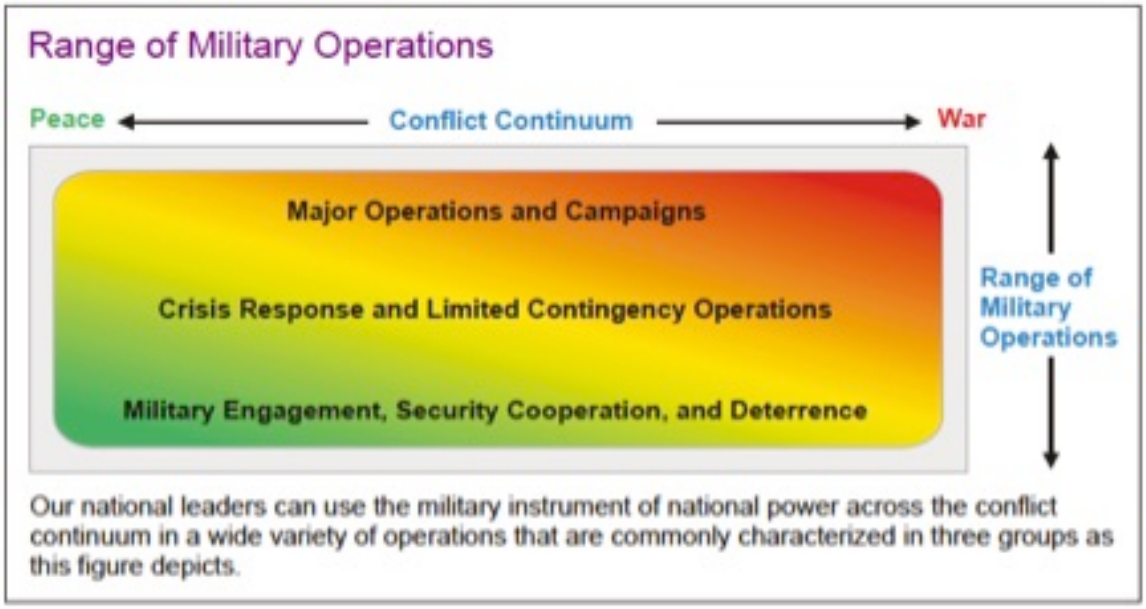

Figure 1. Range of Military Operations

Source: Department of Defense, Joint Publication 3-0, *Joint Operations* (Washington, DC: Department of Defense, 2011), 29.

Security Cooperation-Studies and Policies

Figure 2 depicts the Notional Operational Plan Phases identified in JP 5-0. The DOD uses this figure to portray the six distinct planning phases that occur within and around conflict. Within each of these phases, military efforts of activities focused on all six areas occur at varying degrees. These efforts are identified as shaping, deterring, seizing the initiative, dominating, stabilizing, and enabling civil control. During the analysis of literature that focused on security cooperation most of the operations identified commonly fell within Phase Zero - shaping operations. Phase Zero shaping operations occur simultaneously with all other phases as well as continuously before, during and after a conflict.

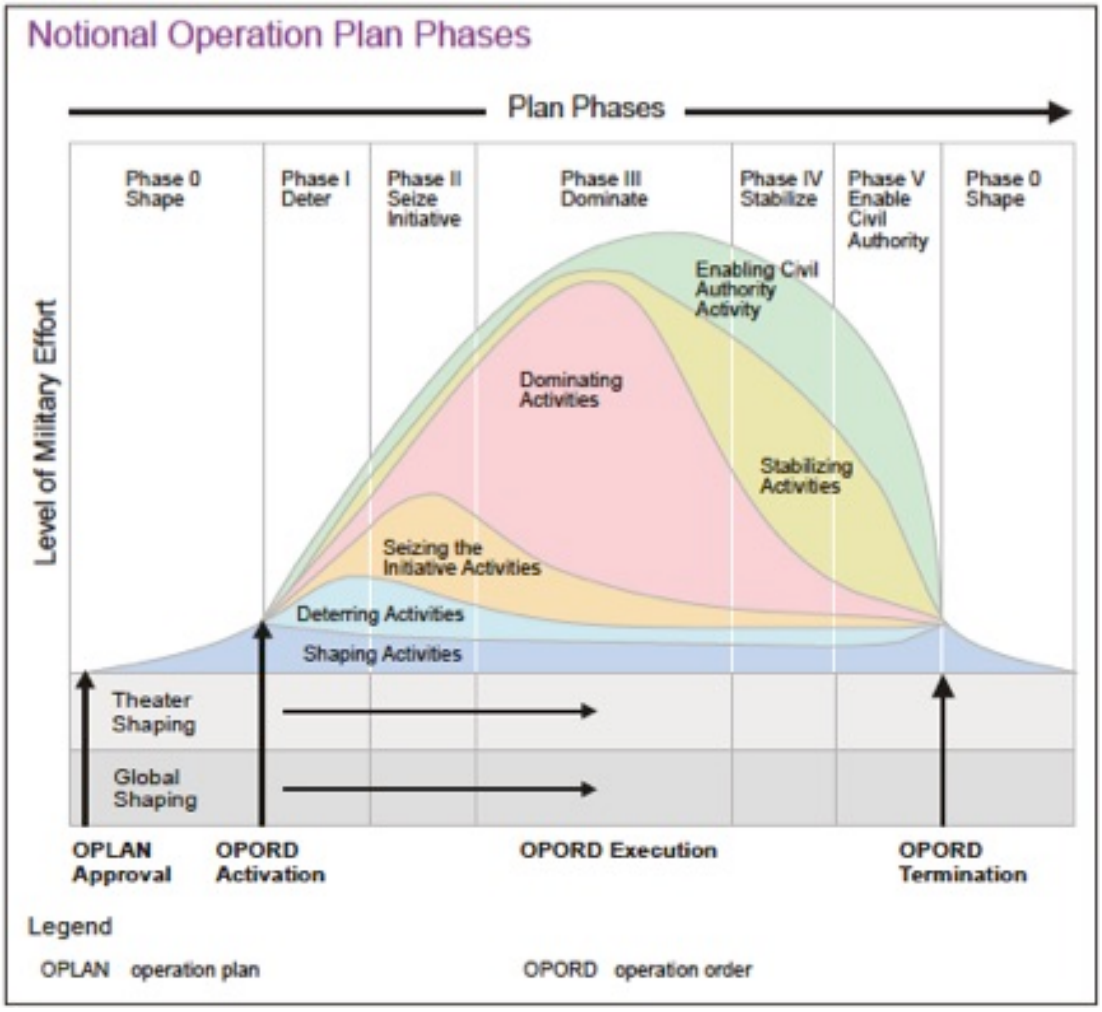

Figure 2. Notional Operation Plan Phases

Source: Department of Defense, Joint Publication 5-0, *Joint Operation Planning* (Washington, DC: Department of Defense, 2011), 117.

The studies from the Rand Corporation and the Congressional Research Service provide reviews of current security cooperation efforts across the DOD, frameworks for success in building partner capacity in security cooperation efforts, and the budgets programed to support efforts in Africa. In Rand's *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity*, the concepts of

efficiency and effectiveness are used to focus improvements identified for security cooperation. In analyzing the instruments Africa Command (AFRICOM) uses to build partner capacity in counterterrorism efforts, Rand identifies several Title 10 mechanisms that are evaluated in figure 3 and defined in table 1.

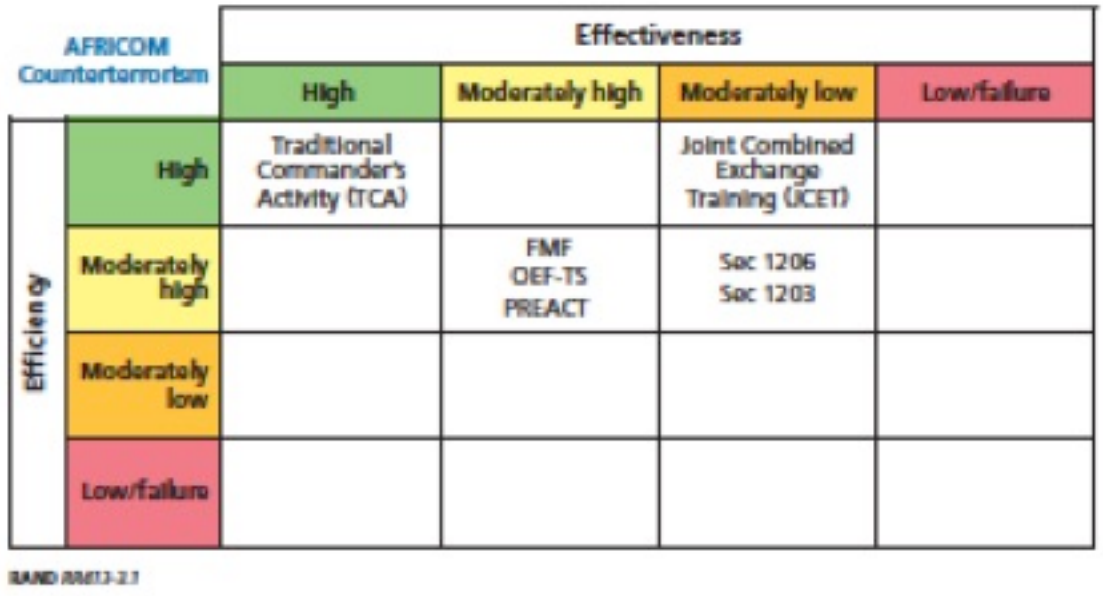

Figure 3. Security Cooperation Mechanism Effectiveness and Efficiency for AFRICOM Building Partner Capacity in Counterterrorism

Source: Jennifer D. P. Moroney, David E. Thaler and Joe Hogler, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity* (Santa Monica, CA: RAND Corporation, 2013), 38.

Table 1. Mechanisms used for Building Partner Capacity

Mechanism	Definition / Findings
Traditional Commander's Activity (TCA)	Combatant Command controlled funding source, used to fund mil-mil events, flexible utility in engaging partners
Joint Combined Exchange Training (JCET)	Training conducted by U.S. Special Operations Forces synchronized with AFRICOM
Foreign Military Financing (FMF)	Slow, not prioritized against DOD objectives, inflexible and difficult to control once dispersed. AFRICOM able to specify partner uses of funds, but not burn rate
Operation Enduring Freedom–Trans Sahel (OEF-TS)	AFRICOM-dedicated counter terrorism mechanism in West Africa Trans-Sahel region, provides flexibility in how and when to apply resources. Comes from multiple accounts and not directly funded by Congress.
Partnership for Regional East-African Counter Terrorism (PREACT)	AFRICOM-dedicated counter terrorism mechanism in East Africa, provides flexibility in how and when to apply resources.
Section 1206	Congressional authority allows DOD to shift funds from O&M accounts to build capacity of a foreign country's national military forces. Global Train and Equip program requires coordination between DOS and DOD,
Section 1203	Expansion of temporary authority to use acquisition and cross-servicing agreements to lend certain military equipment to certain foreign forces for personnel protection and survivability

Source: Author created, utilizing Jennifer D. P. Moroney, David E. Thaler and Joe Hogler, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity* (Santa Monica, CA: RAND Corporation, 2013).

While the focus of this particular Rand study is on the effectiveness and efficiency of the various mechanisms used to build partner capacity, an important conclusion can be drawn from the analysis: security cooperation efforts are less successful when restrained by time. As identified in figure 3, the most efficient but also least effective security cooperation mechanism used by AFRICOM for building partner capacity, is the use of Joint Combined Exchange Training (JCET) Teams. While JCETs

are highly successful, they are "designed for U.S. readiness training, with benefits to partner's considered ancillary"[1] and are therefore not considered part of the long-term solution for sustained security cooperation efforts with partner nations. The Combatant Command (CCMD) with the supporting Theater Special Operations Command (TSOC) coordinates JCETs; therefore if planned appropriately they have the potential to achieve greater effectiveness.

A recurring theme throughout the Rand study is a focus on long-term effects in building partner capacity. Juxtaposed to this theme, the various mechanisms discussed are repeatedly highlighted for their inflexibility and short time span to execute due to the restrictions of the programs. A timeframe of two years is the regular default timeline for many of these mechanisms. The examples of security cooperation programs of Village Stability Operations (VSO) and the Civilian Irregular Defense Group (CIDG) utilized in Afghanistan and Vietnam took place over timeframes much longer than two years. The conclusion from these points is that either the programs must change to allow for improved effectiveness or the manners in which the programs are used must be addressed differently.

Communications infrastructure makes an excellent candidate for incorporation into a long-term strategy for building partner capacity in security cooperation. Much like VSO and CIDG missions, communications infrastructure improvement projects will take much longer than two years to accomplish. Information Communication Technology (ICT) requires a continual obligation of maintenance, but provides an enduring asset for use by host nation security forces. Discussed in detail in the next section of this chapter, ICT growth improves many assets of society, including security. With improved

communication infrastructure, information sharing within the partner nation is improved. These improvements to the nation with whom the U.S. security forces are partnered are experienced in security cooperation efforts. Greater coverage of cellular communications, greater distribution of information, expanded abilities of host nation security forces all reflect in the ability of U.S. security forces to partner with other nations. Building partner capacity through improving the communication capabilities of the partner nation will meet both long-term goals of security cooperation while simultaneously improving on immediate goals. These efforts can be planned through the CCMDs and their associated TSOCs in line with JCETs, so as to bolster the effectiveness of the training.

The next Rand Study reviewed, *A Capabilities-Based Strategy for Army Security Cooperation*, focuses on how the U.S. Military in the near future will approach multinational force compatibility (MFC) with non-allied armies.[2] This study reviews a much different approach at security cooperation than the previous study that focused on building partner capacity. The primary difference is in designing a strategy to enhance compatibility with non-core partner armies, often referred to in military and political rhetoric as 'coalitions of the willing.' Innovative methods used for this type of security cooperation uses a new framework that focuses on the niche capabilities of the non-core partner armies. Named the 'Niche Capability Planning Framework', the process uses a four phase planning cycle. First, the niche capabilities and shortfalls of each partner are characterized and prioritized. Next, an assessment of potential non-core militaries is made through analyzing a range of considerations. Then, an integrated program of security cooperation efforts is developed, designed to nurture proficiencies in non-core

partnered armies. Finally, the developed program is executed and continuously assessed for lessons learned and improvements for the development of future programs.

The Rand Study makes six recommendations for capability-based strategies for security cooperation. Two of these recommendations provide considerations that support the thesis of this research paper. The first is to revise the Army's definition of multinational force compatibility not as a characterization for how the Army conducts security cooperation, but rather as a goal for security cooperation activities. As part of U.S. strategy regarding security cooperation, if we plan to build toward the capacity and capability of our partners in security cooperation, whether through an alliance or a coalition of the willing, the way in which we can affect our partners broadens. At this juncture, policy can influence U.S. Foreign Aid and Assistance Programs to partner countries, specifically within Africa.[3] Both Security Assistance and Economic Support Funds can be used to bolster the communications infrastructure along this line of strategy, and improve the multinational force compatibility of partner forces to communicate during security cooperation activities. The second recommendation from this study that supports this research paper is the recognition of non-core partners as opportunities. As outlined in the study, the non-core partners will either "be problems or assets for future warfighting commanders."[4] As a way to shape the future security cooperation environment, strategy should focus on helping to develop partner nation capabilities now, specifically through developing communication infrastructure. In times of future domestic stress, the U.S. military may be called upon to help our non-core partners. With a large reliance on communication support at every warfighting function within the

military, robust infrastructure in potential future operational areas will help the U.S. military to support our partners through our own niche capabilities.

Army Field Manual (FM) 3-22 identifies three purposes for conducting security cooperation activities.[5] First, building defense relationships that promote specific U.S. security interests. These relationships are fostered over time and through experiences, the majority of this type of security cooperation occurs during Phase Zero shaping operations. The second purpose for conducting security cooperation activities is to develop allied and friendly military capabilities for self-defense and multinational operations. The methods through which these purposes are developed vary from foreign military sales to foreign military training, and the mechanisms used to fund these methods are just as varied. Finally, the third purpose for security cooperation is to provide U.S. forces with peacetime and contingency access to a host nation. This access to host nations is paramount to both security cooperation and conventional operations, as without access to the area requiring influence or support, the mission cannot be completed.

