GAS ATTACK: SIMULATING LARGE-SCALE CHEMICAL WARFARE AT THE SECOND BATTLE OF THE MARNE, 1918

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE
Wargame Design

by

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This wargame thesis seeks to answer the question: "Can the employment of chemical weapons be effectively represented to illustrate its impact on maneuver in large-scale combat operations in a competitive wargame set in a scenario from World War One?" The United States has not effectively experienced chemical since World War One, but the threat heightens in the context of large-scale combat. The 2nd Battle of the Marne on the western front from around 14 July 1918 to 6 August 1918 is an optimal scenario for a wargame because it features peer level adversaries employing chemical warfare on a large scale to support maneuver operations. Research and experimentation with various existing wargames and models inspired the development of mechanics and key aspects of the wargame that create a functional, playable, and adaptable simulation. The wargame's foundation is based on historical research on the 2nd Battle of the Marne and data on German and American capabilities in 1918 during World War One. The author selected key aspects of the historical data based on warfighting functions, applied gaming mechanics, and adjusted balancing in order to create a competitive wargame.

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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

GAS ATTACK: SIMULATING LARGE-SCALE CHEMICAL WARFARE AT THE SECOND BATTLE OF THE MARNE, 1918, by John Bradley, 113 pages.

This wargame thesis seeks to answer the question: “Can the employment of chemical weapons be effectively represented to illustrate its impact on maneuver in large-scale combat operations in a competitive wargame set in a scenario from World War One?” The United States has not effectively experienced chemical warfare since World War One, but the threat heightens in the context of large-scale combat. The 2nd Battle of the Marne on the western front from around 14 July 1918 to 6 August 1918 is an optimal scenario for a wargame because it features peer level adversaries employing chemical warfare on a large scale to support maneuver operations. Research and experimentation with various existing wargames and models inspired the development of mechanics and key aspects of the wargame that create a functional, playable, and adaptable simulation. The wargame’s foundation is based on historical research on the 2nd Battle of the Marne and data on German and American capabilities in 1918 during World War One. The author selected key aspects of the historical data based on warfighting functions, applied gaming mechanics, and adjusted balancing in order to create a competitive wargame.

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ACRONYMS

AO	Area of Operations
BDE	Brigade
BN	Battalion
CBRN	Chemical Biological Radiological Nuclear
CO	Company
DIV	Division
ENG	Engineers
FA	Field Artillery
HE	High Explosives
HQ	Headquarters
ID	Infantry Division
MOPP	Mission Oriented Protective Posture
MG	Machine Gun
OHL	*Oberste Heeresleitung* (German High Command)
REGT	Regiment

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CHAPTER 1

INTRODUCTION

Background

In the *Final Report of General John J. Pershing*, the Commander-in-Chief of the American Expeditionary Forces during World War One, he stated, "Whether or not gas will be employed in future wars is a matter of conjecture, but the effect is so deadly to the unprepared that we can never afford to neglect the question."[1] In view of the United States Army's shift in doctrinal focus from counterinsurgency operations to large-scale combat operations, the purpose of this project is to enhance commanders' understanding of the impacts of chemical weapons in fighting against a peer level adversary in large-scale ground combat. The last time the United States Army engaged in large-scale combat in a chemical environment was over one hundred years ago during World War One. Despite the century elapsed since America's experience with chemical weapons, the threat persists.[2] According to the National Security Strategy of the United States, chemical warfare is a serious threat in the next large-scale conflict and the threat is

[1] John J. Pershing, *Final Report of Gen. John J. Pershing, Commander-in-Chief American Expeditionary Forces (1920)* (Washington, DC: U.S. Government Printing Office, 1920), 76-77.

[2] Headquarters, Department of the Army (HQDA), Field Manual (FM) 3-11, *Chemical, Biological, Radiological, and Nuclear Operations* (Washington, DC: Government Printing Office, Date Pending), 1-1.

increasing.[3] Russia, China, North Korea, and Iran all have or are developing Chemical Radiological Biological and Nuclear (CBRN) capabilities.[4]

Due to years of operating with insignificant chemical threats, maneuver commanders are not accustomed to training and fighting in operational environments that are impacted by chemical weapons. As a result, maneuver commanders often do not understand how the enemy will employ chemical weapons, the effects of chemical weapons, or how to mitigate their effects.[5] Furthermore, based on Joint Regional Training Center results, nearly all units that rotated through in 2017 and 2018 lacked an emphasis on chemical training and equipping.[6] Without an improved understanding of chemical effects and increased effort on equipping and training, today's Soldiers could suffer severe consequences on the battlefield. The Soldiers of the American 3rd Infantry Division during the Second Battle of the Marne in 1918 during World War One were inadequately prepared for large-scale chemical attacks and suffered nearly double the chemical related casualties as their more experienced allies from Britain and France.[7]

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[3] U.S. President, *National Security Strategy of the United States of America* (Washington, DC: The White House. December 2017), 8.

[4] Ibid.

[5] Val Lopez, "Joint Regional Training Center Chemical Radiological Biological and Nuclear Trends" (PowerPoint presentation, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 25 July 2018), slide 5; Val Lopez, telephone conversation with author, Fort Leavenworth, KS, 25 February 2019.

[6] Ibid.

[7] Rexmond C. Cochrane, *The 3rd Division at Chateau Thierry, July, 1918* (Washington, DC: Army Chemical Center: U.S. Army Chemical Corps Historical Office, 1959), 101-102.

This project seeks to answer the question, can the employment of chemical weapons be effectively represented to illustrate its impact on maneuver in large-scale combat operations in a competitive wargame set in a scenario from the 2nd Battle of the Marne during the summer of 1918 in World War One in a way that offers insights to modern commanders?

World War One is the best context for this wargame. While technology and doctrine have evolved since a century ago in 1918, World War One is the only historical context in which chemical weapons were used on a large scale by peer adversaries with comparable capabilities. World War One can also work as a scenario for modern commander because the latter part of World War One, 1917 to 1918, ushered in the "modern style of warfare."[8] This modern style introduced "three-dimensional conflict through artillery indirect fire."[9]

As a modern, three-dimensional war, World War One can provide a scenario that can incorporate all of the warfighting functions which modern commanders consider to conceptualize combat power and accomplish their mission.[10] In today's doctrine, the six warfighting functions are mission command, movement and maneuver, intelligence, fires, sustainment, and protection.[11] All of them were essential on the World War One

[8] Jonathan B.A. Bailey, "The First World War and the Birth of Modern Warfare," in *The Dynamics of Military Revolution 1300-2050*, ed. MacGregor Knox and Williamson Murray (New York, NY: Cambridge University Press, 2003), 132.

[9] Ibid.

[10] Headquarters, Department of the Army (HQDA), Field Manual (FM) 3-0, *Operations* (Washington, DC: Government Printing Office, October 2017), 2-105.

[11] Ibid.

battlefield. Despite updates throughout the years, the fundamentals in doctrine remain largely the same and modern maneuver commanders will find nothing foreign to them, except perhaps chemical warfare, in this wargame.

Today, despite modern advances in chemical warfare technologies and the development of a wider variety of weapons of mass destruction, the overall operational and tactical purpose of chemical weapons on maneuver remains relatively unchanged. For example, in both 1918 and 2018, persistent agents remain in a location over time and can be used to block, turn, or disrupt the enemy's approach. Non-persistent agents dissipate quickly, initially disrupting enemy forces, but clearing away to allow the arrival of friendly forces.[12] Due to the added effect of forcing an enemy to assume a Mission Oriented Protective Posture (MOPP) in full protective gear, chemical weapons then and now are excellent tools to suppress an enemy, disrupt, and slow momentum. As such, modern chemical weapons will be employed for generally the same effects as they were in 1918. Modern commanders will have to consider the chemical operational environment much like commanders in World War One had to.

The intended audience are maneuver commanders; therefore, the wargame must center on maneuver in ground combat. Since the Army's role, as the land component, is ultimately to seize terrain in ground combat,[13] the wargame focuses specifically on the impact of chemical warfare on ground combat. It should teach maneuver commanders how chemical weapons can disrupt or enable their mission. It simulates the tactics of

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[12] David T. Zabecki, *The German 1918 Offensives: A Case Study in the Operational Level of War* (New York, NY: Routledge, 2006), 55-56.

[13] Mark A. Milley, *39th Chief of Staff of the Army Initial Message to the Army* (Washington, DC: 2015).

chemical warfare and illustrates chemical effects enough to teach commanders key aspects to consider in planning to operate in a chemical environment. Finally, the wargame educates commanders in what FM 3-0 states they must be prepared for, "large-scale ground combat against a peer threat."[14]

While giving a speech at the Naval War College, Admiral Nimitz once said, "The war with Japan had been re-enacted in the game room here by so many people and in so many different ways that nothing that happened during the war was a surprise – absolutely nothing except the *Kamikaze* tactics towards the end of the war; we had not visualized those."[15] While there are many ways to present this topic, and while wargaming cannot identify everything, a competitive wargame is uniquely effective in that it not only informs the audience, but it also tests them. This wargame does not explicitly teach where and how to employ chemical weapons, but rather puts the player into a situation in which they must draw upon experience, intuition, and the art of war to discover for themselves the best way to utilize this tool in order to achieve their objectives. It thus awakens an understanding of chemical warfare associated with real military operations.[16] It is an efficient way to gain insights into the effects of chemical warfare by having the liberty to create courses of action and play them against an opponent who will then react and concoct a course of action in response.[17]

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[14] HQDA, FM 3-0, ix.

[15] Ministry of Defense, *Wargaming Handbook* (Wiltshire, UK: The Development, Concepts and Doctrine Centre, 2017), 4.

[16] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2014), 31.

[17] Peter Perla, *The Art of Wargaming: A Guide for Professionals and Hobbyists*, ed. John Curry (United States Naval Institute, 2011), 23.

Another advantage of this topic as presented in a wargame is that chemical warfare does not only encompass weapons and protective measures, but it also changes the operational environment. This wargame is designed to reflect changes to the environment. By setting the wargame in a historical scenario during World War One, the wargame can model the scenario in order to determine mechanics, but players can make decisions that could change the outcome of the scenario. The actions of one player and reactions of the other, will allow both players to learn by trial. They will each be impelled to improve their understanding of chemical effects and skill in employment in order to defeat their opponent.

Limitations

While a scenario from World War One is the best fit for this project, it also comes with limitations. Capabilities in chemical warfare and delivery have evolved significantly over the last century. Today's commanders must consider biological, radiological, and nuclear threats in addition to chemical, each with their own methods for detection and mitigation. Modern commanders must also consider further ranged delivery capabilities. Chemical, biological, radiological, and nuclear (CBRN) munitions delivered by aircraft or missiles can reach deep into friendly areas and destroy or disrupt critical infrastructure. Modern commanders will have to consider CBRN threats immediately upon entry into theater whereas during World War One, the chemical threat was generally confined to the front within range of enemy artillery.

While World War One brought the development of aircraft and armor, the speed, synchronization, and prominence on the battlefield was far behind what modern commanders experience today. Cyber and space did not yet exist as domains of war.

Modern commanders will most certainly have to consider how armor, aircraft, cyber, and space interact with chemical weapons.

Delimitations

In order to achieve the learning objective, this wargame is created to be comprehensible and playable in under four hours. With some familiarity, it should be playable within two hours. In order to achieve this goal, it does not have the capacity to fully simulate the scenario or chemical warfare. Some important aspects that are delimited include: diverse effects of terrain and elevation on chemical gas, fog of war, combat engagements, and variety of chemical agents.

Next, while the foundation of this wargame is maneuver, tactics of World War One were fairly different than what they are now. Players can choose their own tactics, which may differ from those of World War One, or even modern doctrine. Since the model is based on 1918 tactics, players are encouraged to adopt the tactics of the period for optimal results.

Finally, during World War One, chemists from both sides constantly experimented and developed new capabilities for chemical warfare. Each side had a variety of options to use, employed by a variety of means.[18] The purpose of this wargame is not to create chemical technical experts, but to train maneuver experts how to employ and mitigate the effects of chemical weapons. Therefore, chemical weapons are simplified to the most commonly used categories during 1918.

[18] Amos A. Fries and Clarence J. West, *Chemical Warfare* (New York, NY: McGraw-Hill Book Company, Inc., 1921), 22-30.

Despite the limitations and delimitations in this wargame, it has an adequate balance that both represents all of the key aspects as described in chapter 3, while also simplified enough to be manageable and playable within four hours. Using the 3rd Infantry Division's battle against the German 10th Division during the 2nd Battle of the Marne in the summer of 1918 as a model, this project will be a tool to train maneuver commanders to consider how chemical warfare changes the operational environment. It will provide the opportunity for practice on how to mitigate against chemical attacks in an easily accessible medium.

CHAPTER 2

LITERATURE REVIEW

Background

The idea for producing a wargame based on large-scale combat operations during World War One was originally inspired by the significant role chemical weapons played in enabling German and Austrian forces to infiltrate through Italian lines during the battle of Caporetto on the eastern front in the fall of 1917, resulting in an enormous victory that nearly defeated Italy.[19] While the battle of Caporetto featured an expertly planned large-scale chemical attack, patiently timed for optimal weather and effects, chemical warfare was no longer featured in the scenario after the initial infiltration. The scenario lacked peer-to-peer chemical warfare.

Dr. Sanders Marble, the senior historian at the U.S. Army Office of Medical History, author, and expert on the history of chemical warfare, suggested that the western front would be a more suitable scenario for peer-level chemical warfare capabilities. He recommended *Rexmond Cochrane's* accounts of U.S. Divisions' experiences with chemical warfare in 1918.[20] This advice proved to be critical to the development of *Gas Attack,* as the scenario closely follows the 3rd Infantry Division's experiences during the 2nd Battle of the Marne. The primary literary source of *Gas Attack* is *Rexmond Cochrane's* account of *The 3rd Division at Chateau Thierry, July, 1918.*[21]

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[19] John R. Schindler, *Isonzo the Forgotten Sacrifice of the Great War* (Westport, CT: Praeger Publishers, 2001), 249-253.

[20] Sanders W. Marble, email message to author, 3 October 2018.

[21] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918.*

Literature

The 3rd Division at Chateau Thierry, July 1918 by *Rexmond Cochrane* provides day by day reports, accounts, and analysis of all of the chemical events that occurred with the 3rd Infantry Division during July 1918, the period of the 2nd Battle of the Marne. This data was critical in constructing combat models to determine how effective gas attacks are in the wargame. It also illustrated the amount of gas munitions used, by type, and casualties, by type. It provided the perspective of the 2nd Battle of the Marne from the 3rd Infantry Division's level without any embellishments which allowed for the modeling of combat power and capabilities with minimal bias.[22]

The *Rapport du marechal commandant en chef les Armees francaises du Nord et du Nord-Est sur les operations en 1918*, a report from the commander of French armies, Field Marshal Petain, translated by *Aage Woldike*, was the most comprehensive source describing the events of 18 July to 6 August 1918 from the operational level. It included detailed maps, daily orders, daily reports to subordinate units, including the 3rd Infantry Division, and it depicted German disposition.[23] It also described the French strategy to absorb the German attack and transition to the offense with a counter-attack,[24] a very important piece to the scenario as it reverses the roles of the players.

The Second Battle of the Marne by *Paul Greenwood* and *The German 1918 Offensives: A Case Study in the Operational Level of War* by *David Zabecki*,

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[22] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918.*

[23] Philippe Pétain, *Rapport du marechal commandant en chef les Armees francaises du Nord et du Nord-Est sur les operations en 1918*, trans Aage Woldike (Paris, 1921).

[24] Ibid., 17.

complemented *Petain's Report* by providing the strategic picture of the scenario that was useful in understanding the role of the scenario in World War One. They both described the situation leading up to the 2nd Battle of the Marne, why Ludendorff chose to conduct the offensive, and how it played out.[25] *Zabecki* also inspired the breakdown of key aspects of the wargame by warfighting function from his discussion of operational art in relation to the German offensives in 1918.[26]

While *Cochrane's* account was thorough to the scenario, *Amos A. Fries* and *Clarence J. West*'s *Chemical Warfare*, from 1921; *C.H. Foulkes' "Gas!" The Story of the Special Brigade*, from 1934; and *Charles E. Heller's Chemical Warfare in World War I: American Experience, 1917-1918*, were very useful complementary material on chemical warfare during the period. For example, while *Cochrane* would mention a gas-proofed dugout in the 3rd Infantry Division's sector,[27] *Heller* would describe the effectiveness of gas-proofed dugouts,[28] which was useful for incorporating the dugouts into the wargame.

In addition to *Petain's Report* and *Cochrane* the *Handbook of the German Army 1918* was very useful in understanding German capabilities, tactics, techniques, and procedures at the time of the scenario. The handbook described the German

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[25] Zabecki, *The German 1918 Offensives: A Case Study in the Operational Level of War*; Paul Greenwood, *The Second Battle of the Marne, 1918* (Shrewsbury, England: Airlife Pub., 1998).

[26] Zabecki, *The German 1918 Offensives: A Case Study in the Operational Level of War*, 35-37.

[27] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918,* 18.

[28] Charles E. Heller, *Chemical Warfare in World War I: American Experience, 1917-1918* (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command and General Staff College, 1984), 71-73.

organization,[29] the role and significance of chemical protection,[30] use of gas,[31] employment of *Stoßtruppen* and engineers.[32] All of these were important in modeling German units, abilities, and cards.

Games

Many of the board games researched for *Gas Attack* had similar features with each other that collectively inspired *Gas Attack*. However, a few games distinguished themselves as especially useful. These are *Battle for Moscow* by *Frank Chadwick*; *Strike of the Eagle* by *Brian Bennett*, *Uwe Eickert*, and *Robert Żak*; and *Yom Kippur* by *Dean Essig* and *Al Sandrick*. All three are similar in that they are all combat scenario-based board games involving pieces representing combat units that maneuver on a map board attempting to defeat the opponent. Each provided inspiration by the different ways they addressed various aspects or mechanics. Two other very different games, *Terraforming Mars* by *Jacob Fryxelius* and *Diplomacy* by *Allan Calhamer*, introduced mechanics not found in typical scenario-based combat board games, but nevertheless greatly contributed to the learning objectives of *Gas Attack*.

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[29] Imperial War Museum (IWM) (Great Britain) Department of Printed Books. *Handbook of the German Army in War, April 1918* (London: Imperial War Museum: Battery Press; Skokie: Articles of War, 1996), 34.

[30] Ibid., 42.

[31] Ibid., 89.

[32] Ibid., 94.

