COMBAT WITH THE GOD OF WAR: A COMPARISON OF RUSSIAN CANNON ARTILLERY FROM 2000 TO 2016 USING A DOTMLPF FRAMEWORK

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While the United States Army's artillery branch transitioned to fight a counter-insurgency fight for over 15 years, other militaries' artillery arms were in a transition as well. The use of U.S. artillery was limited in the conflicts of Iraq and Afghanistan. Meanwhile, Russia fought in Chechnya, Georgia, and Ukraine, all using artillery, the so called "god of war," as the centerpiece of their tactical and operational approach. Russia used lessons learned from each of these conflicts as well as the United States' conflicts in adapting their use of artillery. This thesis is a comparative study of Russian cannon artillery from 2000 to 2016, and what the United States Army, and more precisely, the artillery community of the United States Army, should learn from what the Russians implemented. Although this generation of warfare is perceived as new, the use of artillery on the battlefield remains relatively unchanged.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

COMBAT WITH THE GOD OF WAR: A COMPARISON OF RUSSIAN CANNON ARTILLERY FROM 2000 TO 2016 USING A DOTMLPF FRAMEWORK, by Major Sean R. Grubofski, 85 pages.

While the United States Army's artillery branch transitioned to fight a counter-insurgency fight for over 15 years, other militaries' artillery arms were in a transition as well. The use of U.S. artillery was limited in the conflicts of Iraq and Afghanistan. Meanwhile, Russia fought in Chechnya, Georgia, and Ukraine, all using artillery, the so called "god of war," as the centerpiece of their tactical and operational approach. Russia used lessons learned from each of these conflicts as well as the United States' conflicts in adapting their use of artillery. This thesis is a comparative study of Russian cannon artillery from 2000 to 2016, and what the United States Army, and more precisely, the artillery community of the United States Army, should learn from what the Russians implemented. Although this generation of warfare is perceived as new, the use of artillery on the battlefield remains relatively unchanged.

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ACRONYMS

BTG	Battalion Tactical Group
COIN	Counter-insurgency
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities
FM	Field Manual
NSS	National Security Strategy
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
PGM	Precision-Guided Munition
SPH	Self-Propelled Howitzer
TRADOC	Training and Doctrine Command
UAV	Unmanned Aerial Vehicle

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CHAPTER 1

INTRODUCTION

> I do not have to tell you who won the war. You know the artillery did.
>
> —General George S. Patton, *Military Quotes*

> Artillery is the god of war.
>
> —Joseph Stalin, *AZ Quote*

Overview

After the initial invasions of Iraq and Afghanistan, the United States Military transitioned to primarily an advise and assist role in stability operations to support Iraqi and Afghan partners. Many artillery personnel transitioned from their traditional role of lethal combat operations to non-lethal fires such as Information Operations. The flexibility of the soldiers within the branch also led to non-doctrinal roles such as Company Intelligence Support Teams which allowed intelligence gathering and processing at the company level. Field artillery batteries largely deployed to theater without their cannons, received Mine Resistant Ambush Protected vehicles, and served as trainers in infantry tactics or acted as security for Provincial Reconstruction Teams. Continual deployments conducting these types of missions for more than a decade created a void in the very perishable skills of providing fire support to maneuver units. The use of artillery personnel in non-lethal roles created many issues as described in the White Paper, “The King and I: The Impending Crisis in Field Artillery’s ability to provide Fire Support to Maneuver Commanders.” “No branch of the Army has suffered a

greater identity crisis than Field Artillery as a result of transformation, COIN-centric operations and the non-standard manpower demands of OIF/OEF."[1]

While the United States military's void in artillery knowledge and skills has continued to grow, our near-peer competitors, specifically Russia, have evolved their use of their field artillery branches, which Russia calls "the god of war." The Russians adapted their artillery skills through lessons learned during engagements in Chechnya in 2000, Georgia in 2008 and currently in Ukraine. The Russian employment of artillery has shown a marked increase in capability and new techniques in target identification and adjustment of fires.

The implications of the United States' focus on the counter-insurgency (COIN) fight and the increased Russian capability and techniques in using artillery have created a gap between the two militaries. The United States Military has a void which requires half a generation of officers and non-commissioned officers to regain their knowledge and skills in preparation to fight a near-peer competitor on future battlefields.

Primary Research Question

The decreased knowledge of mid-grade U.S. Army leaders and the ever-changing battlefield allowed U.S. adversaries to bridge the gap in artillery skills which existed prior to the Global War on Terror. Since the Global War on Terror, the tactical use of artillery in the United States Army has diminished. Over the course of multiple conflicts, the Russians have demonstrated their ability to adapt to new technology and incorporate

[1] Sean MacFarland, Michael Shields, and Jeffery Snow, "The King and I: The Impending Crisis in Field Artillery's Ability to Provide Fire Support to Maneuver Commanders (White Paper for the Chief of Staff of the Army, 2006).

new systems in their tactics. The U.S. military has lost its advantage and should relearn their artillery skills to prepare for the future possibility of fighting a peer/near-peer competitor. In order to prepare for a future conflict, a baseline should be set to determine how artillery will be used in conflicts of the twenty-first century. One possibility to establish a baseline is by conducting a comparative study to answer the question: "What were the changes in Russian cannon artillery from 2000 to 2016 when examined within the framework of Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities (DOTMLPF)?"

Secondary Research Questions

To derive an answer to the primary research question: "How did DOTMLPF change in Russian cannon artillery from 2000 to 2016 a few secondary questions should first be answered. Understanding the secondary questions provides a logical approach to understanding Russian artillery integration and how it may impact on U.S. Army artillery by utilizing the DOTMLPF framework.

The secondary questions to be answered in this thesis are:

1. What was Russia's approach to the use of cannon artillery in 2000?
2. What was Russia's approach to the use of cannon artillery in 2016?
3. What does Russian experience with the use of cannon artillery since 2000 tell other militaries about how they will use it in the future?

Definition and Terms

The following definitions and terms provide greater granularity in the context of this thesis. The intent is to provide a common understanding of core concepts presented to the reader in the framework of this thesis.

Cannon Fire: Artillery fired from a rifled cannon, self-propelled and towed, either offensive or defensive in nature. Cannon fire does not include rockets, missiles, or mortars.

Decisive Action: Decisive action is the continuous, simultaneous combinations of offensive, defensive, and stability or defense support of civil authorities' tasks.[2]

DOTMLPF: The Department of Defense uses the DOTMLPF framework as described by the Joint Capabilities Integration Development System to provide solutions to problems. DOTMLPF is an acronym to define Doctrine, Organization, Training, Materiel, Leadership and Education, and Personnel, and Facilities. One can use DOTMLPF as a framework to analyze another country and use the data to translate the information to structure a solution for the United States military. The framework in this thesis will not use facilities since the process in which the Russian military uses design bureaus for its artillery does not correlate with how the U.S. Army utilizes facilities in the framework.

Full Spectrum Operations: in 2008, was the "Army's core idea about how to conduct operations on land—its operational concept. Full-spectrum operations entail the

[2] Headquarters, Department of the Army (HQDA), Army Doctrine Reference Publication (ADRP) 3-0, *Operations* (Washington, DC: Government Printing Office, 2016), 3-1.

application of combat power through simultaneous and continuous combinations of four elements: offense, defense, stability, and civil support."[3]

Unified Land Operations: The Army's contribution to Joint Operations is Unified Land Operations. Unified land operations are simultaneous offensive, defensive, and stability or defense support of civil authorities' tasks to seize, retain, and exploit the initiative and consolidate gains to prevent conflict, shape the operational environment, and win our Nation's wars as part of unified action.[4]

Assumptions

A primary assumption of this thesis is that Russian artillery practices or employment did not evolve or change significantly between 1984 when Field Manual (FM) 100-2-1, *The Soviet Army: Operations and Tactics* was published, and 2000, which is the beginning year of study pertaining to the thesis.

Limitations and Delimitations

Limitations are inherent restrictions in the study that the researcher cannot control or influence; they are acknowledged study design weak points. Delimitations are deliberate restrictive choices made by the researcher; they are self-imposed limitations to establish a refined scope of research. A significant limitation of this study is much of the data pertinent to this thesis is classified, but the paper itself must remain unclassified for

[3] U.S. Department of the Army, *2008 Army Posture Statement*, accessed 19 April 2018, https://www.army.mil/aps/08/information_papers/transform/Full_Spectrum_Operations.html.

[4] HQDA, ADRP 3-0, 3-1.

distribution purposes, so the researcher did not conduct any classified research. The classification creates a major issue when it comes to Russian artillery employment. Therefore, Russian employment described in this thesis is identified through tactical application during wars and conflicts Russia participated in from the dates analyzed in this thesis, with the exception of Syria. A delimitation will be focusing only on cannon artillery from the U.S. and Russian armies, not on rocket systems or other fires. However, the thesis will examine improvements of artillery pieces and the use of cannon artillery to include: target identification, adjusting fire, and how troops were organized tactically to employ cannon artillery. All aspects of DOTMLPF concerning Russian cannon artillery is analyzed throughout this thesis apart from facilities. Although Russia does not use DOTMLPF framework for its military, Russian artillery in this thesis is analyzed through an American perspective to allow a comparative analysis. Another delimitation will consist of time. Technology changes frequently so the thesis needs an endpoint. Therefore, this thesis will focus on the time period from 2000 to 2016, with only a brief snapshot of 1999 to illustrate how policies came to be in 2000. When discussing the Russian-Chechen War, the researcher will focus on the Second Russian-Chechen War which took place from August 1999 to April 2009. Finally, examining cannon artillery, allows this thesis to focus on the tactical use of artillery, but will examine national and regional level documents which led to developments of artillery systems and the tactical use of cannon artillery on the battlefield. Although Russian cannon artillery is considered self-propelled howitzers, towed howitzers, mortars and anti-tank systems, the researcher will not take mortars or anti-tank systems into account for the purpose of this thesis. Research cut-off date for this thesis is August of 2017.

Significance

The United States Army, is in a state of transition as doctrine moves from Full Spectrum Operations to Unified Land Operations which focuses on Decisive Action. The transition is due to the threat of a peer or near-peer competitor, most notably, Russia, China, North Korea, and Iran, as the big four. Russia, as one of the big four, uses artillery as the focal point of their military. The United States military has enablers such as artillery, which support maneuver, while in the Russian military, "maneuver supports artillery. Artillery is the decisive finishing arm for the Russian army,"[5] which shows the emphasis the Russian military places on artillery.

The significance of this thesis is its reflections upon the implications of changes in Russian artillery for the United States artillery branch. The branch's adaptation is especially imperative as many artillery officers' knowledge and skills for supporting maneuver with fires have eroded over the past fifteen years. The lack of skills, if not reversed quickly, will erode the trust of maneuver forces as well as diminish the effectiveness of support. There is no better time than the present to learn from ourselves and a potential enemy to implement lessons and concepts into the force. Technology changes rapidly and once implemented into a formation, it can increase the effectiveness of a military. However, the military may become over reliant on the new technology which creates problems if an adversary has a countermeasure to defeat it. Additionally, while the United States has focused on COIN operations for over fifteen years, its adversaries have learned new ways to attack and defend against the U.S. military. This

[5] Asymmetric Warfare Group, *Russian New Generation Warfare Handbook* (Fort Leavenworth, KS: Center for Army Lessons Learned, 2017).

thesis is unique because it will compare a near-peer threat prior to the so-called "Global War on Terror" to the recent past using the DOTMLPF framework.

Conclusion

The United States military needs to be proactive in its ability to adapt to possible wars in the future. Artillery skills are perishable and should be trained consistently within combined arms in order to provide responsive fires on the future battlefield. Currently the U.S. military is behind in the tactical employment of artillery. The U.S. artillery branch needs to work diligently to rebuild its skills and to learn from other countries to improve these skills.

The next chapter explores relevant literature organized by DOTMLPF in the areas of Russian artillery, Russian TTPs, the Russo-Chechen War, the Russo-Georgian War, and Ukrainian conflict in the Donbas to describe the comparison between Russian cannon artillery from 2000 to 2016:

1. What was Russia's approach to the use of cannon artillery in 2000?
2. What was Russia's approach to the use of cannon artillery in 2016?
3. What does Russian experience with the use of cannon artillery since 2000 tell other militaries about how they will use it in the future?

A systematic approach to answering the secondary research questions is useful in the comparative study of the primary research question, "What were the changes in Russian cannon artillery from 2000 to 2016 when examined within the framework of DOTMLPF?"

CHAPTER 2

LITERATURE REVIEW

> Know thy self, know thy enemy. A thousand battles, a thousand victories.
> —Sun Tzu, *Brainy Quote*

Introduction

Since Russia is a top-tier military adversary of the United States, numerous people inside and outside the United States have studied their tactics. This thesis includes doctrine, books, articles, National Security Strategies, studies, and first-hand accounts to answer the research question, "What were the changes in Russian cannon artillery from 2000 to 2016 when examined within the framework of DOTMLPF?" The comparison is derived from the ZAPAD exercise of 1999, which led to new Russian practices in 2000, when compared with case studies of Russia's approach in its use of cannon artillery in Chechnya, Georgia, and Ukraine. Finally, after analyzing how Russian cannon artillery has progressed, the paper will examine its potential impacts on the United States Army artillery branch. While other studies such as the Russian New Generation Warfare discuss improvements in Russian artillery and provide some recommendations, it does not compare Russian artillery prior to the so-called "War on Terror" to current conditions and it does not use a DOTMLPF framework.