"[T]he Department of State (DOS) leads and provides oversight for security cooperation efforts through its bureaus, offices, and overseas missions, [but] security cooperation activities are conducted and coordinated throughout the geographic combatant command area of responsibility (AOR) by, with, or through the theater army."[6] FM 3-22 places all security cooperation efforts in host nation countries into one of five categories. Funded and authorized by the DOS, the first category, called Security Assistance, is a method whereby the U.S. supplies foreign governments with "defense articles, military training, and other defense-related services by grant, loan, credit, or cash

sales,"[7] often through methods administered by the DOD. The next category, Security Force Assistance (SFA), consists of activities categorized as events that develop the capacity and capability of foreign security forces and their supporting institutions. This category broadly includes JCETs and VSOs, and a myriad of other shaping activities that routinely occur during Phase Zero. The third category, Internal Defense and Development (IDAD), refers to "measures taken by a nation to promote its growth and to protect itself from subversion, lawlessness, insurgency, terrorism, and other threats to its security."[8] Similar to both IDAD and SFA, the fourth category, Foreign Internal Defense (FID), is the "participation by civilian and military agencies of a government in any of the action programs taken by another government or other designated organization to free and protect its society from subversion, lawlessness, insurgency, terrorism, and other threats to its security."[9] Much like SFA, through FID, the U.S. enables partners through developing their capacity and capabilities but focused on internal defense where SFA can focus on both internal and external threats. The final category identified by FM 3-22, Security Sector Reform focuses on the methods through which a host nation can provide safety, security and justice to citizens.

While all of the security cooperation activities can occur during any one of the six phases of the Notional Operational Plan Phases depicted in figure 2, they primarily occur during Phase Zero. As observed by Colonel Brian Petit, "security cooperation is an umbrella term to describe nearly all military activities undertaken in Phase Zero."[10] The military activities identified as solutions from the Rand studies on security cooperation, the framework identified in the Army's Field Manual 3-22, and the 2016 U.S. AFRICOM

Posture Statement all provide ample solutions for how security cooperation activities are used to enable partners through shaping the security environment.

Communication Infrastructure Development Case Studies

In order to ensure a wide range of potential processes to bolster infrastructure in the area of concern were reviewed for the research paper, case studies of communication infrastructure development from three different areas were selected. The first area reviewed covered the Republic of Korea's infrastructure development: specifically the steps taken and the results of those steps; this case study provides the best-case scenario for the research. The second area reviewed focused on rural provinces in China; while not as efficacious as Korea's development, the rural experience in China lends more to the area of concern for the research. Finally, the last area researched focused on the African Nation of Zimbabwe. More specifically the case study was an example of utilizing new technology, specifically cognitive radio, to perform a simulation for wide implementation in Zimbabwe and the associated benefits and losses associated with the technology. While cognitive radio is a real and available technology utilized in many applications, it has not yet been implemented on the scale proposed in the conclusion of this particular case study. Most importantly, this case study points out key considerations when considering solutions for broadband access in underdeveloped regions of the world.

Along with the three case studies examined, historical data was collected from the World Bank databases along three categories to use as measures of effectiveness. Relative data was then plotted on a graph to compare progress among the countries of study. The average measurement for the world was also included to use as a common comparison. Additionally, secondary graphs of each set of data were created that

excluded the Asian countries and the world data in order to illustrate the differences among the progress of the countries within Africa. These secondary graphs better convey the difference among the African countries because the magnitude of the difference between the African countries and the Asian countries case studies were so great that the resulting graph does not accurately depict the level of separation among the African countries. Data gathered included measurements of Internet users per 100 people, mobile cellular subscriptions per 100 people, and fixed broadband subscriptions per 100 people. The graphs follow here for comparison; all numerical data sets supporting these graphs are listed in Appendix A.

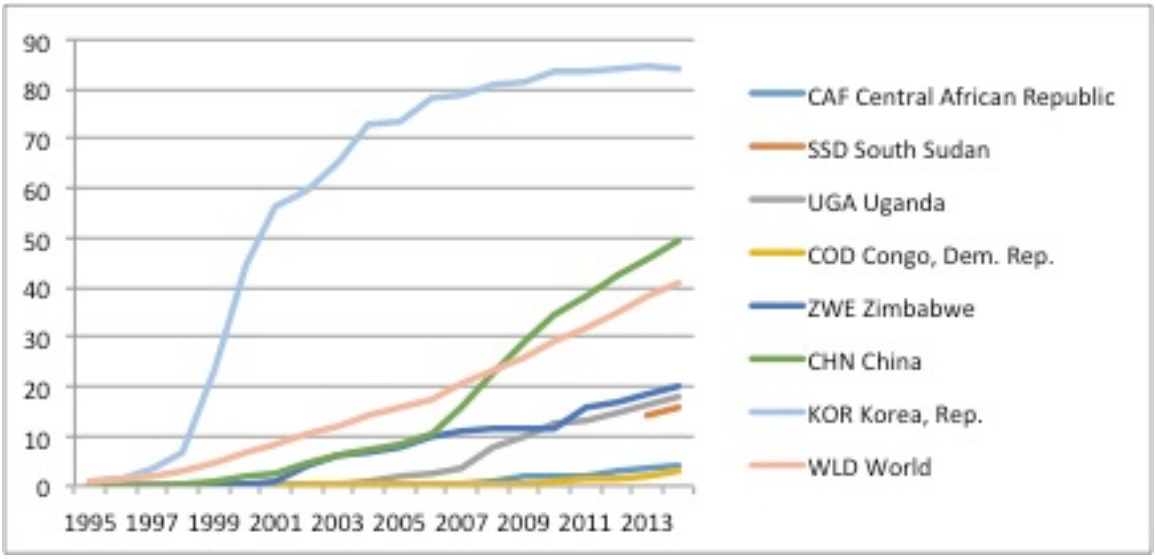

Figure 4. Internet Users per 100 people for 7 countries and the world

Source: Created by the author, utilizing The World Bank. "Data," accessed March 20, 2016, http://data.worldbank.org/ indicator/IT.CEL.SETS.P2.

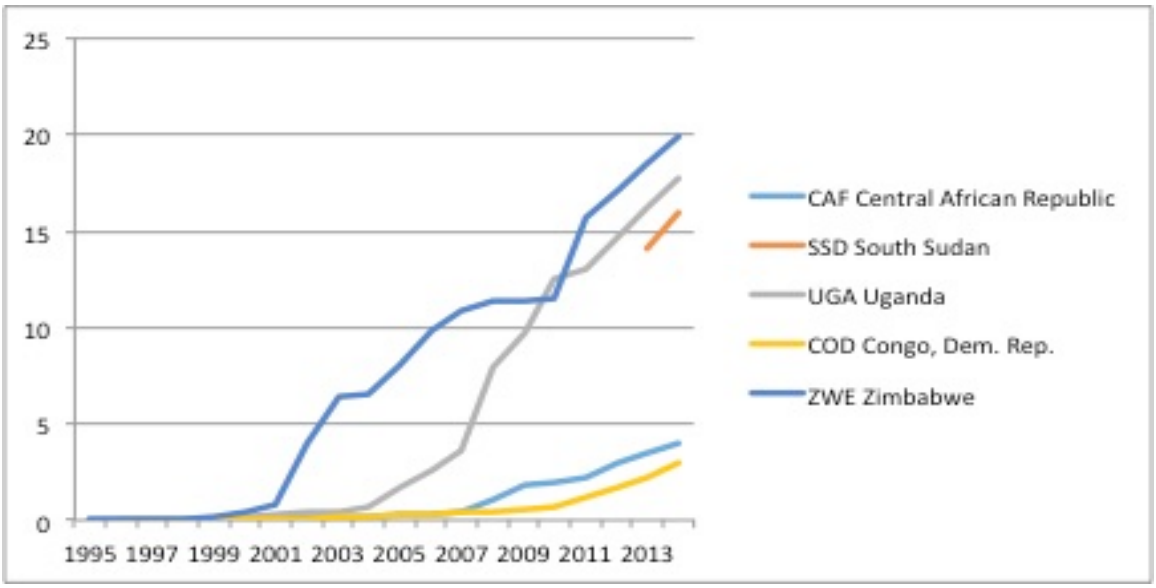

Figure 5. Internet Users per 100 people for 5 African countries

Source: Created by the author, utilizing The World Bank, "Data," accessed March 20, 2016, http://data.worldbank.org/ indicator/IT.CEL.SETS.P2.

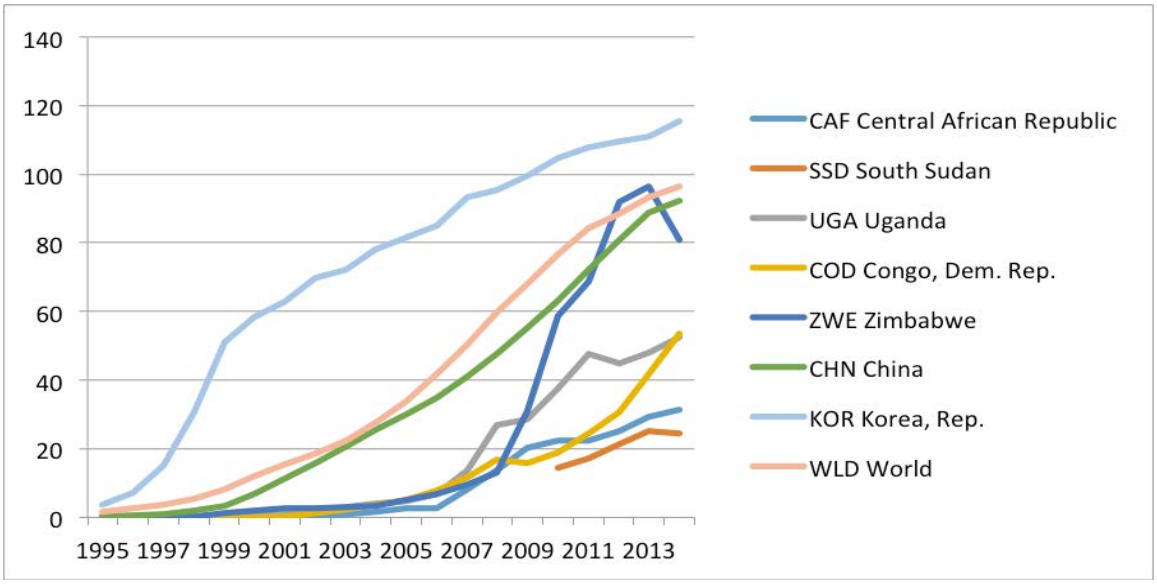

Figure 6. Mobile Cellular subscriptions per 100 people for 7 countries and the world

Source: Created by the author, utilizing The World Bank, "Data," accessed March 20, 2016, http://data.worldbank.org/ indicator/IT.CEL.SETS.P2.

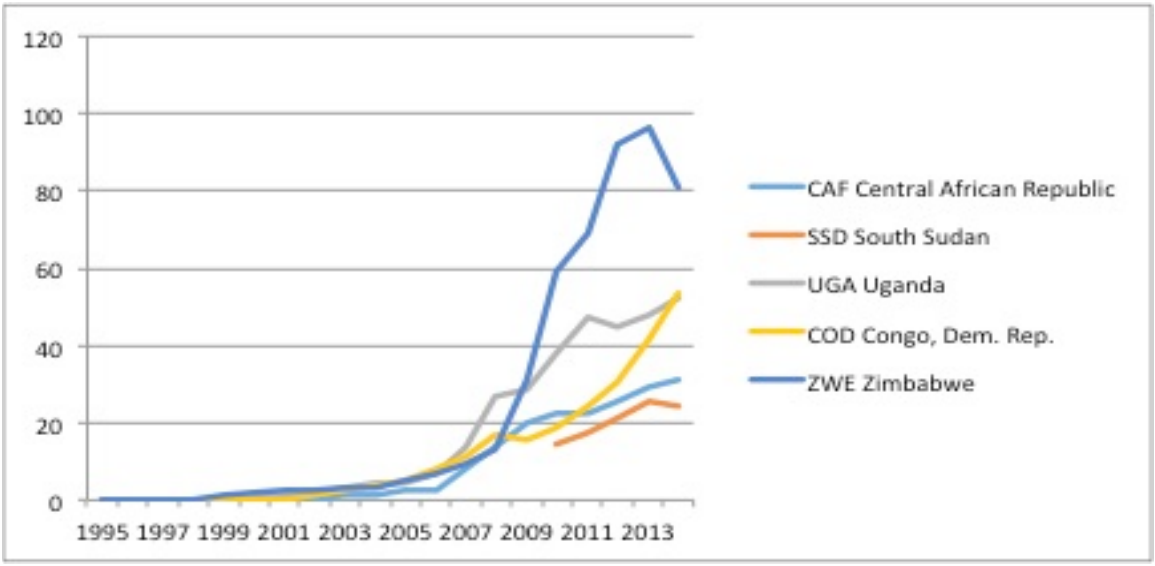

Figure 7. Mobile Cellular subscriptions per 100 people for 5 countries

Source: Created by the author, utilizing The World Bank, "Data," accessed March 20, 2016, http://data.worldbank.org/ indicator/IT.CEL.SETS.P2.

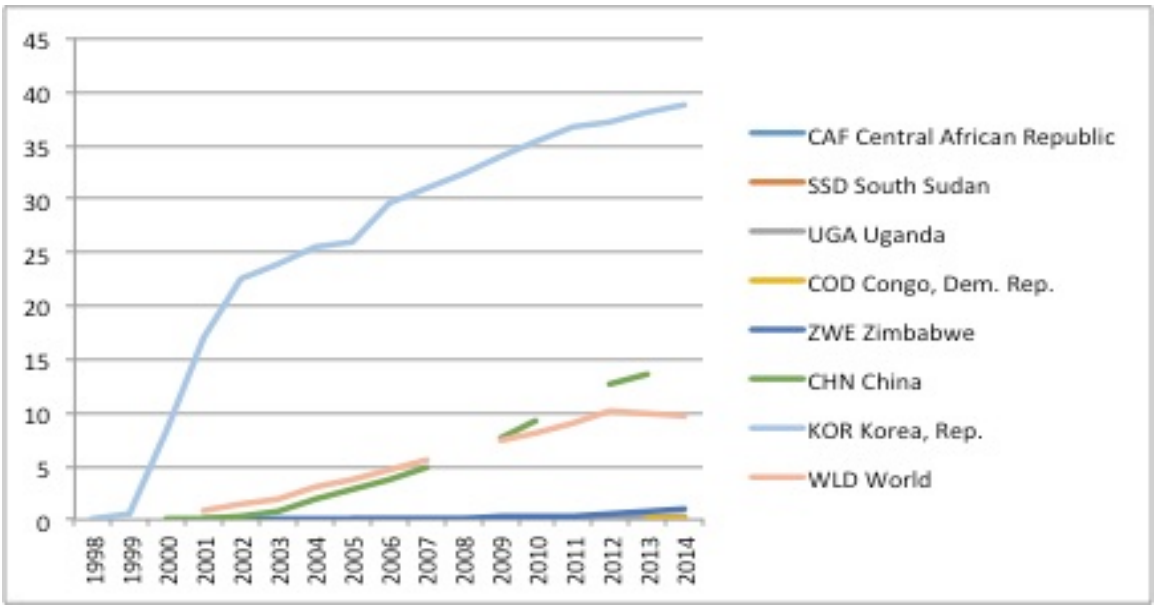

Figure 8. Fixed Broadband subscriptions per 100 people for 7 countries and the world

Source: Created by the author, utilizing The World Bank, "Data," accessed March 20, 2016, http://data.worldbank.org/ indicator/IT.CEL.SETS.P2.

