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RESEARCH ARTICLE

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LITERATURE REVIEW ON MULTI-DOMAIN BATTLE

Rogério Barbosa Marques¹, Murillo de Oliveira Dias^{*2} and Fernanda Navas Camargo³

^{1,3}Escuela Superior de Guerra - ESDEGUE, Colombia; ²Fundação Getulio Vargas, Brasil

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*Corresponding author:

Murillo de Oliveira Dias

ABSTRACT

This article investigated, through an extensive literature review, the principles, requirements, components, and possibilities needed by space and cyberspace domains, which along with three-dimensional domains (land, air, and sea) comprise the multi-domain environment/operations. It also analyzed the importance for the military forces to include multi-domain battle in their concepts and doctrines. Under the concern and studies carried out by the US Military Forces, the results showed that this new type of battle will change the strategies adopted by the military forces. Consequently, military and political success depend on the effective integration of capabilities in all domains and thus avoids a position of relative disadvantage against an adversary, who is already using these geographic spaces, particularly cyberspace, before a declared conflict.

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INTRODUCTION

War can be reflected upon through lenses that have certain filters corresponding to the time under analysis, historical studies, concepts of sociology, culture, strategies, and generations of war, among others. From a social point of view, it is a violent phenomenon by which societies have sought to satisfy their objectives against other societies. Considering the complexity of analyzing the phenomenon of war, French sociologist Gastón Bouthoul coined the term Polemology, that is, the objective and scientific study of the nature of wars as a social phenomenon (Molina, 2014). "Polemology was developed as a methodological tool that seeks to interpret and understand the war phenomenon from a broader perspective" (Llantén Quiroz, 2021, p. 719). It gained strength as of 1945 after the given emotional impacts left by World War II and the complexity of the meaning, causes and consequences of the war phenomenon. In the studies of historiography, war is not a recent phenomenon as it has accompanied humanity since prehistoric times. Human usage of fire, rocks, spears, and sticks against animals to ensure their survival were refined to become crossbows, arrows, slings, daggers and, often times, used against the same man in an organized way characterizing primitive war. Under the strategic aspect in which States' armed forces fight another State, according to the classical definition of Oppenheim (1906), with the purpose of mutual domain and imposing the peace conditions which please the winner, many authors have developed theoretical models that seek to combine military and

political ends with available means to achieve the desired national goals. To Sun Tzu, it was possible to win a war in many ways without the fighting (echoes of deterrence strategies); Lidell Hart (1954) considered that the indirect approach strategy was by far the most successful and cost-effective war strategy. Antoine Henri de Jomini, proclaimed as the father of the science of war, raised analysis from tactical to operational and strategic levels. To Clausewitz, a successful strategy should be a rational process and would be based on the clear identification of political goals, assessment of the enemy's relative comparative advantage, calculation of costs and benefits, and examination of risks and rewards of alternative strategies (Álvarez et al., 2018). According to the typology whose common elements are the capabilities and techniques used by the opponents, wars are classified into generations, from the first to the fourth, and hybrid wars. First generation wars comprise tactical line and column warfare, tight formations, and State armies. The Industrial Revolution influenced second-generation battles as it allowed for the improvement of weapons and firepower. Third generation wars are not based on firepower and attrition, but on speed, surprise, and mental and physical dislocation. During fourth generation wars, States lose their monopoly over war, and this is also against non-State actors (terrorist groups and guerrillas). Hybrid wars are those asymmetric wars that mix regular and irregular elements whose objective is not military victory in battle but social influence and conviction in a country. Through these various lenses to reflect upon wars, there is a common element that has permeated the filters to the historical, social, strategic, and the generation of the

phenomenon of war: the domain where the forces employ their capabilities and develop operations. “The operational domains are useful as a mental framework for planning” (UK Ministry of Defence, 2020, p. 17), and even those confrontations that do not necessarily come through military-type combat, with asymmetrical or irregular actors, involving force-force operations in the classical domains: land, air, and sea, as well as in the space and cyberspace domains. This being said, technological advances have allowed for the integration of military capabilities in space and cyber domains, which could stop a State’s power projection (US Army Department, 2017). Therefore, the military forces should change their concepts and doctrines in such a way that they comply with the principles, requirements, components, and possibilities needed by the multi-domain environment, a fact that goes beyond the three-dimensional domains (land, air, and sea), thus translating into new strategic and ethical (Navas-Camargo & Ardila Castro, 2022) perspectives for countries to maintain or project power.