Background

Since artillery is the main weapon system of the Russian military, one has to relate this to the country's practice of deterrence. Analyzing how Russia approaches war using cannon artillery is critical to understanding the Russian military as a whole.

Sources that provide background include *Military Balance*, *The Russian Way of War,* old U.S. Doctrine on Soviet Tactics, and the National Security Strategies of both Russia and the United States.

Military Balance is an annual assessment of global military capabilities and defense economics by IISS (International Institute for Strategic Studies), which is a global think tank researching political and military conflict.[6] *The Russian Way of War* is a comprehensive study by Dr. Les Grau and Charles Bartles from the Foreign Military Studies Office located at Fort Leavenworth, Kansas. Both are well-renown experts in the field of Russian war and tactics. Field Manual (FM) 100-2-1, *The Soviet Army: Operations and Tactics* from July of 1984, provides a baseline knowledge of Soviet tactics and organization during the Cold War and provides an unclassified view of how Russia used artillery in Chechnya. The National Security Strategies (NSS) of the United States and Russia describe the focus of each country on potential global threats and explains deterrence strategies in preparation for a conflict that may or may not happen. The NSS further examines what internal and external factors lead to military development. The researcher will show how the United States NSS relates to the European Command Military Strategy to formulate a baseline with which to focus the importance of artillery to Russia's deterrence policy.

Russia's NSS from 2000 reflects a weakened country whose primary focus is on economic growth and defense. It states the main threats in the international sphere are due to a threat to international security, danger of a weakened economy and military

[6] The International Institute for Strategic Studies, accessed 19 February 2018, iiss.org.

influences. Russia's personal sovereignty was at risk through NATO expansion eastward, to possibly threaten Russian land.[7] The Russian NSS is defensive. Not once in the entire NSS, does Russia refer to the United States by name. In contrast, the United States NSS of 2000 mentions Russia by name 43 times and optimistically portrays the relationship between Russia and the United States.

Comparison of the NSS of Russia from 2000 to 2016 and the United States in 2015 shows that each nation's view of the world has shifted dramatically. Russia now mentions the United States by name, and although one of the references relates to partnership, at other times it relates to a threat to Russian national interests. The tone of Russia's NSS is also much more optimistic as to their impact globally. The United States NSS of 2015 has an entire section relating to the deterrence of Russian aggression most closely related to the engagements of Russia in Crimea and the Donbas regions. The impact regionally is further translated in the European Command Military Strategy where it states:

> Russia is presenting enduring challenges to our allies and partners in multiple regions; therefore, it is a global challenge that requires a global response. USEUCOM will work with other combatant commands, the Joint Staff, and the Office of the Secretary of Defense to ensure that collective DoD deterrence efforts are synchronized and achieve the desired effect without causing unwarranted escalation or provocation.[8]

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[7] Arms Control Association, "Russia National Security Strategy," 1 January 2000, accessed 20 December 2017, https://www.armscontrol.org/act/2000_01-02/docjf00.

[8] Gen Philip M., Breedlove, USAF, *United States European Command: Theater Strategy* (Germany: Headquarters, United States European Command, 2015), 5, accessed 20 December 2017, www.eucom.mil/media-library/document/35147/useucom-theater-strategy.

Therefore, to preserve the sovereignty of countries within Europe, the United States Army should be ready to act in support against a common enemy, especially an enemy which uses artillery as its major conventional/nuclear weapon system of its ground forces to deter western aggression.

Second Chechen War

The Second Chechen War provides a baseline of Russian artillery tactics and capabilities in the beginning of the twenty-first century. The Second Chechen War was examined by multiple professionals to provide guidance to the United States military. Research for this paper identified two such professionals to specifically analyze Russian artillery in Chechnya. Olga Oliker analyzes the Russian-Chechen Wars in *Russia's Chechen Wars 1994-2000: Lessons from Urban Combat*, published in 2001. She is one of the leading experts of Russia on the Second Chechen War. She is a Senior Adviser and Director of the Russia and Eurasia Program as part of the Center for Strategic and International Studies and was formerly a member of the RAND Corporation.[9] Her analysis of the Second Chechen War while she was part of the RAND Corporation is vital to explain the use of cannon artillery and the leadership involvement during the war. Another source used to describe Russian artillery during the Second Chechen War comes from a Master of Military Arts and Sciences thesis by Richard Wallwork titled "Artillery in Urban Operations: Reflections on Experiences in Chechnya." Wallwork's thesis explains the reliance of artillery in the Russian army and the reactionary nature to

[9] Center for Strategic and International Studies, "Olga Oliker, Senior Adviser and Director, Russia and Eurasia Program," accessed 19 February 2018, https://www.csis.org/people/olga-oliker.

overcome obstacles unforeseen from an unpracticed army. The thesis also describes problems that arise when one military underestimates another.

Russian-Georgian War

Research of the Russian-Georgian War describes a mid-point in the comparative years of 2000 through 2016 to explain lessons learned from the Second Chechen War and subsequent artillery tactics used in the Donbas of Ukraine. The data points come from the book, *Guns of August 2008: Russia's War in Georgia* by Svante Cornell and Frederick Star. Although the war only lasted five days, Russia learned many lessons that led to new innovative ways to aid artillery.

Russian-Ukrainian Conflict

Russia's actions in Ukraine created global unease when they attacked an unsuspecting sovereign nation with artillery. Russia was able to deploy quickly, identify targets with Unmanned Aerial Vehicles (UAV), and changed their organization for combat to support a wide front in the Donbas. Much of what has occurred in Ukraine led to a recent update to Field Manual (FM) 3-0, *Operations* of U.S. doctrine. With FM 3-0, the United States Army transitioned away from Full Spectrum Operations of a continuous and simultaneous combinations of offense, defense, stability, and civil support operations used during the conflicts in Iraq and Afghanistan. Now the emphasis is on Unified Land Operations, which describes how the Army seizes, retains, and exploits the initiative to gain and maintain a position of relative advantage in sustained land operations through simultaneous offensive, defensive and stability operations in order to prevent or deter

conflict, prevail in war and create the conditions for favorable conflict resolution.[10] In FM 3-0, the introduction identifies China, North Korea, Iran, and most notably Russia as the four main adversaries to the United States.[11] To further explain the threat of Russian artillery, FM 3-0 provides an example of a devastating Russian artillery strike against Ukrainian forces in Zelenopillya, Ukraine:

> In July 2014, the Ukrainian Army moved several mechanized brigades into a position near the Russian border to prevent the illegal movement of military equipment across the frontier to rebels in eastern Ukraine. Early on the morning of 11 July, soldiers at the position noticed a drone orbiting above them for some time. Not long after the drone disappeared, rockets fired from 9A52-4 Tornado multiple launch rocket systems began landing on one of the brigades. The barrage lasted four minutes. Rockets carrying a mixture of high explosive, cluster, and thermobaric munitions smothered the unit's position. Cannon rounds followed the rockets with devastating effect. The Ukrainian soldiers took appalling losses. One battalion was virtually destroyed, and others were rendered combat ineffective due to heavy losses in vehicles and personnel. Casualties quickly overwhelmed army and local medical facilities. In the days that followed, rocket and cannon strikes continued, disrupting the Ukrainian Army's ability to defend that region of eastern Ukraine.[12]

At first glance, the Russian success in its use of artillery at Zelenopillya looks daunting, however, through further examination of the engagement, this is not the case. The Russians attacked an unsuspecting Ukrainian military that was not ready for combat where Ukrainian vehicles which were positioned bumper to bumper much like in a motor pool. Russia used primarily high explosive, point-detonating munitions which rendered

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[10] Headquarters, Department of the Army (HQDA), Army Doctrine Publication (ADP) 3-0, *Unified Land Operations* (Washington, DC: Government Printing Office, 2011), 14.

[11] Headquarters, Department of the Army (HQDA), Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, 2017), ix.

[12] Ibid., 1-3.

multiple battalions ineffective, but caused only a few casualties compared to the number of rounds fired. In addition to the new FM 3-0, other research, studies, and articles have been published to conceptualize the artillery tactics in Ukraine. One study is the *Russian New Generation Warfare* by the Asymmetric Warfare Group which is a handbook for U.S. Army formations to increase awareness of Russian tactics, near-peer capabilities, and current U.S. non-material solutions to mitigate the threat posed by Russian proxies.[13] *Red Diamond*, a newsletter by U.S. Training and Doctrine Command (TRADOC) provides operational environment analysis and control element threats integration[14] out of Fort Leavenworth, Kansas. Grau and Bartles from Foreign Military Studies Office, who are the recognized Russian experts, continue their study through numerous publications of articles on the subject of Russian artillery tactics on the Ukrainian conflict. These documents provide insight into how uses artillery in its army and potentially how Russia will use artillery in future conflicts.

Practical Application

As the United States Army transitions from Full Spectrum Operations to Unified Land Operations, the emphasis of doctrine links high-intensity conflict to the threat of a peer or near-peer competitor. Therefore, the enemy should be understood in order to build a foundation to allow creative and critical thinking, and gather the lessons learned from friendly and enemy tactics/operations to further develop U.S. and allied forces.

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[13] Asymmetric Warfare Group, *Russian New Generation Warfare Handbook*, cover.

[14] TRADOC Threats, *OEE Red Diamond* 8, no. 8 (August 2017): cover.

The Army has been in a COIN fight in Afghanistan and Iraq for over fifteen years. Numerous lessons learned came from these campaigns, both for U.S. doctrine and for our adversaries. Russia have implemented changes to its organization and introduced new technology that the U.S. used in Iraq and Afghanistan, but in a new way. The Russian Army has restructured their army around the brigade to operate in a broad front. A motorized rifle (mechanized infantry) or tank brigade has four maneuver battalions, four artillery battalions, two air defense battalions, a logistics battalion, a maintenance battalion, a signal battalion, an engineer battalion, an electronics warfare company, an UAV company, a Nuclear, Biological, and Chemical company, and a medical company.[15]

Creative and critical thinking is imperative when developing ideas on how to defeat an enemy and plan for the next war rather than continue to fight the previous war. Critical and creative thinking are the basis for the Army Design Methodology to understand, visualize, and describe complex, ill-structured problems and develop approaches to solve them.[16] With the knowledge of the Russian Army's strength in artillery, the benefits of thinking critically and creatively enables a military to exploit gaps. Although maneuver is one approach to accomplish the task, this thesis will concentrate on the fires aspect. Once artillery concepts are identified, the use of them should benefit maneuver forces.

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[15] Lester W. Grau and Charles K. Bartles, *Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces* (Fort Leavenworth, KS: Foreign Military Studies Office, 2016), 101.

[16] Headquarters, Department of the Army (HQDA), Army Doctrine Reference Publication (ADRP) 6-22, *Army Leadership* (Washington, DC: Government Printing Office, 2012), 5-1.

Similarly to how the Russians have developed new Tactics, Techniques, and Procedures (TTPs) through the U.S. experience, the U.S. Army can adapt based on the lessons learned from the Russian conflicts in Chechnya, Georgia, and Ukraine. While the conflicts in Chechnya and Georgia may appear to be decisive victories, Russia made numerous mistakes that the U.S. Army can exploit. It would not be prudent to assume Russia would fight against America in the same way they did in each of the above conflicts, but it is probable they would build upon their experiences.

Conclusion

During the Cold War, the United States invested heavily in understanding the only other superpower in the world. The focus of the U.S. military shifted after the fall of the Soviet Union to the Middle East, which is evident since every major conflict the U.S. was involved in occurred in that region since 1991. While the U.S. fought in the Middle East, Russia regained its global reputation by attacking Chechnya, Georgia, and Ukraine. Once again, the United States is paying attention. The evidence is clear from how the NSS has changed its language and tone towards Russia and the increase in reporting and research from the Second Chechen War to Ukraine.

The next chapter presents the research methodology for assessing the comparison of Russian cannon artillery from 2000 through 2016.

Chapter 4 furnishes answers to the following secondary research questions:

1. What was Russia's approach to the use of cannon artillery in 2000?
2. What was Russia's approach to the use of cannon artillery in 2016?
3. What does Russian experience with the use of cannon artillery since 2000 tell other militaries about how they will use it in the future?

A sequential and systematic approach to answering the secondary research questions is useful in answering the primary research question, “What were the changes in Russian cannon artillery from 2000 to 2016 when examined within the framework of DOTMLPF?” Ultimately, in chapter 5, the answer to these questions should help answer the final question: What recommendations can be identified to counter or defeat Russian artillery?