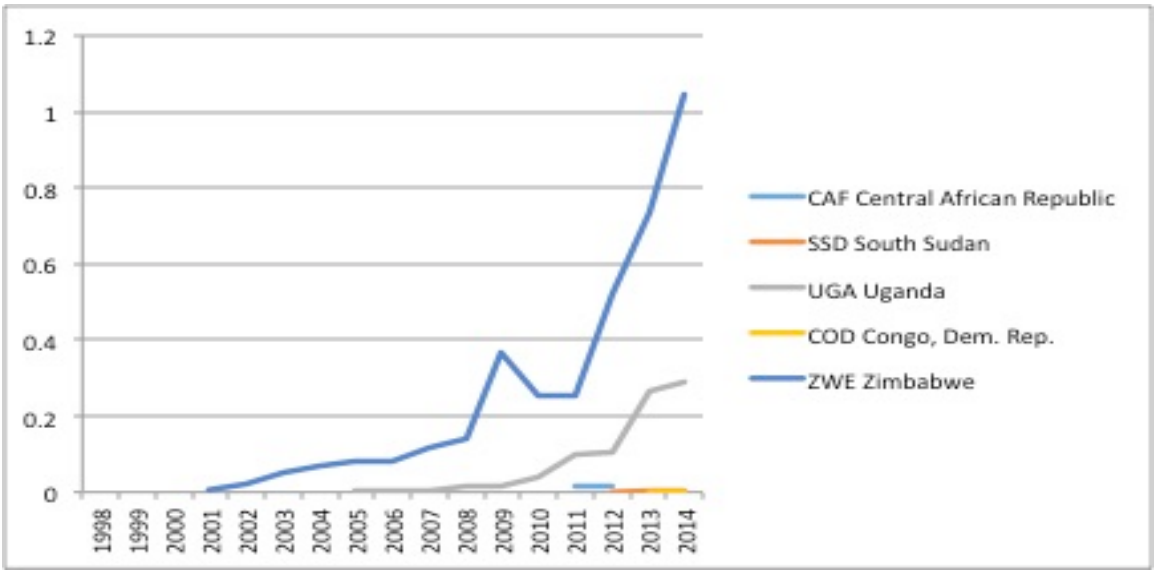

Figure 9. Fixed Broadband subscriptions per 100 people for 5 countries

Source: Created by the author, utilizing The World Bank, "Data," accessed March 20, 2016, http://data.worldbank.org/ indicator/IT.CEL.SETS.P2.

South Korea Case Study of Communication Infrastructure Development

When comparing the first case study of South Korea with the charts from the World Bank data, the rise in levels of Internet penetration, mobile telephony subscription, and broadband subscription all coincide with the plans South Korea designed and executed. South Korea's ascent up the ICT success ladder began in August of 1995, when the Korean government enacted the "Framework Act on Informatization Promotion."[11] This framework act led to the creation of the first of three Master Plans for Informatization Promotion in June of 1996. This was the action plan that "established a national organization for planning and implementing the goals outlined in the Master Plan"[12] and established a definite deadline and specified tasks for the realization of an advanced information society by 2010.

The next major adjustment came in March of 1999 with the establishment of Cyber Korea 21. This second Master Plan came about as part of the response to the Asian economic crisis of the day with the goal of developing the information infrastructure in Korea and transforming into a knowledge-based economy. The three main aims of this second Master Plan were to increase the capacity of all areas of society to utilize information technology, strengthen the ability to rapidly respond to changes in the information environment, and stimulate the development of the country and economy through informatization efforts.

The third and final Master Plan, dubbed the e-Korea Vision 2006, was developed in April of 2002, building off of the aforementioned standards of the Cyber Korea 21 blueprint. Below in figure 10, the framework for e-Korea Vision 2006, gives an overview of the methodology followed in the final plan. The e-Korea Vision 2006 followed a three-

prong approach: (1) Establish objectives and policy plans, (2) Advance the Information Infrastructure and (3) Strengthen international cooperation for the Global Information Society.[13] These three overarching guidelines are then broken down into subtopics for executing each line of effort. Once established, the South-Korean government then implemented a yearly operational plan to achieve the objectives identified along the three-prong approach of the Master Plan. As required the plan is revised and adjusted in response to technological advances or fluctuations to the environment.[14]

While all three prongs of the e-Korea Vision 2006 strategy were paramount to the success of South Korean ICT advancement, of particular interest to this research study, is the second prong of the three-prong approach. This portion of planning focused specifically on advancing the communication infrastructure. This portion of the strategy was broken down into four primary areas: (1) Transforming the legal system, (2) strengthening security, (3) advancing towards the next generation of telecommunications infrastructure and (4) strategic promotion of the IT industry. These four key areas were then each broken down further into specific tasks to be accomplished, each with specific standards to establish. Further analysis of these efforts reveal the step-by-step process South Korea followed.

The South Korean strategy depicted how joint coordination between the public and private domains of a state empower the government, the private industry and the people, ultimately resulting in greater prosperity. The issue in Central Africa involves governments of multiple states, all at different levels of infrastructure development, all with different motivations for those governments, and all at different levels for implementation of their strategies. This case study demonstrated the ability of

coordination of multiple entities towards a common goal to achieve success. For the Central African problem, the coordinating body will need to come from an Intergovernmental Organization (IGO) of which all involved state governments are willing to work through to advance toward a common goal. While the successes observed in the South Korean case study could be replicated by each individual state in the Central African region, the results will likely be uneven as they depend on each country's particular endowments, resources and desire to create and follow the strategy. Conversely, the success observed in the South Korean case study could be replicated by the entire Central African region through the leadership of a central IGO. In this case study, the South Korean strategy advanced more than just the communications international ties were fostered as well. Comparative results could be expected in the Central African Region.

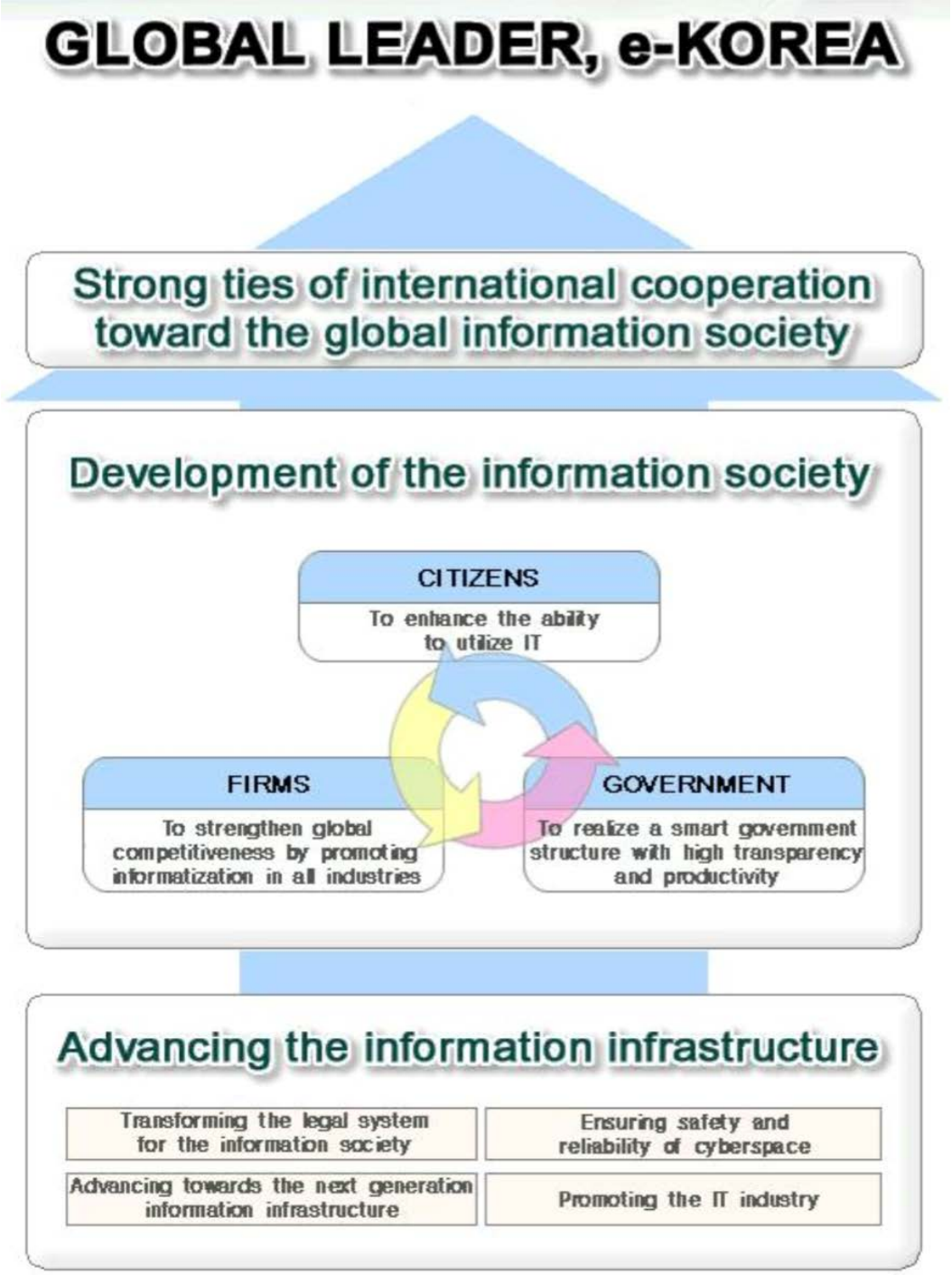

Figure 10. Framework for e-Korea Vision 2006

Source: Hakikur Rahman, "Capacity Development Initiatives for Grass Root Communities: Two Cases," in *Cases on Progressions and Challenges in ICT Utilization for Citizen-Centric Governance*, ed. Hakikur Rahman (Hershey, PA: IGI Global, 2012), 77.

China Case Study of Communication Infrastructure Development

The China Case Studies focused on the effects of expansion of Communication Infrastructure in rural areas of China. Two case studies were used, both with differing but complementary breadths of information. The first case study, *Information and Communications in the Chinese Countryside: A Study of Three Provinces*,[15] was most useful for its findings on the resulting prosperity and improvements realized from the various infrastructure projects. The second case study, *Rural Informatization in China*, [16] was most useful because it provided background and analysis of the policies and programs in China that shaped the infrastructure improvements in rural China. The most important takeaway from both of these studies was the demonstration of the ability of infrastructure expansion into rural areas to produce positive effects for China.

Discussed in both case studies were the recurring National Economic and Social Development Five-Year plans that the government of China publishes every five years. While these five-year plans have incorporated specific goals and frameworks for the expansion of communication infrastructure, more recently China has utilized "strategies such as the State Informatization Development Strategy, 2006–2020 [which] underscore the importance the government has accorded to rural informatization."[17] Various initiatives and programs abound that detail strategies for improving infrastructures in rural areas, both at the National and Provincial levels in China. Appendix B, Central Government Strategies and Initiatives for Rural Informatization, adapted from *Rural Informatization in China*, provides a listing of these various programs and strategies. Highlighted in both case studies, was the fact that the various programs are disjointed and sponsored by various ministries within the Chinese government; currently the

government of China lacks coordination between these programs to maximize the overall potential benefits.

Promotion of rural informatization has been in progress since the mid-1970s, the overall process can be divided along three phases. The first phase occurred from the mid-1970s to the early 1990s, this phase materialized from the economic plan requiring agricultural statistics. Even with the introduction of computers in the 1980s, this area did not realize much growth until the 1990s. The second phase occurred with the computerization of agricultural data and its subsequent introduction into the Chinese economic market system. Lastly, the third phase began in 2001, as the Chinese government began to encourage and require the development of strategies to improve services, information content and service models to expedite informatization.[18]

The informatization strategies employed by the government of China, while disjointed, have achieved the overall intended effects. As depicted in figures 4 and 8, China's growth exceeded that of the world in Internet usage and broadband subscription, and as depicted in figure 6, China's mobile cell subscription is increasing at a comparable rate to that of the world. Rural users in China "reported monetary benefits from productivity gains due to learning better production techniques, buying agricultural inputs at a cheaper price, and selling farm products through new sales channels."[19] Outside of these primarily agrarian improvements from communication infrastructure expansion in rural china, users also have acquired new skills through learning how to use ICT interfaces. However, these rural areas that are now more connected to the outside world, still have much room to improve. The users of the ICT systems in these areas are primarily male farmers; coordination in education of the remainder of the population: the

nonfarm workers, unemployed, women, and senior citizens make up a large population of potential ICT users that can expand and improve the economic prosperity of China.

China's success, while limited compared to the developments made in South Korea, was compelled by a strategy set by the government of China. The case studies show that the Chinese strategy, through a centralized and directed program, though slow and disjointed, still achieved results. This illustrates that although the strategy did not partner the public and private domains, and lacked synchronization across the various government entities, it still produced the intended results. The obvious difference between China and Central Africa is a strong central government with the ability to create a strategy and compel the regions in the area of concern to enforce that strategy.

By contrast, the lack of strong national governments in Central Africa has raised concerns for how to coordinate and compel strategy implementation. The most viable solution to this difference is the use of an IGO or creation of an organizing body from the countries involved to build the strategy and implement it. This case is still applicable even substituting an IGO with a strong central government, as the results in Central Africa can be presumed to be similar to the Chinese model examined. The efforts in each country will be employed at different levels and to different degrees based on the country's endowments, dedication to the strategy, and perceived benefits. Similar to how various government entities in China implemented the Informatization strategy to differing degrees using a variety of methods and programs, the various member countries in Central Africa will also enforce the strategy across an assortment of methods and programs to differing degrees. The outcome will still be an improvement in Communications infrastructure over the existing situation in Central Africa

Zimbabwe Case Study of Communication Infrastructure Development

The Zimbabwe Case Study provided a unique view of communication infrastructure in relation to the research for this paper. This particular case study provided context for the systems currently employed in Zimbabwe and provided insight on a potential cutting edge solution for establishing infrastructure support to rural areas currently without some form of broadband connectivity. Similarities between the cultures of the rural population in both China and Zimbabwe are realized in regards to the methods in which the populace in these areas receive information. In both areas, the populace generally depends on radio and television sources from which to receive information rather than the two-way communication methods provided through communication infrastructures. These passive forms of information reception require much less commitment and investment from the end user. Cost is a major factor as well; the sunk cost of purchase is easily overlooked when compared to the recurring costs of subscription. The financial gap in rural Zimbabwe is higher than that of rural China, but the solutions in China were commonly state-sponsored and therefore free of additional cost for the user.

In addition to the issue regarding the culture for gathering information, another issue in rural Zimbabwe similar to rural China, is limited and non-existent communication infrastructure. The major difference is that the extreme in Zimbabwe is much higher. As shown in figure 4, the percentage of individuals with access to the Internet in China was low prior to the policies and programs that the government of China employed to increase communication infrastructure in the rural areas. While China and Zimbabwe both began to see increases in levels of internet penetration in their

countries from 2000-2005, around 2006 China's growth took off while Zimbabwe's figuratively remained flat in comparison. Examining Zimbabwe in comparison to the other African countries in the study, Zimbabwe improved much more, but in a broad comparison with the remainder of the world, they continue to lag behind. The case study established from International Telecommunication Union (ITU) reports that:

> About 7.8% of Zimbabweans have access to the Internet. This has been attributed to a number of reasons collectively known as "the Zimbabwean problem" which include limited bandwidth problems, high cost of services, and inefficiency in existing broadband networks and to a greater extent - no internet coverage in rural areas, rural schools and small village towns.[20]

While the author illustrates this as the "Zimbabwean problem" it can be more broadly be described as the "Rural African Problem."

The case study evaluated and proposed a solution to solve "the Zimbabwean problem" which utilizes idle electromagnetic spectrum to propagate connectivity to rural locations. Specifically, the project evaluates the use of idle spectrum apportioned for television in Zimbabwe. In most sovereign countries throughout the world, the government of the country allocates certain portions of the electromagnetic spectrum for specific uses such as radio, television, and cellular use. The governments of these countries typically then sell licenses for the usage of portions of these spectrums to corporations that then use that portion of the electromagnetic spectrum to sell a service such as radio programs, television programs and cellular phone connections.