RESEARCH DESIGN AND LIMITATIONS

This is a descriptive, retrospective, and qualitative study based on secondary data extracted from comprehensive and systematic bibliographic reviews on operations in a multi-domain environment, taking into account offensive, defensive, and dissuasive military strategies, and their relationships with geopolitics. This work was limited to establishing the principles and capabilities required for multi-domain operations placing emphasis on cyber domain under the North American perspective. Therefore, it was not considered necessary to submit this research for approval by the Research Ethics Committee. This study has strategic, military, and geopolitical implications. In the next section, literature review on the proposed topic will be presented.

Literature Review on Multi-domain Battle: taking into account relevant historical observations and lessons from engagements in various global conflicts, the United States Army Training and Doctrine Command (TRADOC) began generating doctrinal and conceptual proposals on how ground forces should adapt to changing operational environments. “This time, the Army must understand changes as they occur and anticipate how they will affect operations. Doctrine must evolve before armies face potential enemies, not after” (Perkins, 2017a, p. 6).

In this sense and considering how emerging technologies affect modern and future battlefields, TRADOC is developing a new concept of military operations called multi-domain battle. In 2007, the document entitled “Multi-Domain Battle: evolution of combined arms for the 21st century, 2025–2040” was published. Multi-domain battle is defined as that battle which “describes how Army forces, as part of the Joint Forces along with partners, will operate, fight, and campaign successfully across all domains – space, cyberspace, air, land, maritime – against peer adversaries in the 2025-2040 timeframe” (U.S. Department of the Army, 2017, p. 1).

Multi-domain battle is intended to seize the advantage from potential adversaries and restore credible conventional deterrence and warfare capability against peer competitors. Its concept presents various ideas for addressing operational challenges presented by adversaries and, in many ways, are evolutionary and based on relevant past and present doctrinal practices. However, “they offer a new, holistic approach to aligning the actions of friendly forces across domains, environments, and functions across time and physical spaces to achieve specific purposes in combat” (U.S. Department of the Army, 2017).

Regarding this concept and to execute multi-domain battle, the Joint Force and its allies operationalize three interrelated solution components which allow the forces to succeed in the operational environment in progress:

- **To calibrate force posture:** this requires a dynamic mix of forward presence, forces and capabilities, expeditionary forces

and capabilities, and partner forces to deter and, when required, to defeat an adversary plan within days;

- **To employ resilient formations:** this demands formations capable of conducting semi-independent, dispersed, mutually supporting, cross-domain operations at operational and tactical levels. These scalable and task organized units, empowered by the mission command philosophy, possess the essential protection, sustainment, and mission command capabilities to operate in lethal, contested environments while retaining the agility to mass capabilities at a desired place and time; and
- **Converging capabilities:** these require converging political and military capabilities – lethal and nonlethal capabilities – across multiple domains in time and space to create windows of advantage that enable the Joint Force to maneuver and achieve objectives, exploit opportunities, or create dilemmas for the enemy. (US Department of the Army, 2017, p. 2)

Thus, Army forces operationalize these components by calibrating force posture to deter adversaries’ campaigns of accomplished facts by employing resilient formations that can semi-independently maneuver in the expanded battlespace, and by converging capabilities to create windows of advantage to enable maneuver.

The United States military operations Desert Storm, Iraq Freedom, and Enduring Freedom have let Americans’ adversaries know their way of war, where the emphasis is on “joint and combined operations; technological dominance; global power projection; strategic, operational, and tactical maneuver; effective joint fires; sustainment at scale; and mission command initiative” (U.S. Department of the Army, 2018). With this concern in mind, the U.S. Army General Staff published, in 2018, the document TRADOC Pamphlet 525-3-1: The U.S. Army in Multi-Domain Operations 2028 (U.S. Department of the Army, 2018). This pamphlet expands on the ideas explained earlier over multi-domain battle: evolution of combined arms for the 21st century, 2025–2040 (U.S. Department of the Army, 2017), and describes “how U.S. Army forces, as part of the Joint Force, will militarily compete, penetrate, disintegrate, and exploit our adversaries in the future” (U.S. Department of the Army, 2018).