CHAPTER 3

RESEARCH METHODOLOGY

> The speed, accuracy and devastating power of American Artillery won confidence and admiration from the troops it supported and inspired fear and respect in their enemy.
>
> —Dwight D. Eisenhower, *AZ Quote*

Introduction

After the fall of the Soviet Union in 1991, Russia has worked to return to the world stage as a military threat. Although somewhat constrained by funding, Russia has continued to increase their artillery capabilities to remain relevant whereas the United States has limited its advancements in artillery since the 1980s. In order to remain relevant as a global power, "Russia links external threats to NATO's enlargement and its readiness to undertake out-of-area operations,"[17] such as the perceived threat of Chechen guerillas. Russia has learned lessons from their own conflicts in Chechnya, Georgia, and Ukraine as well as from the conflicts of the United States in Iraq and Afghanistan. This thesis will conduct a qualitative comparative study analysis to "Compare Russian cannon artillery from 2000 to 2016 using a DOTMLPF framework." Artillery in the United States Army is viewed as the "King of Battle" where as in Russia it is viewed as the "god of war." Therefore, it is beneficial to look at how Russian artillery has evolved in

[17] The Military Balance, "Russia," *The Military Balance* 100, no. 1 (2000): 110, 22 January 2009, accessed 17 December 2017, https://doi.org/10.1080/04597220008460142.

doctrine, organization, training, materiel, leadership and education, and personnel to return as a peer/near-peer competitor with the United States military.

Doctrine

Russian doctrine[18] will consist of unclassified versions of U.S. field manuals during the Cold War era to establish a baseline of knowledge. The evolution of Russian doctrine will be revealed by examining Russian best practices in Chechnya, Georgia, and Ukraine to show an increase in artillery capability. The U.S. Army should learn from Russian practices to help derive an answer to secondary question 4, "What recommendations can be identified to counter or defeat Russian artillery?"

Organization

The depiction of Russian artillery organization comes from written and graphic examples that come from articles written by the Foreign Military Studies Office by Grau and Bartles, from the Russian New Generation Warfare study from the Asymmetric Warfare Group, RAND studies from such authors as Olga Oliker, and from articles written by Brad Marvel in *Red Diamond*. These documents demonstrate how Russia changed its artillery organization depending on whether it was fighting in urban or rural terrain.

[18] Russians define doctrine as preparing the entire nation for war economically, politically, agriculturally, morally, militarily, and industrially which has strategic implications. Russian doctrine is used in this thesis to describe Russian best practices or employment in order to fit the DOTMLPF framework and the U.S. concept of doctrine.

Training

Training of Russian artillery soldiers focuses on the ZAPAD exercise in 1999 and how it has translated into new best practices and TTPs. Furthermore, an analysis of what training followed due to lessons learned through Russia's conflicts in Chechnya, Georgia, and Ukraine demonstrate where Russia found gaps in their soldier's abilities to use artillery to overwhelm their enemy.

Materiel

Materiel will be depicted using descriptions, charts, and pictures to show Russian cannon artillery systems and their capabilities from 2000 to 2016. It will also show the evolution of these cannon systems in each of the conflicts from Chechnya, Georgia, and Ukraine. Chapter 5 explains the ramifications of cost benefits of U.S. PGMs to Russian PGM and the effect if Dual-Purpose Improved Conventional Munitions are removed from the U.S. Army arsenal.

Leadership and Education

Leadership and Education will be derived from articles again written by Grau and Bartles describing how officers are the "backbone" of the Russian artillery military and the kind of training the officers receive prior to entering their unit.

Personnel

Personnel in the Russian artillery units will be explained through the evolution from conscripts to contract Non-Commissioned Officers using Foreign Military Studies Office articles and the *Russian New Generation Warfare* study. The intent of the Russian

military shows an evolution from solely an officer-centric organization to relying more and more on Non-Commissioned Officers, much like the western world.

Reasoning for Choosing the Years 2000 Through 2016

The years between 2000 and 2016 coincide with the implementation of Russian military policy under President Putin which led to the increase in activity, reformation, and recapitalization of its military effort including conflict with its former Soviet Union states. Conflicts in Chechnya, Georgia, and Ukraine provide concrete case studies of the outcomes of the efforts pushed to improve the capabilities of Russian artillery and lessons learned therefrom. During the same time period, the United States, which neglected any Russian military threat in the 1990s, after the fall of the Soviet Union, was focused on a COIN fight in both Iraq and Afghanistan during the so-called "Global War on Terror" campaign. In 2016, the United States shifted its focus from a COIN-centric military of Full Spectrum Operations to Unified Land Operations and began to look again at deterring Russia in Europe.

Russia was suffering from an economic crisis when it attacked Chechnya in the First Russo-Chechen War. The cost of oil increased during the Second Chechen War, which allowed Russia to put its economy on a good footing and to also take measures against former Soviet states to prevent them from joining NATO. Russia fought in Georgia in 2008 and began a conflict with Ukraine over Crimea and the Donbas region to prevent such an encroachment of NATO states and prevent the loss of their key Black Sea Fleet bases. Another benefit of the increase in oil prices was Russia could upgrade its artillery. This is identified with the production of the 2S35 and Global Navigation Satellite System (GLONASS)-enabled munition. One can learn much from an adversary

through their triumphs and failures over a timeframe as well as learn from one's own triumphs and failures. Historically, the United States has not gone to war with the country(ies) it has planned to fight but should continually strive to be prepared for such a war with a near-peer adversary.

Conclusion

Research indicates that the years between 2000 and 2016 were formative years in the transition of Russia artillery from decentralizing its artillery, the use of UAVs to support forward observers, and looking to the future to increase materiel capabilities. Knowing that Russia uses artillery as the focal point of its army lends one to believe that it is important to study this transition to understand how to combat this threat. The United States Army is also in a state of transition as it lessens its commitment in the Middle East and returns to training for large-scale, high-intensity conflicts. In chapter 4, the researcher strives to answer the secondary questions of,

1. What was Russia's approach to the use of cannon artillery in 2000?
2. What was Russia's approach to the use of cannon artillery in 2016?
3. What does Russian experience with the use of cannon artillery since 2000 tell other militaries about how they will use it in the future?

Finally, by comparing how tactics and developments affect Russian cannon artillery, the researcher can help provide an answer in chapter 5 on the last secondary question,

4. What recommendations can be identified to counter or defeat Russian artillery?

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

> The worse the troops, the greater the need of artillery.
>
> —Napoleon Bonaparte, *Quote Fancy*

Introduction

The United States was attacked on 11 September 2001 which focused its military effort on the Middle East. The initial invasion of Iraq relied heavily on artillery, but once phase IV stability operations began, artillery became less and less important. Depending on which Regional Command in Afghanistan a unit was serving, cannon artillery may or may not have been used to great extent. If artillery was employed, it was most likely as counterfire in reaction to incoming rockets or mortars. In contrast, the Russian military was involved in three regional conflicts since 2000: Chechnya, Georgia, and Ukraine. In each of these conflicts, Russia used cannon artillery consistently. While the skills of the U.S. army artillery began to diminish due to lack of use, the Russian artillery's skills improved. Therefore, it begs the question, what was Russia's approach to the use of cannon artillery in 2000 compared to 2016? Through analysis of the Second Chechen War, the Russo-Georgian War, and the Ukraine conflict, this thesis will strive to answer those questions.

Doctrine

The study of an adversary's doctrine can identify strengths and weaknesses in their ability. Some areas of artillery doctrine to focus on are the positioning of artillery, in reference to maneuver forces as well as firing positions, how artillery is employed

offensively and defensively, and what are the possible future updates based on TTPs used in combat. Although Russian "doctrine" is difficult to acquire through unclassified means, the U.S. military conducted extensive research on Russian artillery during the Cold War, which produced a U.S. understanding of Soviet (Russian) tactics. With the fall of the Soviet Union and the rebuilding of an army, it can be assumed that Russian artillery in 2000 was used in much the same matter as it was during the Cold War era.

In preparation for a high-intensity conflict Russia's gun positions normally were laid out at right angles to the axis of advance. The batteries deployed in a straight line, a half circle, a lazy "W," or a "V" formation with equal intervals between guns. to reduce emplacement/ displacement time[19] (see figures 1 and 2). Although vulnerable to counterbattery fire and air attacks, the Russians continue to favor this Soviet-style disposition to conduct manual gunnery quicker where enemy counterbattery fire was relatively weak. The reduced computation and mission time enables batteries to complete missions and relocate more quickly, thereby reducing their exposure to enemy fire and compensating somewhat for the vulnerability inherent in the formation.[20]

[19] Headquarters, Department of the Army (HQDA), Field Manual (FM) 100-2-1, *Soviet Tactics: Operations and Tactics* (Washington, DC: Government Printing Officer, 1984), 9-9.

[20] Ibid.

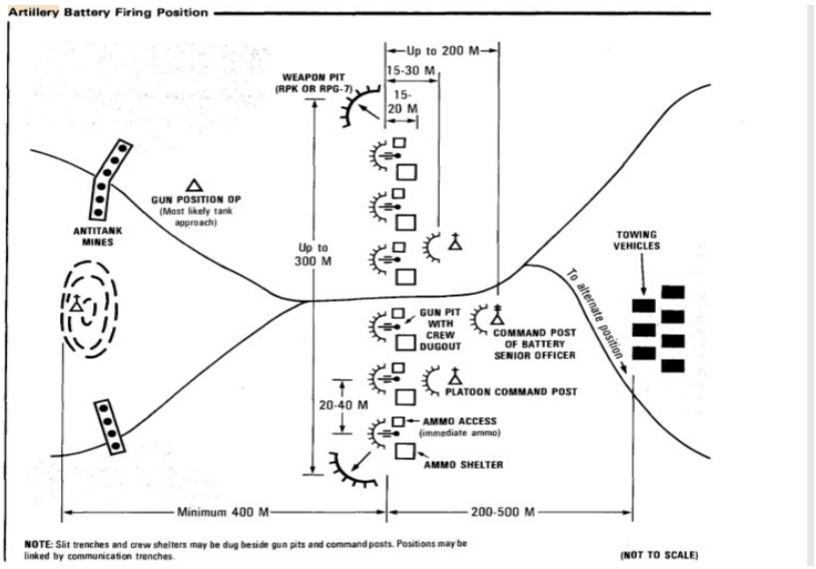

Figure 1. Artillery Battery Firing Position

Source: Headquarters, Department of the Army, Field Manual. 100-2-1, *Soviet Tactics: Operations and Tactics* (Washington, DC: Government Printing Office, 1984), 9-9.

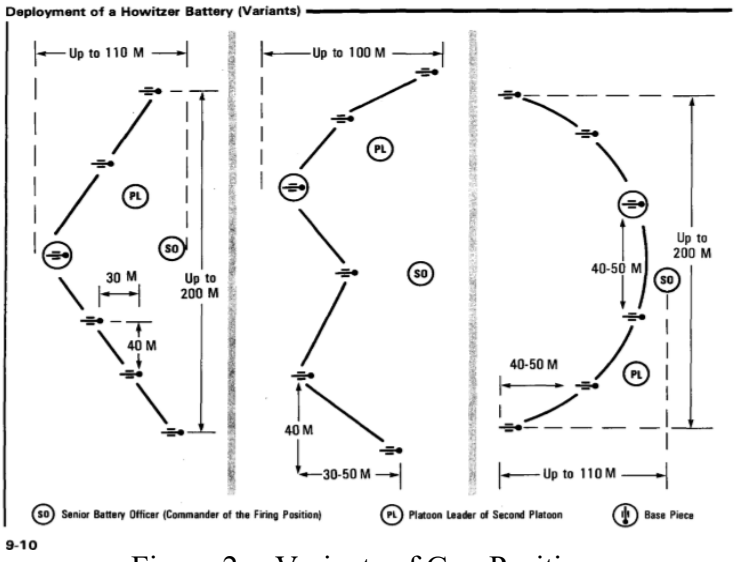

Figure 2. Variants of Gun Positions

Source: Headquarters, Department of the Army, Field Manual. 100-2-1, *Soviet Tactics: Operations and Tactics* (Washington, DC: Government Printing Office, 1984), 9-10.

Russian artillery in 2000 was employed in five methods of fire: rapid fire, systematic fire, counterbattery fire, maneuver by fire, and fire with direct aiming. Rapid fire is a method where the weapon is fired as quickly as possible without exceeding its maximum rate of fire and without sacrificing accuracy. Systematic fire usually alternates with rapid fire and is used against unobserved targets during fire assaults, controlling fire, and harassing fire.[21] Counterbattery fire is reactive fire against an enemy's artillery to suppress or destroy screened fire positions. Maneuver by fire is the shifting of a unit's fire from one target (or group of targets) to another without changing firing positions and is normally part of the defensive fire plan. Fire with direct aiming occurs when a gunner can sight directly on a target using visual contact. Direct aiming is recommended against relatively short-range targets under 1,200 meters.[22] For further reference, full descriptions of each method of fire is found in Attachment A. Direct aiming is effective since gun positions are deployed between one and four kilometers from the forward line of troops.