Battle for Moscow inspired the map board for *Gas Attack.* It presented movement of units in relation to the hex-based terrain and proximity of enemy units[33] in a way that was also suitable for *Gas Attack*. *Gas Attack* also uses a hex-based map board with diverse terrain. Units have a limited allocation of movement that can be affected by terrain. *Battle for Moscow* also had a simple turn tracker that illustrated changing conditions based on the turn that could introduce reinforcements or change the weather.[34] This mechanism greatly inspired the turn tracker in *Gas Attack* which determines quantities of supply to each player and can change weather conditions. *Battle for Moscow* employed a simple combat results table to quickly adjudicate combat by rolling dice.[35] While *Gas Attack* originally resisted using a combat results table, the simplicity of *Battle for Moscow's* table influenced *Gas Attack* to incorporate one as well.

Strike of the Eagle by *Brian Bennett*, *Uwe Eickert*, and *Robert Żak* was the primary inspiration for the maneuver unit pieces, turn phases, the orders process, and the use of action cards to increase player options while incorporating key aspects of the game.[36] For maneuver units, *Strike of the Eagle* used upright block pieces with unit information and step strength printed on one side facing the player, and the blank side facing the opponent. The piece could be rotated to track loss of step strength to the unit.[37]

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[33] *Battle for Moscow*, created by Frank Chadwick, board game (Victory Point Games, 2009).

[34] Ibid.

[35] Ibid.

[36] *Strike of the Eagle*, created by Brian Bennett, Uwe Eickert, and Robert Zak, board game (Academy Games, Inc., 2011).

[37] *Strike of the Eagle*.

This is an important feature in *Gas Attack* as it allows units to experience weakened effects of combat without being immediately removed from play unless the combat is especially destructive. *Strike of the Eagle's* turn phases and orders process allowed players to plan turns and issue orders by placing order tokens face-down on units or objectives on the map board, including decoy tokens, thus concealing orders from the opponent until both players completed the orders process. Then the turn transitioned to resolve the orders according to the tokens.[38] This created a gameplay that nearly resembled simultaneous planning because all planning was complete prior to any action or reaction. The cards in *Strike of the Eagle* illustrated that a wargame can incorporate many options for the player that are self-explanatory on the card.[39] *Gas Attack* uses cards to incorporate important events of the scenario while giving players options and better understanding of other aspects of chemical warfare that cannot be illustrated elsewhere in the wargame.

Yom Kippur by *Dean Essig* and *Al Sandrick* complemented hex-based wargame research from *Battle for Moscow*, while introducing some important features of its own. *Yom Kippur* used artillery barrage and air support tables[40] which effectively demonstrated three-dimensional war on a board game. The separate artillery and air tables inspired *Gas Attack's* artillery and aerial reconnaissance tables. *Yom Kippur* also

[38] Ibid.

[39] Ibid.

[40] *Yom Kippur*, created by Dean Essig and Al Sandrick, board game (The Gamers, Kokusai-Tsushin Co., Ltd., 1995).

used markers to illustrate suppression, fatigue, and temporary loss of combat power.[41] This was helpful in creating *Gas Attack's* marking system for gas effects and disruption on units.

Terraforming Mars by *Jacob Fryxelius* provided the most unique inspiration for *Gas Attack* with its separate player resource boards apart from the main map game board. The separate resource boards keep track of resources for each player and can adjust based on events or player actions.[42] This was excellent inspiration for *Gas Attack's* supply boards which manage three different munition types, vary by day, and can adjust depending on player actions. This mechanism allows *Gas Attack* to illustrate chemical warfare's effects on sustainment and encourages players to think about economy of force with chemical warfare.

Finally, the fifth edition of *Diplomacy* by *Allan Calhamer*, uses map sheets for players to plan and issue orders by drawing on the map sheets.[43] This mechanism improved upon the orders process from *Strike of the Eagle* by allowing true simultaneity for planning and created an optimal way to allocate artillery targets without revealing them to the opponent. This inspired the creation of the mini map targeting boards in *Gas Attack* which ended up being one of the most effective mechanisms of the game.

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[41] *Yom Kippur*.

[42] *Terraforming Mars*, created by Jacob Fryxelius, board game (Stronghold Games, 2016).

[43] *Diplomacy*, created by Allan Calhamer, board game (Avalon Hill, 2008).

Doctrine

Having an understanding of chemical warfare doctrine today and comparing it to doctrine of the period helped refine the focus of the wargame. Modern chemical warfare doctrine focuses on protection, but during World War One it also focused on employing chemical weapons in the offense. Since *Gas Attack* seeks to improve understanding for protection and planning in a chemical environment by creating an understanding of chemical warfare employment, World War One doctrine is especially useful to the wargame.

Chemical Warfare 1921 by *Amos Fries* and *Clarence West* was the best source of American World War One doctrine for *Gas Attack. Chemical Warfare 1921* described the use of chemical weapons at various echelons and provided data on capabilities for both German and Allied forces[44] that was used to model chemical effects in *Gas Attack*. The Army War College's *Gas Warfare Part II: Methods of Defense Against Gas Attacks* illustrated World War One protection doctrine and inspired the development of defense modifiers in *Gas Attack*.[45]

Modern doctrine consisted of FM 3-0, *Operations* and FM 3-11, *Chemical, Biological, Radiological, and Nuclear Operations*. Both FM 3-0 and FM 3-11 illustrate how the protection warfighting function integrates with the other warfighting functions.[46]

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[44] Fries and West, *Chemical Warfare*.

[45] U.S. Army War College (AWC), *Gas Warfare Part II. Methods of Defense Against Gas Attacks* (Washington, DC: War Department, 1918).

[46] HQDA, FM 3-0; HQDA, FM 3-11.

This inspired the way *Gas Attack* approaches key aspects of the wargame by demonstrating how chemical warfare impacts each of the warfighting functions.

CHAPTER 3

KEY ASPECTS TO BE MODELED IN THE WARGAME

Gas Attack is a wargame modeling division-level ground combat against peer adversaries within the overall context of large-scale combat operations. The intent of this wargame is to provide a medium for maneuver commanders to gain understanding and practice in the art of chemical warfare and learn how it can be used to enable maneuver objectives. This wargame is based on the American 3rd Infantry Division's (3rd ID) engagement with the German 10th Division (10th Div), and a regiment of the 36th Division (5th Grenadiers), during the 2nd Battle of the Marne in World War One starting around 14 July 1918, (the build-up towards the German offensive on 15 July 1918).

This chapter will discuss an overview of the selected scenario, why this scenario is an optimal model for this wargame, and the aspects of the situation that are most important in order to meet the intent. In planning for large-scale combat operations, commanders and their staffs consider all of the warfighting functions to understand capabilities and combat power.[47] Key aspects of the wargame illustrate ways that chemical warfare impacts, or is impacted by, each of the warfighting functions. Since the intent is to teach modern maneuver commanders, most of the important aspects of the wargame are organized within the six warfighting functions. Terrain, weather, time, and friction are also key aspects of the wargame, but they are not addressed by a warfighting function.

[47] HQDA, FM 3-0, 2-21.

The highlight of the wargame is to illustrate how chemical warfare impacts these capabilities and combat power in ground combat and changes the environment. Following the historical context of the wargame, the remaining key aspects of the wargame are arranged in the six warfighting functions: Movement and Maneuver, Fires, Intelligence, Sustainment, Protection, and Mission Command. Additional key aspects follow the warfighting functions.

The Context of the 2nd Battle of The Marne, Summer 1918

The 2nd Battle of the Marne, or the period from 14 July to 6 August 1918 on the western front along the Marne River, France, is the optimal period and setting for this wargame. While the specific part of the scenario applied in the wargame is at the division level, here is an overview of the background of the situation leading up to the battle.

In the beginning of 1918, the German *Oberste Heeresleitung* (OHL), or the German Supreme Command, realized that even though Russia was no longer a threat on the eastern front, the rapid build-up of American forces on the western front would soon shift the balance of power towards the Allies.[48] In order to achieve victory, First Quartermaster General Erich Ludendorff, determined that Germany had to force France to sue for peace by the summer of 1918.[49]

Part of Germany's 1918 summer offensive was operation MARNESCHUTZ-REIMS (to defend along the Marne while seizing the city of Reims). Originally OHL envisioned the operation as a way to sustain the gains made in the spring offensive by

[48] Zabecki, *The German 1918 Offensives: A Case Study in the Operational Level of War*, 82.

[49] Greenwood, *The Second Battle of the Marne, 1918*, 1.

securing the rail logistics hub at the city of Reims.[50] However, after the French stubbornly held Reims against multiple attempts,[51] Ludendorff expanded the scale of MARNESCHUTZ-REIMS in an attempt to finally achieve a decisive victory in France before German forces completely caved and more American troops arrived.[52] The western edge of the offensive began just east of the town of Château-Thierry, in the area assigned to the German 10th Division (10th Div), opposed across the Marne river by the American 3rd Infantry Division (3rd ID), the part of the battle selected for this wargame.[53]

Importance of the Scenario to the Wargame

The 3rd ID engagement against the German 10th Division and 5th Grenadier Regiment of the 36th Division during the 2nd Battle of the Marne is an optimal scenario for this wargame. First, this engagement is part of the large-scale combat operations of World War One. Each side had comparable strength and capabilities, making them peer adversaries. Despite the typical battle of World War One being characterized as a gridlock in trench warfare, this particular battle featured maneuver in the offense by each side. The Germans started in the offense, then transitioned to the defense and retrograde. The Americans started in the defense, then transitioned to the offense and pursuit. Most

[50] Zabecki, *The German 1918 Offensives: A Case Study in the Operational Level of War*, 246-248.

[51] Ibid., 251.

[52] Greenwood, *The Second Battle of the Marne, 1918*, 63-64.

[53] Ibid., 78-79.

importantly, each side employed chemical weapons in both the offense and the defense, and practiced chemical protection and decontamination.

The Divisions

The 3rd ID is the area of operations of focus for this scenario. The situation and description of the area that follows are important aspects to be represented in the wargame because they describe the set-up of the model for the wargame.

Despite having to cut training short due to the German advance, the 3rd ID arrived to its area of operations fresh, and with a high state of morale.[54] The 3rd ID served under the French XXXVIII Corps within the French 9th Army and was assigned to an area spanning approximately nine kilometers along the Marne River between Château-Thierry and the village of Varennes.[55] The area included the Surmelin River valley, a smaller river that fed into the Marne, whose strategic valley provided a natural terrain opening to the south.[56] This was located less than one hundred kilometers east of Paris and less than fifty kilometers west of Reims.

The Marne River is a roughly fifty-meter-wide obstacle that separated 3rd ID to the south and the German 10th Division and the 5th Grenadier Regiment of the 36th

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[54] F.V.H., Division Historian, *History of the Third Division United States Army in The World War* (Cologne: M. Dumont Schauberg, 1919), VII.

[55] Historical Division, Department of the Army (HDDA), *United States Army in The World War 1917-1919 Volume 3, Training and use of American Units with British and French* (Washington, DC: Government Printing Office. 1948), 572-575; Historical Division, Department of the Army (HDDA), *United States Army in The World War 1917-1919 Volume 5, Military Operations of the American Expeditionary Forces, Champagne-Marne, Aisne-Marne* (Washington, DC: Government Printing Office. 1948), 597.

[56] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918,* 12.

Division to the north.[57] During the battle of this scenario, the German 10th Division was considered a "first class" division.[58] However, after fierce fighting during the Spring of 1918, it had suffered losses and the replacements were not as well trained as the veterans of the division.[59] The German 10th and 36th Divisions both belonged to Corps Kathen of the German 7th Army, which provided additional fire support to the divisions.[60] The 3rd ID's mission was to prevent German forces from crossing the Marne River and to protect the Surmelin valley.[61]

The German Attack across the Marne

The following events are key aspects of the wargame because they describe how the historical scenario facilitates learning of the employment of chemical warfare in both the offense and the defense.

Just after midnight, 15 July 1918, the German bombardment was to begin. Just before dawn, the German 10th Division and the 5th Grenadiers Regiment were to attack 3rd ID positions across the Marne River and secure a foothold.[62] The Allies, however, received ample intelligence on the German offensive and generally knew when and

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[57] Greenwood, *The Second Battle of the Marne, 1918*, 78-84.

[58] U.S. Army G-2 (USAG2), *Histories of Two Hundred and Fifty-One Divisions of the German Army which Participated in the War (1914-1918)* (Washington, DC: United States Government Publishing Office, 1920), 183.

[59] Ibid.

[60] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 35.

[61] HDDA, *United States Army in The World War 1917-1919 Volume 5, Military Operations of the American Expeditionary Forces, Champagne-Marne, Aisne-Marne*, 597.

[62] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 29.

where to target German units massing for the attack.[63] The 3rd ID Field Artillery Brigade received 3,000 shells of mustard gas from their French corps with instructions to suppress German artillery and disrupt assembly areas thirty minutes prior to the attack.[64]

The Allied counteroffensive fire was a shock to the Germans who realized that the element of surprise from their grand offensive was in fact reversed in favor of the Allies.[65] Despite Allied counteroffensive fire, the German artillery was nevertheless able to commence its own bombardment preceding the attack, attempting to suppress 3rd ID units at penetration points.[66] The German bombardment, featuring an abundance of non-persistent gas, was very effective against the inexperienced American Division.[67] The Germans were ultimately able to cross the Marne River, but due to effective Allied counteroffensive fire, low morale, and stiff resistance from the 3rd ID, they did not achieve as much success as anticipated.

The Allied Counter-Offensive

The following is the context for the 3rd ID's transition to the offense against German forces on 18 July 1918. The Allied forces Commander-in-Chief, Ferdinand Foch, considered two courses of action in anticipation of the German offensive: either to send every available unit to plug areas where the Germans breached, or a prepare a large

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[63] Greenwood, *The Second Battle of the Marne, 1918*, 77-78.

[64] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 29.

[65] Bruce I. Gudmundsson, *On Artillery* (Westport, CT: Praeger Publishers, 1993), 99-100.

[66] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 31.

[67] Ibid., 93-95.

counter-attack force to crush the German advanced guard prior to receiving reinforcements.[68] The Germans, unable to achieve their objectives for the "Offensive for Peace," and having over-extended themselves with the effort, provided an opportunity for the Allies to conduct their own decisive attack. On 18 July 1918, Allied forces initiated the counter-attack.[69]

The 3rd ID Transition to the Offense

3rd ID's transition to the offense is a key aspect of the wargame because it facilitates learning objectives for both the offense and the defense for both players. The German player must shift from planning chemical warfare in the offense to the defense, whereas the American player shifts from the defense to the offense.

Unable to consolidate gains, the Germans withdrew back to the north side of the river on the evening of 19 to 20 July 1918.[70] On 21 July 1918, the 3rd ID received the order to continue the counter-attack north of the Marne towards Le Charmel.[71] At this point, the 3rd ID was facing elements of the German 10th Landwehr Division, which covered the Corps Kathen withdrawal.[72] However, due to the complexity of introducing elements of another division halfway into the wargame, and since the German 10th

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[68] Pétain, *Rapport du marechal commandant en chef les Armees francaises du Nord et du Nord-Est sur les operations en 1918*, 17-18.

[69] Ibid., 5-8.

[70] Ibid., 48.

[71] Ibid., 47.

[72] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 65.

Division is already given additional assets for the wargame, the 10th Landwehr is omitted.

With the roles reversed, German intelligence learned of 3rd ID's attack on 22 July, and concentrated fires and persistent mustard gas on routes, assembly areas, and villages in the area.[73] Upon receiving nearly 4,000 replacements, the 3rd ID pursued the Germans north of the Marne River until 26 July 1918, at which point all of the division except for the 4th Infantry Brigade culminated and was relieved by the 28th Division. The 4th Infantry Brigade culminated two days later, on 28 July 1918.[74]

Both the 10th Division and the 3rd ID culminated while in the offense. The 10th Division successfully crossed the Marne River, but the overall German offensive did not succeed. The 3rd ID culminated before August, but the overall Allied counter-offensive was successful. This is an important aspect of the scenario because each player has to overcome significant challenges in order to accomplish their objectives and win the wargame.

Key Aspects as Warfighting Functions

Most of the remaining key aspects of this wargame fall within one of the six warfighting functions: movement and maneuver, fires, intelligence, sustainment, protection, and mission command. In order to answer the question, can the employment of chemical weapons be effectively represented to illustrate its impact on maneuver in a competitive wargame, the wargame illustrates the key aspects in a way familiar to

[73] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 65.

[74] Ibid., 73-77.

maneuver commanders. All of the key aspects contribute to the objective while also being understandable concepts that can be playable within the structure of the wargame. These key aspects are described in the following paragraphs within their respective warfighting function.

Movement and Maneuver

The movement and maneuver warfighting function includes the ways and means to "employ forces to achieve a position of relative advantage over the enemy."[75] The first element of this wargame is to ensure the primacy of maneuver because it is ultimately the foundation of the wargame. To win the game, players must seize terrain from their opponent in ground combat. Therefore, the movement and maneuver of combat units, ground combat, offense, defense, are all represented in the wargame.

Organization of Units

The organization of units is a key aspect of the wargame because it combines the historical context with representative units that move, maneuver, conduct combat, and ultimately reflect the decisions of the players. The following units are represented in the wargame.

The tactical unit of the German Army defensive battle in 1918 was the division, within the division it was the battalion.[76] The German division in 1918 had only one infantry brigade, with three infantry regiments. Each regiment had three infantry

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[75] HQDA, FM 3-0, 2-202.

[76] Timothy T. Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War* (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command and General Staff College, 1981), 302.

battalions arranged in depth. Each battalion had four infantry companies and a machine gun company. The division also had an artillery command (consisting of a heavy artillery battalion and a field artillery regiment), a cavalry squadron (the size of a U.S. company), a combat engineer battalion, and signal and logistics assets.[77] See figure 1.

The U.S. division was more than twice the size of the German division (approximately 28,000 soldiers compared to roughly 11,600). It was organized into two infantry brigades, each with two regiments and a machine gun battalion. Each regiment had three infantry battalions and its own machine gun company. The U.S. division also had a motorized machine gun battalion, a division artillery brigade, an engineer regiment consisting of two battalions, medical, logistics, and signal assets.[78]

In this wargame, the German 10th Division's experience and training balance it against the 3rd ID's morale. Also in order to create some parity in the wargame, the German 10th Division has an elite Storm Trooper battalion attached to it, along with the 5th Grenadier Regiment from the 36th Division to the 10th Division's east. Based on German tactics of the time, it is likely that the 10th Division had a Storm Trooper battalion attached to it during this offensive.[79]

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[77] IWM (Great Britain), *Handbook of the German Army in War, April 1918*, 33-34, 43; Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, 301.