Additionally, it refers to emerging technologies that are driving a fundamental change in warfare and have the potential to revolutionize battlefields as these technologies mature. In his introductory remarks on Pamphlet 525-3-1, Gen. Mark A. Milley, 39th Chief of Staff of the Army, noted that such a pamphlet is an important step in doctrinal evolution, but stated that strategic competitors such as Russia and China are synthesizing emerging technologies with their analysis of military doctrine and operations

They are deploying capabilities to fight the US through multiple layers of stand-off in all domains – space, cyber, air, sea, and land. The military problem we face is defeating multiple layers of stand-off in all domains in order to maintain the coherence of our operations. (US Department of the Army, 2018)

The concept of multi-domain operations established in Pamphlet 525-3-1 (U.S. Department of the Army, 2018) challenges Army leaders to envision and maneuver in fundamentally new ways to defeat Chinese and Russian systems. Although this concept focuses on China and Russia, the ideas apply to other threats as well. One of the highlighted problems or threats refers to the emerging operational environment, in which four interrelated trends shape the conflict in a multi-domain environment, namely:

adversaries are contesting all domains, the electromagnetic spectrum (EMS), and the information environment, and U.S. dominance is not assured; smaller armies fight on an expanded battlefield that is increasingly lethal and hyperactive; nation-States have more difficulty in imposing their will within a politically, culturally, technologically, and strategically complex environment; and near-peer States more readily

compete below armed conflict making deterrence more challenging. (US Department of the Army, 2018, p. vi)

Russia and China have taken advantage of these trends to expand the battlefield in time (transition from peace to war), in the domain (space and cyberspace), and in geography to create a tactical, operational, and strategic confrontation (U.S. Department of the Army, 2018). For the authors of the Pamphlet (U.S. Department of the Army, 2018), the challenge is clear; adversaries seek to achieve their strategic objectives, without reaching conflict, through the use of confrontation in a layered stand-off in the political, military, and economic spheres. If a conflict arises, they will employ multiple layers of engagement across all domains (land, sea, air, space, and cyberspace) to separate US forces from their allies in time, space, and defeat them.

In conducting multi-domain operations, according to Pamphlet 525-3-1, the central idea is that Army forces, as an element of a Joint Force, carry out operations in several domains to prevail in conflict; when necessary, forces penetrate and disintegrate enemy systems employed in anti-access and area denial (A2/AD) and exploit the resulting freedom of maneuver to achieve strategic objectives (win) and force a return to competition on favorable terms (US Department of the Army, 2018).

Opening parentheses, "not even the best chess player can win if he cannot get his pieces on the board" (Tangredi, 2013). This idea is used by Tangredi (2013) to explain the logic of the A2/AD concept, which aims to prevent the opponent from operating in the surroundings, on the border, or within a disputed region. Thus, by denying access and freedom of action, it is intended to prevent an attacker from being able to position his forces and maneuver them, generating paralysis and attrition. "Therefore, it is expected that the attacking forces will not be able to deliver any decisive blow to the defender's centers of gravity. A2/AD are made up of actions and capabilities that complement each other in the same strategy" (Sotoriva, 2021, p. 49977). The idea of Multi-domain Battle, or Multi-domain Operations connects expressively with the capabilities of A2/AD. "These capabilities incorporate weapon systems, operational concepts, doctrine, and organizational structures that generate capabilities for an actor to produce a multi-domain layered defense system" (Teixeira Júnior, 2020, p. 11).

Closing parentheses and returning to the main points made in Pamphlet 525-3-1, the problems presented by multi-domain operations can be solved through the application of three interrelated principles: calibrated force posture, multi-domain formations, and convergence. Such principles are similar to the components established in the document Multi-Domain Battle: Evolution of Combined Arms for the 21st Century, 2025–2040 (U.S. Department of the Army, 2017).

Calibrated force posture is the combination of position and the ability to maneuver across strategic distances. Multi-domain formations possess the capacity, capability, and endurance necessary to operate across multiple domains in contested spaces against a near-peer adversary. Convergence is rapid and continuous integration of capabilities in all domains, the EMS, and the information environment that optimizes effects to overmatch the enemy through cross-domain synergy and multiple forms of attack all enabled by mission command and disciplined initiative. The three tenets of the solution are mutually reinforcing and common to all multi-domain operations, though how they are realized will vary by echelon and depend upon the specific operational situation. (US Department of the Army, 2018, p. vii)

David G. Perkins is a retired United States Army general who was Commander of the United States Army Training and Doctrine Command from 2014 to 2018. During this period, he published three articles discussing the impact of the multi-domain battle and also incorporated relevant historical observations and lessons to highlight the new and differentiate it from the old (Perkins, 2017a). The first

article entitled Multi-Domain Battle Driving Change to Win in the Future, Perkins (2017a) presents the ideas to determine how Army forces might conduct operations in the future within the multi-domain battle concept being developed by TRADOC.

In addition, Perkins (2017a) has reflected on the participation of the U.S. Expeditionary Forces in World War I and asks an inspiring question about how ground forces should adapt according to changing operational environments. Regarding the operational environment, Perkins (2017a) highlights that it will be different from the circumstances seen in recent experiences. "It will be defined by an enemy who will challenge our ability to maintain freedom of maneuver and superiority across the air, cyberspace, land, maritime, and space domains and the electromagnetic spectrum" (Perkins, 2017a, p. 7). Perkins (2017a) reinforces in his article that the Army must develop and change in order to avoid the bloody and traumatic learning that the expeditionary forces experienced in 1918.