The proposed solution in the project uses a combination of two recent technological developments: cognitive radio and wireless regional access networks. The author describes cognitive radios as systems that "will intelligently identify portions of the [electro-magnetic] spectrum that are idle at a specific time and/or location, leading to

the best spectrum and appropriate operating parameters being selected [for use]."[21] Another way to describe a cognitive radio is as a "smart radio" which measures the use of the electromagnetic spectrum and then selects vacant frequencies to transmit across. This radio then reconfigures transmission paths as necessary based on frequency vacancy within the electromagnetic spectrum.

The use of a cognitive radio solution in Wireless Regional Access Network (WRAN) architecture is rudimentary. The WRAN would utilize the cognitive radio to transmit the communication signal to a customers base station utilizing an industry standard of IEEE 802.22. This industry standard is designed specifically for the use of cognitive radios to operate in vacant frequencies in "bands between 54 MHz and 862 MHz to support enhanced broadband services and monitoring applications."[22] The WRAN architecture uses a point to multipoint system; this means that a single base station broadcasts a signal to multiple fixed-location wireless stations.

The solution proposed within the Zimbabwe case study is technically possible to implement in Central Africa. Several challenges exist to this solution that convey meaning to the greater purpose of this research study of improving communication infrastructure in Central Africa. The major problems identified in the Zimbabwe case study are also true for implementation in Central Africa.

The first problem in applying this solution in Zimbabwe is the issue of "persuading service providers to invest in this new technology (CR network) and particularly to invest in a low dividend market."[23] This solution potentially creates new income streams for corporations in an industry that is currently focused in a niche area.

The customer base in this potential market currently is not profitable and therefore not attractive to service providers.

The second problem in applying this solution in Zimbabwe is in "bring[ing] about a paradigm shift within the rural community," [24] primarily in the manner in which the population receives their information. The benefits that accompany communication infrastructure improvements are not in dispute. The main concern is in how to motivate a population that is content with their passive forms of information reception to desire to change that method. Education of the benefits that arise from expanded communication infrastructure to the populace and government influence through programs and policies to attract industry investment are principal measures that must be included in any solution.

The Zimbabwe case study provided an example of a method to employ an emerging technology to create infrastructure to rural areas where there is none. This strategy provided an affordable solution that could be used in Central Africa. This solution could reach rural locations without significant investment in satellite services or fiber-optic cables. Furthermore, this solution provided an approach that could be coordinated between government and industry to bolster both the public and private domain. As part of a holistic communications strategy, the use of cognitive radio and WRAN technology to provide robust communication infrastructure in Central Africa is both affordable and feasible. Any state or organization that decided to utilize this method as part of a strategy would need to consider the marketing and messaging required to address the two identified problems: to motivate television corporations and the audiences intended to utilize the technology.

Current Communication Infrastructure

In order to analyze the possibility of integrating any of the potential solutions utilized in the case studies examined into solutions in the area of concern, an understanding of the current infrastructure picture is necessary. To adequately depict the layout of communication infrastructure pertinent to the area of concern, broadband infrastructure, microwave infrastructure and satellite infrastructure were reviewed. The International Telecommunications Union (ITU) Interactive Transmission Map combines the TeleGeography submarine cables map with ITU maps depicting terrestrial and microwave transmission networks on the continent. Figure 11 depicts the communication infrastructure surrounding the area of concern. This view shows the primary locations where submarine cables connect the African continent to the remainder of the world. Furthermore, this view depicts the various terrestrial fiber-optic and microwave links in Central Africa that are currently active or planned.

Figure 12 is an overview of the area of concern and the nearest networks in proximity to the area. This map clearly displays the dearth of communication infrastructure in Central Africa. As measured using the Daftlogic.com Google Maps Area Calculator tool[25] the total area displayed in this map is approxiamtely1.2 million square miles, roughly equal to a third the size of the United States. The area of concern for this research project is the area from Northern Uganda near Gulu, the Murchison Falls National Park and Lake Albert, extending northwest to the disputed Kafia Kingi region of South Sudan and Sudan and the Bamingui-Bangoran and Vakaga prefectures of the Central African Republic, nearly 200,000 square miles. A yellow parallelogram is overlaid on figure 12 to identify the general location of the area of concern.

Figure 11. Communication Infrastructure from area of concern to African coasts

Source: International Telecommunication Union (ITU), "ITU Interactive Transmission Map Public Version," accessed February 9, 2016, https://www.itu.int/itu-d/tnd-map-public/.

Figure 12. Communication Infrastructure inside area of concern

Source: International Telecommunication Union (ITU), "ITU Interactive Transmission Map Public Version," accessed February 9, 2016, https://www.itu.int/itu-d/tnd-map-public/.

Figure 13 shows the MTN South Sudan mobile cellular coverage while Figure 14 displays the mobile cellular coverage map for AT&T in the area of concern. The MTN South Sudan map shows that cellular coverage is largely concentrated around the other major infrastructure routes in South Sudan, the roads. Population centers are also located in closer proximity to the roads as this infrastructure provides a means for trade and travel. The AT&T map shows that cellular coverage is nonexistent in the majority of the area of concern, with the exception of major population centers. Through the combination of the fiber-optic and microwave infrastructure maps from ITU and the cellular coverage maps from MTN South Sudan and AT&T, the research must infer that the limited connectivity in the area of concern must transpire through satellite networks. These remote areas have no identified terrestrial connection to other networks; therefore they are connected through a communication satellite relay.

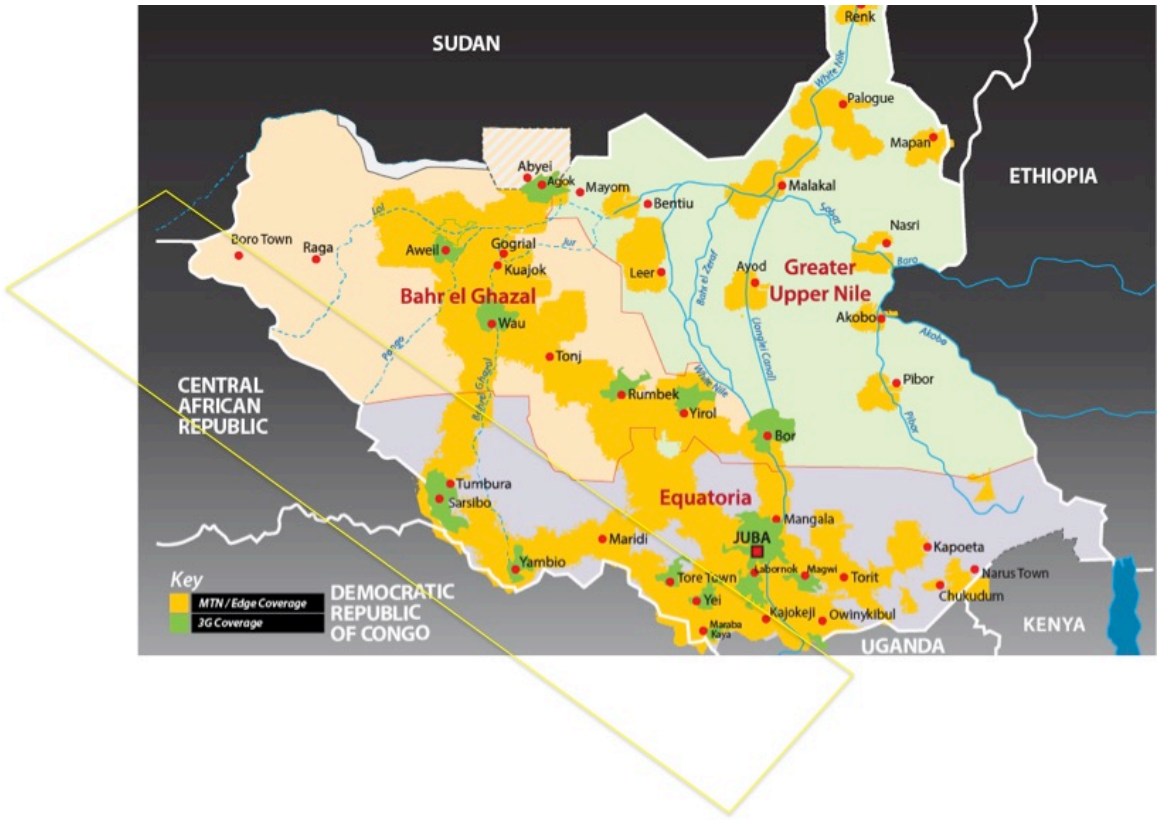

Figure 13. MTN South Sudan Coverage Map

Source: MTN, "MTN Coverage," accessed February 9, 2016, http://mtn-ssd.com/coverageLanding.html.

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Figure 14. AT&T Wireless Coverage Map

Source: AT&T, "International Wireless Voice Coverage," accessed February 9, 2016, https://www.att.com/maps/wireless-coverage.html?q=Central%252520African%252520Republic.

Conclusion

The previous experience of the governments of South Korea and China provide Central Africa with possible approaches to improve regional communication infrastructure. The technological solution examined in Zimbabwe provides a method that fits the problem set of the area of research. The studies, doctrine, and policies of the U.S. provide ample ideas for methods in which to bolster security cooperation activities

through improvements to, and expansion of, communication infrastructure in Central Africa. Through applying the lessons learned from the case studies to improve the current communication infrastructures, the efficiency and effectiveness of U.S. security cooperation actions will increase.

In examining the case studies of China and South Korea, the method to increase communication infrastructure in Central Africa must begin with a strategy. Individual strategies at the state level can achieve results, however coordination with entities outside of the state governments such as industry and academia showed increased results in the case of South Korea. Furthermore, from the case studies, it can be concluded that oversight of the implementation of the strategies must be coupled with regular revision of the strategy. This process is necessary to keep the progress of the strategy on track and readdress programs and policies as they are implemented in order to guarantee they are accomplishing their intended purpose.

The methods along which security cooperation is executed in Central Africa will improve over time through communication infrastructure expansion. The improved infrastructure will increase information sharing between the U.S. and African partner militaries in the region by providing more capacity and capability across which to share. The increased paths for communication to travel will lead to increased connectivity and coverage to the average citizen. A secondary benefit from the increased infrastructure to civilians is the capability of the partner security forces to receive and disseminate information among the populace and react quickly to emergencies and disasters. Additionally, through improving the ability of our partner nations to react quickly to their

internal problems, we increase opportunities to develop partner militaries and technologies available to them.

The lack of a single centralized government to coordinate and oversee an improvement strategy and design projects and policy to support that strategy is the biggest identified shortcoming. From the analysis of the case studies, government coordination was a common factor in both South Korea and China. From this, it can be determined that a coordinating entity is necessary, particularly when attempting to harmonize policies with industry including managing frequency licenses to that industry across sovereign borders. Ultimately, in order to gain the best outcome, all four countries that have a stake in the strategy need to decide on a single, united agency or intergovernmental organization to manage the process.

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[1] Moroney, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity*, 38.

[2] Moroney, *A Capabilities-Based Strategy for Army Security Cooperation*, 5.

[3] Dagne, 1-3.

[4] Moroney, *A Capabilities-Based Strategy for Army Security Cooperation*, 82.

[5] Department of the Army, Field Manual 3-22, 1-1.

[6] Ibid.

[7] Ibid., 1-9.

[8] Ibid., 1-11.

[9] Ibid.

[10] Petit, 68-69.

[11] Rahman, 76.

[12] Ibid., 77.

[13] Ibid., 93-98.

[14] Ibid., 79.

[15] Beschorner.

[16] Zhen-Wei Qiang.

[17] Ibid., 3.

[18] Ibid., 4-5.

[19] Beschorner, 17.

[20] Roslee, 29.

[21] Ibid., 30.

[22] IEEE Computer Society, *IEEE Standard for Information Technology—Telecommunications and information exchange between systems Wireless Regional Area Networks (WRAN)* (New York, NY: The Institute of Electrical and Electronics Engineers, 2015), 4.

[23] Roslee, 40.

[24] Ibid.

[25] Daftlogic. “Google Maps Area Calculator Tool,” last modified April 4, 2016, accessed April 20, 2016. https://www.daftlogic.com/projects-google-maps-area-calculator-tool.htm.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations examined here correspond with the "The Three Core Pillars" of the World Bank Group (WBG) ICT Strategy for Sub-Saharan Africa.[1] The first pillar, "The Core Reform Agenda" identifies several key sectors where changes need to occur; this research paper also concludes changes in the area of concern must occur in these sectors. Recommendations in the subsequent section fall largely along the sectors identified in this pillar of the WBG Strategy. The second pillar, "Addressing Market Failures", identified the primary sector in which this research paper focused examination: access to rural areas and the backbone infrastructure to provide that access. Finally, the third pillar, "ICT for Development Applications", parallels with the requirements identified in the conclusions and recommendations for a sustainable long-term solution to the issues raised in the course of research.

Conclusions

Communication is the common thread throughout all facets of military operations including security cooperation. Communication relies on robust infrastructure provisions; through improvements to communications infrastructures in Central Africa, security cooperation in the region will also improve. This research paper sought to discover methods in which to improve military effectiveness in security cooperation through improved communication capabilities. Research for this paper examined robust backbone infrastructure implementation in other regions in the world with the purpose of discovering the methods necessary to provide similar high-speed broadband access to

Central African and U.S. military partners security cooperation activities. Four research questions were used to focus the research of this study.

What are the key strategic challenges to the US Military conducting security cooperation with the dearth of communication infrastructure in the 800-mile long, rural region of Central Africa (North-Western Uganda to North-Eastern Central African Republic)?

The lack of communication infrastructure in Central Africa restricts partner capabilities, response time and capacity. This same limited capacity for communications also hinders the methods in which U.S. partners can provide support to Central African partners in the region. These shortcomings challenge security cooperation because the methods in which partners communicate to coordinate operations are limited by coverage areas, access to communication systems and performance of networks. Improved infrastructures increase the abilities of security cooperation partners to share information and plan operations. Furthermore, the ability of partners to react to developing security situations or changes to cooperation programs is restricted from a lack of infrastructure, potentially causing delays or degradation in performance.

The dearth of communication infrastructure in Central Africa also challenges security cooperation through effects on the populace. The limited communication infrastructure restricts methods available for the civilian populace to communicate with government or military officials. This situation reduces reporting from the populace of criminal or terrorist activity. Indirectly related to security cooperation effects, the limited infrastructure reduces the economic advancement of the populace. Another secondary impact is that the lack of a communications infrastructure lends to an increased potential for the population to participate in criminal or terrorist activity, requiring increased demand on the military to counter this activity.

Lastly, the lack of a strong central government to oversee operations occurring within the area that is inclusive of four separate governments is a key challenge. Any programs, policies or strategies in this area require coordination that would normally be overseen by a central government. With four distinct governments, all with differing agendas and motivations, the challenge of coordination between the four sovereign partners is extensive and varied.

What are the implications, and potential solutions, from an increase to commercial communication infrastructure?

The consequences of increased commercial communication infrastructure include military and economic benefits. The focus of this research paper covers improvements to security cooperation from these increases. Primarily, coordination among security cooperation partners is improved through an increase. Specifically, the improvement results in increased information sharing abilities both internal to the individual militaries of the states in the region, and amongst the militaries that partner in the region. Improved coordination between the military partner forces would result in more efficient uses of resources and faster responses to emerging requirements.

This increased commercial communication infrastructure also results in improvements to both domestic and international security in the region. The increased communication abilities increases the capability of the partner nations to react to security situations in a timely manner. Additionally, the increased information sharing and communication sharing capabilities with partners in the region could result in coordinated responses for security activity across borders.

In addition to improvements to the security situation in the Central African region, the improved infrastructures will also result in economic benefits. These systems can provide communication support to agriculture, industry and service developments in the region. Increases to commercial infrastructure would support commerce in the region resulting in more capable corporations and inject capital into a region lacking in industrialized resources but with an abundance of natural resources.