[78] Jonathan M. House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization* (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command and General Staff College, 1984), 41.

[79] Ibid., 35.

In contrast, by July 1918 the 3rd ID was consolidated and practically at full strength of personnel.[80] Having recently arrived into Europe, the American soldiers had a high state of morale. What the 3rd ID had in strength and morale, it lacked in training and experience. The 3rd ID had pre-deployment training, and training once it arrived to France, but it was never able to fully integrate the units and ensure readiness as its training was cut short to move to the Marne.[81] Since *Gas Attack* uses infantry battalions as the primary maneuver unit, a modification in the wargame is that the 3rd ID retains all of its infantry battalions instead of losing three battalions to the Corps Reserve.[82]

[80] HDDA, *United States Army in The World War 1917-1919 Volume 3, Training and use of American Units with British and French*, 572.

[81] F.V.H., *History of the Third Division United States Army in The World War*, VII.

[82] HDDA, *United States Army in The World War 1917-1919 Volume 3, Training and use of American Units with British and French*, 575.

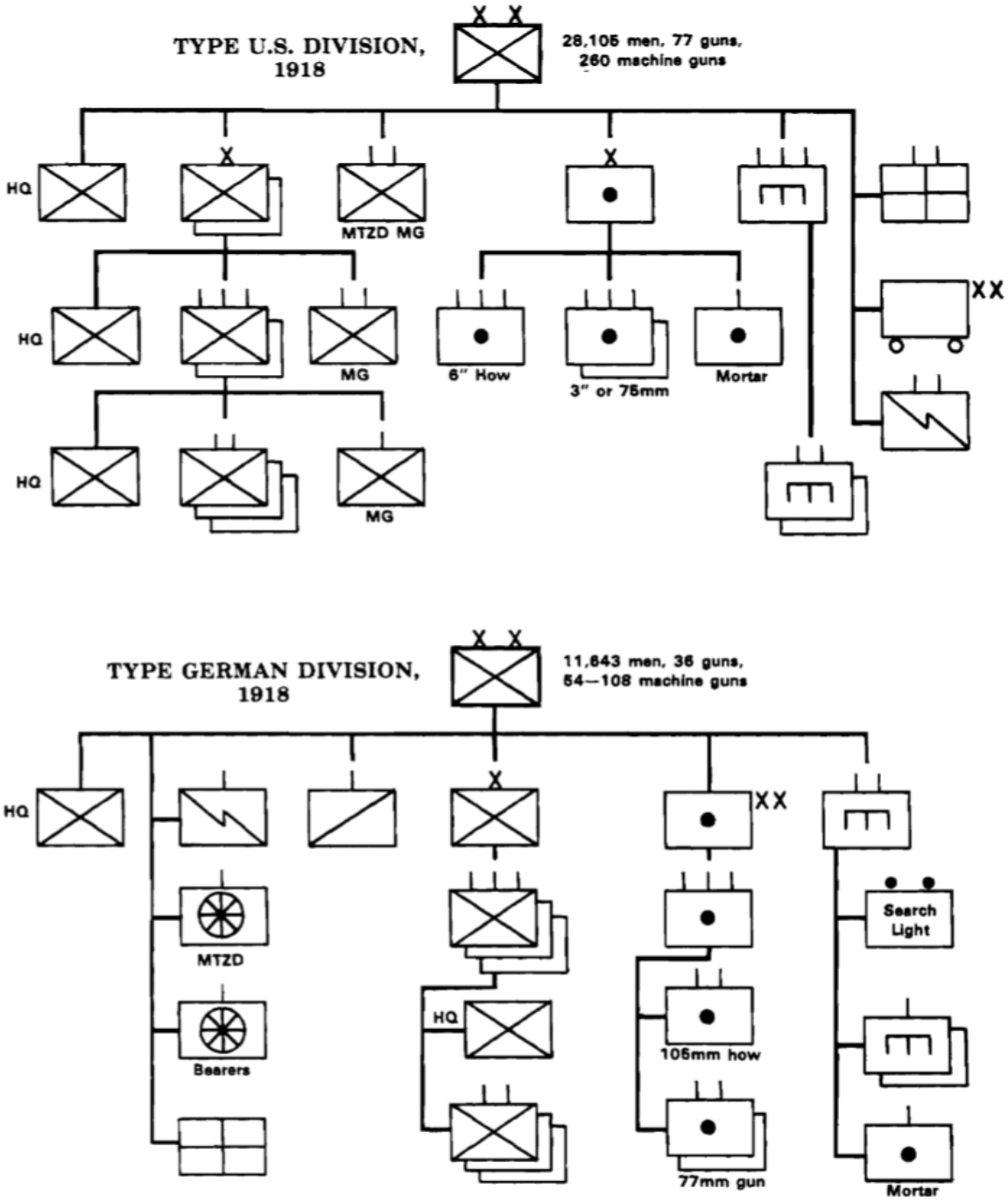

Figure 1. American and German Infantry Division Organization during 1918

Source: Jonathan M. House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization* (Fort Leavenworth, KS: Combat Studies Institutes, U.S. Army Command and General Staff College, 1984), 41.

Maneuver Tactics of 1918

Generally, the maneuver tactics for both sides of 1918 are important aspects of the wargame because they reflect how units employed their capabilities. While the tactics of 1918 are useful for the historical context, they are also delimited because each player can select their own tactics, and deviate from World War One tactics.

By early 1918 the German Army had adopted the doctrine of the elastic defense.[83] Front line units no longer needed to be as strong as their immediate opposing enemy because they could fall back on layered defensive positions. As the enemy advanced, they would become weaker as they were slowly whittled down by artillery, hidden pockets of defense, machine gun fire, and strongpoints as they had to wait for their own artillery support to catch up. Then the Germans would counter-attack the weakened enemy in order to take back the lost ground.

By the summer of 1918, the Allies also adopted this tactic. It is exactly the course of action that Field Marshal Foch adopted in response to the German offensive at the operational level in July 1918.[84] U.S. division tactics allowed for some sustained operations at the brigade level. Brigade commanders could attack with one regiment and bring the next fresh regiment to follow and assume for the next objective. Meanwhile, the first regiment could fall back and recover.[85] The 3rd Infantry Division originally had a

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[83] Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, 297-299.

[84] Pétain, *Rapport du marechal commandant en chef les Armees francaises du Nord et du Nord-Est sur les operations en 1918*, 17-18.

[85] House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*, 42.

defense in echelon with two regiments forward and two in the rear. However, by the time of the German offensive on 15 July 1918, the 3rd ID front had expanded and all four regiments had assigned sectors on the front,[86] thus limiting their ability to have regiments "follow and assume."

For the German offense, OHL determined that it must be able to penetrate the enemy line with limited resources. It attempted to solve this problem by updating its doctrine, and published the updated method in early 1918 called, *Attack in Position Warfare*.[87] The new attack doctrine depended on speed, depth, and initiative at the battalion level. Regular infantry would probe the enemy and locate the best area to attack, specialized highly trained *Stoßtruppen* units would penetrate the enemy lines and attack as deep as possible by bypassing defensive strong points. Regular infantry would follow up and prevent the strong points from disrupting the attacking units.[88] This tactic is an important feature of the wargame because it reflects bold maneuver and it is a useful tactic to illustrate chemical warfare. Chemical weapons could be used in a variety of ways on both the offense and defense to help or hinder these tactics.

Chemical Impact on Movement and Maneuver

The following are important aspects of the wargame because they illustrate how chemical warfare interacts with the movement and maneuver warfighting function.

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[86] American Military History, *The U.S. Army in World War I, 1917-1918*. 34, accessed 15 March 2019, https://history.army.mil/books/AMH-V2/PDF/Chapter01.pdf.

[87] Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, 318.

[88] Ibid., 319.

During the 2nd Battle of the Marne, movement and maneuver took place by soldiers marching by foot. Chemical warfare impacts movement and maneuver by impeding movement, reducing combat power, attrition of forces, and suppression. Units mitigate the effects of chemical weapons by training to fight in contaminated environments and wearing protective equipment.

Mission Oriented Protective Posture (MOPP)

Chemical attacks force units to assume a protective posture in which soldiers don gas masks and protective garments that reduce vision, mobility, and ultimately combat power. In this wargame, units are either in MOPP or not. While MOPP is intended to protect soldiers from chemical weapons, it can also be used by an enemy to disrupt movement and reduce combat effectiveness. MOPP has severe effects on movement and maneuver because soldiers wearing heavy protective clothing, having restricted breathing through filtered masks, and being unable to eat (or drink during World War One), cannot move or fight as efficiently as soldiers free of this burden. By 1918, gas was not only being used to kill, but specifically to exhaust an enemy by forcing them to remain in MOPP for prolonged periods.[89] When coordinating a gas attack with an infantry assault, the gas would force the enemy to don their masks, not knowing when the gas would subside, or what kind of gas was used.[90] Then the attacker could attack freely without MOPP, while the defender was still encumbered.

[89] C. H. Foulkes, *"Gas!" The Story of the Special Brigade* (London: William Blackwood & Sons Ltd., 1934), 245-246.

[90] Wilhelm Balck, *Development of Tactics – World War*, trans. Harry Bell (Fort Leavenworth, KS: The General Services School, 1922), 146.

Chemical Obstacles

Another chemical impact on maneuver is that persistent agents can be used to create obstacles or force an enemy unit to displace. Persistent agents have the ability to contaminate an area for an extended period of time. Mustard gas employed on an enemy defensive position would eventually force the enemy to displace as it would eventually work its way through protective clothing.[91] It can also block or disrupt enemy movement on an avenue of approach as the enemy would have to find a clean route or assume MOPP.

During the scenario the Germans used gas not only to disrupt and suppress Allied positions and artillery, but also to block Allied reserves from reaching German points of penetration.[92] Once the attack culminated and the Germans began to withdraw, they targeted roads and routes with mustard gas to block Allied avenues of approach.[93] The German use of gas to cover their withdrawal was especially effective on American replacements, many who arrived unequipped and untrained to handle the chemical exposure.[94]

Chemical Impact on Combat Power

Chemical weapons impact maneuver by degrading combat power. Not only do chemical weapons degrade combat power as described above by forcing soldiers to

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[91] Heller, *Chemical Warfare in World War I: American Experience, 1917-1918*, 67-68.

[92] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 25.

[93] Ibid., 65.

[94] Ibid., 66.

assume MOPP, chemical weapons produce significant casualties on units. Gas casualties accounted for at least a quarter of American casualties during World War One.[95] Chemical effects include temporary blindness, restricted breathing, burns and blisters, and hysteria which can remove soldiers from combat for several days. The suffering, sense of helplessness, and discomfort of MOPP in chemical warfare has severe effects on morale, enough to make a poorly trained unit combat ineffective. The combined effects of chemical weapons on unit strength, morale, and posture can reduce its effectiveness enough to change the outcome of a battle.

In the scenario during the German offensive from 15 to 17 July 1918, the 3rd ID hospitals reported approximately 30% of the casualties were caused by gas.[96] This increased to 50% when the 3rd ID transitioned to the offense and the Germans used mustard gas to disrupt the attack.[97] Gas was also very effective for neutralization.[98] Furthermore, gas created panic among soldiers causing them to abandon their defensive positions.[99]

Fires

The fires warfighting function includes targeting and delivery of lethal and nonlethal effects in support of maneuver objectives.[100] It is important to the wargame

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[95] American Military History, *The U.S. Army in World War I, 1917-1918*, 26.

[96] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 40.

[97] Ibid., 40, 89.

[98] Ibid., 42.

[99] Ibid., 43.

[100] HQDA, FM 3-0, 2-217.

because indirect fires are what bring the third dimension of modern warfare into the wargame.[101] Combined arms is critical to movement and maneuver, and fires is critical to combined arms. It is also an important aspect of the wargame because during World War One artillery was the dominant warfighting function, and by 1918, it was the primary delivery means of chemical weapons.[102]

Artillery Tactics of 1918

Artillery tactics are important to the wargame because they show the integration of combined arms and warfighting functions. Despite the massive firepower achieved by artillery during World War One, eventually the Germans realized that fires alone could not defeat the enemy. By the summer of 1918, the Germans adopted artillery tactics developed by COL Georg Bruchmüller which carefully synchronized artillery on specific high value targets to disrupt enemy lines of communication, counter-fires, massed forces, and selected defensive positions in order to position friendly forces for the attack.[103] Improved intelligence with aerial reconnaissance and surveys allowed the Germans to adopt this technique of key target selectivity.[104] While the Allies also refined targeting and coordination, they had the advantage of a superior industrial base and more abundant

[101] Bailey, "The First World War and the Birth of Modern Warfare," 133.

[102] Foulkes, *"Gas!" The Story of the Special Brigade*, 330.

[103] House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*, 34.

[104] Ibid.

supply of artillery ammunition. As such, area suppression remained a key component for a successful attack.[105]

Artillery Systems

The artillery systems are important to the wargame because they are the systems that facilitated combined arms and chemical warfare in the scenario. By 1918, both sides had refined their field artillery task organization. While corps retained the heavy artillery assets, divisions had ample organic artillery. As German tactics adjusted to focus on precision and high value targets, German divisions reduced their organic field artillery from a field artillery brigade with twelve total batteries to a regiment with nine total batteries.[106] Three of the batteries were 10.5cm light field howitzers with a maximum range of just over eleven kilometers. The remaining six were typically 7.7cm field guns with a slightly lower maximum range and smaller caliber of munitions.[107] In contrast, the U.S. division had a field artillery brigade with three regiments, two regiments of 7.5cm field artillery and one of 6" howitzers.[108]

Since the focus of this wargame is on Divisions, it is limited in that it only minimally represents corps fires support for each side. With reduced corps support, in order to maintain parity in the wargame, the 3rd ID's artillery regiments are limited to

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[105] Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, 318.

[106] IWM (Great Britain), *Handbook of the German Army in War, April 1918*, 67-68

[107] Ibid., 71-74.

[108] House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*, 41.

battalions, to have comparable strength against the German 10th Division's organic artillery. Also, since the focus of the wargame is on the effects of munitions as opposed to their size and range, the wargame is limited in that all artillery units have the same simplified effect. For example, although 10cm howitzers could thoroughly gas an area the size of a hectare with 50 rounds, whereas light artillery would require 100 rounds,[109] the effect is ultimately the same on the area.

Chemical Munitions

Chemical munitions are a key aspect of the wargame because the intent of the wargame is to teach the impacts of chemical warfare. While each country experimented with a variety of different chemicals during World War One, by 1918, the two primary chemical munitions used by both sides were mustard gas (dichlorethyl sulfide) and phosgene gas (or diphosgene by the Germans).[110] Mustard gas was a persistent agent that could contaminate an area for multiple days. Phosgene was non-persistent and would generally dissipate shortly after dispersion. Both were affected by weather. Employment of gas was used to suppress fires, supply, lines of communication, enemy positions, as well as prepare the battlefield for an attack. The Germans also used blue cross (diphenylechlorarsine), which was nonlethal but it could penetrate the Allies' gas masks and cause them to sneeze or vomit. It would usually precede a deadly diphosgene attack

[109] Balck, *Development of Tactics – World War*, 252.

[110] IWM (Great Britain), *Handbook of the German Army in War, April 1918*, 89; Heller, *Chemical Warfare in World War I: American Experience, 1917-1918*, 14.

so that soldiers would remove their masks and inhale the lethal gas.[111] Versions of these same chemicals are still used today, one hundred years later.[112]

Projectors

Projectors are an important aspect of the wargame because they were weapons systems specifically designed to employ chemical weapons. As such, they are also used to illustrate modern doctrine's active defense approach against chemical weapons.

During World War One, projectors were used to mass vast quantities of chemical gasses on enemy positions by creating dense gas clouds. They were essentially make-shift mortars that could each fire thirty to forty pounds of chemicals.[113] They were partially dug into the ground for stability, but took time to emplace. The German 38th Pioneer Battalion emplaced projectors to be used as preparatory fires against 3rd ID positions during the 2nd Battle of the Marne; however, Allied counteroffensive fire using mustard gas greatly reduced their effectiveness.[114]

Target Prioritization and the Deep Area

Target prioritization and the deep area are important aspects of the wargame because commanders must employ their limited resources judiciously in order to mass

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[111] IWM (Great Britain), *Handbook of the German Army in War, April 1918*, 89.

[112] Technical Secretariat of the Organization for the Prohibition of Chemical Weapons (OPCW), *Report of the Fact-Finding Mission Regarding the Incident of Alleged Use of Toxic Chemicals as a Weapon in Douma, Syrian Arab Republic, on 7 April 2018* (The Hague, Netherlands: 2019), 4.

[113] Heller, *Chemical Warfare in World War I: American Experience, 1917-1918*, 20.

[114] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 30.

fires on an enemy at the appropriate moment. Fires have the ability to hit targets behind the enemy front lines, in the deep area of the battlefield. With this ability, commanders prioritize and balance when and where to focus the fight in the deep area or the close area. Effects in the deep area can disrupt command and control, supply, the reserve or reinforcements, and suppress enemy fires. Chemical warfare amplifies these effects.

Suppression and Massing Effects

Fires can also suppress the enemy in order to facilitate freedom of maneuver and support friendly maneuver forces in combat. By adjusting the amount of fires to mass on a target, effects can range from disruption, suppression, to destruction. In order to highlight chemical effects in this wargame, the effects of high explosives (HE) are contrasted against the effects of persistent and non-persistent chemical agents. Both HE and chemical munitions can be used to suppress an enemy and suppression of the enemy is critical for successful maneuver.

Intelligence

The intelligence warfighting function is a key aspect of the wargame because it provides information about the enemy and the operational environment that is necessary to plan operations.[115] While intelligence has always been important in war, the third dimension with indirect fire has certainly amplified its importance. Intelligence is critical to acquiring targets in depth and prioritizing them based on an understanding of the enemy and the enemy's objectives.[116] In this wargame, intelligence reduces the fog of

[115] HQDA, FM 3-0, 2-205.

[116] Bailey, "The First World War and the Birth of Modern Warfare," 133.

war, provides targets in the deep area, and allows players to attempt to mitigate against their enemy's course of action. Intelligence impacts chemical warfare by providing targets for chemical weapons, facilitating chemical active defense, and facilitating early warning for chemical passive defense.