An advantage of multi-domain battle concept relates to the level of detail of the problems on which solutions can be developed, applied, tested, and evaluated. According to Perkins (2017a), a critical element in achieving this level of detail is the establishment of a battlefield framework.

A battlefield framework is a cognitive tool used to help commanders exercise mission command. The right battlefield framework allows commanders to clearly visualize, describe, direct, lead, and assess the application of combat power in time, space, purpose, and resources. As operational environments change, previous frameworks will prove inadequate for these tasks. Reimagining the battlefield framework is essential to a multi-domain battle's success. (Perkins, 2017a, p. 9)

Multi-domain battle takes place on the largest battlefield framework to fight across the breadth and depth of enemy capabilities, spanning from the battlefield to the garrison itself across multiple domains. "Assignment and delineation of these areas are completely dependent on the geopolitical terrain" (Perkins, 2017a, p. 10).

In his second article, Perkins (2017b) discusses the logic and approach to incorporating multi-domain battle aspects into Field Manual 3-0, Army Operations. Here are the primary analysis (Perkins, 2017b):

- the Army needs to anticipate medium and long-term trends and prepare for them as best it can;
- TRADOC normally publishes concepts more than five years before their ideas are expected to evolve into the doctrine that guides operating forces;
- introduced the concept called cross-domain synergy, in which forces would seek complementarity in different domains (to include space and cyberspace) in such a way that each enhances effectiveness and compensates for the vulnerabilities of the others;
- Multi-domain battle captures the idea that military success depends upon capabilities in the air, cyberspace, land, maritime, and space domains and the electromagnetic spectrum;
- it will help units avoid a position of relative disadvantage against a peer or near-peer adversary in critical geographic spaces around the world;
- it guides closer coordination and integration of capabilities than ever before; and
- the most egregious doctrinal void has been the lack of principles for multi-domain capabilities in large-scale combat operations.

In the final article in a series of three discussing the impact of multi-domain battle through the lens of TRADOC, Perkins (2017c) discusses how the Army must adapt to meet the requirements of a

future force operating in a multi-domain environment. Perkins (2017c) cautions that US opponents and potential adversaries have studied and learned from their battlefield successes since the first Gulf War. With that knowledge, they are adapting their warfare methods, while accelerating the modernization and professionalization of their fighting forces. "Adversaries possess significant integrated air defenses and long-range fires, as well as sophisticated intelligence, surveillance, and reconnaissance and information, electronic warfare, and cyber capabilities" (Perkins, 2017c, p. 11).

Accordingly, Perkins (2017c) argues that in order to address these dilemmas of diversely capable adversaries, the Army must converge and integrate multi-domain solutions and approaches before the battle begins. According to Perkins (2017c), the success of multi-domain battle depends on the ability to match the concept with the doctrine, organization, training, material, leadership and education, the personnel and facility capabilities, and material modernization requirements. "The Army of 2028 must prepare to decisively defeat any adversary in a high-intensity, multi-domain conflict while simultaneously maintaining a credible deterrence capability at all times" (Reina, 2019, p. 23).

Some of the emerging capabilities required to achieve this are: "Long-Range Precision Fires, Next-Generation Combat Vehicle, Future Vertical Lift, Network, Air and Missile Defense, Soldier Lethality, and Organizational Design" (Perkins, 2017c, p.12).

The papers researched and presented so far in this study have analyzed the challenges of multi-domain battle from the perspective of employing US Army forces. However, one of the components of the solution that allows the powers to succeed in the operating environment of multi-domain battle is the convergence of capabilities.

Consequently, the requirements must also include the capabilities of the Navy and the Air Force. In this sense, Perkins and Holmes (2018) published an article to describe what TRADOC and the Air Combat Command (ACC) are doing to provide information to the Army and the Air Force jointly to integrate and converge their capabilities to create the merged multi-domain capabilities that will be required for future combat success.

Given this concern, the emergence of Russia and China as great-power competitors has brought a new urgency to the question of how the United States leverages its air and land power, not to mention the sea, space, and cyberspace, to prevail against a formidable adversary. With this inquiry, Johnson (2018) published an article in which he reinforces the need for "the Army, in collaboration with the Air Force, to develop the multi-domain battle concept to better coordinate air and ground forces to face shared challenges" (Johnson, 2018).