Potential solutions to the dearth of commercial communication infrastructure will be covered in detail in the 'Recommendations' section of this chapter. Solutions include actual technology to utilize for infrastructure improvements, intervention from the public and private domains, and the methods necessary to generate the change required. The solutions covered include those targeted at infrastructure and security cooperation.

How will an increase to commercial communication infrastructure affect the U.S. Military's ability to partner with the militaries of Central African states?

Security Cooperation occurs along multiple efforts, some of these are directly dependent on communications infrastructures while others are affected indirectly. Systems that are directly affected are easily identified. Systems such as the common operational picture (COP) used for situational awareness in military operation centers rely heavily on constant connectivity in advanced militaries such as that of the United States. Operation centers in Central African states may not require a COP that is continuously fed technical data and updated in real time via a communications network, but these partner militaries form situational awareness informed on some level through communication infrastructures. Instead of a direct logical connection, these militaries receive updates from subordinate units through radios, phone calls, or possibly through

other lines of communication. Other lines of communication can include a message delivered by courier that may have walked, driven or flown from his original location to the operations center to deliver the message. These "routes take many forms. They cross land, sea, and air; they may be natural geophysical features or the physical constructs of men,"[2] but they are all considered lines of communication.

With the understanding of this idea of lines of communication, the concept of improving this capability for situational awareness through delivering information at high rates of speed is obvious. A human courier cannot compete against electrons traveling unimpeded at near the speed of light. High-speed communication infrastructures cut transit time and overall cost significantly. Through increased commercial communication infrastructure, Central African states can improve the efficiency of delivering timely information to commanders, permitting better informed decisions and reactions to adversary actions.

Situational awareness is not the only aspect of security cooperation that can be improved through communication infrastructure improvements in the rural areas of the area of concern. Coordination and planning between U.S. and Central African partner forces occur through lines of communication as well. The effects described above for delivering situational awareness information are the same effects on lines of communication for coordinating between partners. Routine operations such as security patrols, training activities, and logistic delivery of goods or services, are all enhanced through improved communication infrastructure. Improved communications allow users to maneuver decisively and effectively based on up to date information. Development of training plans and execution of training activities are enhanced through efficiencies

gained by sharing ideas and consolidating planning efforts. Delivery of goods in a timely reaction to emerging requirements is enhanced by the ability to communicate requirements and prioritize mission support. These various aspects of security cooperation require management of knowledge through a robust communication infrastructure system.

Does the situation present any unique opportunities for U.S. Military or Diplomatic involvement?

U.S. Military and Diplomatic entities are represented primarily though the Department of Defense (DOD) and the Department of State (DOS). The involvement of the two organizations with one another to achieve a common objective is described as interagency coordination. In security cooperation activities, the DOS authorizes the programs that the DOD performs in various partner states worldwide. A unique opportunity exists to align the strategies between the DOS and the Combatant Command (COCOM) of each geographical theater to affect commercial communication infrastructures.

The research of this study specifically focused on the Central African region inclusive of the territories of the sovereign states of the Central African Republic (CAR), South Sudan (SSD), the Democratic Republic of the Congo (DRC), and the Republic of Uganda. Opportunities abound in Central Africa from which the United States can partner with industry. Through U.S. government interagency coordination, a common approach can result in improved security and economic prosperity in the region.

Opportunity exists for both the DOS and the DOD to shape policies and strategies within partner governments. The communication infrastructure field is a growing

industry and Central Africa is ripe for development. With a focus on helping partner governments and partner militaries develop the commercial communication infrastructure in their countries, the U.S. entities can coach, teach and mentor our African partners. The DOD and the DOS can each craft solutions along these opportunities focused on their specific roles in government which guide partners to advance infrastructure through their own unique mechanisms. Likewise, the two entities can jointly focus a solution to coach a partner nation on interagency coordination to develop that nations ability to achieve a common goal within their government, such as a strategy to improve commercial communication infrastructure.

With improved communications infrastructures, the possibilities for improvement in Central Africa are endless. Security cooperation is enhanced through these improvements not just through direct military effects realized, but also through the impacts to the populace and economy of the state that the military protects. Robust communication infrastructures lower the cost of communicating which allows for an increase in the populace that can both access and afford to access communication systems. With this improved access, education opportunities are increased, economic options are created, and social welfare is improved. “Development of other social sectors (like education and health) can be accelerated through an initial boost to the ICT sector.”[3] Employment of several recommended courses of action will lead to these successes.

Recommendations

Recommendations identified from this research paper fall into two categories: first, methods to improve security cooperation and second, methods to improve communication infrastructure. A common underlying factor inherent to all the

recommendations is the requirement for an overarching strategy, with the four countries' engagement for the programs, policies, and methods each country will undertake. State institutions, interested foreign investors, and international organizations can best posture support to developing states through identifying and publishing lines of effort that the state plans to implement to accomplish specified goals. This strategy should be developed prior to, or in conjunction with, any other actions the state decides to undertake.

Methods to Improve Security Cooperation

Interagency partnership is the backbone of how security cooperation is influenced, planned and resourced. Coordinated efforts between Department of State and Department of Defense representatives for each individual country team are critical to successful security cooperation efforts. Country teams should establish detailed strategies on how diplomatic efforts to influence and shape a country's policies to improve their economic affluence complement security cooperation efforts. Through joint planning, efforts by the interagency representatives within the country team can help to move all levels of national power for a foreign country in the same direction to improve communication infrastructures.

Foreign Military Sales (FMS) are a fundamental component of security cooperation efforts where a partner nation provides reimbursement for defense articles and services. While the actual training of partner militaries on defense articles falls within a separate category of Security Assistance, the application of these two requirements are complementary. Positive effects are achieved through encouraging and focusing FMS on communication systems that utilize broadband communication infrastructures. While deployable communication infrastructure capabilities are an important component of

military competencies, more important are the utilization of civil communication infrastructure to enhance the military communication networks. Security cooperation will advance communication infrastructures of sovereign state partners through FMS and Security Assistance training of equipment that utilizes civil communication infrastructure in conjunction with military systems.

Security cooperation planning must utilize partner nation's abilities and foster development within the means of each individual partner nation. Affordable and sustainable solutions for knowledge management, communications security, and communications infrastructure expansion must follow a plan of action along emerging technologies. Security cooperation planning must consider the current attributes and assets of the partner nation, the partner nation's strategy for advancing their communications infrastructure, and the feasibility of that plan along an affordable and sustainable solution. Coaching, mentoring, and supporting of partner nation plans of action should guarantee these factors are incorporated.

Security cooperation employs "authorities and programs used in Phase Zero [to] include Title 10, Title 22, Title 32, Section 1206, 1208, 1210, counter-narcotics, military-to-military programs and all forms of security assistance (twelve programs total including Foreign Military Financing (FMF), International Military engagement training (IMET), and Peacekeeping Operations (PKO)."[4] All of these programs must be coordinated through the interagency process with DOS as the lead agency for each country team. Combatant Commanders (CC) must include specific guidance within their theater strategy and campaign plans to guarantee that DOD interagency representatives include the development of robust communication infrastructure in coordination with the country

team of each partner nation. While the AFRICOM theater campaign plan and theater strategies were not reviewed for this study, the 2016 Posture Statement and the Command Brief for AFRICOM do not directly mention the efforts undertaken to develop communication infrastructures. Combatant Commanders must make communication infrastructure improvement a specified task for security cooperation activities within the theater campaign plan. Through specifically identifying this key task as part of his intent, the Combatant Commander will communicate to the interagency team the importance of communication infrastructure improvement, and the necessity of a united voice along all instruments of national power.

Methods to Improve Communication Infrastructure

In support of the strategies formulated by sovereign state governments, certain policies and procedures of the U.S. government can help to improve communication infrastructure in the rural areas of Central Africa. Communication infrastructure can also be improved through investments from private industry and foreign governments, use of emerging technologies, and combinations of existing infrastructures with new infrastructures. Most importantly, intergovernmental organizations in Africa must be further developed to foster the creation of sustainable solutions for communications infrastructures in Africa.

While the coordination at the interagency level for security cooperation efforts was discussed in the prior section, the concept of interagency cooperation must be visited further. Interagency efforts extend beyond security cooperation coordination; specifically, the methods in which the U.S. government can help to foster improvement are through the use of the instruments of national power. Security cooperation efforts cover the

military instrument, but greater opportunities exist from the three other instruments: Diplomatic, Informational, and Economic. While these three elements are identified separately, they are all interconnected and rely on one another.

The most important diplomatic effort that the government of the United States can undertake to improve the communications infrastructure in Central Africa is through focusing government policies and strategies to encourage industry to invest in Africa. These policies cross into the economic instrument as well, but include ideas like tax-breaks for industries that invest in the most remote areas. Grants to businesses can also motivate development in regions that are currently not forecasted to provide profits, but have potential to show profitable venture over time. Coordination by the DOS between industry and foreign state governments can help to inject opportunities for businesses to invest in the Central African region. A focus of the diplomatic missions in foreign states to mentor the development of communication infrastructure strategies in their partner countries is key. As demonstrated in China and South Korea, strategy and focus are key to accomplishing goals. Even the disjointed programs in China were successful with improving infrastructure in rural areas.

Along the informational instrument of national power, the U.S. government can provide the greatest influence through the use of soft power by increasing the awareness and understanding of communications infrastructure. Through coordination with academia, the U.S. government can establish programs to attract universities to Central Africa and Central African students to America along academic programs focused on communication technology, international relations, and business. The dearth of communications in Central Africa is a problem resulting from not only a lack of

knowledge of the technical means to install the equipment, but also the means in which to solve the problem. Education programs in Central Africa need to emphasize ICT training as well as governance and economic education.

The influence of education is a great power; education will bring increased skills to operate and maintain communications equipment and also increase the ability of the business oriented professionals wishing to further prosperity in their countries. The U.S. government can encourage this pull towards academia through providing foreign aid to Central African students to study abroad in America. The U.S. government can also encourage American universities to establish schools in Africa through apportioning a part of the annual national U.S. budget to establish grants to support their creation. In the case of South Korea, educational growth came as a result of the success of the government-led strategy and helped to increase progress. While a strategy in Central Africa will eventually lead to similar benefits, the influence from the U.S. government on education in the region can help spur progress.

The economic instrument of national power has the greatest potential for improving communication infrastructure in Central Africa, but it will require the longest amount of time and greatest amount of effort. Opportunities abound in Central Africa; if American industry realizes the potential of this remote but capable area of the world, then the prospect of success is high. Multinational Corporation investment in Central African countries is key to improving communication infrastructure. Infrastructure improvements require capital and in order for state governments to attract investment capital they need to institute government policies that attract business. Friendly fiscal policy, monetary

policy, and laws protecting the rights of foreign investors in Central African states are all crucial aspects of state government policies for attracting foreign investment.

The mobile market worldwide has increased exponentially over the last ten years, and Africa is no exception. In comparing figures 3, 5 and 7 of Chapter 4, even in the Central African countries where development of access to the Internet and broadband subscribers were low compared to other countries in the region, mobile subscriptions in all of the countries show marked improvements over the last ten years. Mobile technology is also affordable on a broad scale in Central Africa. High potential exists in plans that focus on increasing mobile coverage areas. As stated in multiple portions of this research paper, all communication ultimately needs a strong backbone communication infrastructure at some level to tie into. This backbone infrastructure will increase the opportunity for mobile technology proliferation.

Mobile broadband is achievable in Central Africa with the establishment of supporting robust communication infrastructure. Current solutions rely heavily on satellite systems to support remote areas without fiber-optic or microwave infrastructure. While usage of satellite connections increase latency in the network, this issue can be marginalized through increasing the available bandwidth. Cellular companies such as MTN and AT&T offer coverage within specified areas of Central Africa, but these areas are connected through robust satellite links. Companies such as RascomStar[5], MEASAT[6], and SCSAG[7] currently offer satellite constellations dedicated to Africa that can provide broadband connectivity. American satellite communication companies such as IntelSat currently offer these same capabilities, but these aforementioned companies

differ in that they are focused on partnering with African companies and establishing satellite-landing sites within Africa.

Through joint ventures with African businesses and establishing constellations dedicated to the African Continent, the U.S. satellite communications industry can remain competitive in Africa. Increasing competition for satellite communication in Africa will result in lower prices for Central African businesses desiring to use satellite communications as the solution to their infrastructure requirements, resulting in increased communications infrastructure. As more communication infrastructure enters the region, more industry and business will also be attracted to enter the area, as was the example from the expansion in South Korea.

While satellite communication infrastructure is the current and immediate solution for remote locations in rural Central Africa, in the long term, more solutions will emerge. As demand grows in the region, new infrastructure will also grow. The potential for cognitive radio use of idle television spectrum through a Wireless Regional Access Network (WRAN) as proposed in the Zimbabwe case study is a conceivable solution. This method of communications infrastructure delivery creates new access for television business that previously did not have a share of the communications market. Businesses that already own the license for the spectrum in the area of concern need only purchase and set up the equipment. Additional land for towers to receive and broadcast the signals may be necessary, as well as additional trained manpower, and a marketing strategy to promote the use of their system. U.S. businesses once again have an opportunity to invest in Central African companies that already own the licenses for the frequencies.

Similar to the solution proposed by cognitive radio, microwave communications utilize portions of the electromagnetic spectrum to pass data between two points. These solutions require line of site between the two locations and therefore need towers to reach above the tree line and pass data. Microwave communications can be used as robust infrastructure, but still require a secondary solution to then spread the signal out to areas that are not line of sight and blocked by trees, buildings or other obstacles. This area for which to spread the signal across is referred to within the communication profession as "the last mile."[8] The last mile is a generic term that does not actually equal an exact measurement of one mile, but rather refers to the distance between a user and the major node in the area of that user. The connection of "the last mile" is accomplished through many different means: wireless networks, coaxial television cable, copper telephone lines, or cellular networks. This solution is in place in many locations worldwide where laying fiber-optic infrastructure is not feasible physically or economically. U.S. industry can influence the use of microwave technology for communication infrastructure through partnering with local cellular service companies in Central Africa.

Fiber-optic infrastructure is the most challenging technology to implement in Central Africa. A lack of development in the region and a lack of other infrastructures such as roads, rails, power lines, pipelines, or water lines create an environment non-conducive to installing fiber-optic infrastructures. Fiber-optic infrastructures can travel much farther between nodes than microwave or cognitive radio WRAN infrastructures, and require much less electricity and maintenance. However they do require physical access in order to service or repair sections of the cable. This requirement for access by serviceable road, along with the general harsh conditions of many of the areas of Central

Africa, make fiber-optic infrastructure a far off solution for solving the communication infrastructure issues in Central Africa.

Central Africa is made up of primarily agrarian societies, with trade and industrialization in the region in a nascent state, stemming from a lack of general infrastructure. These issues prevent development, and in turn preventing infrastructure improvements, causing both issues to compound upon each other. However, the rural areas of Central Africa have potential to grow in agriculture, industry and services. With U.S. economic partnership and investment in agriculture, industry and services, Central Africa is poised to grow. Land in Central Africa is highly fertile and capable of supporting mass agriculture for export. The labor force is largely focused on small agriculture; an introduction of mass farming technologies coupled with the projected large population growth, will increase the labor pool and allow for increases in industry and service capabilities in the region. As the economy of the region grows, so will the infrastructure requirements, eventually lending to potential capability to deploy fiber-optic infrastructures. Opportunities exist within Central Africa for foreign investment to improve the area while also turning a profit.

Finally, in order for Central Africa to implement these recommendations to improve communications infrastructure, an international governmental strategy will need to be employed and overseen. Both the South Korean and Chinese strategies employed the use of a strong central government to coordinate or direct the execution of the strategy. In the situation in Central Africa, without a governing body over the four sovereign states involved, an IGO will need to fill this role to coordinate the strategy.