The intent of offensive artillery fire in the Russian army is to mass as much cannon artillery as possible on a target by using several batteries or battalions on a single target(s). Cannon artillery in a defense is used like a barrier, or curtain, with sectors of fire much like an infantry unit deploys its rifles and crew-served weapons. The standard reaction time for an artillery battalion is first rounds down range within two to three minutes, with the standard to adjust fire within another two minutes. The standard to

[21] HQDA, FM 100-2-1, 9-12.

[22] Ibid.

emplace or displace for self-propelled units is five minutes with towed-artillery being fifteen minutes.[23]

The above establishes a reference to what the United States was planning for in a fight with the Soviet Union during the Cold War. As the only perceived threat at the time, a large effort was conducted to understanding the primary enemy of the United States. This provides a baseline to the employment of Russian artillery tactics (doctrine) used during the Russian-Chechen War. In 2000, Russia was looking to focus more defensively and looking to improve their military through new procedures to develop and train against a decreased threat. "The doctrine was driven by a need to mass fires into concentrations to defeat a large number of armored targets on the battlefield. Battalion groupings are considered to be the optimal size to create the right balance between firepower, responsiveness, and flexibility."[24]

Russian combat during the second Chechen campaign demonstrated their preparation of the battlefield by using artillery as the main effort allowing maneuver to move and engage freely afterwards. This has remained the standard through all Russian tactics. Also, an update to best practices can be identified by a less centralized command and control system. Junior officers had more independent authority than in previous Russian/Soviet tactics to call for artillery support.[25]

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[23] HQDA, FM 100-2-1, 9-15.

[24] Chris Bellamy, *Red God of War: Soviet Artillery and Rocket Forces* (London: Brassey's Defence Publishers, 1986), 186.

[25] Olga Oliker, *Russia's Chechen Wars 1994-2000: Lessons from Urban Combat* (Santa Monica, CA: RAND Corporation, 2001), 58.

Next, a relatively new concept of Russian tactics in Chechnya was the increased employment of Laser-Guided munitions on the battlefield to gain an advantage in urban terrain. The 2K25 Krasnopol precision-guided munition (PGM) fired from the 2S19 MSTA proved valuable as its accuracy helped engage pinpoint targets. At the time the Krasnopol was the Russian howitzer round comparable to the U.S. Copperhead munition. "The 30F39 Krasnopol is a Russian 152/155 mm cannon-launched, fin-stabilized, base bleed-assisted, semi-automatic laser-guided, explosive projectile. It automatically 'homes' on a point illuminated by a laser designator, typically operated by a ground-based artillery observer." The package of a Krasnopol munition includes: The ammunition (1), the firing unit (2), the guided projectile (3) in flight, the target (4) and the laser emitter (5) and designator.[26] Precision-guided artillery munitions were used by Russian forces in Chechnya to attack reinforced Chechen positions with a high degree of accuracy.[27] The Krasnopol can be fired without meteorological and ballistic data at a range of ten to twelve kilometers.[28] A comparison between the Krasnopol and Copperhead rounds are described in table 1.

[26] Military Analysis Blog, "PGM Artillery," July 2015, accessed 4 March 2018, http://militaryanalysis.blogspot.com/2015/07/pgm-artillery.html.

[27] Richard Wallwork, "Artillery in Urban Operations: Reflections on Experiences in Chechnya" (Master's Thesis, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 2004), 62.

[28] Walter Williams, "Threat Update Krasnopol—A Laser-Guided Projectile for Tube Artillery," Federation of American Scientists, accessed 23 March 2018, https://fas.org/man/dod-101/sys/land/row/krasnopol.htm.

In the Russo-Georgian War of 2008, Georgia was not prepared for a conventional engagement with Russia.[29] Although relations were deteriorating, Georgia did not expect a unified military effort between separatists and the Russian military. Russia began its support of the separatists of South Ossetia by shelling Georgian villages breaking a 1992 ceasefire agreement.[30]

However, due to poor communication systems and a poor command and control structure, Russia relied heavily on its Air Force rather than its artillery. The failure to initially identify and destroy Georgian air defenses resulted in numerous aircraft being shot down and eventually led to Russia purchasing UAV from Israel after the war.[31] Since there were limited avenues of approach, the Georgian artillery had a larger impact on the battle than the Russian artillery. Once again, although the Russo-Georgian War was widely viewed as a success of Russian artillery, research indicates Russian artillery effects were minimal in the conflict. Therefore, more lessons needed to be learned to better incorporate artillery after the annexation of Crimea to the escalation of conflict in the Donbas region of Ukraine.

Table 1. Krasnopol and Copperhead Comparative Operational Data

[29] Svante E. Cornell and S. Frederick, eds., *The Guns of August 2008: Russia's War in Georgia* (New York: M.E. Sharpe, 2009), 164-165.

[30] Hakan Karlsson, "Competing Powers: U.S.–Russian Relations 2006-2016" (Swedish Defense University, 12 September 2016), 50, accessed 21 March 2018 www.diva-portal.org/smash/get/diva2:1119554/FULLTEXT02.pdf.

[31] Cornell and Starr, *The Guns of August 2008*, 168.

CHARACTERISTICS	KRASNOPOL	KRASNOPOL-M	COPPERHEAD
Caliber (mm)	152	152/155	155
Firing System (NOTE: The following list of systems are presented as examples for each projectile caliber.)	TOWED: D-20, 2A36, 2A65 Msta-B SP: 2S3, 2S5, 2S19 Msta-S	TOWED: D-20, 2A36, 2A65 Msta-B, (US) M114A2, M198 SP: 2S3, 2S5, 2S19 Msta-S, (US) M109,	TOWED: M114A2, M198 SP: M109A2/3, M109A6
Range (km)	20	17	16
Warhead Type	Frag-HE	Frag-HE	HEAT
Length (mm)	1,300	955	1,370
Weight (kg)			
Projectile	50	43	62
Warhead	20.5	20	22.5
Explosive	6.5	6.5	6.7
Targets Engaged	Armored Vehicles, C^4I Posts, Field Fortifications	Armored Vehicles, C^4I Posts, Field Fortifications	Armored Vehicles
Target Attack Profile	Diving Top Attack	Diving Top Attack	Laser Illuminated Point

*Sourc*e: Walter Williams, "Threat Update Krasnopol—A Laser-Guided Projectile for Tube Artillery," Federation of American Scientists, accessed 23 March 2018, https://fas.org/man/dod-101/sys/land/row/krasnopol.htm.

By 2016, Russia's five methods of fire evolved from the Soviet form to its current form. The five described methods for conventional maneuver war under nuclear-threatened conditions were employed in the Donbas region of Ukraine as: Single Target Fire: fires directed against self-acquired targets or direct fire. Concentrated Fire: fires employed by more than one artillery system directed against the same target. Fixed Protective Curtain Fires: a continuous fire barrage, which is delivered on one of, or simultaneously on, several fronts of an attacking enemy. Moving Curtain Fires: a continuous fire barrage created on one or multiple fronts along the axis of advance of the enemy's armored units, which can later be directed at follow on locations depending on

the withdrawal of the enemy's advance. Accompanying Fires: the concentration of fires on targets located in front of an advancing friendly force, their flanks, and can later be directed at the enemy's rear area targets.[32] These methods of fire describe the use of artillery in both offensive and defensive actions.

Definitions of the classification of artillery target effects explain the priority of artillery in a military. Unlike U.S. artillery which classifies target effects as suppress, neutralize (10 percent destruction), and destroy (30 percent destruction), Russia classifies their target effects with artillery into four categories: annihilation (Kill probability of 70 to 90 percent), demolition (physical destruction of installations or positions), suppression (requires 30 percent destruction of targets), and harassing fires (focus on disrupting enemy operations).[33] The fact that Russian suppression fires are equivalent to U.S. destruction fires further demonstrates the Russian reliance of artillery on the battlefield.

Data from the Ukraine conflict show that artillery is producing 85 percent of casualties on both sides[34] especially when cannon artillery is used in a direct-fire mode. Specifically, the 2S1, 122mm, has been used as both an assault gun and as an anti-tank weapon. Typically, cannon artillery is two to six kilometers behind the front lines,[35] which is much closer to the forward line of troops than how U.S. artillery is employed.

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[32] Asymmetric Warfare Group, *Russian New Generation Warfare*, 18.

[33] Ibid.

[34] Philip A. Karber, "'Lessons Learned' from the Russo-Ukrainian War" (Historical Lessons Learned Workshop, Johns Hopkins Applied Physics Laboratory and U.S. Army Capabilities Center (ARCIC), 8 July 2015), 17.

[35] Asymmetric Warfare Group, *Russian New Generation Warfare*, 20.

Russia uses UAVs to observe and shift artillery. Russia is able to mass fires on targets in ways not previously used or seen prior to this conflict. In Eastern Ukraine, Russian Forces have demonstrated their ability to direct and adjust fires with their drones. Ukrainian forces have repeatedly seen a systematic approach by the Russians to acquire a target with a UAV. A high-altitude UAV will identify a Ukrainian target. It will then pass off that target to a lower altitude UAV to determine the target coordinates. Then the Russians will adjust their fire with the UAV based on the initial artillery strikes. The total time for this process can be as little as 10 to 15 minutes.[36]

> The July 11, 2014 strike at Zelenopillya is perhaps the most noticeable example to emerge from the war of the combined effects of tactical drones with the battalion tactical group—a task-organized force designed to achieve tactical overmatch against opponents—and its organic fires capabilities. The attack was a preemptive undertaking against Ukrainian brigades, postured in assembly areas, which were preparing to conduct offensive action against Russian and partisan forces. The buzzing of tactical drones and cyber-attacks targeting Ukrainian communications preceded the strike. An onslaught of rockets and artillery fell on the Ukrainian position shortly after the drones arrived, leaving thirty Ukrainian soldiers dead, hundreds more wounded, and over two battalions' worth of combat vehicles destroyed. This strike created anxiety within the US Army, specifically in relation to the sophistication of Russian cyber capabilities and the effectiveness of the new Russian reconnaissance-strike model. This strike also highlights the disparity in artillery and rocket munitions between Russia and the US Army. Russia still possesses and employs a variety of munitions, to include dual-purpose improved conventional munitions and thermobaric munitions, that the US Army elected to eliminate from its arsenal.[37]

The actions at Zelenpillya is a clear example of how lethality can increase with the incorporation of UAVs into the artillery community. However, there are still lessons

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[36] Ibid.

[37] Amos C. Fox, "The Russian–Ukrainian War: Understanding the Dust Clouds on the Battlefield" (Modern War Institute at West Point. January 17, 2017), accessed 20 March 2018, https://mwi.usma.edu/russian-ukrainian-war-understanding-dust-clouds-battlefield/.

being learned using this system to help expedite the process to incorporate all fires, and more specifically, cannon artillery used by the Russian army.

In order to determine the amount of artillery needed to create the most effects, Russia uses a nomogram system to determine what is needed. A nomogram is a mathematically-based tool used to determine the number of artillery pieces needed, the rounds expended, the rate of fire, and size of target in hectares (100 x 100 meters/2.471 acres).[38] Figure 3 shows a diagram of a nomogram. The example describes how the nomogram is used for indirect fires.

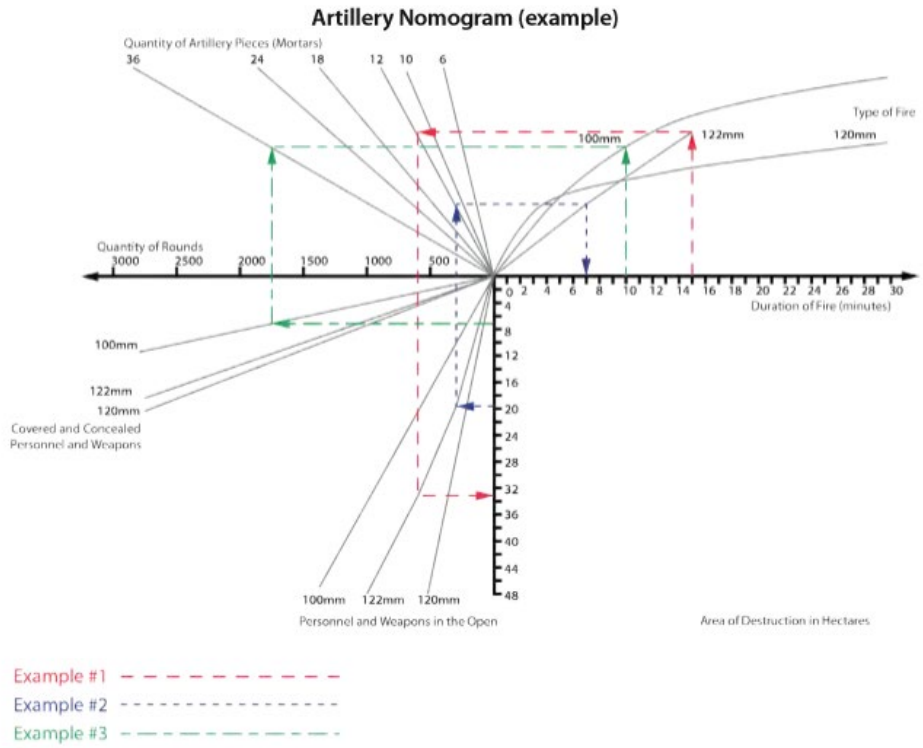

Figure 3. Artillery Nomogram Example

Source: Lester W. Grau and Charles K. Bartles, *Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces* (Fort Leavenworth, KS: Foreign Military Studies Office, 2016), 53.