"The distinction between what is and what is not a battlefield is increasingly blurred: the so-called common spaces are all potential battlefields, but also non-physical spaces" (Cantalapiedra, 2019, p. 224). Based on this premise and taking into account the knowledge, arguments, and aspects addressed by the authors on multi-domain operations presented in this work, it should be noted that the Armed Forces are going to face in this way the unavoidable qualitative leap that will make it possible to be in a position to dissuade and, if necessary, fight within the concept of multi-domain battle (land, sea, air, space, and cyberspace) that has been envisioned for the future.

For that reason, the military forces will change their concepts and doctrines so that they are in accordance with the principles, requirements, and components of the solution in a multi-domain environment: calibrate the posture of the force, employ resilient formations, and converged capabilities. In case of conflict or after it has broken out, the Armed Forces seek to achieve their ends through dissuasive, offensive, or defensive strategies. However, from the point of view of multi-domain battle, such strategies must be analyzed to decide whether they are suitable for the challenges of this environment.

In order to reduce the scope of the work, only the strategies adopted by the United States and Russia since the Cold War will be analyzed. A contributing factor to this reduction is the fact that the main sources of reference on multi-domain battle are issued by the US military. Additionally, these posts include how Russia and China are adversaries and seek solutions to deter and defeat Chinese and Russian aggression in conflict. However, Chinese strategies will not be analyzed due to the difficulty of accessing reliable references. This being said, Sotoriva et al. (2021) analyzed how two of the major world powers, the United States and Russia, used anti-aircraft defense as a deterrent during the elaboration and implementation of their defense strategies and verified, among existing strategies, that one was used by such countries, especially during the Cold War. In his essay, Teixeira Júnior (2020) sought to analyze how the deterrent strategic posture and operational concept of A2/AD, a typical Russian defensive strategy, are linked to a type of geostrategy characterized by a multi-domain environment. With a historical approach, Simón and Portugal (2021) collect in detail the events, strategies, and organization of the armies in the conflicts that took place in the 20th and 21st centuries, with a leading role for Russia and the US.

DISCUSSION AND IMPLICATIONS

After discussing what was published on the multi-domain environment and offensive, defensive, and dissuasive military strategies, the next step is to relate the knowledge presented with geopolitics. In the main concepts of geopolitics, geography is the starting point to analyze the relationships between peoples, guide the development of nations and guide the policy of States. As conceptualized by Meira Mattos (2011), geopolitics consists above all on the art of "applying power to geographic spaces" (Meira Mattos, 2011). The geopolitical analysis takes into account that the geopolitical scenario is constantly changing. Technological advances have expanded the possibilities of relationships between people. According to Castro (1999), the 20th century was the scene of comprehensive geopolitics with the advent of three-dimensional warfare (land, sea, and air). However, in the first decades of the 21st century, the horizon of the application of military power was expanded and strategic competition began to develop in five geographical domains of warfare: land, sea, air, space, and cyberspace (Sloan, 2008).

Thus, in geopolitics, geographic factors influence the life and evolution of States. In this affirmation, the characteristics of positive nonconformity of the human being and the need for him to dominate his environment are considered. Technological advances enabled new domains of power projection, including the three-dimensional model in other domains (space and cyberspace), emerging the concept of multi-domain battle. Therefore, such a concept involves the integration of multiple domains, which consists of the use of military capabilities in harmony with other instruments of national power, as well as allies, to maintain or project power in all geographic spaces, including cyberspace and space, in all operational domains and levels of warfare.

CONCLUSION AND FUTURE RESEARCH

This research allowed us to recognize and understand the importance for the military forces to include in their concepts and doctrines the principles, requirements, components, and possibilities that space and cyberspace domains demand, which together with the three-dimensional domains (land, air, and sea) comprise the multi-domain environment. Under the concern and studies carried out by the U.S. military forces, it became clear that military success depends on the integrated capabilities of the army, navy, and air force in this environment, as well as on avoiding a position of relative disadvantage against an adversary, which is already using these geographical spaces, particularly cyberspace, even before a declared conflict.

The Multi-domain Battle is a new concept and lacks more studies on the extent to which defensive, offensive, and dissuasive strategies are influenced by the environment of multi-domain operations and what are their impacts on the geopolitical scenario, especially in Latin America. For future work, research is recommended on: the military strategies used by Russia and the U.S., after the cold war (case study) in order to analyze whether the multi-domain conflict environment influences the strategy adopted; the impacts and advantages of the inclusion of the domains of space and cyberspace in the processes of art, design and operational planning; and the experimentation and testing of ideas in this multi-domain battlefield framework concept based on game theory.

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