The African Union (AU) is the highest level of Intergovernmental Organizations in Africa. In order to create a strategy inclusive of international governments outside of Africa, the AU should work through the UN to establish an international strategy for improving communications infrastructure in Central Africa. The International Telecommunications Union is best positioned for the task of supervising the overall task of monitoring and reporting on implementation of policies agreed upon between state governments on the international stage outside of the African Union. "The ITU is the United Nations specialized agency for information and communication technologies (ICTs),"[9] therefore it has position authority in regards to countries outside of the AU and any overarching policies or strategies to support communication infrastructure efforts. The ITU should be the coordinating organization between the AU and the rest of the international community. Within the African Union, three different intergovernmental organizations exist which can be used to oversee and report on specific progress of the strategy.

The mission of the African Telecommunications Union (ATU) is "to promote the rapid development of the ICTs in Africa in order to achieve universal service and access to broadband."[10] This organization is the ideal Intergovernmental African Organization that should oversee all communication infrastructure expansion efforts activities within Central Africa and coordinate between all of the governments of sovereign African states that will impact these efforts. The ATU should be the coordinating organization within Africa. To improve the performance of this organization and its oversight of the efforts, two further intergovernmental organizations can further aid efforts.

The Regional African Satellite Communication Organization (RASCOM), not to be confused with the Communication Satellite Corporation of the same name, is an intergovernmental commercially run African organization whose capital is open to investment from the private sector. “RASCOM's mission is to design, implement, operate and maintain the space segment of the African telecommunications satellite system and translate into services and tools for African integration, all the opportunities provided by satellites by linking it, where necessary, with any other appropriate technology.”[11] As part of an international strategy to improve communication infrastructure in Central Africa through satellite networks, RASCOM should lead the efforts to unite industry with state governments in Central Africa.

The Central African Posts and Telecommunication Conference (COPTAC) was founded for member states to establish a specialized consultation platform to define a common strategy for post and telecommunications in the Central African region.[12] Currently COPTAC has seven members, of which the Central African Republic and the Democratic Republic of the Congo are both member states.[13] While COPTAC is mostly focused on efforts in the western portion of Central Africa, with influence from the ATU and the AU, COPTAC should be the coordinating organization within Central Africa to oversee the installation efforts of communication infrastructure.

All of the potential solutions for communication infrastructure expansion presented in this recommendation are not only feasible, but also probable. Fiber-optic lines now run through the Saharan Desert and across the floors of all of the oceans on the planet. The ultimate solution to the dearth of communication infrastructure in Central Africa is a strategy that employs a combination of all of the current available

technologies in a capacity where they can be best employed. This strategy must be malleable and ready to adapt to emerging technologies as they become available. The question is not 'which of these solutions is the best choice', but rather 'when will each be implemented and by whom?'

Risks and Future Research

Several potential risks were identified during the course of research that should be considered during any strategy creation or policy design. These risks also provide areas for future recommended research. The topics of risk and potential research focus on two topics: the cyber influence in the region from expansion of commercial communication infrastructure and the national will or desire of the state governments to improve communication infrastructure the region.

The penetration of Central Africa with an expanded communication capability creates a potential haven for cyber-crime. The remoteness of the location that is described throughout the course of the research in regards to security cooperation is a benefit to potential cyber criminals looking for a location from which to conduct cyber attacks where security enforcement is already a challenge. This risk also creates an opportunity within security cooperation of developing partner nation cyber capabilities, particularly of nations in remote areas with a growing gap in cyber education. Potential future research may focus on the effects of commercial communication infrastructure expansion in Central Africa with regards to the growth of cyber crime. Future research may also focus on security cooperation activities concentrating on the development of cyber defense capabilities of partner nations.

The second topic focuses on the desire of the Central African governments to work towards improved commercial communication infrastructures. Throughout history and even today, control of information is a powerful tool of influence; a government may not want people in their remote areas to have access to robust communication networks. The aforementioned risk of cyber security issues is a potential argument for a government to use for why they may not desire expansion in their rural areas. The local politics of the governments in the area of research may not desire to implement programs for the area if they do not see any direct benefits. A future research topic could cover the will of governments in developing nations to improve the prosperity within the remote areas of their sovereign states. Another area of potential research may also focus on determining why a state would not want to increase the communication infrastructure in their rural areas.

Final Conclusion

In closing, the development of communications infrastructure in Central Africa is not a simple undertaking. Multiple costs and risks exist along the path to success but the benefit to US security cooperation efforts could be dramatic. The resultant benefit to the people of the region is potentially transformative. The proposed recommendations are not easy, but with support from states outside of Central Africa, coordination among our Central African partners, and the assistance of the United States, this region can leap ahead to a better world.

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[1] Guislain, 2.

[2] Ispahani, 3.

[3] Guislain, 22.

[4] Petit, 70.

[5] RascomStar, "Our Services," accessed April 3, 2016, http://www.rascomstar.com/services.php

[6] Measat, "Africasat Overview," last modified 2016, accessed April 3, 2016, http://www.measat.com/africasat.html.

[7] Spaceref, "Satellite Constellation Tailored for African Continent now Operational," last modified March 11, 2016, accessed April 3, 2016, http://spaceref.biz/company/satellite-constell ation-tailored-for-african-continent-now-operational.html.

[8] National Research Council Committee on Broadband Last Mile Technology et al., *Broadband: Bringing Home the Bits 2002* (Washington, DC: National Academies Press, 2002).

[9] ITU, "About ITU," last modified 2016, accessed April 14, 2016, http://www.itu.int/en/about/Pages/default.aspx

[10] African Telecommunications Union, "Mission and vision," last modified http://www.atu-uat.org/index.php/about-U.S./mission-and-vision.

[11] RASCOM, "RASCOM's Missions and Objectives," accessed April 14, 2016. http://www.rascom.org/info_detail.php?langue_id=2&id_r=19&id_sr=0&id_gr=2

[12] Journal du Cameroun.com, "Postes et Télécommunications: l'Afrique centrale fait son état des lieux," last modified August 10, 2015, accessed April 14, 2016, http://www.journalducameroun.com/article.php?aid=21729.

[13] Universal Postal Union, "COPTAC Members," accessed April 14, 2016, http://www.upu.int/en/the-upu/restricted-unions/coptac/members.html.

GLOSSARY

Backbone networks–High capacity links that carry communications traffic between fixed points in the networks and form a crucial component in the communications supply chain. National backbones are core infrastructure, and broadband backbones such as fiber-optic cable are needed to bring broadband Internet connectivity.[1]

Bandwidth - Bandwidth is the range of frequencies that can pass over a given transmission channel. In the commercial satellite bandwidth leases DOD acquires, it is usually measured in millions of hertz, or megahertz (MHz)—such as 36 MHz, 54 MHz, or 72 MHz—which determine the rate at which information can be transmitted through the circuit.[2]

Building Partner Capacity (BPC) - Targeted efforts to improve the collective capabilities and performance of the DOD and its partners. BPC activities mainly include training, equipping, exercises, and education designed to enhance a partner country's ability to improve its own internal security situation and make valuable contributions to coalition operations. Importantly, familiarizations, workshops, conferences, and staff talks, for example—generally termed military-to-military, or mil-mil, events—are often key enablers to BPC.[3]

Common operational picture (COP) -A single identical display of relevant information shared by more than one command that facilitates collaborative planning and assists all echelons to achieve situational awareness.[4]

Country Team (CT) - The senior, in-country, United States coordinating and supervising body, headed by the chief of the United States diplomatic mission, and composed of the senior member of each represented United States department or agency, as desired by the chief of the United States diplomatic mission. [5]

Economic Support Fund (ESF)–A DOS program for promoting U.S. interests; used to support a wide range of programs, including economic reform, a "safe skies" program to improve African air traffic safety, human rights and democracy education, and other objectives. ESF aid is also helping strategic partners in combating terrorism through cooperation on border control, freezing terrorist assets, implementation of the peace agreement in southern Sudan, and other activities.[6]

Foreign Military Financing (FMF) - Slow, not prioritized against DOD objectives, inflexible and difficult to control once dispersed. AFRICOM able to specify partner uses of funds, but not burn rate.[7]

Foreign Military Sales (FMS) - That portion of United States security assistance authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act of 1976, as amended. This assistance differs from the Military

Assistance Program and the International Military Education and Training Program in that the recipient provides reimbursement for defense articles and services transferred. Also called FMS.[8]

Informatization - The transformation of an economy and society driven by information and communications technology.[9]

Infrastructure - The basic physical and organizational structures and facilities (e.g., buildings, roads, and power supplies) needed for the operation of a society or enterprise.[10]

Instruments of National Power - All of the means available to the government in its pursuit of national objectives. They are expressed as diplomatic, economic, informational and military.[11]

Interagency - Of or pertaining to United States Government agencies and departments, including the Department of Defense.[12]

Interagency Coordination - Within the context of Department of Defense involvement, the coordination that occurs between elements of Department of Defense, and engaged US Government agencies and departments for the purpose of achieving an objective.[13]

Internal Defense and Development (IDAD) - The full range of measures taken by a nation to promote its growth and to protect itself from subversion, lawlessness, insurgency, terrorism, and other threats to its security[14]

Joint Combined Exchange Training (JCET) - A program conducted overseas to fulfill United States forces training requirements and at the same time exchange the sharing of skills between United States forces and host nation counterparts.[15]

Latency - The delay from input into a system to the desired outcome. Network latency is an expression of how much time it takes for a packet of data to get from one designated point to another. Ideally latency is as close to zero as possible.[16]

Line of communication (LOC) - A route, either land, water, and/or air, that connects an operating military force with a base of operations and along which supplies and military forces move.[17]

Node - In communications and computer systems, the physical location that provides terminating, switching, and gateway access services to support information exchange; areas where multiple communication links connect together and redistribute across the network.[18]

Operation Enduring Freedom–Trans Sahel (OEF-TS) - AFRICOM-dedicated counter terrorism mechanism in West Africa Trans-Sahel region, provides flexibility in

how and when to apply resources. Comes from multiple accounts and not directly funded by Congress.[19]

Partnership for Regional East-African Counter Terrorism (PREACT)–AFRICOM-dedicated counter terrorism mechanism in East Africa, provides flexibility in how and when to apply resources.[20]

Section 1203 - Expansion of temporary authority for use of acquisition and cross-servicing agreements to lend certain military equipment to certain foreign forces for personnel protection and survivability.[21]

Section 1206 - Global Train and Equip Program, Congressional authority allows DOD to shift funds from O&M accounts to build capacity of a foreign country's national military forces. Global Train and Equip program requires coordination between DOS and DOD.[22]

Security Assistance (SA) - Group of programs authorized by the Foreign Assistance Act of 1961,as amended, and the Arms Export Control Act of 1976, as amended, or other related statutes by which the United States provides defense articles, military training, and other defense-related services by grant, loan, credit, or cash sales in furtherance of national policies and objectives. Security assistance is an element of security cooperation funded and authorized by Department of State to be administered by Department of Defense/Defense Security Cooperation Agency.[23]

Security Cooperation - All Department of Defense interactions with foreign defense establishments to build defense relationships that promote specific U.S. security interests, develop allied and friendly military capabilities for self-defense and multinational operations, and provide U.S. forces with peacetime and contingency access to a host nation.[24]

Security Cooperation Activity - Military activity that involves other nations and is intended to shape the operational environment in peacetime. Activities include programs and exercises that the U.S. military conducts with other nations to improve mutual understanding and improve interoperability with treaty partners or potential coalition partners. They are designed to support a combatant commander's theater strategy as articulated in the theater security cooperation plan.[25]

Security Force Assistance (SFA) - The Department of Defense activities that contribute to unified action by the US Government to support the development of the capacity and capability of foreign security forces and their supporting institutions.[26]

Security Sector Reform (SSR) - A comprehensive set of programs and activities undertaken to improve the way a host nation provides safety, security, and justice.[27]

Situational Awareness (SA) - Immediate knowledge of the conditions of the operation, constrained geographically and in time[28]

Traditional Commander's Activity (TCA) - Combatant Command controlled funding source, used to fund mil-mil events, flexible utility in engaging partners[29]

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[1] Guislain, 17.

[2] U.S. Government Accountability Office, 2.

[3] Moroney, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity*, 2.

[4] Department of Defense, Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms* (Washington, DC: Department of Defense, September 2016), 42.

[5] Ibid., 54.

[6] Dagne, 4.

[7] Moroney, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity*, 37.

[8] Department of Defense, Joint Publication 1-02, 92.

[9] Zhen-Wei Qiang, 62.

[10] Oxford Dictionaries, "Infrastructure," last modified 2016, accessed April 28, 2016. http://www.oxforddictionaries.com/us/definition/american_english/infrastructure

[11] Department of Defense, Joint Publication 1-02, 112.

[12] Ibid., 117.

[13] Ibid.

[14] Ibid.

[15] Ibid., 122.

[16] WhatIs.com, "Latency," last modified 2016, accessed April 28, 2016, http://whatis.techtarget.com/definition/latency.

[17] Department of Defense, Joint Publication 1-02, 141.

[18] Ibid., 166.

[19] Moroney, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity*, 35.

[20] Ibid.

[21] Ibid., 144.

[22] Ibid., 5.

[23] Department of Defense, Joint Publication 1-02, 212.

[24] Ibid., 198.

[25] Department of Defense, Joint Publication 3-0, *Joint Operations* (Washington, DC: Department of Defense, September 2006), 244.

[26] Department of Defense, Joint Publication 1-02, 213.

[27] Ibid.

[28] Department of the Army, Field Manual 3-0, *Army Support to Security Cooperation* (Washington, DC: Department of the Army, 2013), 195.

[29] Moroney, *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity*, 38.