In World War One, as well as today, much of intelligence came from reconnaissance, imagery intelligence (IMINT), and human intelligence (HUMINT). These are important aspects of the wargame because they feed the targeting and prioritization process the necessary information for maneuver commanders to decide where and how to allocate combat power and chemical weapons. World War One saw the advent of IMINT as aerial reconnaissance took photographs of enemy positions from above and provided them to ground commanders and artillery units.[117] HUMINT was very common during World War One, as there were many prisoners or deserters from the opposing side to provide information.[118] Aircraft were used predominantly as reconnaissance and counter-reconnaissance, but by 1918 they were used for a variety of purposes to include bombing, aerial interdiction, and to show friendly unit how to better conceal themselves from enemy aircraft.[119]

In the scenario of during the 2nd Battle of the Marne, elements of the 3rd ID patrolled their areas, even venturing across the Marne River, in order to piece together

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[117] House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*, 28, 34; Balck, *Development of Tactics – World War*, 246.

[118] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 9; Balck, *Development of Tactics – World War*, 279.

[119] Balck, *Development of Tactics – World War*, 138-143.

information about the Germans' positions and activities.[120] Allied forces captured German prisoners who revealed the exact time and locations of the German offensive.[121] Aerial reconnaissance and reports from patrols verified the information gained from prisoners.[122] With this information, 3rd ID and Allied artillery targeted German assembly areas, artillery batteries, and German gas projectors with mustard gas, causing significant disruption to the attack.[123]

Sustainment

The sustainment warfighting function provides "support and services to ensure freedom of action, extend operational reach, and prolong endurance."[124] It is an important aspect of the wargame because it represents the scarcity of resources that commanders need to consider when prioritizing targets and objectives. Without sustainment, no combat force could function. Sustainment supplies soldiers with food, ammunition, and chemical protective equipment. It supplies fires its munitions. Sustainment provides the daily HE and chemical munition supply that fires require to mass to achieve effects on targets. Commanders must manage a scarcity of resources and vulnerability of sustainment in the deep area. Sustainment both supplies, and can be

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[120] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 9.

[121] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 9; Greenwood, *The second battle of the Marne, 1918*, 77-78.

[122] House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*, 34; Balck, *Development of Tactics – World War*, 63.

[123] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 30.

[124] HQDA, FM 3-0, 2-233.

disrupted by chemical weapons. While sustainment is a very important warfighting function, it is limited in this wargame due to the limited scope that the wargame can cover. Sustainment is represented by a supply of limited resources, by the sustainment system and units are not represented.

In the scenario, the Germans had recently extended themselves far from their lines of support. They needed the rail hub at Reims in order to be in a better logistical position to attack towards Paris.[125] Originally Germany intended for operation MARNESCHUTZ-REIMS to improve sustainment for the Marne salient.[126] Without the rail hub, German forces struggled to supply units on the front. Even though Kathen Corps received a massive allotment of HE munitions and gas to prepare for the assault, possibly only 75% was actually used, in part due to the difficulty of supplying dispersed battery positions along poorly developed supply corridors.[127] The Americans had supply challenges as well. Although the 3rd ID was a high priority for filling equipment, it struggled to receive sufficient chemical protective equipment due to underdeveloped production in the U.S. and limited supply from the British and French.[128]

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[125] Zabecki, *The German 1918 Offensives: A Case Study in the Operational Level of War*, 246-248.

[126] Ibid., 246-248.

[127] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 35-36.

[128] Historical Division, Department of the Army (HDDA), *United States Army in The World War 1917-1919 Volume 8, Reports of Commander-in-Chief A.E.F. Staff Sections and Services: Chief of Chemical Warfare Service A.E.F* (Washington, D.C.: Government Printing Office. 1948), 296.

Protection

The protection warfighting function "preserves the force so the command can apply maximum combat power to accomplish the mission."[129] This is an important warfighting function to the wargame because it reflects chemical defense and survivability in large-scale combat. Since the United States does not intend to employ chemical weapons in the future, modern doctrine puts chemical warfare under the Protection warfighting function. World War One was the first war in which a specific officer was assigned as a protection officer against chemical warfare in a division. The German division staff had a *Gas-Schutz-Offizeri,* a Gas Protection Officer,[130] and the 3rd ID had a Division Gas Officer, responsible for planning chemical protection for the division and ensuring readiness.[131]

In World War One, characterized by trench warfare, survivability was the primary role of protection. The trench systems were built to protect against direct fire weapons and designed with constant turns and angles to reduce the lethality of indirect fire. Deep dugouts were built to survive bombardments of indirect fire and were intended to be made gas proof.[132] Billets and battery positions had supplies for decontamination.[133] Dugouts too close to the front risked being overrun as soldiers remained in them during a

[129] HQDA, FM 3-0, 2-247.

[130] IWM (Great Britain), *Handbook of the German Army in War, April 1918*, 42.

[131] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 6, 17.

[132] Ibid., 18.

[133] Ibid., 8.

barrage and were captured by enemy advancing troops when they emerged.[134] Cellars in villages also provided protection from indirect fire and could be made gas proof.[135] 3rd ID only had a few weeks within their sector before the German offensive, and did not have elaborate trenches or survivability established. Despite instruction to do so, some units did not build dugouts. Other units that actually built dugouts did not adequately gas proof them.[136]

A unit's training and readiness also determines how well the unit survives a chemical attack. The 3rd ID did not prepare adequately for chemical warfare during pre-deployment training.[137] Upon arrival to the front, many soldiers in the 3rd ID disregarded the gas threat and did not carry their masks.[138] In some cases, masks were only worn as punishment.[139] The Germans seemed to have known about the Americans' deficiencies in gas training. During the first few weeks of 3rd ID's arrival, the Germans fired a limited quantity of nonlethal blue cross shells to give the 3rd ID soldiers a "false sense of security," before massing chemical gasses during their preparatory bombardment for their offensive.[140]

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[134] Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, 300.

[135] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 18.

[136] Ibid.

[137] Ibid., 6.

[138] Ibid., 9.

[139] Ibid., 19.

[140] Ibid., 14.

Mission Command

Mission command integrates the other warfighting functions and provides command and control.[141] In this scenario, mission command is an important aspect because command and control facilitates coordination between maneuver and fires. Commanders issue orders to their subordinate units, and then the units execute the orders to the best of their ability, depending on the situation on the ground. In order to maintain mission command, the command post must remain undetected and displace if the enemy locates it and uses fires to disrupt it. Chemical warfare can impact mission command because it can disrupt the orders process. It can also change the environment on the ground that prevents the order from being executed.

By 1918, communications were developed enough that both sides had signal units that emplaced telegraph and telephone lines. German Divisions even had wireless telegraphy.[142] In order to ensure redundancy, units also communicated by lamp signals, runners, and pigeons.[143] In the scenario, the German 10th Division's preparatory fires against the 3rd ID severed wire communications, forcing the 3rd ID to rely on runners until they could repair the lines the following day.[144]

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[141] HQDA, FM 3-0, 2-23.

[142] IWM (Great Britain), *Handbook of the German Army in War, April 1918*, 119.

[143] Ibid., 118-121.

[144] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 33.

Additional Aspects of the Wargame

Terrain

Since this wargame is ultimately about maneuver, it is also based on terrain. Terrain represents maneuver objectives. Terrain also shapes how to best use chemical weapons since some terrain is more suitable than other terrain. A variety of terrain is useful to the historical context of the battle since the Germans attempted to attack entrenched positions across the Marne River, and the Allies conducted counter-attacks through dense forests and villages.

The scenario also featured a variety of terrain that impacted ground combat and chemical warfare. The most notable terrain feature is the Marne River itself. With only two bridges, the Marne River is a natural linear obstacle dividing the battlefield. The area further consisted of open pastures, sloped banks, villages, and thick forests.[145] During defense planning, the 3rd ID took note that forests as well as low ground, valleys, trapped gas and should have been avoided if possible.[146]

Weather and Time

Weather impacts movement, intelligence, and employment of chemical weapons. Rain and the mud that results from rain impedes movement. Rain during World War One prevented aircraft from conducting reconnaissance to gather intelligence.[147] Rain also

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[145] Greenwood, *The Second Battle of the Marne, 1918*, 71.

[146] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 16.

[147] Pétain, *Rapport du marechal commandant en chef les Armees francaises du Nord et du Nord-Est sur les operations en 1918*, 27.

washes away chemical contamination and reduces its initial dispersion.[148] Unpredictable changes in weather can cause a player to have to change plans on when and how to employ chemical weapons. Time needs to be accounted for in order to maneuver units across terrain within a period. Day and night also made a difference with the terrain, movement, maneuver, and fires. Time provides the contrast between non-persistent and persistent chemical agents. Commanders must always consider how terrain, weather, and time impact the operational environment.

In the scenario, weather played an important role during the German assault across the Marne River. Early on the 15th of July, at the time of the German attack, the weather was rainy and foggy.[149] While the weather later cleared up, the early rain and fog was not a good condition for gas, and likely contributed to its limited effect early on.[150]

Friction

Friction is a key element of war represented by randomness. Each side can plan to attempt to mitigate friction, but everything may not always go according to plan. Some fires missions may be more effective than others, some units may have better luck in battle.

[148] Balck, *Development of Tactics – World War*, 145-146.

[149] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 27.

[150] Ibid., 27-28, 33.

Conclusion

While there are many other aspects to *Gas Attack* not discussed in this chapter, the key aspects that allow *Gas Attack* to meet its objective of illustrating chemical warfare to maneuver commanders are covered. Ultimately, these are the chemical warfare's relationship with the warfighting functions, constructed into the model of the historical scenario of the 2nd Battle of the Marne, 1918. Chapter 4 will discuss how these aspects are designed into *Gas Attack*.

CHAPTER 4

WARGAME DESIGN

Gas Attack models division level ground combat on a large-scale by using a turn-based hexagon-based map board inspired by the *Battle for Moscow*.[151] Each hexagon (hex) represents a diameter of approximately 500 meters and reflects a variety of terrain to be described in the terrain section. The hex-based model most adequately facilitates the representation of key aspects of the wargame by separating combat units by time (12-hour turns) and space (500-meter hexes). *Gas Attack* avoids much of the artificiality of alternating player turns[152] by incorporating an orders process inspired by *Diplomacy*,[153] in which players plan and issue orders to their unit pieces simultaneously. During the execution phase, players alternate to move their pieces according to their orders to avoid confusion. However, orders do not change until the next turn.

Gas Attack is primarily designed for two players, one representing the 3rd ID commander, and one representing the German 10th Division commander. However, the game can also include more players as subordinate commanders. The German player can win by seizing (moving combat pieces into) the three hexes that represent villages along the Surmelin valley on the map board, seizing five total hexes that represent villages south of the Marne River on the map board, or by preventing the American player from achieving their objectives. The American player can win by denying the German player

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[151] *Battle for Moscow*.

[152] Sabin, *Simulating War*, 104.

[153] *Diplomacy*.

their objectives, clearing all German pieces south of the Marne River, and by advancing a combat unit piece to the furthest northern line of hexes on the map board. If neither player can achieve their objectives, then the player who secures the strongest foothold, by having the most remaining combat power, on the opponent's side of the Marne River wins.

The Context of the 2nd Battle of The Marne, Summer 1918

The wargame represents the historical scenario of the 2nd Battle of the Marne, summer 1918, by the map board, task organization, and presentation of key historical events of the battle. The map board reflects the terrain and boundaries of the scenario. The pieces reflect the task organization of the divisions. Key historical events occur based on the turn number, resulting in bonuses or consequences based on the scenario.

Importance of the Scenario to the Wargame

Gas Attack can be modified for other custom scenarios, depending on the learning objectives of the players. However, for the purposes of this project, the historical scenario provides an ideal situation because it transitions the defense to the offense (or vice versa for the German player), which broadens the players' perspective and scope of learning in regards to chemical warfare.

The Divisions

The 3rd ID and the German 10th Division are represented by block pieces on the map board, artillery pieces on a separate artillery board, and some elements such as the division headquarters, signal, supply, and field hospitals, represented notionally. Block pieces represent regimental headquarters, battalions, and special company-sized assets

such as machine gun companies, trench mortars, engineers, and reconnaissance. Each block either belongs to a specific regiment (marked on the block), or it is a division level asset. Players array their pieces within regimental boundaries (delineated on the map board) based on the historical scenario. However, players also have the liberty to array their pieces as they please within those boundaries. Division level assets are not confined to regimental boundaries and can be placed anywhere on the player's side of the Marne River. The historical scenario already provides an ideal placement of units, however, players can choose to deviate with division assets in order to accomplish their goals.

The German Attack Across the Marne

Corps assets are represented by cards or supply replenishment on certain turns. When the French corps supplied the 3rd ID 3,000 rounds of mustard gas to fire on German assembly areas and battery positions,[154] the American player receives additional mustard gas, yellow cubes, supplied in the wargame. When the German player attacks across the Marne River, the German player can play a card to receive additional artillery support from Kathen Corps.

The 3rd ID Transition to the Offense

The 3rd ID's transition from the defense to the offense is not guaranteed because there is a chance that the German player could maintain momentum and keep the American player in the defense until the conclusion of the game. However, the learning opportunities are greatly enhanced if each player can experience both offense and the defense, along with the transition. In order to encourage the transition, *Gas Attack*

[154] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 29.

follows the historical scenario by reinforcing the 3rd ID. In the historical scenario, the 3rd ID received 4,000 replacements just prior to transitioning to the offense.[155] This is represented in *Gas Attack* by restoring combat power points to the American player on turn 10.

Representing Key Aspects as Warfighting Functions

Gas Attack represents all of the Warfighting Functions and how chemical warfare interacts with them. Some, like movement and maneuver, fires, and protection, are represented more strongly than others due to their role in chemical warfare. Chemical warfare was designed to affect maneuver forces, it was applied by fires, and the purpose of protection is to mitigate against its effects. Nevertheless, all warfighting functions are necessary in a wargame about large scale combat operations.

Movement and Maneuver

Gas Attack takes inspiration from *Battle for Moscow*[156] and *Strike of the Eagle* to represent movement and maneuver. As inspired by *Strike of the Eagle*,[157] square wooden block pieces stand upright and represent units. Each block contains printed information about the unit including its type, size, and its step strength printed in a clock-like pattern. The step strength also represents combat power. *Gas Attack* uses combat power broadly to include all of the characteristics of a unit that makes it an effective fighting force. This includes the number of soldiers, quality of training, state of equipment, morale, and

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[155] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 73-77.

[156] *Battle for Moscow*.

[157] *Strike of the Eagle*.

leadership of the unit. As such, German and American battalions are simplified to have the same amount of combat power. American battalions had roughly 1,000 soldiers whereas the German battalions had less than 800,[158] however, in this scenario the German battalions were better trained and battle-hardened.[159] If the unit incurs combat losses that equal a step loss, the player rotates the block to the next lower number, counterclockwise, to reflect the loss and display the unit's current combat power on the top of the block.

Gas Attack takes a unique approach to combat power by allotting one six-sided die per available combat power of a unit. It merges this concept with the way many games, such as *Battle for Moscow*, resolves combat by adjudicating the results of dice rolls on a combat results table.[160] Various modifiers such as unit readiness and terrain, discussed later, can alter the amount of combat power available as well as the results on the combat results table.

To represent movement, each piece has a limited number of hexes it can move per turn as noted on each player's guide board. Terrain, chemical effects, and proximity to headquarters can reduce a unit's ability to move. A typical unit piece can move six hexes, (representing three kilometers), per turn, (representing 12 hours). The short distance is a limit in the wargame, but it also represents the time it takes to receive orders, prepare, and conduct combat or establish new fighting positions.

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[158] Balck, *Development of Tactics – World War*, 44-45.

[159] F.V.H., *History of the Third Division United States Army in The World War*, VII; USAG2, *Histories of Two Hundred and Fifty-One Divisions of the German Army which Participated in the War (1914-1918)*, 183.

[160] *Battle for Moscow*.

Organization of Units

Gas Attack represents the organization of units under the movement and maneuver warfighting function by allocating pieces to each player that represent the subordinate units of the 3rd ID or the German 10th Division. The American player has pieces that represent the 4th, 7th, 30th, and 38th regimental headquarters; three pieces for each regiment representing infantry battalions, one piece for each regiment representing a machine gun company, and division level asset pieces. The division level assets consist of three pieces representing artillery battalions, two pieces representing machine gun battalions, two pieces representing engineer battalions, one piece representing a motorized machine gun battalion, and a piece representing a trench mortar company. The pieces generally align with the structure of the 3rd ID and with the typical American Division fighting on the line in 1918 (see figure 1 in chapter 3).[161] Some units, such as the division and brigade headquarters, field hospitals, supply, and the signal battalion, are not represented by pieces, but by actions during game play.

The German player also receives pieces that generally look similar to figure 1 in chapter 3.[162] However, in *Gas Attack*, the German player also has full control of the 5th Grenadier regiment from the 36th German Division and a *Stoßtruppen* battalion in addition to the organic units from the German 10th Division. As such, the German player has four pieces representing the 398th, 47th, 6th Grenadiers, and 5th Grenadiers regimental headquarters respectively. Three pieces for each regimental headquarters

[161] House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization*, 41.

[162] Ibid.

represent infantry battalions and one piece for each represents a machine gun company. The division level assets consist of three pieces representing artillery battalions, one piece representing the *Stoßtruppen* battalion, one piece representing an engineer battalion, two pieces representing engineer companies, one piece representing a reconnaissance squadron, and a piece representing a trench mortar company at the division level.

Maneuver Tactics of 1918

While players have the freedom to choose their own tactics, *Gas Attack* is designed to incorporate combined arms in a manner that facilitates and works well with the employment of 1918 maneuver tactics. The ground combat mechanics of *Gas Attack* greatly favor the defense by granting the defense terrain and survivability modifiers and allowing the defender to inflict losses on the attacker first. As such, it is critical that an attacker employ combined arms, using artillery and gas to suppress the defender prior to attempting an assault on defensive positions. Furthermore, similar to *Battle for Moscow*, each piece has a zone of control of an adjacent hex.[163] Zone of control is a mechanism that favors the defender because any unit moving into another unit's zone of control must halt further movement or engage. This represents range of engagement and also prevents players from rushing units to their objectives without any combat. The exception to the rule is the German *Stoßtruppen* battalion, which was specially trained to bypass defensive positions and could fight independently.[164] The *Stoßtruppen* is a unique way to

[163] *Battle for Moscow*.

[164] Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, 319.

incorporate 1918 German doctrine into *Gas Attack* and help balance capabilities since the American division is much larger than the German Division.