[38] Grau and Bartles, *Russian Way of War*, 52.

Example 1 (depicted in red): Determine the area of destruction of 12 122mm howitzers against enemy personnel in the open using a 15-minute artillery fire strike. Begin at the "Duration of Fire" axis and find 15 minutes. Go straight up to find the 122mm "Type of Fire" line. Move horizontally left from that point to find the 12 line for the "Quantity of Artillery Pieces (Mortars)." Drop from that point to the 122mm line for "Personnel and Weapons in the Open." From that point, go horizontally to the "Area of Destruction" axis to read the answer-33 hectares. When the red line passed through the "Quantity of Rounds" axis, it showed that it will require 600 rounds[39] to destroy the target. Although Russia has the capability to use PGMs, Russia still prefers mass over precision. While the United States has spent a lot of time and money developing extremely accurate PGMs, Russia still focuses its effort in massed artillery. For Russia, not using PGMs is cheaper and is as effective as PGMs in destroying a target. The Russian military also does not care as much about collateral damage as the rest of the western world. Massed conventional rounds are possibly even more effective psychologically when it comes to the sheer terror it imposes on the enemy. Moreover, by using UAVs to adjust fire, the probability of error decreases, allowing for a much more destructive force of steel rain.

Past and current tactics used by Russian artillery remain more or less consistent, from 2000 to 2016. The need to use artillery to prepare the battlefield until maneuver forces can deploy uninhibited is the way Russia has always used artillery. It can be

[39] Grau and Bartles, *Russian Way of War*, 53.

assumed that Russia will continue to use artillery in the same way in the future. An exception is PGMs will augment direct fire artillery through echelonment of fires in urban operations. There are two main differences currently identified in the employment of Russian artillery practices in 2000 through 2016. First is the decentralization of the command and control system learned in the Second Russian-Chechen War. The second, learned through the Russo-Georgian War and demonstrated in Ukraine is the use of UAVs to identify targets and adjust fires on the target.

Organization

Organization of an army changes depending on the threat to give the army an advantage against its adversary or to better command and control a formation. For example, the United States Army transitioned from a Corps-based military to a Brigade-based military during COIN operations in Iraq and Afghanistan. With the transition, Division Artilleries were replaced with Fires Brigades. In recent years, and with the new FM 3-0, the U.S. Army has brought back Division Artilleries and the Corps is now the highest level of tactical command. During the Second Russian-Chechen War, Russia compiled a "heavy artillery group" from multiple sources, including artillery elements from the permanent readiness units created between the Chechen wars. Each ground force company commander had an artillery or mortar battery attached for direct support, and also had additional units on-call for general support.[40] Russian artillery was organized at a battalion level to provide effects on target prior to maneuver's incorporation into the fight. The direct support organization for combat was different than

[40] Oliker, *Russia's Chechen Wars*, 58.

how Russian tactics were perceived by the U.S. during the Cold War. During the war, artillery was effective, however, was unable to support ground forces to the level that was needed once Chechen forces closed the distance.

In 2016, Russia spent approximately $640 billion on improving their ground combat forces to include increasing their number of self-propelled howitzers by 2000 guns.[41] Changes to Russian organization in Ukraine show a transition to battalion tactical groups known as Battalion Tactical Groups (BTGs). BTGs commonly consist of a tank company, three mechanized-infantry companies, two anti-tank companies, two artillery batteries, and two air-defense batteries.[42] An example of a BTG is depicted in Figure 4. Russia has also invested heavily in UAV technology to provide better target acquisition on the battlefield. This effort shows that Russia is attempting to better integrate multiple warfighting functions much like a Brigade Combat Team of the United States Army.

[41] Amos C. Fox, "Russian Hybrid Warfare and the Re-Emergence of Conventional Armored Warfare: Implications for the U.S. Army's Armored Force," *eArmor* (July-September 2016), accessed 18 January 2018, http://www.benning.army.mil/armor/earmor/content/issues/2016/JUL_SEP/3Fox-Russia16.pdf.

[42] Ibid.

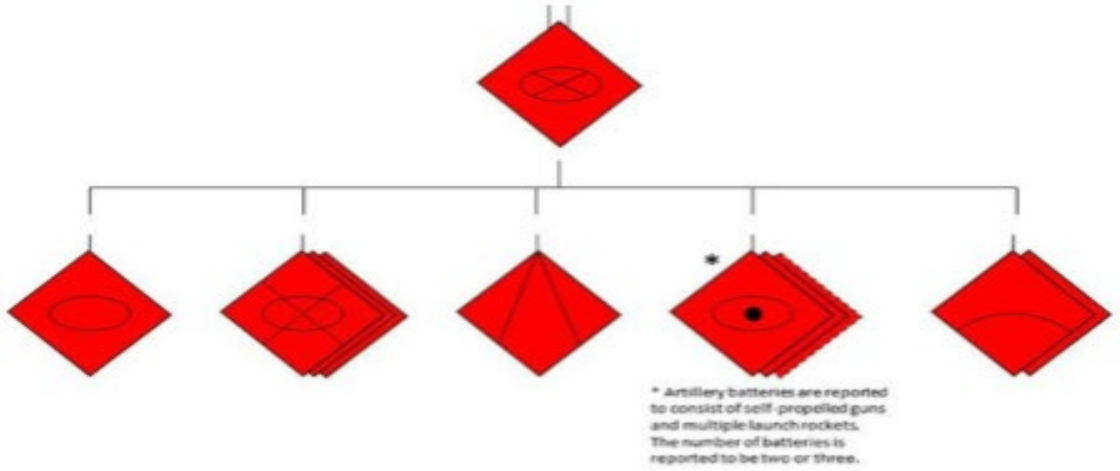

Figure 4. Reported task-organization of Russian combined-arms battalion

Source: Amos C. Fox, "Russian Hybrid Warfare and the Re-Emergence of Conventional Armored Warfare: Implications for the U.S. Army's Armored Force," *eArmor* (July-September 2016), accessed 18 January 2018, http://www.benning.army.mil /armor/earmor/content/issues/2016/JUL_SEP/3Fox-Russia16.pdf.

At the next higher echelon, a Russian brigade commander has three organic artillery battalions at his disposal. While their composition varies, a typical allocation is one light self-propelled gun (2S1) battalion, one heavy self-propelled gun (2S19) battalion, and one heavy rocket (9P140) battalion.[43] In addition, the brigade commander can expect reinforcing fires from one of the field army's artillery brigades, likely a battery of towed heavy (2A65) howitzers.[44] The organization supported by multiple echelons of fires enables the brigade commander to provide fires consistently in a battle.

[43] Brad Marvel, "The Snow Dome, Part 2: Russian Artillery Tactics and Systems," *OEE Red Diamond* 8, no. 8 (August 2017): 7.

[44] Ibid.

Much like Chechnya's fight, in Ukraine, Russia has decentralized its artillery to the maneuver battalions. Since the end of World War II, most armies have placed their artillery fire support at the brigade (U.S. and NATO) or regimental (USSR) levels. However, in the Donbas, the Russians are permanently assigning (not cross-attaching) artillery batteries to mechanized and tank battalion groups.[45] Many of these systems are the self-propelled 2S1 122 mm or towed D-30 gun-howitzer, which allows the capability to provide dual direct/indirect role.[46] Furthermore, with better communication and computer systems, Russian artillery is now capable of conducting split-battery fire with each battery having its own Fire Direction Center.[47] This is a benefit in a broad front such as Ukraine to provide fire support when needed.

Training

Since 2000, Russia has increased its artillery training in PGMs and the synchronization and integration of fires through annual exercises. Much like the United States Army conducting major exercises in places like Korea to learn and adapt, Russia conducts major annual exercises, one of which is called ZAPAD. The ZAPAD, which means "west," can lead to a change in their military operations, tactics or strategic approach. ZAPAD-99 in June of 1999, which consisted of 50,000 troops, was set in the Baltics and the scenario was one of a NATO-launched attack against Russia and its

[45] Karber, "'Lessons Learned' from the Russo-Ukrainian War: Personal Observations."

[46] Ibid.

[47] Grau and Bartles, *Russian Way of War*, 241.

allies.[48] The result of the exercise was an identification by Russia that it could not win conventionally against a NATO-led engagement. Because of this, Russia's main change to their Military Strategy was one that included non-strategic nuclear deterrence. Other results were to put an emphasis on PGMs, Information Operations called Information Warfare, advanced command, control, communication, and intelligence.[49] PGMs can be inferred relating to all fires, but one can assume with Russian artillery being the "god of war," that Russia would take a vested interest in building and training with PGMs for their artillery weapon systems. However, through its actions in Ukraine, Russia still relies mostly on "dumb" munitions, with little emphasis on PGMs. The lack of PGMs in Ukraine can be explained with UAV support to provide accurate grids to deliver cheaper munitions.

Critical to any operation is the integration of artillery on the battlefield. The First Chechen War demonstrated an inability of Russian forces to coordinate joint operations between ground and air forces due to lack of training,[50] which remained consistent during the Second Chechen War. With the development of BTGs, Russia is striving to fix the issue of integrating and synchronizing fires in a joint operation.

A lesson learned by Russia during the Second Russian-Chechen War was to only deploy "career soldiers" to the front line while less-trained conscripts would remain further behind the forward line of troops. Also, learning from their experiences in the

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[48] Jacob W. Kipp, "Russia's Nonstrategic Nuclear Weapons," *Military Review* (May-June 2001): 27-38.

[49] Ibid.

[50] The Military Balance, "Russia," 113.

First Chechen War to the Second Chechen War, Russian artillery and targeting became more enemy focused rather than terrain focused. To further integrate and synchronize artillery, Russian forces introduced upgraded Pechela-IT UAV as a part of the Story-P UAV reconnaissance system. This system allowed Russian commanders to obtain real-time aerial-reconnaissance data on guerrilla positions. Better communications and reconnaissance allowed Russian forces to locate mobile groups of fighters and to restrict supplies of weapons and ammunition to the guerrillas from outside Chechnya.[51] The training and use of UAVs proved valuable in Chechnya but did not become imbedded in Russian operations until after the Russo-Georgian War.

The benefit of using UAVs to support military operations was relearned after the problems faced in Georgia. The inability to synchronize artillery and air assets was identified by the Russian military which led to Stability-2008. The exercise Stability-2008 was the largest Russian exercise since the end of the Cold War. The exercise involved 50,000 soldiers from land, sea, and air units and involved a scenario which outlined a local conflict escalating into an all-out air, sea, and land war between Russia and the West which, in turn, escalates into a global nuclear conflict with the U.S.[52] After the exercise, the use of UAVs now seems to be integral as another set of eyes to help in artillery support.

UAVs have become more prevalent in their usage and integration with artillery, especially while fighting Ukraine in the Donbas. It is clear an emphasis on training

[51] Ibid., 114.

[52] Cornell and Starr, *The Guns of August 2008*, 179.

occurred between 2008 and 2014 to better integrate systems to support artillery. Russia's actions in Ukraine have revealed several innovations learned from previous conflicts; most notably the employment of the semi-autonomous battalion tactical group. BTGs are integrated with reconnaissance-strike models that directly link drones to strike assets, hastening the speed at which overwhelming firepower is available to support tactical commanders.[53] With improvement in technology, Russia has developed TTPs for other forms of calling for and adjusting fire to supplement forward observers on the ground.

Materiel

Materiel is always the most expensive part of the DOTMLPF framework outside of payment of troops. To better analyze how materiel plays a factor in Russian artillery, one can look at how the Russian Gross Domestic Product and the prediction of federal income leads to the military defense budget. Since oil is Russia's number one export, the rise and fall of oil prices can determine how much money Russia has to support its military. The price of crude oil in 2000 was $27.60 a barrel, in 2008 it was $94.10 a barrel, dropping a bit from 2009 to 2010 averaging around $68 a barrel. From 2011 to 2013 the price of crude oil stayed above $100 a barrel but had a sharp decrease from 2015 to 2016 when the price stayed below $50 a barrel.[54] In 2012, Russia's gross domestic product was $2.015 trillion, which made it the sixth largest economy in the world. In 2013, its economy grew at a rate at less than half of the 2012 economy,

[53] Fox, "The Russian–Ukrainian War."