APPENDIX A

World Bank Data

Internet Users per 100 people								
Country Code	CAF	SSD	UGA	COD	ZWE	CHN	KOR	WLD
Country Name	Central African Republic	South Sudan	Uganda	Congo, Dem. Rep.	Zimbabwe	China	Korea, Rep.	World
1995			0.002863471		0.00768354	0.00495471	0.81968667	0.782312674
1996	0.005849503		0.004625948	0.000108207	0.016790484	0.013081692	1.624237192	1.334112339
1997	0.014270881		0.010319341	0.000211213	0.033080327	0.032394861	3.600801564	2.052749045
1998	0.027878201		0.065289465	0.000413065	0.081648476	0.168540297	6.781815468	3.156586186
1999	0.040894287		0.10554394	0.001009076	0.161675528	0.708187957	23.55219445	4.654126336
2000	0.053394174		0.163714063	0.005902114	0.401433535	1.775913207	44.7	6.770369523
2001	0.078543428		0.237945087	0.011475782	0.799846046	2.639650215	56.6	8.095858937
2002	0.128537117		0.384093505	0.092790702	3.994356135	4.595704331	59.4	10.58632719
2003	0.151563338		0.46484984	0.134914837	6.394786458	6.2	65.5	12.28525223
2004	0.223401395		0.71997068	0.196208375	6.564045027	7.3	72.7	14.18245532
2005	0.268195609		1.742205503	0.238037799	8.015978089	8.523257003	73.5	15.79998197
2006	0.311159173		2.529363038	0.29605361	9.791841502	10.52315262	78.1	17.61936381
2007	0.375815961		3.671965351	0.37	10.85	16	78.8	20.55234505
2008	1		7.9	0.44	11.4	22.6	81	23.2869563
2009	1.8		9.78	0.56	11.36	28.9	81.6	25.80017676
2010	2	7	12.5	0.72	11.5	34.3	83.7	29.19600651
2011	2.2		13.01354333	1.2	15.7	38.3	83.75912015	31.82406187
2012	3		14.6896	1.679961015	17.09	42.30011749	84.07	35.14950461
2013	3.5	14.1	16.2	2.2	18.5	45.8	84.77	37.99131625
2014	4.03	15.9	17.71	3	19.89	49.3	84.33	40.68913661

Mobile Cellular subscriptions per 100 people								
Country Code	CAF	SSD	UGA	COD	ZWE	CHN	KOR	WLD
Country Name	Central African Republic	South Sudan	Uganda	Congo, Dem. Rep.	Zimbabwe	China	Korea, Rep.	World
1995	0.001343226		0.008423042	0.020232062	0	0.293245078	3.675661704	1.585085397
1996	0.031967296		0.018684872	0.016696581	0	0.549163873	7.078148774	2.499085584
1997	0.040003118		0.022640286	0.020191297	0.047601602	1.052726386	15.21163954	3.65660963
1998	0.046681951		0.131691862	0.022241527	0.155362034	1.886071369	30.81749792	5.339147415
1999	0.116598212		0.239741703	0.026150001	1.404956282	3.401326149	51.2497731	8.13711498
2000	0.136519203		0.522799789	0.031949396	2.130905435	6.658707962	58.32541383	12.07503129
2001	0.296972634		1.130100554	0.311416239	2.494700186	11.24474524	62.87887506	15.52632773
2002	0.334461655		1.516028656	1.130925646	2.680018119	15.90376731	69.71267379	18.58099919
2003	1.04448569		2.892006194	2.444905248	2.869470879	20.72082242	72.09806317	22.30578577
2004	1.540992322		4.195756068	3.792769423	3.354159171	25.55100154	78.17313661	27.40006942
2005	2.524680647		4.578959089	5.082723491	5.091109468	29.84470593	81.52202954	33.91292587
2006	2.728105589		6.761102482	7.942801654	6.673415953	34.76674887	84.99862058	41.76468389
2007	8.278756443		13.65261655	11.52690544	9.620397232	41.01687431	93.26624778	50.52487555
2008	13.61972672		26.92003559	16.89524742	12.94364591	47.75671627	95.27662025	59.70663668
2009	20.24357708		28.55294653	15.63752578	30.96458524	55.29808341	99.54168558	67.89625747
2010	22.51148929	14.44932189	37.74438345	19.00647586	58.88210564	63.17027802	104.7742463	76.56502837
2011	22.37140338	17.33918627	47.50472743	24.47130767	68.86878087	72.0713209	107.7446102	84.28434668
2012	25.26102109	21.22255382	45.00206351	30.58009217	91.90938245	80.76271455	109.4316142	88.55751276
2013	29.46657548	25.25835962	48.08192773	41.81656407	96.3498668	88.70833462	110.9984678	93.14403717
2014	31.3598713	24.50094636	52.42923963	53.49321638	80.81642131	92.27349082	115.5435591	96.26504895

Fixed broadband subscriptions per 100 people								
Country Code	CAF	SSD	UGA	COD	ZWE	CHN	KOR	WLD
Country Name	Central African Republic	South Sudan	Uganda	Congo, Dem. Rep.	Zimbabwe	China	Korea, Rep.	World
1998							0.030776583	
1999							0.607755179	
2000						0.00176972	8.417213659	
2001					0.006125483	0.026110917	16.92471047	0.841704142
2002					0.022522091	0.254646331	22.42852	1.349954891
2003					0.050390185	0.861139213	23.99243669	1.987185286
2004					0.070644976	1.903186524	25.47244725	2.960730483
2005			0.002959108		0.08013004	2.833458987	25.919439	3.67833742
2006			0.004072511		0.08016153	3.834644405	29.69392105	4.699727482
2007			0.006052964		0.119386256	4.977279055	30.92116605	5.541288856
2008			0.015098116		0.14080055		32.32836279	
2009			0.018256877		0.365662967	7.694963045	33.94286624	7.512687181
2010			0.041191962	0	0.252351881	9.290704938	35.48581435	8.18921934
2011	0.0182588		0.101041127		0.25451506		36.64796736	9.033616007
2012	0.013369548	0.000156862	0.105651648		0.523924068	12.72147733	37.24828904	10.14382922
2013		0.000885256	0.26850191	0.000666532	0.734406962	13.63406195	38.03590701	10.0306639
2014		0.000851882	0.291932289	0.000720875	1.042746839		38.77630457	9.596899156

Source: The World Bank, "Data," accessed March 20, 2016, http://data.worldbank.org/indicator/IT.CEL.SETS.P2.

APPENDIX B

CHINA CENTRAL GOVERNMENT STRATEGIES AND

INITIATIVES FOR RURAL INFORMATIZATION

Ministry of Information Industry		
Year	**Strategy/Policy Statements**	
2006	"Suggestion on Promoting the Construction of the New Socialist Countryside"	
Year	**Key Supporting Initiatives**	**Progress Made**
2007	**1. Extend Telephone Coverage to Every Village Project** • Extend telephone coverage to every village • Speed up the construction of village Internet connections	• 99.5 percent of administrative villages have telephone coverage • More than 97 percent of townships and villages have Internet access • 92 percent of townships and villages have broadband access
2001-2005	**2. Initiative to Promote IT Applications in Agriculture** • Guide the ICT industry in developing appropriate agricultural IT products and systems to serve "three-dimensional rural issues" (i.e farmers, countryside and agriculture) and promote agricultural modernization	• "Farmer computers" developed in collaboration with Haier and Intel. • National organization of computer and IT application "multiplier plan" resulted in 113 agriculture-related projects with total investment of around 1.7 billion RMB. Direct economic benefit was more than 110 billion RMB
2005	**3. Rural Comprehensive Agriculture *Informatization* Services Pilot Projects** • Develop affordable, easy to use information terminals and corresponding information systems for farmers • Integrate information resources of agriculture-related departments, scientific research institutes, and colleges to develop "three-dimensional rural issues" related to local information • Form a market mechanism for rural comprehensive information services involving domestic enterprises • Provide training and promote the application of *informatization* in rural areas	• The pilot projects in Anhui Province yielded substantial economic impacts. • Xuanzhou District built a comprehensive information platform that provides timely agricultural information to prevent the paddy rice disease-carrying insect, saving 22,000 tons of food and 1,400 tons of cotton. • Jingde County stabilized the poultry production during SARS by disseminating useful information through TV broadcasting after receiving inquiry telephone calls at the information center. New agricultural technologies, also broadcast on TV increased annual farmer income by 3.1 million yuan. http://www.tzag.gov.cn/documents/docdetail.asp?documentid=134382&sub_menuid=101 http://www.mxwz.com/yxcz/inside.aspx?xl=%B4%F3%C1%AC&NewsId=100041

Ministry of Agriculture		
Year	**Strategy/Policy Statements**	
2007	**Overall Framework of National Agriculture and Rural *Informatization* (2007–2015)** • Greatly improve agricultural and rural integrated information infrastructure management • Develop information service organizations at township and village levels • Complete a sustainable development mechanism for agricultural and rural *informatization*, to meet the needs of modern agriculture and the construction of a new socialist countryside	
2001	**10th Five-Year Plan: Action of Rural Market Information Service**[1] • Enlarge the rural market information dissemination dynamics by providing timely and accurate information to the farmers in all levels (province, city, county, major villages) • Establish the rural information service platform • Set up interactive Intranet and website to stimulate comprehensive information exchange among all stakeholders (province, city, county, village, etc.) • Strengthen the capacity of the rural information services by providing the adequate training	
Year	**Key Supporting Initiatives**	**Progress Made**
2007	**1. Pilot Projects: Overall Framework of National Agriculture and Rural *Informatization* (2007–2015)**[2] • Build stations in 100,000 villages, providing 1 million village officers and 10 million farmers with Internet access • Extend the agricultural information services network to more than 90 percent of administrative villages • Train one or two rural information assistants in every administrative village	• Listed in local development plans, and funding provided by local finance bureaus or self-collected. • Ministry of Agriculture is piloting information service stations in all new countryside construction demonstration villages. http://www.gov.cn/ztzl/yzn/content_479462.htm
2007	**2. "Jinnong" Project** ("Golden" e-government project) • Establish three major application systems, for agriculture monitoring and warning, agricultural market information, and rural market service the technology information services • Develop and integrate domestic and international information resources • Standardize criteria and regulations; train information service teams	• Construction period of the project is ongoing, from August 2007 to July 2009
2005	**3. Three in One (Telephone, TV, and Computer) Agriculture Information Service Pilot Project** • Extend information services to "the last mile" through computer (Internet information services), telephone (advisory call centers), and TV (local TV broadcasted agricultural information programs) • Establish a long-term mechanism to provide timely, accurate agricultural information services	• Ministry of Agriculture provides the equipment, software, and support for the pilot areas of every province • Central government funds 10 million RMB a year

2005	**4. Demonstration Project for Extending Agricultural Science and Technology to Every Rural Household** • Promote agricultural science and technology to households in 100 pilot counties	• Formed a network of experts and a technical instruction and service system • Promoted 20 kinds of technologies • Provided technical instruction to 92,000 demonstration households • Ministry of Agriculture is using IT to develop rural economy e-map
2001–2006	**5. Rural Market Information Service Action Plan**	• Agricultural information service organizations set up in 97 percent of districts (cities) and 80 percent of counties • Agricultural information service stations set up in 64 percent of villages and towns • More than 200,000 rural information assistants trained
State Administration of Radio, Film, and Television		
Year	**Key Supporting Initiatives**	**Progress Made**
1998-2006	**1. Extend Telecommunications Coverage to Every Village Project** • Extend telephone coverage to every village	• Investment for administrative villages totaled 3.6 billion RMB • About 117,000 administrative villages with electricity but no telecom ("blind" villages) covered • About 100,000 natural blind villages with more than 50 households covered • 15,000 villages that were "back to the blind" were repaired • Provided nearly 100 million farmers with access to radio and TV
Ministry of Science and Technology		
Year	**Key Supporting Initiatives**	**Progress Made**
	2. "Spark" Agricultural Science and Technology 110 Information Services Project (Spark 110) • Provide farmers with agriculture technology services through a low-cost ICT platform, based on collaboration between the government science and technology sector and the telecommunications sector • Integrate information resources with a service hotline	• Set up more than 23 unified regional hotlines, covering more than 900 counties and 7,500 towns and townships • Governments in more than 20 provinces have set up cooperative relations with local agricultural universities, institutes, or research agencies

Ministry of Culture		
Year	**Key Supporting Initiatives**	**Progress Made**
2002	**1. National Cultural Information Resources Sharing Project** • With Ministry of Finance, digitally process and integrate China's cultural resources • Share digitized cultural resources nationwide	• Central authorities have invested 903million RMB, while local investment totaled more than 700 million RMB. • Resources total about 60 terabytes (1 terabyte is equivalent to 250,000 e-books or 926 hour-long videos) • 6,700 centers and basic service stops completed at all levels
2006–10	**2. Comprehensive Culture Station Project** • Implemented with State Development and Reform Commission • Sets up rural comprehensive culture stations in all villages and towns countrywide, and trains cultural laborers • Develops a sound, effective rural culture management system • Improves rural public culture service skills by 2010	• The funding has been provided by special project subsidy by the central government, as well as funding from local finance bureaus, or self collected. • In 2007, the central government has invested 100 million RMB for piloting. http://www.china.com.cn/culture/zhuanti/07ggwhfubg/2007-12/21/content_9416225.htm
Ministry of Education		
Year	**Key Supporting Initiatives**	**Progress Made**
2003	**1. Modern Distance Learning Project in Rural Primary and Secondary Schools** • Implemented with State Development and Reform Commission and Ministry of Finance • Covered by local governments and subsidized by central based on regional development • Each rural junior high school equipped with a 30-computer classroom and a multimedia classroom with CD players and satellite teaching posts. Each post needs an average investment of 150,000 RMB.	• By end of 2006, established call centers to support services in rural primary and secondary schools • Improved education quality and contributed to sharing of resources in rural areas • More than 100 million students in central and western rural areas have benefited

Ministry of Commerce		
Year	**Key Supporting Initiatives**	**Progress Made**
2006	**1. Rural Commercial Information Service Project** • Set up rural commercial information service stations in 10,000 villages • Train 10,000 farmers to use the Internet and improve their ability to incorporate supply and demand information in their business • Establish an information resources system, with special databases on agricultural products and commercial information for farmers	• The New Countryside Commercial Website was launched in August 2006. It organized 6 times online trading. About 5 billion tons of agricultural products, worth 10.9 billion RMB, were traded. • Rural commercial information service stations were piloted in one county in each of 20 provinces.
2005	**2. Thousands of Villages and Townships Project** • The project aimed to establish 25,000 "rural shops" from 2005 to 2007 as extensions of the urban commercial distribution network (e.g. chain stores and super-markets). This modern rural the information network can improve rural consumption environment and meet production and living demands by rural population.	• 160,000 "rural shops" and 480 extensions of urban commercial distribution network were subsidized by the government in 2005 and 2006.
Central Committee of Communist Party of China		
Year	**Strategy/Policy Statements**	
2006–2010	**1. 11th Five-Year Plan for National Economic and Social Development** • Proposed strengthening agriculture service systems, promoting agricultural technology, and building production safety standards. Also proposed integrating agriculture-related information resources, strengthening construction of the rural economic information application system, promoting agricultural service organizations and mechanism innovation, encouraging and guiding farmers in developing specialized economic cooperatives, and improving the organization of agriculture.	
2007	**2. Opinions of the Committee and the State Council on Developing Modern Agriculture and Promoting the Construction of a New Socialist Countryside** • Made clear that *informatization* is one of the three main goals for agriculture, along with mechanization and irrigation.	
2007	**3. 17th National Congress of the Communist Party of China** • Set modernized agriculture and a reinvigorated rural economy as primary tasks. Proposed to strengthen rural infrastructure, improve rural markets and agriculture service systems, and promote advances in agriculture-related science and technology to increase agricultural production capacity.	
2006	**4. 2006–2020, State *Informatization* Development Strategy** • Proposed to "use the public network with a variety of access methods and affordable prices for farmers, improve rural network coverage, integrate agricultural information resources, standardize and complete the public information intermediary services, build urban-rural information service system in a concerted manner, provide farmers with the applicable information services such as market, science and technology, education, health care etc, and advocate a reasonable and orderly flow of the surplus rural labor."	