Chemical Impact on Movement and Maneuver

Mission Oriented Protective Posture (MOPP)

Gas Attack incorporates the chemical impact on maneuver by representing protective posture, chemical obstacles, and loss of combat power. In order to represent the reduced vision and mobility soldiers encounter when they don their gas mask and protective garments, unit pieces receive a small plastic green cube to represent a temporary reduction in movement and combat power when they get gassed. The temporary reduction means that the unit loses one combat power and two movement points for the remainder of the turn. If the turn is during the night, then the movement points are reduced by three in order to represent the additional difficulty of moving in darkness while wearing protective equipment. The green gas cubes are not cumulative because they represent the impact of protective equipment, not the attrition of units caused by gas.

Chemical Obstacles

Gas Attack facilitates a variety of methods of chemical warfare, as used during the 2nd Battle of the Marne, by including persistent and non-persistent agents. Players can use persistent, mustard, gas to emplace chemical obstacles. When players choose to employ persistent agent, they place a four-sided die on the targeted hex. The four-sided die represents contamination and serves as a counter for the amount of turns that the hex remains contaminated. At the end of each turn, the four-sided die counts down one. Once the four-sided die completes its count-down, the die is removed and the hex is considered

uncontaminated. If the hex becomes re-contaminated at any point, the counter resets back to four. If a player wants to move a unit through a contaminated hex, they must immediately reduce two movement points (or three at night) and one combat power from the unit for the turn. Then the player must roll one six-sided die, adjudicated by the combat results table, to determine if the unit suffers any additional consequences for moving through the contaminated area. This mechanism illustrates to players that while it is possible to move units through contaminated areas, commanders must be willing to accept the risk of doing so. Players can mitigate the risk by moving engineer pieces to decontaminate the area. Engineers can reduce the counter an additional point per turn.

Chemical Impact on Combat Power

In *Gas Attack*, chemical warfare impacts maneuver by disrupting and reducing forces. Chemical munitions are adjudicated on the combat results table with equal effectiveness as HE munitions. The results can disrupt a unit by placing additional white cubes on the targeted piece that represent temporary reductions of combat power. The results can also cause a step loss, a counterclockwise rotation of the piece that represents permanent loss of combat power. *Gas Attack* shows players that the combined effects of gas forcing protective posture as well as producing casualties make gas the suppression weapon of choice, weather and situation permitting.

Fires

Since chemical warfare was mostly conducted by fires in 1918, *Gas Attack* includes several novel approaches to represent artillery, targeting, and the contrast between HE, persistent, and non-persistent chemical munitions. Inspired by the economy system of *Terraforming Mars*, each player in *Gas Attack* has a separate board to

determine supply[165] of fires munitions and allocation of munitions to artillery units. Each player also has a targeting map board. During each supply phase, players receive an allotment of black cubes representing HE, yellow cubes representing persistent agent, and green cubes representing non-persistent agent. Each cube represents a fires mission of its respective munition. During the planning phase, players allocate the cubes to their fires battalions and indicate each battalions' targets on the targeting map board. By allocating resources to units and indicating their targets, players become familiar with their resource constraints and prioritize targets based on their objectives. In order to determine the effects of fires missions, each allocated cube is exchanged for a six-sided die which is rolled and adjudicated by the combat results table.

Artillery Tactics of 1918

Gas Attack features the mechanics that facilitate artillery tactics of 1918, but players can choose to employ fires how they please. Limited supply of munitions, provided only during night turns, illustrate the importance of economizing fires and prioritizing targets.

Artillery Systems

Since the focus of *Gas Attack* is on the Division level fight, the game limits the amount of corps artillery support, especially from the German Kathen Corps. Corps support is still represented in *Gas Attack* by playing cards, but these do not represent pieces on the board or targets for the opposing player. With the reduction of Kathen Corps' role, *Gas Attack* reduced the size of the 3rd ID Field Artillery Brigade from three

[165] *Terraforming Mars*.

regiments to three battalions, to be comparable in size to the German 10th Division organic fires, in order to maintain parity in fires. This adjustment proved to be necessary during playtesting.

Chemical Munitions

Gas Attack simplifies chemical munitions in order to focus on their effects. Persistent agent, or mustard gas, is represented by yellow cubes supply. Areas contaminated by persistent agent are represented by four-sided dice in order to illustrate the duration of the agent on an area. Green cubes represent non-persistent agents, or phosgene and diphosgene gases. The German player also has the ability to use blue cross (diphenylchlorarsine) gas by playing a card. It is represented the same as the non-persistent gas, except that the card increases its effectiveness to represent its ability of penetrating gas masks and increasing casualties.

Projectors

Gas Attack represents chemical projectors and active defense strategy by taking inspiration from *Triumph and Tragedy's* use of cards to enable special technology and abilities.[166] Players can play a card to represent their projectors. Since projectors take time to establish, a four-sided die counts down until they are ready to be fired. The opposing player can use active defense by using reconnaissance to attempt to locate the projectors by rolling a six-sided die and adjudicating it on the reconnaissance table. If the player conducting reconnaissance successfully locates the projectors, the player can

[166] *Triumph and Tragedy*, created by Craig Besinque, board game (GMT Games, 2015).

target the projectors with artillery before the projectors can be operational. Once operational, projectors give players the ability to mass large concentrations of chemical agents (up to six cubes) on up to four adjacent hexes. By having the projectors notionally off the map board, played by a card and counter, *Gas Attack* incorporates an active defense strategy of locating and targeting chemical weapons before they can be used while also accurately representing the historical scenario.

Target Prioritization and the Deep Area

Gas Attack incorporates target prioritization and deep area targeting by limiting supply and providing some key targets off the map board. Each turn provides a finite amount of resources so that players must determine the best way to use them. The deep area is represented in the reconnaissance table on each player's guide board. Division headquarters, supply depots, and artillery are beyond the confines of the map board; they can only be located by successful reconnaissance, to be discussed in intelligence. Once located by reconnaissance, players can target elements in the deep area in order to suppress fires, disrupt orders, or disrupt supply. This method developed from originally playtesting with actual pieces on the map board. Testers easily deduced what targets were by where the pieces were placed on the map board. Removing the pieces decreased clutter on the map, while improving the role of intelligence, deep fires, and the effects of fires and chemical agents on supply, the headquarters, and artillery.

Suppression and Massing Effects

With each fires cube representing a six-sided die, *Gas Attack* facilitates suppression and massing effects by allowing players to combine multiple cubes on a single target in order to achieve more powerful effects on the combat results table.

Players can allot more or less fires on a target depending on the desired effect. If a player wishes to merely disrupt an enemy unit, they only need to achieve a three or greater on the combat results table, potentially allotting just one cube. If the player wishes to attrit the enemy unit of combat power, the player must achieve at least seven on the combat results table to reduce the enemy by a step rotation, costing a minimum of two cubes. In order to destroy a full-strength battalion, the player must achieve 34 on the combat results table, costing at least six cubes, and requiring exceptional fortune from the dice roll.

Intelligence

In order to represent intelligence, *Gas Attack* first limits certain information to each player. Starting with the unit pieces on the board, while each player knows which regiment is in each area, the pieces face their respective player, exposing the blank side to the opponent. Only the American player can see the information displayed on each of the American pieces. Likewise, only the German player can see the information on each of the German pieces. Furthermore, players can array their forces as they please within their regimental areas. They can array division level assets without regimental boundary constraints, giving further indications to or flexibility to deceive their opponent. Deep area assets such as the division headquarters, supply depots, and artillery positions are also hidden from the opponent, and can only be targeted once located by gathering intelligence.

Gas Attack provides intelligence first by ground reconnaissance. If a player moves a unit to engage an enemy unit, both players turn the pieces face up to reveal information about the units. The German reconnaissance squadron can also select a piece within two hexes to reveal. By seeing the pieces on the board, but not knowing exactly what is what,

Gas Attack also facilitates intelligence gathering by player deduction based on piece position, movement, and understanding capabilities. Next, *Gas Attack* facilitates intelligence gathering by its representation of IMINT, through aerial reconnaissance. Each player is allotted a specific quantity of aerial reconnaissance during each day turn in accordance with their supply table. For each aerial reconnaissance, the player can choose to either reveal enemy pieces in a specific hex, or roll a six-sided die on the reconnaissance table to locate enemy elements in the deep area. Finally, *Gas Attack* incorporates a special card to represent HUMINT from prisoner interrogation, adjudicated similarly to aerial reconnaissance.

Sustainment

Sustainment is represented in *Gas Attack* by two separate player supply boards, one for each player, and nightly resupply of artillery munitions. Each night turn, each player receives the quantity of black, yellow, or green cubes as indicated on their respective supply board for that turn. Players must manage their limited supply for the remainder of the turn as well as the next turn, the day turn. This element reflects the supply system of the scenario and the scarcity of resources facilitates the key aspect of carefully planning and prioritizing targets. Supply depots are also a notional target via the reconnaissance table. If one player locates their opponent's supply by aerial reconnaissance or prisoner interrogation, the player may target the opponent's supply with artillery and gas to reduce future supply.

Protection

Since the theme of *Gas Attack* is chemical warfare, normally a sub-category of protection, *Gas Attack* represents the protection warfighting function in a wide variety of

ways. *Gas Attack* uses defense modifiers inspired by *Small World* by *Philippe Keyaerts* to represent the benefits of defensive positions and actions to improve survivability. A defense modifier is a number that reduces the effects on the combat results table. When the attacker rolls the six-sided dice against the defender, the attacker must subtract the defense modifiers from the results, reducing the effectiveness of the attack. Defense modifiers are assigned to defensive positions, trenches, dugouts, and villages depicted on the map board. The legend on each player's guide board depicts the defense modifiers for each position. *Gas Attack* represents the uniqueness of the structures by their various modifiers. For example, the dugout is very effective against fires with the highest amount of defense modifiers. However, the dugout can be overrun by a ground attack, which has the ability to fire first.

Gas Attack uses pieces that represent engineers. The engineers piece has movement points and combat power like any other unit, but it also has special abilities in *Gas Attack* to represent the variety of ways engineers can be employed. Instead of movement or combat, an engineer piece can use the turn to bridge across the Marne River, construct defensive positions, or decontaminate an area affected by mustard gas.

Gas Attack represents chemical readiness by cards. Well-trained and disciplined units can don their protective equipment quickly and continue combat operations in protective posture. A card represents this by removing the gas cube from a unit. The German player has multiple chemical readiness cards in their deck, as opposed to the American, who only has one. Furthermore, the German *Stoßtruppen* unit is already considered to be well-trained to fight in protective posture, and never receives the gas

cube. This is to represent the scenario and also highlight the impact of chemical readiness.

Mission Command

Gas Attack takes the orders process of *Diplomacy,* in which all players plan and issue orders simultaneously for the turn prior to execution, to represent command and control. However, *Gas Attack* modifies the process from writing the orders on paper to drawing them on the player targeting board. The targeting board allows players to plan, target fires, and issue orders at once, keeping their plans hidden from the opponent.

Mission command is represented by the execution phase. A regiment receives one simple order, but when it is time to execute, the three separate battalions of the regiment must move how they wish, as long as it is in accordance with the order. For example, if a regiment has the order to advance, the player can advance each battalion as the player pleases based on terrain, the enemy, etc. If a battalion is cut off from its headquarters, it cannot receive orders and must either stop and wait for the rest of the regiment, or fight its way back to the headquarters. This process allows the players to put themselves at the regimental commander level and maneuver the battalion pieces based on the situation in that regiment's area on the map board. It also facilitates the adaptation of *Gas Attack* to include more players, by having additional players play as brigade or regimental commanders.

Gas Attack also represents mission command by requiring battalion pieces to remain within four hexes of the regimental headquarters piece. If they become separated, they must either stop in place, or retreat. For the American player, a card represents commander's initiative which a battalion piece takes the exception and can be separated

from its headquarters. The German player's *Stoßtruppen* piece has no regimental headquarters and can move freely.

Additional Aspects of the Wargame

Terrain

Gas Attack represents diverse terrain by placing it on the map board, each type of terrain with its own benefits or drawbacks. The legend on each player's guide board describes how the terrain impacts movement, artillery, gas, or combat. The map board is designed by compiling map information from *Rexmond Cochrane, Greenwood, Petain*, and *Google Earth* of the area beginning east of the town Château-Thierry going east along the Marne River until reaching the village of Varennes. This is approximately a 9 by 11 kilometer area and is represented by a map of 17 by 21 hexes. Terrain is limited in that it is featured by hex, which does not always line up precisely to the map. For example, a hex is either forest, open area, or a village. Forests cannot span partially into hexes.

The Marne River is represented by a large blue line crossing west to east through the map board. While remaining fixed to hex borders, the map board generally depicts Marne as it exists. *Gas Attack* represents the challenges of crossing the large Marne linear obstacle by limiting the bridges to the only two bridges that existed during the scenario. If players wish to cross units without using the existing bridges, they must use engineer units to bridge, or spend an entire turn to move an infantry piece just one hex across, representing ferrying operations.

Gas Attack designates low-lying areas as the hexes adjacent to the rivers in the area, both the Marne as well as the Surmelin. The low areas, as well as the forests have

special rules in dealing with gas depending on the weather. For example, to represent how gas was frequently trapped in the forest,[167] gas attacks receive an attack modifier, the opposite of the defense modifier, when they attack units in forested hexes.

Weather and Time

Gas Attack uses a weather table and a turn tracker to represent weather and time. Since no player can control the weather, the conditions are based on chance by a six-sided die roll. If the weather is clear, then another six-sided die determines the wind direction. The wind direction affects gas attacks by spreading the gas to a hex downwind. If there is no wind, the gas settles in low-lying areas, the hexes adjacent to the Marne and the Surmelin. The weather can also be rainy, in which case, gas does not disperse, and persistent agent is less effective by starting with one less count on the counter.

Friction

Gas Attack uses dice and cards to represent the friction of war. The players do not know the order that they receive cards, or may not even know what the cards can do until they draw them. Dice represent the chances of success or failure in fires and combat. For example, rolling a six on a six-sided die represents the chance that artillery rounds hit their targets precisely at vulnerable points. Conversely, rolling a one represents the chance that many rounds missed their targets.

[167] Cochrane, *The 3rd Division at Chateau Thierry, July, 1918*, 16

Conclusion

Gas Attack uses the historical model of the scenario of the 2nd Battle of the Marne, 1918, to model the game design. The design takes into account all of the key aspects described in chapter 3 to present them in the wargame in a way that meets the objective of illustrating the effects of large-scale chemical warfare on maneuver to maneuver commanders.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Chemical warfare is a complicated subject that can easily devolve into technical discussions on capabilities that could overwhelm an untrained expert. *Gas Attack* sought to translate the most essential and basic principles of chemical warfare to maneuver commanders, with as little technical description as possible, in order to create an understanding and respect for chemical effects on maneuver. As such *Gas Attack* is fairly abstract, omitting technical aspects and the full range of capabilities of chemical warfare in preference of chemical warfare's primary effects. Maneuver commanders will appreciate the severity of chemical effects and know how to mitigate against them based on their experience through *Gas Attack*.

Chapter 1 described the purpose and scope of *Gas Attack* and touched on limitations and delimitations. Chapter 2 highlighted the most important sources in *Gas Attack's* development, including literature, games, and doctrine. Chapter 3 presented the key aspects of *Gas Attack* that must be incorporated to meet its objective. It provided a synopsis of important events and a breakdown of key aspects by warfighting functions. Chapter 4 explained how *Gas Attack* modeled the key aspects described in chapter 3. This chapter contemplates lessons learned and recommends ideas for further development.

Lessons Learned

Three clear lessons emerged from developing *Gas Attack*. Initially, there was a tendency to make the objective overly obvious at the expense of credibility. Next, the

opposite occurred where it was difficult to make the wargame both realistic and playable. Finally, the biggest lesson is that wargaming is a highly effective teaching tool.

During *Gas Attack's* incipient stage, the inclination was to exaggerate the design of chemical weapons in order to clearly illustrate their effects. While chemical weapons are considered a weapon of mass destruction, during playtesting entire regiments were destroyed within the first two turns. This result not only deviated from history, but it limited the play of maneuver since no maneuver elements were left to fight. By being overly obvious with the objective of illustrating chemical warfare, *Gas Attack* would have discredited itself to its intended audience by minimizing maneuver.

On the other side of the pendulum, it was difficult to make *Gas Attack* both realistic and playable. *Philip Sabin* warns in his book *Simulating War* that there is a tendency to attempt to directly simulate a process as opposed to abstraction, which contributes to the complexity of wargames.[168] In order to solve the problem above, *Gas Attack* experimented with a variety of formulas to depict fires results as realistically as possible based on the historical scenario. After much experimentation, a formula successfully accomplished this, but it required four mathematical steps in order to get the result. While achieving accuracy, this process proved to be too cumbersome to the playability of the wargame. Ultimately, a simple combat results table achieved close enough results while simplifying the process.

Finally, *Gas Attack* proved that wargaming is an effective learning tool. Even during *Gas Attack's* early development, play-testers consistently acknowledged having an improved understanding of how to employ or mitigate against the opponent's use of

[168] Sabin, *Simulating War*, 135-136.

chemical weapons. Later versions of *Gas Attack* produced players who deliberately planned their chemical attacks based on their objectives with consideration to enemy, terrain, and weather. Players were able to articulate how they could employ chemical weapons for better results in the future, indicating that they gained a level of understanding from playing *Gas Attack*.

Recommendations

The basic rules and mechanics of *Gas Attack* are designed in a way that can be applied to a variety of scenarios. The map board can change, each side can adjust task organization of units, and scenarios can be tailored to various learning objectives. *Gas Attack* can already be played with two to eight players which can facilitate group learning and officer professional development. *Gas Attack* can evolve from a division level scenario to corps, and even to army level if time, people, and resources permit. *Gas Attack* could also be downscaled to a brigade level scenario. *Gas Attack* could be modified to fit a modern scenario and incorporate other CBRN aspects such as delivery systems and detection systems. These developments could continue the trajectory of better understanding CBRN warfare in large scale combat operations.

Gas Attack would also make an excellent digital simulation, or a board game assisted by a digital application. Digitalizing *Gas Attack* would make it easier to play by having a program to determine fires and combat results. It could then include more variety and technical depth with chemical warfare without adding too much complexity to the operation of the game. An application to accompany *Gas Attack* could also accomplish this by resolving fires and combat automatically.

Finally, the chemical warfare aspects of *Gas Attack* can be extracted from *Gas Attack* to be used in other wargames. This could make elements of *Gas Attack* useful in simulating other conflicts with chemical warfare such as the Iran-Iraq War, or hypothetical modern conflicts. There is no limit to how elements of *Gas Attack* can be applied in other external wargames and simulations.