[54] Statista, "OPEC," assessed 14 April 2018, https://www.statista.com/statistics/262858/change-in-opec-crude-oil-prices-since-1960/.

achieving only 1.3 percent growth, which stagnated Russia's economic growth.[55] Therefore, when the price of oil remained high for six out of seven years from 2008 to 2014, Russia could look ahead in the development of new, better artillery weapons rather than fighting with equipment from the 1970s and 1980s. This enables the Russian military to field a small arsenal and improve on all equipment, which is a cheaper method of improving its capability. However, once the price of oil dropped by more than half in 2015, and worldwide sanctions against Russia occurred, Russia's acquisition of new equipment have slowed, such as the 2S35. Russia does not go into major production of new systems but develop a small set and field-test the equipment before increasing production. However, Russia does upgrade old systems to become more effective as an evolutionary process. Other than upgrades, the artillery systems used by the Russian army have not changed from 2000 to 2016, but since it is critical to understand the capabilities of an adversary, the following are depictions of common systems used by the Russians from the *Worldwide Equipment Guide* of 2016.

Year of Introduction: 1981
Caliber: 152 mm
Range: 30.5 km
Rate of Fire (Normal): 5 RPM
Rate of Fire (Burst): 6 RPM

[55] Douglas Mastriano and Derek O'Malley, eds., *Project 1704: A U.S. Army War College Analysis of Russian Strategy in Eastern Europe, an Appropriate U.S. Response, and Implications for U.S. Landpower* (Carlisle, PA: U.S. Army War College, 2015), accessed 28 April 2008, https://ssi.armywarcollege.edu/pubs/display.cfm?pubID=1274.

Figure 5. 2S5 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 449.

Year of Introduction: 1974
Caliber: 122 mm
Range: 15.3 km
w/RAP: 21.9 km
Rate of Fire (Normal): 4 RPM
Rate of Fire (Burst): 5 RPM

Figure 6. 2S1 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 445.

Year of Introduction: 1989
Caliber: 152 mm
Range: 29 km
Rate of Fire (Normal): 6 RPM
Rate of Fire (Burst): 8 RPM

Figure 7. 2S19 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 453.

Year of Introduction: 2S3: 1973, 2S3M: 1975, 2S3M1: 1987
Caliber: 152 mm
Range: 24.4 km
Rate of Fire (Normal): 3 RPM
Rate of Fire (Burst): 4 RPM

Figure 8. 2S3 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 447.

Year of Introduction: 1981
Caliber: 120 mm
Range: 9 km
w/RAP: 12.8 km
Rate of Fire (Normal): 4 RPM
Rate of Fire (Burst): 6 RPM

Figure 9. 2S9 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 418.

Year of Introduction: 1963
Caliber: 122 mm
Range: 15.3 mm
w/RAP: 21.9 km
Rate of Fire (Normal): 4 RPM
Rate of Fire (Burst): 6 RPM

Figure 10. D-30 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 431.

Year of Introduction: 1987
Caliber: 152 mm
Range: 29 km
Rate of Fire (Normal): 6 RPM
Rate of Fire (Burst): 8 RPM

Figure 11. 2A65 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 439.

Year of Introduction: 1981
Caliber: 152 mm
Range: 30.5 km
Rate of Fire (Normal): 4 RPM
Rate of Fire (Burst): 5 RPM

Figure 12. 2A36 Photo

Source: U.S. Army TRADOC G-2, *Worldwide Equipment Guide: Volume 1: Ground* (Fort Leavenworth, KS: TRADOC, 2016), 435.

The 2S19 Msta-S is the artillery piece of choice by Russian ground forces due to its ability to fire multiple types of projectiles at extended ranges and because it is fitted atop a T-80 chassis and propelled by a T-72 tank engine, making it more cost effective. In total the Russian army operates around 550 Msta-S systems, some of which have been modernized to the new 2S19M2 which includes a new fire-control system,[56] which increases the rate of fire. Russia also fields around 450 towed versions of the same 152 mm artillery piece: the 2A65 Msta-B.[57] This practice of using the same artillery piece in both self-propelled and towed versions is common in Russia. It reduces manufacturing and defense costs as well as providing artillery that is more deployable in difficult terrain. Besides the Msta-S/B, the army continues to field some 250 previous-generation 2S5 Giatsint-S 152 mm Self-Propelled Howitzer (SPH) and 200 towed 2A36 Giatsint-B.

[56] Nick de Larrinaga, "Markit Return of the Bear: Russia Ground Forces Modernisation," Jane's HIS, 2016, accessed 13 April 2018, https://janes-ihs-com.lumen.cgsccarl.com/Janes/Display/jdw61209-jdw-2016.

[57] Ibid.

Similarly, Russia fields some 650 122 mm 2S1 Gvozdika SPH and 550 of its towed D-30 version. Alongside these, Moscow continues to field some 950 2S3 Akatsiya 152 mm SPHs. Frontline professional units tend to use the Msta-series artillery pieces, with older systems largely serving in second-string conscript units.[58] Although the 2S19 is currently the artillery piece of choice, Russia plans on replacing it with the 2S35, which is comparable to the U.S. Crusader which was never fielded.

Of interest are the types of munitions used in Russian artillery. The Krasnopol Laser-guided munition, which was present during the Cold War, was used in Chechnya to implement precision into its formation. Next in the development for Russian artillery is a GLONASS (GPS)-enabled 152mm shell, which should enable the Russian military to achieve more precision engagements of targets. This munition is supposed to be available at the same time as the 2S35, in the year 2020. Reportedly, the cost of each shell would only be $1,000, which is a big difference in cost compared to the M982 Excalibur round which is around $80,000 per round,[59] however, the capability is likely less precise than that of the Excalibur. Of note, the U.S. Army has awarded BAE Systems an $8 million contract to develop modernized precision-guidance kits that ensure the accuracy of 155-millimeter artillery munitions. These kits enable munitions to make in-flight course corrections even in GPS-jammed environments.[60] The reported cost of the precision-

[58] de Larrinaga, "Markit Return of the Bear: Russia Ground Forces Modernisation."

[59] Grau and Bartles, *Russian Way of War*, 262.

[60] BAE Systems, "U.S. Army Selects BAE System to Develop Advanced Precision Guidance Kits for Artillery Shells," 30 January 2018, accessed 21 April 2018,

guidance kits is $10,000[61] with an accuracy of 5 meters. Finally, unlike U.S. artillery, other Russian munitions seen on the battlefield in Ukraine include High-Explosive Anti-Tank rounds and Dual-Purpose Improved Conventional Munitions which provide a capability to penetrate armor.

As mentioned as part of doctrine, Russia has increased its use of UAVs within their artillery formations. The number of UAVs being operated by the Russian armed forces reportedly increased from 180 in 2011 to 1,720 at the end of 2015: a nine-fold increase.[62] UAVs used by the ground forces for guiding artillery include the Russian-designed Orlan and Granat family of UAVs, and the Searcher MkII (known as Forpost in Russian service) and Bird Eye-400 (known as Zastava) UAVs purchased from Israel.[63] The result of using UAVs in Ukraine increases the lethality of Russian artillery against its enemy without the need for precision guidance. This has proven useful in the Donbas based on the dispersion of units to cover a wide front. Finally, the use of UAVs as forward observers to find a target and adjust fire is effective and does not put personnel at risk. This allows UAVs to be embedded into the Russian Target Acquisition Cycle of Find, Fix, and Finish (See figure 13).

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https://www.baesystems.com/en-us/article/us-army-selects-bae-systems-to-develop-advanced-precision-guidance-kits-for-artillery-shells.

[61] Joe Gould, "US Army 'Dumb' 155mm Rounds Get Smart," *Defense News*, 13 March 2015, accessed 21 April 2018, https://www.defensenews.com/land/2015/03/13/us-army-dumb-155mm-rounds-get-smart/.

[62] Larrinnaga, "Markit Return of the Bear."

[63] Ibid.

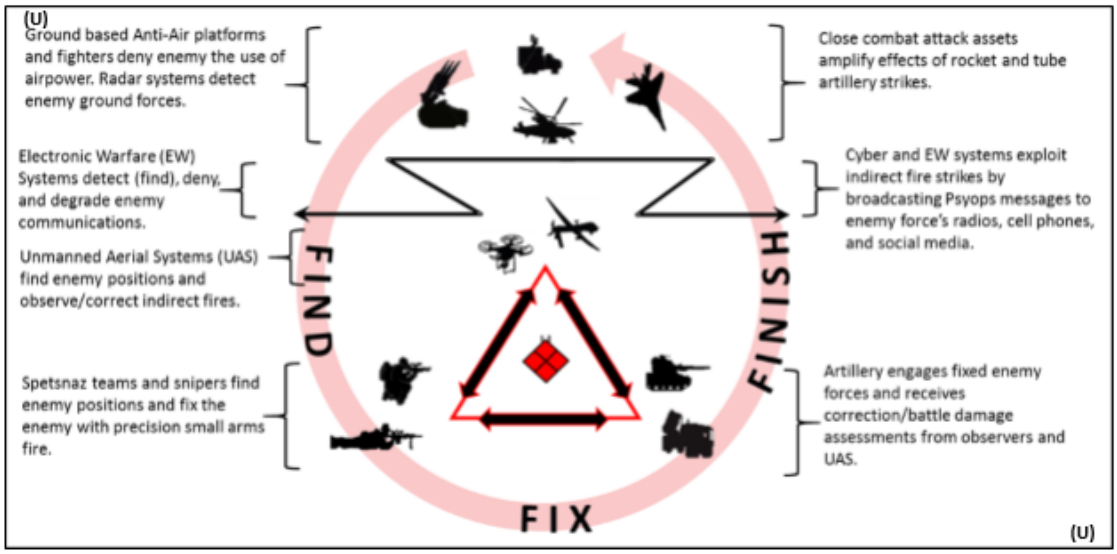

Figure 13. Russian Target Acquisition Cycle from RNGW

Source: Asymmetric Warfare Group, *Russian New Generation Warfare Handbook* (Fort Leavenworth, KS: Center for Army Lessons Learned, 2017), 11.

Leadership and Education

Russia learned though urban combat in Chechnya and Georgia and broad fronts in Ukraine, that it can no longer depend solely on the skills of its officers. In 2000, a major difference between U.S. artillery and Soviet/Russian artillery is the responsibility of the battery commander. The battery commander in the Soviet/Russian artillery is much more centralized, located at the observation post to observe targets, help with computations, and keeps in contact with the maneuver forces.[64] This makes the battery commander in the Soviet/Russian army a mixture of a commander, a fire direction officer, and a forward

[64] Headquarters, Department of the Army (HQDA), Field Manual (FM) 100-2-1, *Soviet Tactics: Operations and Tactics* (Washington, DC: Government Printing Office, 1984), 9-16 - 9-17.

observer. Through hard lessons learned, Russia has evolved its thinking in leadership and education. The Russian officer education and professional development system concentrates on competence, training, and empowering subordinates, which starts to resemble much of the philosophy of mission command in the U.S. Army. In 2000, the role of the officer corps was one of complete responsibility, to include in the training of all their soldiers. Through the experiences in Chechnya and Georgia, in 2008, Russia began to change the dynamic in which it trained its officers. Up until then, most of the Soviet/Russia officer education system emphasized political reliability and loyalty.[65] Junior commanders were now free to make decisions on the battlefield without having to ask for permission to make the most basic tactical moves.[66]

The breakup of the Soviet Union left the majority of the artillery schools outside Russia. This created a teaching and training gap that took several years to overcome and clearly had an impact on effectiveness in Chechnya.[67] Artillery officers at a variety of levels could not operate effectively, particularly in command and control, fire control, force protection, and organization of reconnaissance.[68] This led to streamlining command and control systems in 2008 and the eventual capability of decentralization through the BTGs and placing more responsibility on Non-Commissioned Officers in Ukraine.

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[65] U.S. Army TRADOC G-2, *Threat Tactics Report Compendium: ISIL, North Korea, Russia, and China*, vol. 1 (Fort Leavenworth, KS: TRADOC, 2015), 95.

[66] Ibid.

[67] Wallwork, "Artillery in Urban Operations," 48.

[68] Ibid.

Although a military success, the leadership of Russian artillery officers during a high-intensity conflict in Georgia proved poor. Russia was clearly superior to Georgia in regards to number and employment of artillery systems, and in which the speed of deploying forces, however, initial engagements were inconclusive.[69] Russian artillery officers were unprepared to navigate through Georgian territory, which led to the canalization and decreased ability to use artillery against the Georgians. Therefore, as described above, the Russian military were forced to rely more on air forces rather than their preferred artillery.

Similar to readiness as the number one priority for the United States Army, readiness was key for Russia in the initial engagements in Ukraine. The leadership was able to deploy their troops quickly which allowed actions to be taken against an adversary which was not ready to fight. The decentralized control also allowed more flexibility and initiative by junior leaders to achieve initial tactical success.

Personnel

The Russian military tends to focus on artillery to compensate for the quantity of their personnel. President Vladimir Putin, in 2000, decided to downsize the Russian military stating that the country could not afford to pay the three million personnel currently employed by the military.[70] The military servicemen would decrease from 1.23

[69] Ariel Cohen and Robert Hamilton, *The Russian Military and the Georgian War: Lessons and Implications* (Monograph, U.S. Army War College, Strategic Studies Institute, Carlisle, PA, 2011), 24, accessed 13 April 2018, http://ssi.armywarcollege.edu /pdffiles/pub1069.pdf.