2006	**5. Opinions of the Committee and the State Council on Promoting the Construction of a New Socialist Countryside** • "Actively promote the construction of Agriculture *Informatization*, integrate and make full use of agriculture-related information resources, strengthen the information services of radio and television broadcasting and telecommunications in rural areas and focus on 'Golden Agriculture' project and comprehensive agriculture information service platform construction."	
2005	**6. Opinions of the Committee and the State Council on Several Policies Relating to Intensifying Rural Work and Improving Agricultural Comprehensive Production Capacity** • "Strengthen the construction of Agriculture *Informatization*."	
2005	**7. Opinions of the Committee and the State Council on Intensifying Rural Cultural Construction** • "Provide rural digital culture and information services"	
Year	**Key Supporting Initiatives**	**Progress Made**
2003–06	**1. Modern Distance Learning of National Party Cadres in Rural Areas** • Build an information services platform by 2010 with a batch of teaching resources for rural party members and peasants • Build a batch of terminal receiving posts, including satellite receiving, broadcast and television transmission, broadband set-top-box or P2P transmission, etc. (Rural party members' activity rooms, rural middle and primary schools, etc are usually built up as receiving posts)	• Initiated with pilot experiments in three provinces, it will extend to nine provinces by 2008. Another 19 provinces will be covered by 2010. • Provinces have built up 197,320 terminal receiving posts in villages and towns. • 7,073 IP course-wares delivered. The IP information channel has sent 53.7 billion bytes of information. The teaching center website has published 22,678 pieces of information. The total click rate was around 4.4 million, and the daily visits were over 6,000.
National Development Reform Commission		
Year	**Strategy/Policy Statements**	
2008	**Document for *Informatization* for the New Rural Countryside**	
Year	**Key Supporting Initiatives**	**Progress Made**
2008	**1. Pilot Project for Rural *Informatization*** • Develop a public service platform that consolidates different government service offerings • Through innovative business models, pilot offerings in two or three provinces	• Under development

State Council Leading Group Office of Poverty Alleviation and Development		
Year	**Key Supporting Initiatives**	**Progress Made**
2008	**1. Pilot Project for Rural *Informatization*** • Provide agricultural information on demand; help farmers integrate with national and global markets • Provide training for rural residents—such as distance education • Improve connectivity options, such as video telephony	• Under development

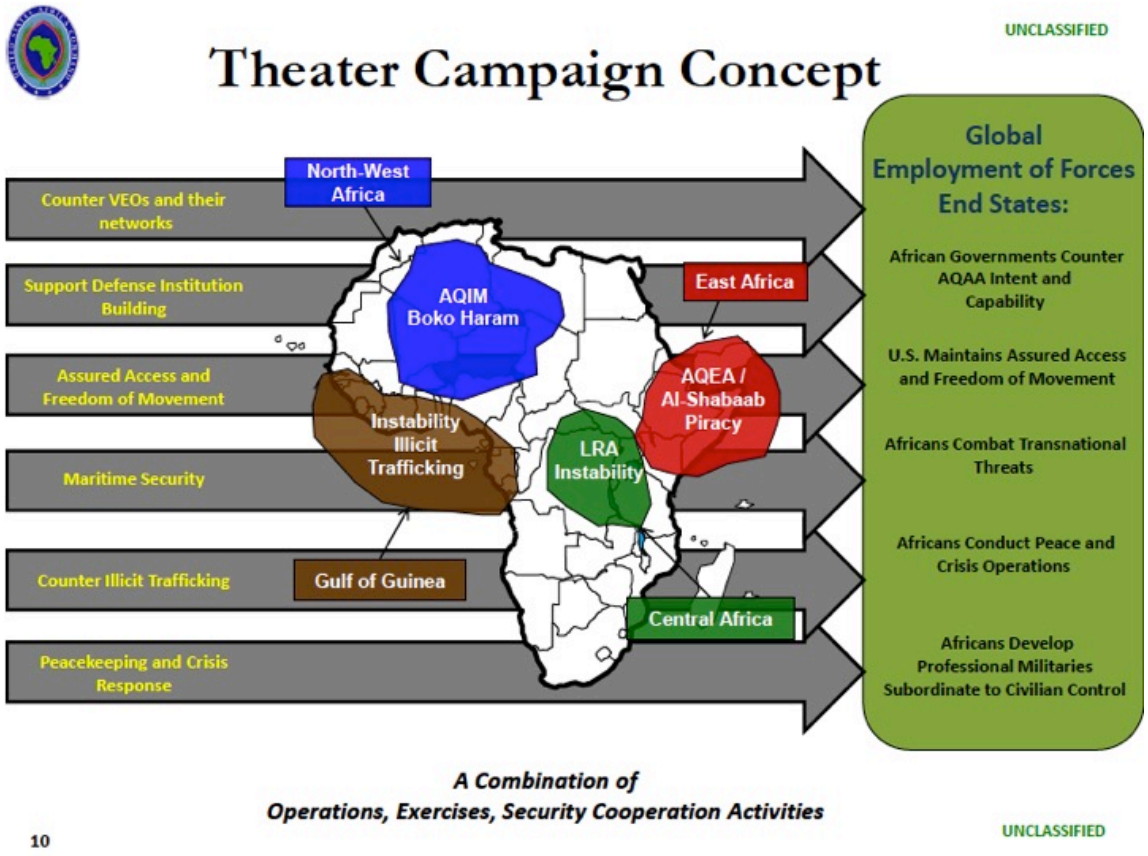
Notes

[1] http://news.xinhuanet.com/zhengfu/2001-09/30/content_84489.htm.
[2] http://www.agri.gov.cn/jhgb/t20080321_1029943.htm.

Source: Christine Zhen-Wei Qiang et al., *Rural Informatization in China* (Washington, DC: World Bank, 2009), 45-51.

APPENDIX C

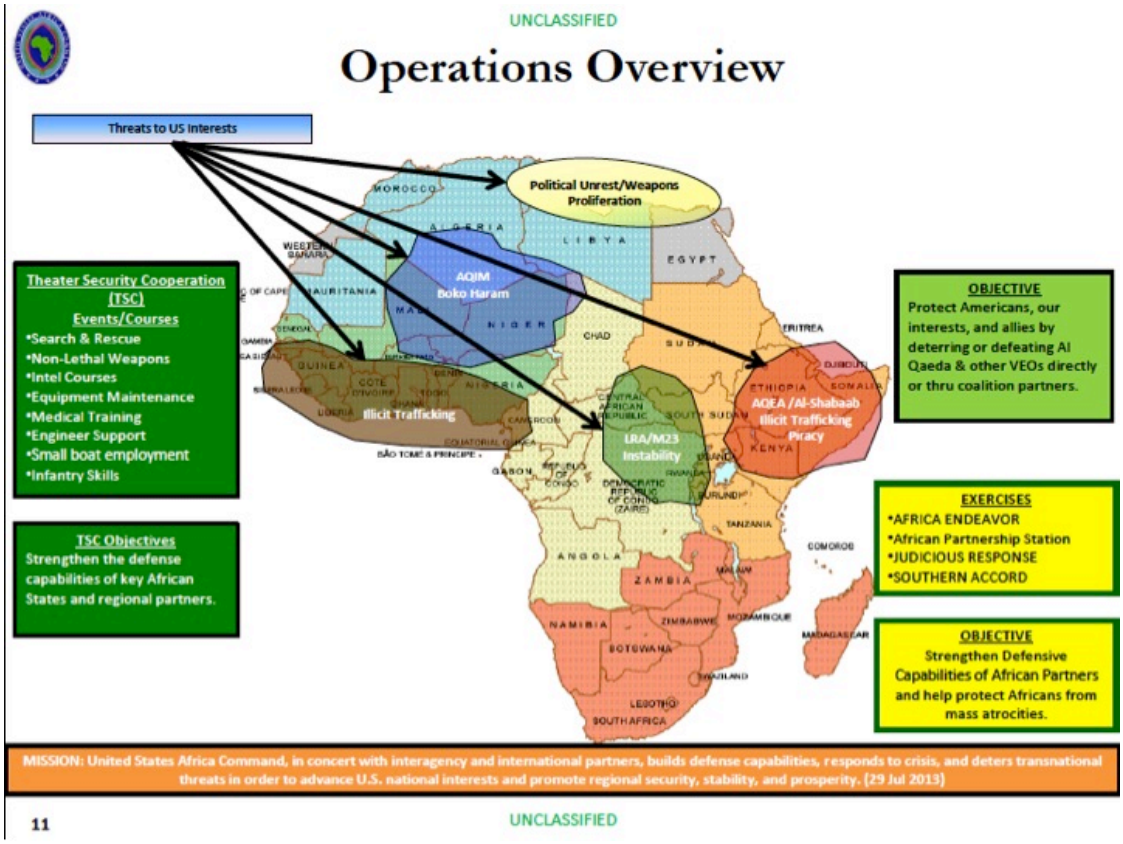
USAFRICOM THEATER CAMPAIGN CONCEPT



Source: Africom.mil, "Command Brief," last modified 2014, accessed April 20, 2016, http://www.africom.mil/NewsByCategory/document/23122/2014-command-brief-english.

APPENDIX D

OPERATIONS OVERVIEW



Source: Africom.mil, "Command Brief," last modified 2014, accessed April 20, 2016, http://www.africom.mil/NewsByCategory/document/23122/2014-command-brief-english.

BIBLIOGRAPHY

African Telecommunications Union. "Mission and Vision." Last modified 2016. Accessed April 14, 2016. http://www.atu-uat.org/index.php/about-us/mission-and-vision

AT&T. "International Wireless Voice Coverage." Accessed February 9, 2016. https://www.att.com/maps/wireless-coverage.html?q=Central%252520 African%252520Republic.

Beschorner, Natasha, Michael Minges, and Kaoru Kimura. *Information and Communications in the Chinese Countryside: A Study of Three Provinces.* Herndon, VA: World Bank Publications, 2014.

Bolton, Stephan R. "Partners of Choice and Necessity: Special Operations Forces and the National Security Imperatives of Building Partner Capacity." Monograph, School of Advanced Military Studies, Ft. Leavenworth, KS, 2015.

Daftlogic.com. "Google Maps Area Calculator Tool." Last modified April 4, 2016. Accessed April 20, 2016. https://www.daftlogic.com/projects-google-maps-area-calculator-tool.htm.

Dagne, Ted. *Africa: U.S. Foreign Assistance Issues.* Washington, DC: Congressional Research Service, 2010.

Defense Institute of Security Assistance Management (DISAM). *The Management of Security Cooperation.* Wright-Patterson Air Force Base, OH: Government Printing Office, 2016.

Department of Defense. Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms.* Washington, DC: Department of Defense, September 2016.

———. Joint Publication 3-0, *Joint Operations.* Washington, DC: Department of Defense, September 2006.

———. Joint Publication 3-22, *Foreign Internal Defense.* Washington, DC: Department of Defense, 2011.

Department of the Army. Field Manual 3-22, *Army Support to Security Cooperation.* Washington, DC: Department of the Army, 2013.

Fish, Grant A. "The Transition to an Independent Southern Sudan: How should the U.S. Military Posture to Influence and Deter Factors that may cause Regional Instability." Master's thesis, Command and General Staff College, Ft. Leavenworth, KS, June 2011.

Garcia-Castellanos, Daniel, and Umberto Lombardo. “Poles of Inaccessibility: A Calculation Algorithm for the Remotest Places on Earth.” *Scottish Geographical Journal* 123, no. 3 (2007): 227-233.

George, Alexander L., and Andrew Bennett. *Case Studies and Theory Development in the Social Sciences.* Cambridge, MA: MIT Press, 2005.

Guislain, Pierre, Mavis A. Ampah, Laurent Besançon, Cécile Niang, and Alexandre Sérot. *Connecting Sub-Saharan Africa: A World Bank Group Strategy for Information and Communication Technology Sector Development.* Washington, DC: World Bank, 2005.

IEEE Computer Society. *IEEE Standard for Information Technology—Telecommunications and Information Exchange between Systems Wireless Regional Area Networks (WRAN)*. New York, NY: The Institute of Electrical and Electronics Engineers, 2015.

International Telecommunication Union (ITU). “ITU Interactive Transmission Map Public Version.” Accessed February 9, 2016. https://www.itu.int/itu-d/tnd-map-public/.

Ispahani, Mahnaz Z. *Roads and Rivals: The Political Uses of Access in the Borderlands of Asia.* Ithaca, NY: Cornell University Press, 1989.

ITU. “About ITU.” Last modified 2016. Accessed April 14, 2016. http://www.itu.int/en/about/Pages/default.aspx

Journal du Cameroun.com. “Postes et Télécommunications: l’Afrique centrale fait son état des lieux.” Last modified August 10, 2015. Accessed April 14, 2016. http://www.journalducameroun.com/article.php?aid=21729.

Kunigami, Arturo, and Juan Navas-Sabater. *World Bank Working Papers: Options to Increase Access to Telecommunications Services in Rural and Low-Income Areas.* Herndon, VA: World Bank Publications, 2009.

Lewis, Chad. “Village Stability Operations in the Democratic Republic of the Congo: A Special Operations Approach.” Master’s thesis, Command and General Staff College, Ft. Leavenworth, KS, 2014.

Marquis, Jefferson P., Jennifer D. P. Moroney, and Justin Beck. *Developing an Army Strategy for Building Partner Capacity for Stability Operations*. Santa Monica, CA: RAND Corporation, 2010.

McEvoy, Brendan John. “The Road to Success in Africa is Paved in Asphalt: Transportation Infrastructure Development in Emerging Economies as a Way to achieve National Strategic Policy Objectives.” Master’s thesis, Command and General Staff College, Ft. Leavenworth, KS, 2014.

Measat. “Africasat Overview.” Last modified 2016. Accessed April 3, 2016. http://www.measat.com/africasat.html

Moroney, Jennifer D. P., Adam R. Grissom, and Jefferson P. Marquis. *A Capabilities-Based Strategy for Army Security Cooperation*. Santa Monica, CA: RAND Corporation, 2007.

Moroney, Jennifer D. P., David E. Thaler, and Joe Hogler. *Review of Security Cooperation Mechanisms Combatant Commands Utilize to Build Partner Capacity*. Santa Monica, CA: RAND Corporation, 2013.

MTN. “MTN Coverage.” Accessed February 9, 2016. http://mtn-ssd.com/coverage Landing.html.

National Research Council Committee on Broadband Last Mile Technology, National Research Council, Computer Science and Telecommunications Board Staff, National Research Council, Division on Engineering and Physical Sciences Staff. *Broadband: Bringing Home the Bits 2002*. Washington, DC: National Academies Press, 2002.

Obama, Barack. *National Security Strategy*. Washington, DC: The White House, February 2015.

Oxford Dictionaries. “Infrastructure.” Last modified 2016. Accessed April 28, 2016. http://www.oxforddictionaries.com/us/definition/american_english/infrastructure.

Petit, Brian S. *Going Big by Getting Small: The Application of Operational Art by Special Operations in Phase Zero*. Denver, CO: Outskirts Press, 2013.

Pham, Thi Luc Hoa. *ICT Development Strategies*. Hamburg, DEU: Anchor Academic Publishing, 2014.

Rahman, Hakikur. “Capacity Development Initiatives for Grass Root Communities: Two Cases.” In *Cases on Progressions and Challenges in ICT Utilization for Citizen-Centric Governance*, edited by Hakikur Rahman, 69-104. Hershey, PA: IGI Global, 2012.

RASCOM. “RASCOM’s Missions and Objectives.” Accessed April 14, 2016. http://www.rascom.org/info_detail.php?langue_id=2&id_r=19& id_sr=0&id_gr=2.

RascomStar. “Our Services.” Accessed April 3, 2016. http://www.rascomstar. com/services.php.

Rodriguez, David. “United States Africa Command 2016 Posture Statement.” Africom.mil. Last modified March 8, 2016. Accessed April 20, 2015. http://www.africom.mil/NewsByCategory/document/28035/2016-posture-statement.

Roslee, Mardeni, and Rasty Last Chimheno. “Wireless Regional Access Networks: A Wise Choice for Internet Connectivity to Rural Areas of Zimbabwe.” *Modern Applied Science* 7, no. 7 (2013): 29-41.

Sharp, Tim. “How Big is Earth?” Last modified September 17, 2012. Accessed December 20, 2015. http://www.space.com/17638-how-big-is-earth.html.

Spaceref. “Satellite Constellation Tailored for African Continent now Operational.” Last modified March 11, 2016. Accessed April 3, 2016. http://spaceref.biz/company/satellite-constell ation-tailored-for-african-continent-now-operational.html.

Universal Postal Union. “COPTAC Members.” Accessed April 14, 2016. http://www.upu.int/en/the-upu/restricted-unions/coptac/members.html.

U.S. Army Command and General Staff College. *Space Reference Text 2016*. Ft. Leavenworth, KS: Government Printing Office, 2016.

U.S. Government Accountability Office. GAO-15-459, *Report to the Committee on Armed Services, U.S. Senate, Defense Satellite Communications, DOD Needs Additional Information to Improve Procurements.* Washington, DC: Government Accountability Office, 2015.

Varrall, Geoff. *Making Telecoms Work: From Technical Innovation to Commercial Success*. Hoboken, NJ: John Wiley and Sons, 2011.

Watts, Stephen. *Identifying and Mitigating Risks in Security Sector Assistance for Africa's Fragile States.* Santa Monica, CA: RAND Corporation, 2015.

WhatIs.com. “Latency.” Last modified 2016. Accessed April 28, 2016. http://whatis.techtarget.com/definition/latency.

World Bank. *Information and Communications for Development 2009: Extending Reach and Increasing Impact*. Herndon, VA: World Bank Publications, 2009.

———. *Information and Communications for Development 2012: Maximizing Mobile.* Herndon, VA: World Bank Publications, 2012.

Zhen-Wei Qiang, Christine, Asheeta Bhavnani, Nagy K. Hanna, Kaoru Kimura, and Randeep Sudan. *Rural Informatization in China.* Washington, DC: World Bank, 2009.