APPENDIX A

COMPONENTS LIST FOR WARGAME

1 x Printed Map Board

1 x Printed Turn Tracker / Weather Board

1 x Printed American Guide Board

1 x Printed German Guide Board

1 x Printed American Supply, and Fires Board

1 x Printed German Supply, and Fires Board

2 x Printed and Laminated Mini Map Board

16 x Printed American Player Cards

16 x Printed German Player Cards

8 x Strong Point Tokens

10 x Six-Sided Dice

12 x Four-Sided Dice

30 x White Cubes

30 x Black Cubes

30 x Green Cubes

20 x Yellow Cubes

10 x Blue Cubes

30 x Blue Square Block Pieces

30 x Gray Square Block Pieces

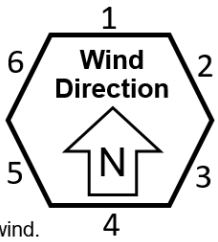
APPENDIX B

PRINTED COMPONENTS

Turn Sequence #	*1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+
Initiator	German Initiative								American Initiative							

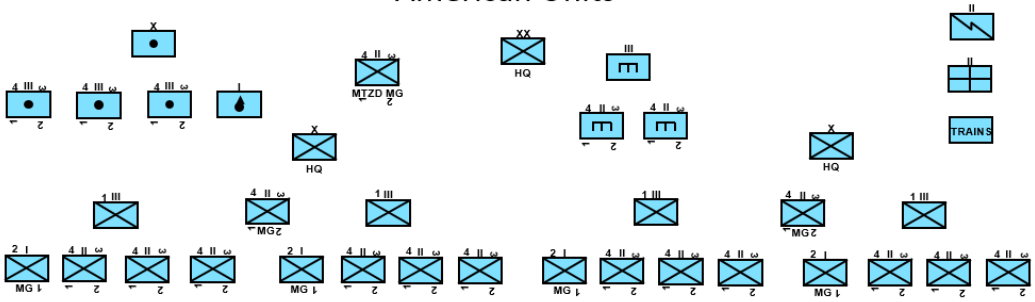
Night Turn (Gas -3 MVMT)	1. Setting Phase a. Weather **b. Supply** c. Tokens	2. Planning Phase a. Allocate Targets and Issue Orders	3. Execution Phase a. Resolve Fires b. Resolve Orders and Movement c. Resolve Ground Combat
Day Turn	1. Setting Phase a. Weather **b. Draw card** c. Tokens	2. Planning Phase **a. Aerial Reconnaissance** b. Allocate Targets and Issue Orders	3. Execution Phase a. Resolve Fires b. Resolve Orders and Movement c. Resolve Ground Combat
Sequence	Players do this phase together. Player with the initiative rolls for weather.	Initiator rolls first for reconnaissance, then the other player. Players do the rest of this phase simultaneously and agree when to move to Phase 3.	Players reveal their targeting boards and place allocated fires cubes on targets simultaneously. For movement, initiator selects which order to resolve first and makes all unit movements in that area. Then the other player resolves their order and makes all movements for that area. If contested movements cannot be resolved by orders, then resolve in combat. Resolve movement before combat. Only withdrawal, pursuit, or bypass can occur as movement after combat.

Weather: Roll 1xD6		
1-4	**5**	**6**
Clear	**Still (No wind)**	**Rain (No Effect from Wind)**
Roll for wind.	1. 1 AM for Gas. 2. Gas disperses 1 hex in each direction in low areas (all hexes adjacent to water)	1. No Aerial Recon. 2. 1 DM against Gas. 3. No further dispersion of Gas from wind. 4. Immediately reduce 1 count for persistent agent. Start new persistent agent at 3.

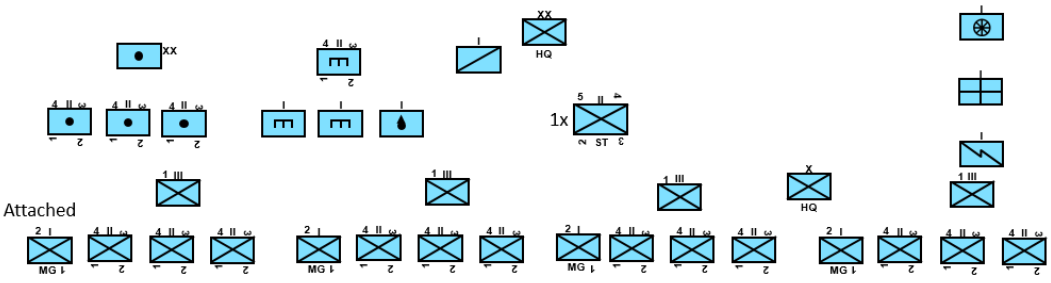


Roll 1xD6:
Gas affects the next hex downwind.
3 or more Gas missions affect in a fan from downwind.

American Units



German Units



American Supply and Fires:

***Mission:** 3rd Infantry Division defends along the Marne NLT Turn 4 in order to prevent German advance. NLT Turn 10, clear the area south of the Marne of German forces. NLT Turn 12, attack north of the Marne. 1x Regiment HQ must be across the river before turn 13 or supply and Recon will be diverted elsewhere. If your forces reach hex row XX.00, you have accomplished your Division's objectives and win.

Turn # Night / Day	1	2	3	4	5	6	7	8	9	10	*11	*12	13	14	15+	16+
Night columns indicate quantity of added supply cubes for the turn. Day: R = Recon, C = Cards. Turn 1 start with 2xR and 5xC.	4 2R	2R	6	1R	5	1R	4	1R	4	2R	5	2R	4	1R	3	1R
	1 5C	2C	5	2C	2	2C	2	2C	1	3C	1	2C	1	2C	1	2C
	0		0		1		1		2	Replace 4xSteps	3		2		2	

Black (High Explosive)	Yellow (Persistent)	Green (Non-Persistent)
Normal explosive munition that damages and disrupts units. Can damage bridges. No effect from wind. Can be used as SOS fire.	Typically Mustard Gas. Reduces 1 CP and 2 MVMT day, 3 at night. Lasts 4 turns marked by a D4 on contaminated hex. If a unit remains, or moves into a contaminated hex, roll 1xD6 on fires CRT for effects.	Typically Phosgene or Diphosgene. Reduces 1 CP and 2 MVMT day, 3 at night. Effective only the turn on the targeted units. Other units can move into the hex and are not affected unless moving from downwind.

Unit Step Strength	Allocate Preliminary Fires	Allocate SOS (on call) Fires (Can be disrupted)	Fires Steps:
1BN (Recon ID 1-2) 4 Max (Displace ½) D -1 G -1	☐☐ ☐☐	HE Only ☐☐	1. Receive Supply according to Turn Tracker above. 2. Allocate munitions to units accounting for step strength (4 maximum), disruption (-1 each), gas (-1), or displacing (½ of available remaining rounded down). 3. Select Preliminary Fires (any munition) or SOS (HE only). 4. Mark the targets on the targeting board by unit. SOS missions do not have a designated target. Since SOS missions are reactionary, they can be disrupted prior to the mission.
2BN (Recon ID 3-4) 4 Max (Displace ½) D -1 G -1	☐☐ ☐☐	HE Only ☐☐	
3BN (Recon ID 5-6) 4 Max (Displace ½) D -1 G -1	☐☐ ☐☐	HE Only ☐☐	

Example: You allocate 4x black cubes (HE) to Preliminary Fires for 1BN. On the targeting board, write "1" on the hex you wish to target because 1BN is conducting those missions.
You allocate 2x black cubes to SOS mission with 2BN. Do not write anything for these missions on the targeting board. If your ground units are attacked, you may allocate one or both missions to support that unit.
If enemy aerial recon locates a fires unit, roll to see which BN: 1-2 for 1BN, 3-4 for 2BN, 5-6 for 3BN. Once located, that unit can be targeted by enemy fires for fires suppression until it displaces. If you displace a FA BN, its mission capacity is halved. SOS fires are suppressed immediately.

German Supply and Fires:

***Mission:** 10th Division attacks across the Marne NLT Turn 4 in order to force the Allies to sue for peace. 1x Regiment HQ must be across the river before turn 5 or supply and Recon will be diverted elsewhere. If you seize 5x villages south of the Marne, or the 3x villages along the Surmelin valley (13.11, 13.14, and 15.20), you have met your Division's objectives and win.

Turn # Night / Day	1	2	*3	*4	5	6	7	8	9	10	11	12	13	14	15+	16+
Night columns indicate quantity of added supply cubes for the turn. Day: R = Recon, C = Cards. Turn 1 start with 2xR and 5xC.	3 2R	2R	5	2R	4	1R	4	1R	4	1R	4	1R	3	1R	3	1R
	1 5C	3C	2	2C	2	2C	2	2C	3	3C	3	2C	2	2C	2	2C
	3		4		4		3		1		1		1		1	

Black (High Explosive)	Yellow (Persistent)	Green (Non-Persistent)
Normal explosive munition that damages and disrupts units. Can damage bridges. No effect from wind. Can be used as SOS fire.	Typically Mustard Gas. Reduces 1 CP and 2 MVMT day, 3 at night. Lasts 4 turns marked by a D4 on contaminated hex. If a unit remains, or moves into a contaminated hex, roll 1xD6 on fires CRT for effects.	Typically Phosgene or Diphosgene. Reduces 1 CP and 2 MVMT day, 3 at night. Effective only the turn on the targeted units. Other units can move into the hex and are not affected unless moving from downwind.

Unit Step Strength	Allocate Preliminary Fires	Allocate SOS (on call) Fires (Can be disrupted)	Fires Steps:
1BN (Recon ID 1-2) 4 Max (Displace ½) D -1 G -1	☐☐ ☐☐	HE Only ☐☐	1. Receive Supply according to Turn Tracker above. 2. Allocate munitions to units accounting for step strength (4 maximum), disruption (-1 each), gas (-1), or displacing (½ of available remaining rounded down). 3. Select Preliminary Fires (any munition) or SOS (HE only). 4. Mark the targets on the targeting board by unit. SOS missions do not have a designated target. Since SOS missions are reactionary, they can be disrupted prior to the mission.
2BN (Recon ID 3-4) 4 Max (Displace ½) D -1 G -1	☐☐ ☐☐	HE Only ☐☐	
3BN (Recon ID 5-6) 4 Max (Displace ½) D -1 G -1	☐☐ ☐☐	HE Only ☐☐	

Example: You allocate 4x black cubes (HE) to Preliminary Fires for 1BN. On the targeting board, write "1" on the hex you wish to target because 1BN is conducting those missions.
You allocate 2x black cubes to SOS mission with 2BN. Do not write anything for these missions on the targeting board. If your ground units are attacked, you may allocate one or both missions to support that unit.
If enemy aerial recon locates a fires unit, roll to see which BN: 1-2 for 1BN, 3-4 for 2BN, 5-6 for 3BN. Once located, that unit can be targeted by enemy fires for fires suppression until it displaces. If you displace a FA BN, its mission capacity is halved. SOS fires are suppressed immediately.

American Player Guide

DM = Defense Modifier, subtract 1 from attack roll. **MVMT** = Movement, units have at least 1 MVMT. **FA** = Field Artillery, includes gas and HE.
AM = Attack Modifier, add 1 to attack roll. **D** = Disruption, temporarily reduces CP. **CBT** = Ground Combat, see below.
S = Step Strength, Combat Power (**CP**) of a unit. **G** = Gas effect, temporarily reduces 1 CP and 1 MVMT.

4x 

Regimental Headquarters: Subordinate units must be within 4 hexes of HQ or cannot move. HQ is destroyed once all of its units are. If HQ incurs S loss, add 1 D to each of its units and change orders to Defense.
MVMT: 4

12x 

Infantry Battalion: Principle Combat Unit
MVMT: 6
Must always be within 4 hexes of Regimental HQ.

4x 

Machine Gun Company: Defense only
MVMT: 2 (only if uncontested)
Must remain in original Regimental AO.

2x 

MG Battalions: Defense only
Movement: 2 (only if uncontested)

1x 

Motorized MG Battalion: Defense only
Movement: 2 (only if uncontested)
Movement along roads: 10 (only if uncontested)

2x 

Engineer Battalion: (bridging, survivability)
MVMT: 6
Can use 3 MVMT to bridge or Decon 1 count.
Can use 4 MVMT to emplace Strong Point.

1x 

Trench Mortar Company: Range = 6 hexes, provides indirect CP during combat.
MVMT: 2

3x 

Artillery Battalion: Located in rear area off map. See Fires Allocation Board
Each step strength = # of fires missions each unit can conduct each turn.


Open Area:
No Effect


Village:
1 DM CBT
3 DM FA


Trench System:
+1 DM All


Forest:
-1 MVMT
2 DM HE and CBT
1 AM Gas


Existing Bridge:
Normal MVMT
If damaged, -1 MVMT


Defensive Positions:
+2 DM All


Road:
Negates MVMT penalty in Forest
Motorized MVMT


River:
All MVMT to cross
1 AM Gas
Engineers can bridge
Column shift for CBT


Dugout:
+3 DM FA
No Gas Effect, However, if CBT follows a Gas attack, then attacker rolls first

Recon	1-2	3	4	5-6
Identify:	**No effect unless: Projector Mission** is in play.	**Enemy Supply** DM = 2, displace automatically.	**Enemy HQs** DM = 2, skip orders 1 turn to displace.	**Enemy Artillery Unit** DM = 1, displacing unit can only fire half capacity of fires.
Assess fires:	Each D & G = 1 projector cube lost. Each S = 1 cube lost and -1 targetable hex.	Each D & G = 1 cube destroyed from the next supply. S = 1 permanent supply loss.	1xD6 greater than # of D & G in order to issue orders. S = force to displace this turn, skip orders next turn.	Each D & G reduces mission capacity by 1 for a BN. Each S reduces a step that permanently reduces capacity.

Orders and Combat:
Defend: NA
Attack: ➔
Supporting Move: ➔

Defend: For Defense benefit, a unit must remain in its original hex from the start of the turn. Units can move into uncontested hexes and support other units in Defense.
Attack: Trumps other movement, does not have to seize terrain, player allocates CP.
Support: Repositions or provides support to other units, movement yields to Attack.
Zone of Control (ZOC) Engagement: Column shift left on Combat Results Table.
Combat with multiple hexes: Players choose how to allocate CP.

Steps to Resolving Ground Combat

1. Defender rolls first. Attacker can cut losses with 1 D, 1 S, and retreat. OR
2. Attacker assesses full losses from results and continues the attack.
3. Attacker rolls and subtracts DM from the results. Defender can cut losses with 1 D, 1 S, and retreat. OR
4. Defender assesses full losses from attacker's final results.
5. The unit with the greatest remaining CP occupies the hex.

Fires	**Each Fires Cube = 1xD6. Roll and subtract DM or add AM = Result.**											
Ground	**Each CP = 1xD6. Defender roll first. Then Attacker roll and subtract DM or add AM.** **Note: Column Shift = -3 to Result.**											
Result	3-4	5-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36+
Disruption Step Loss	1 D	2 D	1 D 1 S	2 D 1 S	3 D 1 S	2 D 2 S	3 D 2 S	4 D 2 S	3 D 3 S	4 D 3 S	5 D 3 S	4 D 4 S

German Player Guide

DM = Defense Modifier, subtract 1 from attack roll. **MVMT** = Movement, units have at least 1 MVMT. **FA** = Field Artillery, includes gas and HE.
AM = Attack Modifier, add 1 to attack roll. **D** = Disruption, temporarily reduces CP. **CBT** = Ground Combat, see below.
S = Step Strength, Combat Power (**CP**) of a unit. **G** = Gas effect, temporarily reduces 1 CP and 1 MVMT.

4x 

Regimental Headquarters: Subordinate units must be within 4 hexes of HQ or cannot move. HQ is destroyed once all of its units are. If HQ incurs S loss, add 1 D to each of its units and change orders to Defense.
MVMT: 4

12x 

Infantry Battalion: Principle Combat Unit
MVMT: 6
Must always be within 4 hexes of Regimental HQ.

4x 

Machine Gun Company: Defense only
MVMT: 2 (only if uncontested)
Must remain in original Regimental AO.

1x 

Stoßtruppen Battalion: Elite Combat Unit
MVMT: 6
Can bypass enemy ZOC.
Does not keep G effect, but -2 MVMT if gassed.
No regimental HQ.

1x 

Engineer Battalion: (bridging, survivability)
MVMT: 6
Can use 3 MVMT to bridge or Decon 1 count.
Can use 4 MVMT to emplace Strong Point.

2x 

Engineer Company: (bridging, strong points, Decon)
Same as above.

1x 

Reconnaissance Company: (sees an enemy unit 2 hexes)
MVMT: 8
Can be attached to (collocated with) a battalion.

1x 

Trench Mortar Company: Range = 6 hexes, provides indirect CP during combat.
MVMT: 2

3x 

Artillery Battalion: Located in rear area off map. See Fires Allocation Board
Each step strength = # of fires missions each unit can conduct each turn.


Open Area:
No Effect


Village:
1 DM CBT
3 DM FA


Trench System:
+1 DM


Forest:
-1 MVMT
2 DM HE and CBT
1 AM Gas


Existing Bridge:
Normal MVMT
If damaged, -1 MVMT


Defensive Positions:
+2 DM All


Road:
Negates MVMT penalty in Forest
Motorized MVMT


River:
All MVMT to cross
1 AM Gas
Engineers can bridge
Column shift for CBT


Dugout:
+3 DM FA
No Gas Effect, However, if CBT follows a Gas attack, then attacker rolls first

Recon	1-2	3	4	5-6
Identify:	**No effect unless: Projector Mission** is in play.	**Enemy Supply** DM = 2, displace automatically.	**Enemy HQs** DM = 2, skip orders 1 turn to displace.	**Enemy Artillery Unit** DM = 1, displacing unit can only fire half capacity of fires.
Assess fires:	Each D & G = 1 projector cube lost. Each S = 1 cube lost and -1 targetable hex.	Each D & G = 1 cube destroyed from the next supply. S = 1 permanent supply loss.	1xD6 greater than # of D & G in order to issue orders. S = force to displace this turn, skip orders next turn.	Each D & G reduces mission capacity by 1 for a BN. Each S reduces a step that permanently reduces capacity.

Orders and Combat:
Defend: NA
Attack: ➔
Supporting Move: ➔

Defend: For Defense benefit, a unit must remain in its original hex from the start of the turn. Units can move into uncontested hexes and support other units in Defense.
Attack: Trumps other movement, does not have to seize terrain, player allocates CP.
Support: Repositions or provides support to other units, movement yields to Attack.
Zone of Control (ZOC) Engagement: Column shift left on Combat Results Table.
Combat with multiple hexes: Players choose how to allocate CP.