[70] Victoria Levin, "Prospects for Military Reform in Russia" Carnegie Endowment of International Peace, December 2000, accessed 15 April 2018,

million to 865,000, a decrease of 365,000 personnel in three years' time.[71] This eventually resulted in a force that relied more on contract volunteers rather that conscripts. This led to a more professional and proficient army-and a less responsive and prepared reserve force. In 2000, a creation of a Non-Commissioned Officer corps,[72] helped in the professionalism and skills of Russian soldiers and take some of the burden off the officer corps in the Russian Army.

Summary

Russian Artillery Lessons Learned from Second Chechen War

Russia learned from actions in the Second Chechen War that massed artillery remains effective, decentralized control enables subordinates and increased timeliness of fires, artillery remains the only all-weather fires asset, and secure communication is key to successful combat. Precision-guided munitions are great for preplanned targets, but to get both a physical and psychological effect, massing artillery onto targets is a valuable technique. Decentralized control is common for the United States Army, but this was a fairly new concept for Russian artillery with roots in Afghanistan. Previously, all aspects of coordination of fires were conducted by the officers corps. By allowing for decentralized control, junior officers could call for fire quicker with better effects. The development of a professional non-commissioned officer corps will devolve more

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http://carnegieendowment.org/2000/12/13/prospects-for-military-reform-in-russia-event-249.

[71] Ibid.

[72] Ibid.

responsibility to the NCOs to call and adjust fires. This was identified during the Second Chechen War, but would not take place until after the war. In the meantime, to still have responsive fires, Russia began assigning forward observers down to the company-level. Furthermore, preparatory fires isolated pockets of resistance, especially in urban areas. Self-propelled howitzers followed after the preparatory fires to engage targets in a direct fire mode.

The next two lessons from the Second Chechen War are not necessarily artillery specific, but critical in terms of using artillery. First, as most military members know, artillery is an all-weather weapon. Russia learned that an overdependence on Close Air Support inhibited operations. The military would plan to use airframes for targets rather than artillery, but when bad weather ensued, there was not an alternate plan to target the enemy. Finally, command and control are essential to a successful operation. A lack of personnel trained in radio communications and a disregard for time-consuming encryption and decryption allowed Chechen soldiers to call artillery and Close Air Support on Russian formations using Russia's own radios and nets to create fratricide.

Russian Artillery Lessons Learned from the Russo-Georgian War

The biggest takeaway from the Russo-Georgian War was combined arms-maneuver is still the most efficient way of conducting military operations. However, much like the war in Chechnya, an overreliance of Close Air Support proved costly. Russia identified how useful UAVs could be through observations of the United States in Iraq and Afghanistan and decided to incorporate them into their own arsenal. However, to remain cost effective, the UAVs Russia uses are not expensive attack platforms like the U.S. Predator. Rather, they are cheaper, effective forward observation platforms that

support artillery targeting and damage assessment. This system requirement was identified at the end of the Russo-Georgian War and implemented in the Ukrainian conflict six years later.

Russian Artillery Lessons Learned from the Russo-Ukrainian Conflict

As in most wars, artillery is the number one casualty-producing weapon system in the Russo-Ukrainian Conflict. Not only does artillery provide indirect fire, but, as in the Second-Chechen War, direct fire artillery provided fast, accurate fires. The terrain in the Donbas is particularly conducive to direct-fire artillery and is widely employed by both the Russians and Ukrainians. Russia decentralized control of its artillery, not like mission command in U.S. doctrine, but rather in direct support at the maneuver battalion level.

Conclusion

Through the description of how cannon artillery was used by the Russians in Chechnya, Georgia, and Ukraine, one can derive an answer to the secondary research question: What does Russian experience with the use of cannon artillery since 2000 tell other militaries about how they will use it in the future? The battalion tactical group proved to be an effective organization in its use of artillery. However, unlike the U.S. military, the number of artillery pieces in the Russian army provides enough flexibility to assign batteries down to the maneuver battalion and frequently company level. This flexibility allowed Russia to effectively engage targets with massed artillery throughout a wide area. Russia showed its capability early in Ukraine with overwhelming results. These results were also due to Russia fighting an enemy who was not prepared for war.

Russian military actions taken in Chechnya, Georgia, and especially Ukraine are more limited in nature due to the political repercussions these conflicts could cause. It should also be noted that these actions were taken against former Soviet states in which two had political aims to join NATO. These types of conflicts are likely to occur in the future if NATO continues to expand into Russia's "near abroad". The political factors of Russia attacking a former Soviet state is very different than if it became a US/NATO war with Russia. Russia would not be as restrictive, and the tactics would be much more like the Zelenopillya example using much more artillery and massed fires. In Zelenopillya, Ukrainian vehicles were an easy target, parked in a motor pool-like fashion. Russia attacked these using high-explosive fuzes, the most basic and most jam-proof fuze, to attack the target. Russia is aware of Western countermeasures and, where appropriate, will continue to use artillery techniques which will not be defeated by modern technology.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

> Artillery is an arm equally formidable in both in the offensive and defensive.
> —Antoine-Henri Jomini, *Your Dictionary*

> History does not repeat itself but it often rhymes.
> —Mark Twain, "History Does Not Repeat Itself but It often Rhymes as Mark Twain Noted

What is Old is "New"

This thesis has demonstrated that all militaries are similar in that they fail to address the lessons learned from one war or conflict to the next. Many tactics learned by Russian artillery troops were known from previous conflicts but were not imbedded in practice until soldiers began to lose their lives on the battlefield. Even with improved technology in the twenty-first century, tactical use of artillery remains relatively the same as it has throughout history. Improved technology allows for more precision and innovative ways to target an enemy, but an overreliance on technology has the potential to create problems when an enemy causes an artillery unit to fight degraded. If artillery units do not train on basic artillery skills before war, soldiers may have to learn them the hard way during war.

Implications for United States Cannon Artillery

U.S artillery needs to take the opportunity to learn from Russia's conflicts in the twenty-first century and have countermeasures in place to defeat any adversary it may face. Russia has fought in multiple high-intensity conflicts while the U.S. fought

counterinsurgents in the Middle East. Recently, the U.S. Army transitioned its focus back to high-intensity combat, forcing internal and external examinations for the military to improve tactics and capabilities which were neglected during COIN conflicts of Iraq and Afghanistan. The Army uses the DOTMLPF framework to consider change. Through the DOTMLPF framework, U.S. artillery should understand the necessity of integrating multiple warfighting functions, the benefit of using direct fire and UAVs, and ultimately how to fire in a degraded mode.

U.S. Artillery Doctrine

Doctrine is the driving force to implement any change in the United States military. 3-09 is the series of field manuals, training circulars, and other publications for field artillery operations. These publications provide a wide range of information for indirect fires, but there should be more information pertaining to direct fire, degraded fire missions, and integration of the other warfighting functions in the manuals.

Direct fire is discussed in field artillery publications, but the focus is strictly on using it in a defensive mode in relation to final protective fires. Focusing only on defensive direct fire ignores an offensive capability that other militaries have proven to be useful. Russia has demonstrated the benefit of using direct fire artillery in every conflict thus far, showing that direct fire is quicker and more beneficial in urban combat.

Current publications fail to adequately address mission command in operations devoid of satellites and GPS. Mission command is the bedrock of a successful artillery branch. Mission command is much easier when communications are working well, and tactical operations centers are within close proximity. Once GPS becomes disrupted and lieutenants and staff sergeants are left alone on top of an observation post without a way

to communicate to higher headquarters, mission command is truly tested. The U.S. Army artillery is too reliant on satellites and neglects the training to operate in an environment without these tools. The concept of laying a battery using distant aiming points such as the sun or the stars has become a lost art. Considering the implications of degraded communications lead some to consider less understood branches like electronic warfare that could be integrated into artillery tactics.

Electronic warfare and cyberspace are very different but are combined into FM 3-12: Cyberspace and Electronic Warfare Operations. Electronic Warfare could be used to great extent within the artillery community to help defeat UAVs or limit having to operate in a degraded mode. The integration of electronic warfare within artillery could help counter adversaries and their attempts to disrupt GPS, a tool artillery has become far too accustomed to using in today's fight.

Doctrine provides the baseline for all changes within the artillery branch. Direct fire provides another way to engage targets offensively that might otherwise not be used. Mission command should be used as intended to provide commander's intent and allow the mutual trust of junior leaders to fight even while degraded. Finally, integration of other warfighting functions could help enable artillery in new ways but should be analyzed through doctrine to test the theory.

U.S. Artillery Organization

The organization of U.S. Army artillery needs to be re-examined further in order to determine the best way to fight future adversaries. The Russians decided that the artillery battalion was not necessarily the best unit size to support urban combat, and in

many cases attached gun batteries to infantry battalions in a direct support role.[73] One implication of this could mean that the organization of U.S. artillery for combat may need to change for urban combat. Survey was removed from the artillery organization since most cannon pieces rely on GPS to determine the gun's position. Also, a recent update was the removal of forward observers from maneuver units to realign them with artillery battalions.

U.S. artillery already changes it organization for combat for such events as gap crossings to employ all artillery assets in a fight. Therefore, with less of a need to mass fires, and the accuracy of U.S. PGMs, the artillery organization for combat could shift to direct support batteries, which may prove beneficial in urban situations.

The reliance on GPS demonstrated a decreased need for survey within artillery battalions. However, if GPS is jammed and units have to fight degraded, survey becomes important to find a unit's position on the ground. The overreliance on GPS allows soldiers to become lazy in basic skills like map reading and land navigation. This overreliance also lessens the proficiency of artillery soldiers to understand site-to-crest, piece-to-crest, and the use of graphical scales and tabular firing tables. Another aspect to help provide protection against degraded artillery tactics is the incorporation of electronic warfare into artillery units. Electronic warfare could protect artillery pieces from becoming jammed. Failure of GPS could result in the inability to meet the five requirements for accurate, predicted fires because in degraded mode the gun position is unknown.

[73] Wallwork, "Artillery in Urban Operations," 76.

Most senior leaders decided to move forward observers back to artillery units to allow for more focused training. Although the ability to train forward observers became easier, the move challenges the integration of forward observers with maneuver outside of field training. A way to lessen the challenge could be to integrate training schedules where forward observers act as liaisons to serve as stewards of the profession to build relationships and train maneuver soldiers in calling for fires.

Organization of artillery in a future fight is unclear. However, some options that could be explored are changing artillery organization for combat in relation to urban combat, realigning survey, assigning electronic warfare within artillery units, and using forward observers as liaisons to integrate the maneuver warfighting function.

U.S. Artillery Training

Changes to doctrine provide the largest impact on training within the DOTMLPF framework. Hard, realistic training bridges the knowledge gap of current mid-level leaders and sets the conditions for future leaders to properly use artillery in combat. There are many implications for training U.S. artillery soldiers, which includes the use of communications, training in degraded conditions, training as combined arms, and direct fire engagement training.

A lack of secure communications proved detrimental for Russia in Chechnya when Chechen soldiers were able to call for Russian artillery fire over Russia's unsecure nets. The U.S. military puts an emphasis on using secure communications while conducting operations, but communications does not only include radios. Soldiers today rely on cell phones just as U.S. artillery relies on GPS. The use of cell phones in combat can result in creating a signature for an enemy to target. Therefore, training at home-

station should be controlled in order to set the standard and ensure junior soldiers understand the implications in a future conflict.

While the use of cell phones could be exploited, digital fire missions could also be degraded once GPS communications are jammed. Therefore, artillery training should be both digital and degraded. In recent years, advanced individual training of artillery soldiers removed analog fire mission computation from its curriculum possibly creating another knowledge gap among Army soldiers. U.S. soldiers need to be prepared to fire artillery in an electronically degraded situation and be able to do so at nearly the same speed as digital computation.

While conducting gunnery tables, it is essential to build scenarios that incorporate as many aspects of combined arms as possible. Artillery units should not go to a firing point and execute Tables I-XVIII without infantry and armor soldiers calling for fire at all echelons. This training would mitigate the effect of forward observers moving back to artillery units. Further integration would benefit training to include rotary-wing and fixed-wing assets as well as to help train echelonment of fires. The U.S. military should emphasize joint operations to prevent learning the hard way, as the Russians did in the Russo-Georgian war when aircraft were shot down and Russia's fires effects became limited.

Finally, as described in the last chapter, most cannon artillery in Ukraine was used in a direct fire mode. Historically, artillery has been primarily used in direct fire engagements. Even in World War II, most Russian artillery was used in direct fire mode. Russia's history regarding artillery in the urban fight reveals that in the Battle for Budapest (early 1945) 40 percent of all artillery fired was direct, and in the assault on

Berlin (starting April 1945), this figure reached 80 percent.[74] The trend of primarily using artillery in direct fire mode continues in the Russian army today. The U.S. does not train heavily in direct fire, especially heavy artillery units, but training in direct fire could offer another means for artillery to support maneuver units. In order to prepare for a possible future conflict with Russia, U.S. artillery should become experts in using the tactics of direct fire artillery.