Steps to Resolving Ground Combat

1. Defender rolls first. Attacker can cut losses with 1 D, 1 S, and retreat. OR
2. Attacker assesses full losses from results and continues the attack.
3. Attacker rolls and subtracts DM from the results. Defender can cut losses with 1 D, 1 S, and retreat. OR
4. Defender assesses full losses from attacker's final results.
5. The unit with the greatest remaining CP occupies the hex.

Fires	**Each Fires Cube = 1xD6. Roll and subtract DM or add AM = Result.**											
Ground	**Each CP = 1xD6. Defender roll first. Then Attacker roll and subtract DM or add AM.** **Note: Column Shift = -3 to Result.**											
Result	3-4	5-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36+
Disruption Step Loss	1 D	2 D	1 D 1 S	2 D 1 S	3 D 1 S	2 D 2 S	3 D 2 S	4 D 2 S	3 D 3 S	4 D 3 S	5 D 3 S	4 D 4 S

American

Pursue:
Play any time.

If you attack and the enemy retreats, immediately pursue the enemy to the next hex with another attack.

American

Dogfight:
Play before Aerial Reconnaissance or in Response to other cards.

Cancel an enemy Aerial Reconnaissance.

OR play in response to cancel an enemy Dogfight card or Aerial Bombardment card.

American

Aerial Bombardment:
Play during Planning.
(Day only)

Gain an extra fires mission (1x HE) during the day.
Mark on target board as A.

American

Prisoners Talk:
Play during Planning.

Select an enemy regimental area to reveal the strength and orders of all units in that area.

OR locate your choice of either enemy supply, HQs, or a FA BN.

American

Extra supplies:
Play during Supply.

Permanently increase daily supply of a chosen munition by 1.

OR immediately collect 3 extra fires of your choice.

American

Critical Orders:
Play any time.

If your HQs are suppressed, select one Regiment to continue to receive orders.

American

Chemical Readiness:
Play any time.

Select a unit that was well-prepared for a gas attack.
Remove gas effects for this turn.

American

Morale Boost:
Play any time.

Remove a disruption from a unit.

OR select a unit that has no disruption and add 1 combat power for this turn.

American *

Seize the Initiative:
Play any time.

Select a battalion that can bypass enemies this turn.

It can also extend beyond 3 hexes from its HQ. However, it must be back within 3 hexes of HQ next turn in order to move again.

American

Replacements:
Play during Supply.

Soldiers are returning and consolidating. Rebuild a step loss during next supply phase, or reconstitute a destroyed unit with 1 step at a regimental HQ.

American

Higher Fires Mission:
Play during Planning.
Permanent Discard.

Gain 3x additional fires this turn.
Gain 1x additional bonus if played during turns 3, 4, or 11, 12.

Does not affect FA BN max, cannot be used as SOS, mark as H on target board.

Projector Mission:
Play during Planning.
Permanent Discard.

Available to use in 4 turns after play. Use 1xD4 to count down on Guide Board.

Gain 6x Gas cubes to target up to 4 adjacent hexes.
Mark P for Projector on target board.

Recon can locate projectors and fires can target them.
See Guide Board.

American

Rest and Recuperation:
Play during Planning

Select a battalion (that is not in an enemy ZOC) to remove from play for 24 hours (2 turns).
Remove all disruption, gas effects, and gain a step back.
When returning to play, place it with the Regimental HQ.

American 2

Morale Boost:
Play any time.

Remove a disruption from a unit.

OR select a unit that has no disruption and add 1 combat power for this turn.

American 2

Dogfight:
Play before Aerial Reconnaissance or in Response to other cards.

Cancel an enemy Aerial Reconnaissance.

OR play in response to cancel an enemy Dogfight card or Aerial Bombardment card.

American 2

Prisoners Talk:
Play during Planning.

Select an enemy regimental area to reveal the strength and orders of all units in that area.

OR locate your choice of either enemy supply, HQs, or a FA BN.

German *

Blue Cross Chemical Duplication:
Play during Planning.

Chemists mixed non-lethal with lethal gas to penetrate enemy masks.

Select a target with Non-persistent Gas to add 2 AM per green cube.

German

Replacements:
Play during Supply.

Soldiers are returning and consolidating. Rebuild a step loss during next supply phase, or reconstitute a destroyed unit with 1 step at a regimental HQ.

German

Higher Fires Mission:
Play during Planning.

Gain 3x additional fires this turn.
Gain 1x additional bonus if played during turns 3, 4, or 11, 12.

Does not affect FA BN max, cannot be used as SOS, mark as H on target board.

Projector Mission:
Play during Planning.
Permanent Discard.

Available to use in 4 turns after play. Use 1xD4 to count down on Guide Board.

Gain 6x Gas cubes to target up to 4 adjacent hexes.
Mark P for Projector on target board.

Recon can locate projectors and fires can target them.
See Guide Board.

German

Rest and Recuperation:
Play during Planning

Select a battalion (that is not in an enemy ZOC) to remove from play for 24 hours (2 turns).
Remove all disruption, gas effects, and gain a step back.
When returning to play, place it with the Regimental HQ.

German *2

Blue Cross Chemical Duplication:
Play during Planning.

Chemists mixed non-lethal with lethal gas to penetrate enemy masks.

Select a target with Non-persistent Gas to add 2 AM per green cube.

German 2

Dogfight:
Play before Aerial Reconnaissance or in Response to other cards.

Cancel an enemy Aerial Reconnaissance.

OR play in response to cancel an enemy Dogfight card or Aerial Bombardment card.

German 2

Chemical Readiness:
Play any time.

Select a unit that was well-prepared for a gas attack.
Remove gas effects and 1 disruption for this turn.

German

Pursue:
Play any time.

If you attack and the enemy retreats, immediately pursue the enemy to the next hex with another attack.

German

Dogfight:
Play before Aerial Reconnaissance or in Response to other cards.

Cancel an enemy Aerial Reconnaissance.

OR play in response to cancel an enemy Dogfight card or Aerial Bombardment card.

German

Aerial Bombardment:
Play during Planning.
(Day only)

Gain an extra fires mission (1x HE) during the day.
Mark on target board as A.

German

Prisoners Talk:
Play during Planning.

Select an enemy regimental area to reveal the strength and orders of all units in that area.

OR locate your choice of either enemy supply, HQs, or a FA BN.

German

Extra supplies:
Play during Supply.

Permanently increase daily supply of a chosen munition by 1.

OR immediately collect 3 extra fires of your choice.

German

Critical Orders:
Play any time.

If your HQs are suppressed, select one Regiment to continue to receive orders.

German

Chemical Readiness:
Play any time.

Select a unit that was well-prepared for a gas attack.
Remove gas effects and 1 disruption for this turn.

German

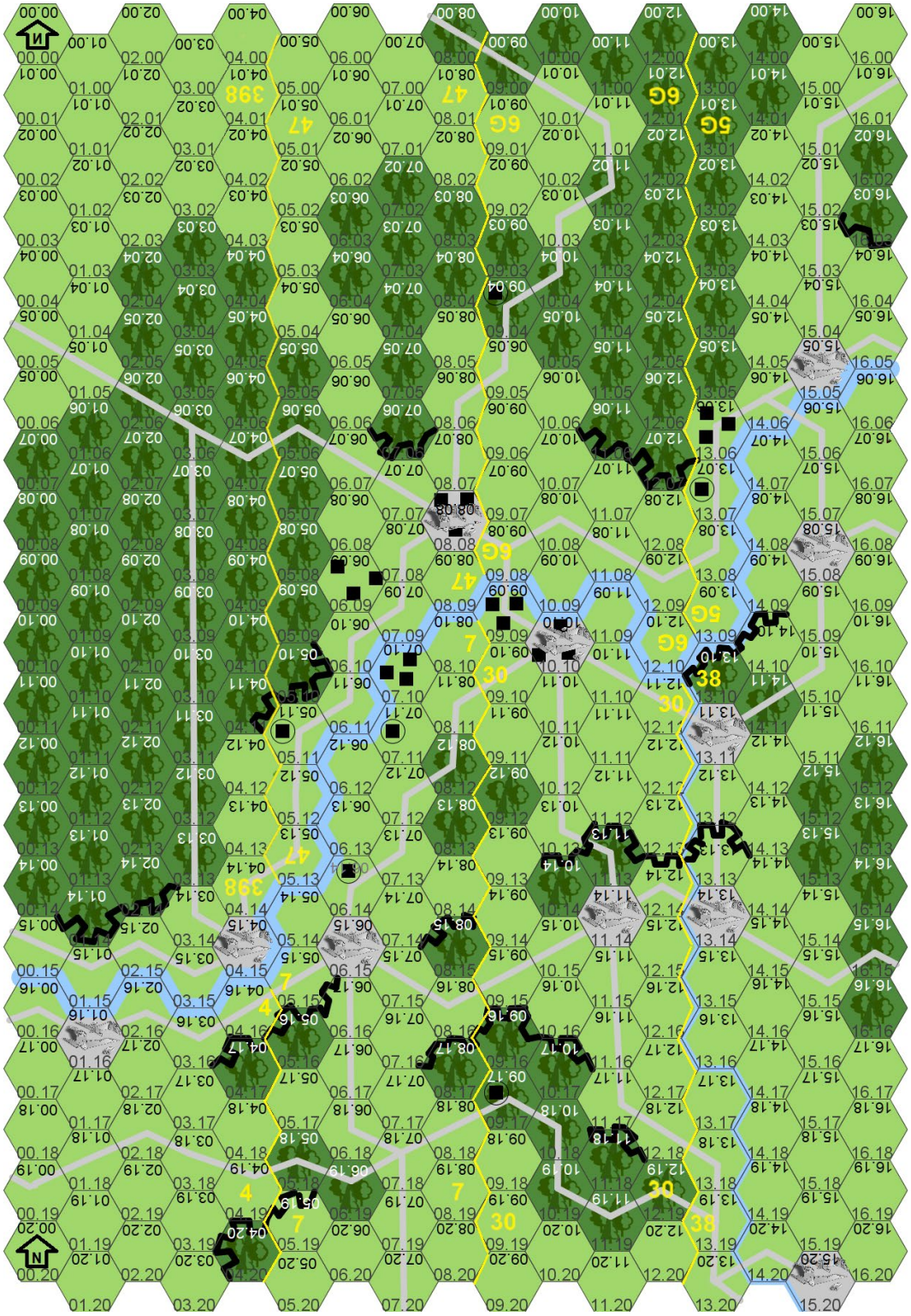
Morale Boost:
Play any time.

Remove a disruption from a unit.

OR select a unit that has no disruption and add 1 combat power for this turn.

APPENDIX C

GAS ATTACK MAP BOARD



APPENDIX D

RULES TO PLAY GAS ATTACK

GAS ATTACK: SIMULATING LARGE-SCALE CHEMICAL WARFARE AT THE SECOND BATTLE OF THE MARNE, 1918

Rules and Designer Notes

Table of Contents

1. Introduction to the Rules:

This wargame models the 2nd Battle of the Marne, 1918, between the American 3rd Infantry Division and the German 10th Division with the 5th Grenadier Regiment from the 36th Division.

In this game, players take on the roles of division level leadership and attempt to defeat each other in combined arms using infantry, artillery, and incorporating chemical warfare in order to seize objectives across the Marne River. Players receive artillery supply, allocate munitions to artillery units, designate targets, and maneuver infantry units in combat.

2. Winning the Game:

The German player wins by occupying 5 villages south of the Marne, or the 3 villages along the Surmelin River south of the Marne, or causing the American player to surrender.

The American player wins by having forces arrive to the furthest north row of hexes (__:00) without being cut off from regimental headquarters, or by causing the German player to surrender.

If neither player can achieve their specific objectives above, then the player with the most combat power across the Marne River by turn 16 wins. Players can agree to shorten or extend the turn 16 deadline.

3. Key Terms:

The following is a list of key terms in *Gas Attack*. They will be repeated throughout the rules and on the Player Boards.

3.1 D6:

A six-sided die, used to determine artillery and combat results according to the Combat Results Table.

Each artillery cube = 1 x D6.

Each unit's Combat Power = 1 x D6.

3.2 Ground Combat (CBT):

This is when ground unit pieces engage each other. See steps to resolving Ground Combat on the Player Guide Boards.

3.3 Field Artillery (FA):

FA is combat conducted by fires. It is represented by Artillery units and the munitions they fire. This includes High Explosives, Persistent Gas, and Non-Persistent Gas. Each

effective CP in an Artillery unit can be allocated a fires cube, each fires cube gets 1 x D6 to be rolled in the CRT for Artillery combat.

3.4 Combat Results Table (CRT):

The table on the bottom of the Player Guides. This table takes the results of dice rolls from either artillery or ground combat and determines their effects.

CRT for Fires: Each fires cube gets 1 x D6, roll all of the D6 and add the results. Subtract any Defense Modifiers and add any Attack modifiers to the result. Now locate the total number on the Results column. Below the Results column, the table shows how much Disruption or Step Loss is caused to the units in the targeted hex.

CRT for Ground Combat: The defender gets to go first except for certain cases with dugouts (See Dugouts in the Terrain portion). Each Combat Power gets 1 x D6, roll all of the D6 and add the results. Subtract any Defense Modifiers and add any Attack modifiers to the result. If there are any column shifts (for Zone of Control combat or attacking across the river) subtract 3. Now locate the total number on the Results column. Below the Results column, the table shows how much Disruption or Step Loss is caused to the units in combat. The attacker must assess the full results of the CRT before getting to roll. If the attacker wishes to call off the attack, they may assess 1D and 1S, and retreat to the hex they originally attacked from.

See Disruption for how it affects units.

See Step Strength for how it affects units.

3.5 Attack Modifier (AM):

An AM is a boost to dice results on the CRT. 1 AM adds 1 to the total number produced by the dice roll.

Forest areas provide 1 AM to gas attacks.

River areas (hexes next to a river) provide 1 AM to gas attacks.

Some cards provide AMs.

3.6 Defense Modifier (DM):

A DM is the reverse of the AM. It subtracts from the dice results on the CRT.

Forest areas provide 2 DM against High Explosives fires and Ground Combat.

Villages provide 3 DM against all Fires, and 1 DM against Ground Combat.

Trench Systems provide +1 DM against everything.

Defensive Positions provide +2 DM against everything.

Dugouts provide +3 DM against all Fires.

3.7 Column Shift:

A column shift only occurs with Zone of Control combat or combat crossing the river. If there is a column shift, subtract 3 from the dice results to reduce the effects of the combat one column on the CRT.

3.8 Step Strength (S):

Represents the life and permanent Combat Power of a unit by the numbers printed clockwise on the unit pieces. Each S on the CRT results in a rotation of the piece to reflect loss. Once the unit is rotated through all of its numbers, it is destroyed and removed from play.

3.9 Combat Power (CP):

CP is how many D6 a unit can contribute to combat. Effective CP is how much CP is available to the unit after subtracting the Gas effect and Disruption from S. For Artillery, effective CP is how many cubes the unit can use to fire in the turn.

3.10 Disruption (D):

D is a temporary reduction of CP represented by a white cube. It cannot exceed the S strength of a unit. Units get D from enemy artillery fire and combat as determined by the CRT. Each turn, during the Tokens step, reduce all D per unit by 1, or to a maximum of 2.

If there are multiple units in a hex, D must be evenly distributed among the units in the hex, or as long as there are S available.

For example: If a there is an infantry battalion with 4 S and a machine gun company of 2 S in the same hex, and the hex receives 5D, then 2D would go to the machine gun company, and 3D would go to the infantry battalion, because the machine gun company has maxed its S.

3.11 Gas Effect (G):

G is a temporary reduction of 1 CP, 2 MVMT (day), and 3 MVMT (night) resulting from gas attacks. It is represented by the same green cube used in Non-Persistent Gas munitions. It affects all units in a hex. Persistent Gas is represented by a D4.

For example: If there is an infantry battalion and a machine gun company in the same hex, and the hex receives a gas attack of only 1 cube, both units get the gas effect because it applies to the whole hex.

3.12 High Explosives (HE):

Are represented by black cubes. They are normal explosive munitions that damage and disrupt units. They can damage bridges, be used in SOS fires, and receive no effect from the wind. Each cube represents 1 x D6 in artillery attacks.

3.13 Persistent Gas (PG):

Are represented by yellow cubes. They were typically Mustard Gas used to block, disrupt, and suppress artillery because once they disperse, they contaminate an area for a long time. They provide a G effect which reduces each unit by 1 CP, 2 MVMT (day), and 3 MVMT (night).

They last 4 turns in the targeted hex marked by a D4 on contaminated hex. The D4 counts down each turn until it completes count-down, and then is removed.

Only rain and engineers can speed up the count-down. (See Rain and Engineers).

If a unit remains in a contaminated hex, or moves into a contaminated hex, roll 1 x D6 on the CRT for additional effects.

3.14 Non-Persistent Gas (NPG):

Represented by green cubes. They were Typically Phosgene or Diphosgene and would last only a few hours at most. They provide a G effect which reduces each unit by 1 CP, 2 MVMT (day), and 3 MVMT (night).

They are effective only for the duration of the turn on the targeted units.

Other units can move into the hex and are not affected unless moving from downwind.

3.15 Movement Ability (MVMT):

Each unit has a number of MVMT points depicted on the Player Guide Boards that are spent to move from hex to hex. G reduces MVMT by 2 during the day and 3 at night. Forest reduces MVMT by 1 per forested hex unless on a road. However, all units can move at least 1 hex per turn unless they are an infantry battalion cut of from its regimental HQ.

3.16 Zone of Control (ZOC):

Every unit has a ZOC of every hex adjacent to it. If an enemy unit moves into another unit’s ZOC it must stop movement. Only units with attack orders can continue to attack into the hex of the unit.

ZOC combat incurs a column shift, -3 on the CRT.

The Stormtrooper battalion and a card also have exceptions in that they can keep moving around a unit, without having to stop in the ZOC.

4. Components:

The following is a list of components for *Gas Attack*. Neutral Components are shared by both players.

4.1 Neutral Components:

1 x Map Board
1 x Turn Tracker / Weather Board
10 x Six-Sided Dice
12 x Four-Sided Dice
30 x White Disruption Marker Cubes
30 x Black HE Cubes
30 x Green NPG Cubes
20 x Yellow PG Cubes
10 x Blue Turn, Supply, and Weather Marker Cubes.