Training in the field can oftentimes be constrained by terrain, ammunition, and time. A way to allow more training is in garrison using simulations. Simulations are an asset many units do not take full advantage of to incorporate into their training cycle. Training schedules should be synchronized across brigades to involve infantry and armor soldiers to work with forward observers in a call for fire trainer. Simulations should also be provided to train artillery soldiers in direct fire engagements, not only for final protective fires, but also for urban combat. Training is essential to the overall success of any soldier. Therefore, to help fix the knowledge gap of an army consumed by a counterinsurgency fight for over fifteen years, high-intensity training needs to occur at every opportunity.

U.S. Artillery Materiel

Improving materiel for artillery increases the capability of the weapon system, whether the materiel is the weapon system itself or equipment to support the weapon. Russian artillery focuses its efforts on heavier munitions that outrange U.S. artillery. This

[74] Jonathon Bailey, *Field Artillery and Firepower* (Hampshire, UK: The Oxford Military Press, 1989), 73.

disadvantage of distance makes the need for counter-battery radar more relevant today than ever before. Russian artillery also uses anti-tank munitions to use artillery in direct fire mode to increase its effectiveness. For U.S. heavy cannon artillery, the M109A6 and M109A7 do not use direct fire telescopes that were used in previous M109 series. Rather, soldiers within a M109A6/7 can identify a target visually through the gun tube which is inherently inaccurate. Russia has also demonstrated the benefit of using UAVs to support observation for artillery. Currently, the U.S. only uses one Raven UAV per fire support team to support observation for artillery.

U.S. counter-battery radars are outranged by Russian artillery weapon systems and the Russians have the ability to use laser-guided or GPS-guided projectiles. U.S. artillery soldiers need to be able to prevent these munitions from reaching their designated target. Ukrainian artillery commanders suggest that the objective in counter-battery fire is less the destruction of the opposing artillery than disruption of its fire missions by forcing it to move.[75] The reciprocal to that is also important – not being able to conduct real-time counter-battery fire condemns the recipient to prolonged fire strikes with each salvo becoming more lethal. This is a trend that is made possible by the combination of both UAVs on the battlefield and the increased capability of Russian counter-battery radar.[76] This reinforces a long-held idea of the importance of the use of counter-battery radar in battle, and, with Russian advancements in target location, makes the training and employment of counter-battery radar essential to mission success.

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[75] Bailey, *Field Artillery and Firepower,* 73.

[76] Ibid., 21.

An alternative to the ability to use direct fire other than GPS should be examined further to allow heavy cannon artillery to use direct fire in a degraded mode. Currently, if GPS is jammed on a Paladin, the weapon system is less effective to fire in direct mode. This potentially puts soldier's lives at risk if they had to fire degraded without a better alternative that was once available. Furthermore, providing anti-tank munitions to artillery should be examined further to allow a more lethal effect if needed.

UAVs proved beneficial for Russian forward observers in Ukraine. The concept was learned through hard lessons in the Russo-Georgian War. The United States Army should take note from these lessons as well. While one Raven is available for a Company Fire Support Team, it may prove beneficial to use cheaper, "off-the-shelf" UAVs to every forward observer in a unit. This provides an extension of sensor-to-shooter for every observer rather than only one per team. Not only would more UAVs be beneficial to acquire targets at the company-level, but forward observers could now be used to observe named areas of interest to further develop the targeting cycle at the battalion and brigade levels.

In order to provide an advantage to the U.S. artillery soldier, materiel should be analyzed further to leverage more capability. Russia has demonstrated advantages through direct fire, munitions that travel farther, and UAVs to extend their ability to acquire targets. While the U.S. may be limited in range due to the need to stay expeditionary, direct fire with more lethal munitions and putting UAVs in the hands of every forward of observer can mitigate the disadvantage in artillery ranges.

U.S. Artillery Leadership and Personnel

The greatest strength of the United States Army is the professionalism of its soldiers and leaders. Leaders of the army are the ones who will put each of the items mentioned above into practice. In order to allow this to happen, artillery lieutenants need to learn each of the following key positions: Fire Direction Officer, Platoon Leader, and Fire Support Officer so as these officers are well-rounded as they continue their careers. When deployments in Iraq and Afghanistan were common, most lieutenants only had experience in one or two of these positions before receiving an expedited promotion to captain. The second order effect of expedited promotion and fighting a counterinsurgency created a knowledge gap in an entire generation of officers. The new generation cannot afford to have the same issues. Winning a war today starts with maintaining standards and discipline, with a clear understanding of basic artillery tactics. Soldiers need to get "back to basics" to shoot, move, and communicate in digital and electronically degraded conditions. Standards need to be held high by leaders to prevent the hard lessons Russia relearned in Chechnya and Georgia.

Recommendations for Further Research

Recommend that further research be conducted to analyze each of the Army Warfighting Functions and Joint Functions relating to how to counter Russia as well each of the top four adversaries discussed in FM 3-0. The researcher believes this should be a continuation study that would create Field Manuals much like FM 100-2-1 where the United States understands its potential enemy fully and military professionals are prepared in the event of an outbreak of war. Only by looking outward towards the enemy, can one truly understand what is needed internally to counter or get ahead of problems.

Conclusion

In 1991, the once global superpower, the Soviet Union, crumbled without a shot being fired. President Putin gave a speech in 2005 stating, "we should acknowledge that the collapse of the Soviet Union was a major geopolitical disaster of the century."[77] The collapse and aftermath made Russia the laughing stock of Europe. Putin's military actions of aggression towards former Soviet states demonstrate an attempt to regain global respect and regional Eurasian prominence. While Russia appears to be a peer competitor of the United States military, this study has shown multiple issues within its military, specifically its artillery forces. Russia won its fights against weaker states using Soviet-era equipment and unprepared soldiers. Even with weaker militaries, Chechnya, Georgia, and Ukraine managed to exploit Russia's weaknesses in its artillery tactics.

Some assumptions can be derived from the conflicts in Chechnya, Georgia, and Ukraine about what would be the most likely chain of events when encountering the United States in a war. First, unlike the former Soviet states, the United States military is much more advanced. No other military has the capability to use technology to such a great effect, which means it is very net-centric. The Russian military would most likely attempt to disrupt U.S. ability to use satellites. This would prevent the use of PGMs, degrade the ability to lay artillery pieces, and disrupt Fire Direction Center operations with the Advanced Field Artillery Tactical Data System, preveningt effective counter-fire data coming from the radar. Furthermore, it would prevent effective communication through tactical and satellite radios as well as prevent the U.S. military's use of UAVs.

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[77] BBC News, "Putin Deplores Collapse of USSR," 25 April 2005, accessed 19 April 2018, http://news.bbc.co.uk/2/hi/4480745.stm.

The attempt to do this would allow superiority in the use of the space domain in order to use Russian UAVs and GLONASS-enabled munitions to target the United States' forces as well as use direct fire to engage targets.

While the 2S19 Msta-S is the current artillery piece of choice for the Russian military and will most likely continue to be upgraded and used on the battlefield, its successor, the 2S35, could be out as early as the year 2020. The 2S35 is supposed to be able to shoot 70 km[78] (U.S. counterbattery radar range) at a rate of fire of 15 to 20 rounds per minute, which doubles the current rate of fire of any of the artillery systems Russia currently fields. The 2S35 will also outrange and fire faster than the U.S. M109A6 Paladin, which shoots 30 km at a rate of fire of six rounds per minute. The United States was in the middle of an acquisition process to develop a self-propelled howitzer that could shoot 10 rounds per minute over 40 km, called the Crusader, but it fell by the wayside in 2002. Ironically, many characteristics of the 152 mm 2S35 Koalitsiya-SV mirror the specifications of the U.S. Army's proposed 155 mm Crusader design such as extended range projectiles, an automatic loader and dedicated armored resupply vehicle.[79] The assumption is Russian artillery would continue to position its artillery within two to six kilometers of maneuver forces to allow for direct fire engagements. The 2S35, however, with its rate of fire and range, may change how Russian artillery fights in the future to focus more on indirect fires.

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[78] James Anderson, "Russian Artillery: Adapting Ancient Principles to Modern Paradigms, Part 2," *OEE Red Diamond* 8, no. 11 (November 2017): 26.

[79] Karber, "Lessons Learned" from the Russo-Ukrainian War," 20.

Russia and other adversaries have learned from America's wars in the Middle East. Russia, of the four main U.S. adversaries, is the only one to actually experience combat in the recent past. Therefore, the United States military and NATO partners should learn from Russia's wars. The U.S. and NATO partners should understand that urban terrain weakens technological advantages. If the U.S. and its allies take note of how Russia uses its artillery, they can improve and possibly deter any future engagement with Russia.

The difference between "Lessons Recorded" and "Lessons Learned" is institutional attitudes toward learning. If the artillery community continues to just write down lessons rather than learn from them, there will be a steep price to pay if the United States ever has to fight a peer or near-peer adversary, especially one that uses artillery as its main effort. Through innovative thought, better technology, and relevant doctrine, U.S. artillery can support maneuver and ultimately defeat any threat that may present itself in the future. This is a common goal everyone in the military should understand and ultimately work to achieve. Russia learned many lessons written in blood in unconventional and conventional wars in Chechnya, Georgia, and Ukraine. The United States has been out of the conventional realm for some time now and cannot afford to learn those same lessons in blood. The U.S. should take the time to learn from the lessons of the Russians and implement them into a U.S. framework, so the United States military does not have to suffer casualties to improve.

APPENDIX A

RUSSIAN METHODS OF FIRE DESCRIPTION FROM FM 100-2-1

Rapid fire is a method of conducting artillery fire whereby the weapon is fired as quickly as possible while not exceeding its maximum rate of fire and not sacrificing accuracy. When the command for rapid fire is given, each individual weapons crew begins to fire independently when ready. Systematic fire is a method of artillery fire where every round (salvo) is fired on command at a set interval. This method is used for firing on observed targets during registration (individual rounds) or when the unit is firing a destruction mission (salvos). Systematic fire is used against unobserved targets in the course of fire assaults * of a given duration, during controlling fire *, and during harassing fire, usually alternating with rapid fire. The tempo of systematic fire against observed targets depends on the capabilities and equipment of the observer, whereas the tempo of fire against an unobserved target is determined by the amount of time allotted for the expenditure of a given amount of ammunition. The tempo of systematic fire is constant during a fire assault but may be intermittent for harassing fire. Systematic fire may be fired by a single weapon, a firing platoon, or an entire battery. On receiving the mission, the firing unit also receives a rate of fire and an ammunition expenditure requirement. Counterbattery fire is the use of artillery to accomplish the suppression and/or destruction of enemy artillery batteries located in screened firing positions. (The Soviets no longer officially use this term but state that the concept it represents is still valid and necessary.) Combat with enemy artillery is one of the Soviet Army artillery's most important missions because it enables Soviet ground forces to achieve fire superiority on the battlefield. However, combat. with enemy artillery today requires more than counterbattery fire. It now requires the destruction of the enemy command and control centers as well as his artillery and requires the cooperation of the other combat arms and combat aviation Maneuver by fire is the shifting of a unit's fire from one target (or group of targets) to another without changing firing positions. This is a combined arms concept in which the artillery plays a critical role. It is used to mass fires on the most important enemy objectives and troop formations to destroy them in a short period of time or to redistribute fires to destroy several targets simultaneously. Maneuver by fire also may be used to shift the main combat effort from one direction to another. In the offense, maneuver by fire is used in the depth of the enemy's defenses to suppress enemy strongpoints, to repulse counterattacks, and to cover by fire the attacking unit's tanks. In the defense, maneuver by fire is used to destroy the enemy as he deploys to attack; repulse the attack; support a counterattack; protect gaps in the defenses, including gaps created by enemy nuclear strikes; seal off enemy penetrations; render assistance to neighboring units; and support a unit that is defending all directions. Wide use of maneuver by fire helps compensate the defending unit for having fewer weapons and enables the defending commander to achieve fire superiority at the critical time in decisive sectors. Plans for maneuver by fire· are normally a part of the defensive fire plan. In such planning, artillery units are assigned several supplementary sectors of fire covering areas along the supported unit's flanks and the gaps between units. In

conducting fire with direct aiming (often confused with "direct fire"), the gunner of the artillery weapon can aim the piece using direct visual contact with the target. An artillery gunner who can sight directly on the target will usually engage it with direct fire, but because of the target's range or characteristics of the weapon, he may engage it with indirect fire. A mortar crew, for example, could sight directly on a target but would have to engage it with indirect fire. The Soviets write at great length about direct aiming advantages like the reduction in mission time and a drastic reduction in ammunition expenditure. Direct fire is recommended against targets at relatively short ranges (under 1 ,200 meters). Indirect fire with direct aiming is considered feasible at ranges out to 3 kilometers and perhaps farther, depending on the weapon sighting equipment and visibility.[80]

[80] HQDA, FM 100-2-1, 9-12.

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