4.2 American Player:

1 x American Guide Board with unit descriptions, map legend, and results tables.
1 x American Supply, and Fires Board.
1 x Mini Map Board
16 x American Player Action Cards
4 x Strong Point Tokens
29 x blue block unit pieces broken down as follows:
4 x Regimental Headquarters each with a number.
12 x Infantry Battalions each with a number corresponding to a regimental headquarters piece.
4 x Machine Gun Companies each with a number corresponding to a regimental headquarters piece.
2 x Machine Gun Battalions (Division Asset, no regimental number).
1 x Motorized Machine Gun Battalion (Division Asset, no regimental number).
2 x Engineer Battalions (Division Asset, no regimental number).
1 x Trench Mortar Company (Division Asset, no regimental number).
3 x Artillery Battalions – These do not go on the map board, but on the Mission, Supply, and Fires Board.

4.3 German Player:

1 x German Guide Board with unit descriptions, map legend, and results tables.
1 x German Supply, and Fires Board.
1 x Mini Map Board
16 x German Player Action Cards
4 x Strong Point Tokens
29 x gray block unit pieces broken down as follows:

4 x Regimental Headquarters each with a number.
12 x Infantry Battalions each with a number corresponding to a regimental headquarters piece.
4 x Machine Gun Companies each with a number corresponding to a regimental headquarters piece.
1 x *Stosstruppen* Assault Battalion (Division Asset, no regimental number).
1 x Engineer Battalion (Division Asset, no regimental number).
2 x Engineer Companies (Division Asset, no regimental number).
1 x Cavalry Squadron (Division Asset, no regimental number).
1 x Trench Mortar Company (Division Asset, no regimental number).
3 x Artillery Battalions – These do not go on the map board, but on the Mission, Supply, and Fires Board.

5. Terrain:

The map is hex based with each hex representing approximately 500 meters in diameter. It represents the following terrain:

5.1 Open Area:

This represents fields and meadows; it has no modifiers and is generally susceptible to any form of attack.

5.2 Forested Area:

This represents areas with thick brush that can provide cover and concealment, but also hinders movement and traps chemical gases. It has the following modifiers to units in this hex:

-1 MVMT.

2 DM against HE and CBT.

1 AM against Gas.

5.3 Roads:

Negate the movement effects of Forested Areas. They also facilitate rapid movement for the Motorized Machine Gun battalion.

5.4 Villages:

Represents areas with enough structures and cellars to provide significant cover and concealment. They have the following modifiers to pieces in this hex:

1 DM against CBT.

3 DM against all artillery fire, including gas.

5.5 River:

The river is a major obstacle and represents low areas on the map. There are two rivers on the map: The Marne River, crossing the map board east to west, and the Surmelin River, from the southeast feeding north into the Marne.

5.5.1 Obstacle:

In order to cross, unit pieces must cross an existing bridge on the map, an engineer bridge, or conduct its own crossing. In order for a unit piece to cross the river without a bridge, it must be in a river adjacent hex at the start of the turn and use all of its movement points to move one hex to cross. Machine Guns cannot cross the river without a bridge.

Any attack across the river without a bridge incurs a column shift to the left (or -3 to the results) on the CRT. A defender does not incur the column shift. Supporting attackers and defenders incur the river column shift in addition to a ZOC column shift.

5.5.2 Low-lying Area:

All hexes adjacent to a river on the map.

1 AM against gas.

If there is no wind, then gas will settle and disperse in these hexes. (See Weather Board).

5.6 Bridge:


Bridges facilitate movement across rivers, but they can be damaged by fires. Each HE that achieves 1S on the CRT gives the bridge a -1 MVMT. Mark it with a blue marker cube.

5.7 Trench System:

 The trench system represents enough of a system to provide an overall benefit to the unit pieces on the hex. However, to be useful in ground combat, it must cover the direction of the attack on the hex.

+1 DM against everything to the existing terrain.

5.8 Defensive Positions:

 Better constructed than trench systems, do not have to face the enemy.

+2 DM against everything to the existing terrain.

5.9 Dugout:

 Gas-proofed dugouts provide significant protection against artillery and gas, but they are vulnerable against ground combat because units sealed up inside cannot to see the enemy coming, and can be taken by surprise.

+3 DM against all artillery, including gas.

No gas effect on unit pieces.

However, if ground combat follows an artillery barrage with gas, then the attacker rolls first, reversing order in resolving ground combat.

6. Unit Types:

The following is a list of units by type and descriptions of how they work. Additional information can be found on the Player Guide Boards.

6.1 Regimental Headquarters:

The HQs represents tactical level command and control. Regiments begin within their assigned areas marked by yellow lines on the map board. Players give unit orders by regiment. When resolving orders, all units in the regiment must generally follow the order given to the regiment. Regiments are not confined to their areas. However, the player must give an explicit order for non-division level assets to cross regimental boundaries.

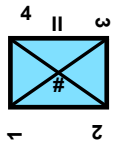
HQs cannot be destroyed unless all of its subordinate units are destroyed.

If a HQs incurs a S from the CRT, all subordinate units receive 1D and the orders to the regiment for the turn are canceled (default to defend with no movement).

Subordinate units must be within 4 hexes of HQ or they cannot move.

Movement ability: 4.

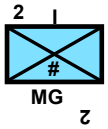
6.2 Infantry Battalion:



The Infantry Battalion (BN) is the primary maneuver unit of the game. It must remain within a 4 hex range of its regimental HQ or it can no longer move. If it gets cut off, it must either wait and defend, or attempt to fight its way back to its HQ.

Movement ability: 6.

6.3 Machine Gun Company:

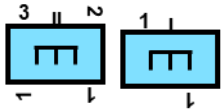


Machine Gun Company (MG CO): This is the primary defensive unit of a regiment. They are much less mobile than other units, but powerful for being a company-sized element.

Since they are responsible for defense, they cover a sector and must remain in their original regimental area.

Movement ability: 2. They cannot move into any area contested by an enemy unit, unless it is already occupied by a friendly unit.

6.4 Engineer Units:



Engineer Units (ENG): Have many special abilities. They can be used in combat, to build a bridge, to decontaminate an area, or dig strong points. They are division level assets, so they can move freely across the board without regard to regimental boundaries.

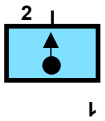
To bridge: costs 3 MVMT. Lay the engineer piece over the river gap and other units can cross. However, it is susceptible to any fires attacks in either adjacent hex, or the opponent can specifically target it.

To decontaminate: costs 3 MVMT per count on a D4 PG counter.

To construct a strong point: costs 4 MVMT. Place the Strong Point token on the hex with the Engineer doing the construction.

Movement ability: 6.

6.5 Trench Mortar Company:

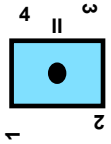


Trench Mortar CO: This unit is a way to gain additional CP from a distance. They have a range of 6 hexes and can provide indirect support during combat. Instead of using the CRT during fires, add the CP of the trench mortars to the unit that is conducting combat. When you engage with the trench mortars, you must reveal their position to show how much combat power they have to contribute.

Range: 6 hexes.

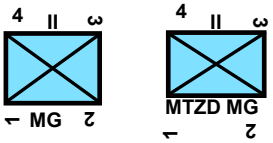
Movement ability: 2.

6.6 Artillery Battalions:



Artillery Battalions: These units go on the boxes marked 1BN, 2BN, and 3BN on the Players' Supply and Fires Boards. Their movement is notional as it takes place off the map board. Their actions take place during the planning phase and the Resolve Fires portion of the Execution Phase. Their step strength represents how many fires missions they are able to conduct. They can be targeted once they have been located by enemy reconnaissance.

6.7 Machine Gun Battalions:



Machine Gun Battalions (MG BN): Division level special units for the American player, they can only defend. They cannot move into contested areas.

Movement Ability: 2.

Motorized Movement Ability: 10 on roads. 2 off roads.

6.8 Stormtrooper Assault Battalion:

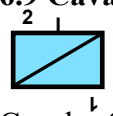
Stormtrooper Assault Battalion (ST BN): German elite offensive unit. It has higher CP to represent assets that are otherwise not in the game. It also does not take gas effects in combat due to its excellent gas training. However, gas still affects movement.

Division asset, not limited to regimental range.

Movement ability: 6.

Can bypass enemy zone of control.

6.9 Cavalry Squadron:



Cavalry Squadron (CAV): Although actually the size of a company, this unit was useful for patrolling into enemy areas and conducting reconnaissance.

Movement ability: 8.

Once per turn, can reveal the enemy units in a hex up to 2 hexes away without engaging in combat.

Division asset, not limited by regimental range.

7. Sequence of Play:

The following describes how *Gas Attack* progresses through a turn. Start with placement, then work through each of the phases. See the Turn Tracker / Weather Board for more information on the Sequence of Play.

7.1 Placement:

The American player places pieces first on the south side of the Marne, then the German player places units on the north side. In order to speed up placement, both players may agree to place units simultaneously, but the American player must defer final adjustments to the German player.

Pieces should be placed upright facing the player so that the opponent does not see the unit on the piece.

All regimental units must be placed within their corresponding numbered regimental area. All other pieces can be placed at the players' discretion on their respective side of the Marne.

Each player may designate one infantry battalion as the reserve. The reserve is not restricted by regimental boundaries, but it must be placed in the rear at least 6 hexes away from the Marne River.

7.2 Turns:

The game is conducted by turns that alternate between night and day. The German player starts the game with the initiative. The American player takes the initiative at turn 9.

The Turn Tracker / Weather Board provides a guide for each phase. At the beginning of the game, place a blue marker cube on the 1 in the Turn Sequence row. Below the Turn Sequence row, the board shows who has the initiative. If the turn number is white with a dark shaded background, it is a Night Turn. If the turn number is black with a white shaded background, it is a Day Turn.

At the end of Phase 3.c., after all combat has been resolved, move the turn tracker token to the next turn.

7.2.1 Night Turn:

Normal MVMT is the same as the day due to the freedom of movement that night cover provides. However, gassed units take -3 in MVMT during the night due to the challenges of wearing protective equipment in the dark.

Supply is unique to Night Turns.

7.2.2 Day Turn:

Instead of supply, players draw a card during Day Turns.

Aerial Reconnaissance is only conducted during Day Turns (except turn 1).

7.2.3 Phases:

Within each turn, there are 3 phases, but each phase has sub-steps. The phases and their sub-steps are as follows:

1. Setting Phase:
    a. Weather
    b. Supply (night) / Draw Card (day)
    c. Tokens
2. Planning Phase
    a. Aerial Reconnaissance (day)
    b. Allocate Targets and Issue Orders
3. Execution Phase.
    a. Resolve Fires
    b. Resolve Orders and Movement
    c. Resolve Ground Combat

7.2.3.1 Setting Phase:

Setting phase starts a fresh turn.

During Night Turns, players receive supply of munitions cubes for artillery. If it is a Day Turn, each player draws a card from their unique deck.

7.2.3.1.1 Weather:

The player with the initiative determines the weather conditions for the turn by rolling 1 xD6. Determine the weather conditions by the results on the Turn Tracker / Weather Board. If the player rolls 1-4, then the player must roll again for Wind Direction. Place a marker on the Wind Direction hex to indicate the direction the wind is blowing towards.

With the exception of cancelling Aerial Reconnaissance during rain, weather only affects gas. See the descriptions in the Turn Tracker / Weather Board for how weather works.

7.2.3.1.2 Supply:

Each player has their own turn tracker on their Supply and Fires Board. On the first turn, each player places a blue marker on the 1, representing turn 1. The following rows indicate the quantity of supply received.

Black on the top row represents Night Turn. Black on the second row represents High Explosive (HE) munitions. Yellow on the third row represents Persistent Gas (PG) munitions, and Green on the fourth row represents Non-Persistent Gas (NPG) munitions. The numbers within the rows indicate the quantity supplied for the turn.

For example, on turn 1, this player receives 3 x black cubes (HE), 1 x yellow cube (PG), and 3 x green cubes (NPG).

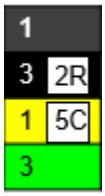


Figure 1. Daily Supply.

7.2.3.1.3 Draw Card:

During Day Turns, players draw cards from their unique decks. The white box in the third row indicates 5C, meaning the player can draw 5 cards this turn. If the deck runs out, reshuffle the discard pile and replay the cards.

Players can play as many cards as they want, but they cannot have more than 16 cards at a time.

Each card is self-descriptive, see each card to learn how they work.

Although Turn 1 is a night turn (as seen above), players still draw cards because it is their initial hand.

7.2.3.1.4 Tokens:

This does not apply in the first turn since there are no existing tokens on the map board. In subsequent turns, reset the marker tokens on the board:

Remove all green NPG markers.

Count down all D4 PG markers by 1.

Reduce all white D by 1, or to a maximum of 2.

7.2.3.2 Planning Phase:

7.2.3.2.1 Aerial Reconnaissance:

(Day only) – Aerial Reconnaissance (Recon), reveals targets in the deep area (off the map board). These targets are Supply, Division Headquarters, Artillery, or Projectors (if in play).

Conduct Recon in accordance with the Recon Table on the Player Guide boards. Each player has an allocated quantity of D6 to roll based on the second row of the supply table for the turn (#R).

Turn 1 is the only Night Turn with Recon because it represents previous intelligence prior to the start of the game. The 2R in the white box above indicates the player receives 2 Recon attempts.

Players roll 1 x D6 per Recon and determine the results by the Recon board. Cards can provide additional Recon, or reduce the opponent's Recon.

When Recon locates something, mark it on the Guide Board with a blue cube. Now that unit can be targeted by fires until it displaces.

Once a unit in the deep area displaces, it has to be relocated by Recon before it can be targeted again.

If Recon locates Artillery, roll again to determine which battalion. Each battalion has Recon ID numbers next to it on the Supply and Fires Board. This means that if the Recon rolls 1 or 2, 1BN is located. If Recon rolls 3-4, then 2BN, and so on for 3BN.

If Recon has already located something, and rolls for that same unit, the player can re-roll. However, if the player rolls 1-2 and there are no Projectors in play, the Recon was unsuccessful, and cannot re-roll.

7.2.3.2.2 Allocate Targets:

Players first use the Supply and Fires Boards to allocate munitions to their artillery battalions from their stock of supply.

For Artillery, each CP represents how many fires missions that Artillery BN can conduct per turn.

If an Artillery BN displaces, it can only fire half of its effective CP, rounded down.

D and G temporarily reduce CP. S permanently reduces CP.

Players follow the steps on the Supply and Fires Board to allocate the quantity of munitions per battalion per mission. They place the black cubes (HE), yellow cubes (PG), or green cubes (NPG), as they please within the dashed squares of the Preliminary Fires column. Players can mix and match munitions cubes.

If they wish to reserve some fires for SOS missions, they can only use HE and 2 cubes maximum per BN.

Then each player indicates their targets on the Mini Map Board.

Players write the BN that is targeting each targeted hex. For example: if 1BN is targeting hex 13.11, then the player writes "1BN" on hex 13.11 on the Mini Map Board.

If players are targeting deep area targets, they simply write it on the Mini Map Board. For example: "2BN Supply" indicates that 2BN will fire its munitions at the opponent's Supply in the deep area.

Each Artillery BN can conduct both Preliminary Fires and SOS missions, as long as they do not exceed their effective CP for the turn.

Unused SOS cubes are preserved for later turns. Therefore, if a player has extra HE cubes and available CP, it is worthwhile to allocate them as SOS missions just in case they are needed.

SOS fires can be suppressed by the enemy's Preliminary Fires.

For example: The American player allocates to 1BN 2 x HE for Preliminary Fires and 2 x HE for SOS. The German player targets the American player's 1BN with gas and achieves 1D. The American 1BN starts with 4 effective CP, however, since it fires 2 x HE during Preliminary Fires, it only has 2 effective CP left for SOS. The German attack with gas and 1D each temporarily reduce the American 1BN by 2 CP, meaning that it can no longer fire its SOS missions.

7.2.3.2.3 Issue Orders:

Players issue 1 order per regiment on the Mini Map Board. They draw arrows to issue movement orders, or leave the area blank to defend. A reinforced arrow gives the order to move into contact, or attack: ➠ If the unit encounters an enemy, it will engage.

A regular arrow ➡ means supporting move, which can still include combat on the defense, but not on the offense. This can also include retrograde and moving across regimental boundaries.

Players issue orders to their division assets by writing an abbreviation for that unit on the mini map board: ST = Stormtroopers, TM= Trench Mortars, ENG=Engineers, Rec=Reconnaissance Company, MG= Machine Gun, R= Reserve.

Players do not have to issue separate orders for division assets if those assets are supporting a regimental order. For example, if the 5G regiment is ordered to attack, and Engineers in the 5G area are supporting the attack by bridging, they do not need a separate order.

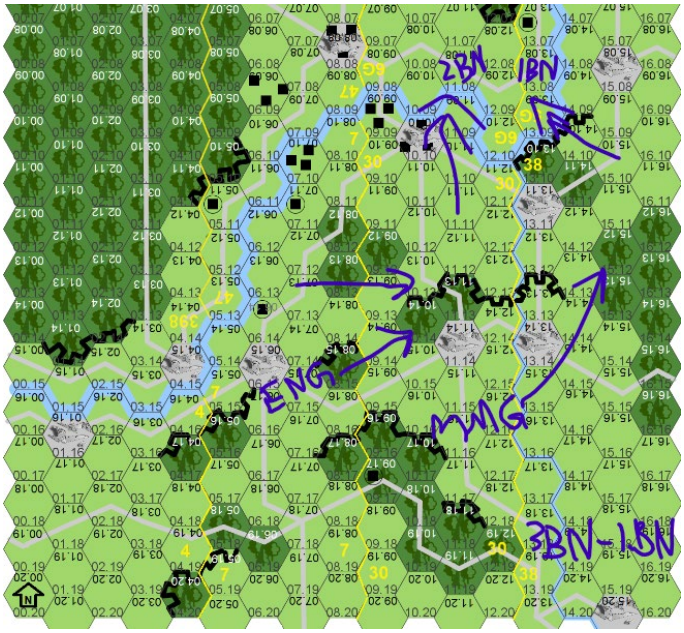


Figure 2. Example of Orders

In this example of orders, the American player is targeting hex 13:08 with 1BN and hex 11:08 with 2BN. 3BN in the bottom right corner is targeting the enemy's 1BN artillery in the deep area.

38th Regiment is attacking to the northwest, probably into hex 13:08, but the order does not have to specify. 30th Regiment is attacking north. 7th Regiment is conducting a supporting move into 30th Regiment's area, setting up for a follow and assume. However, not all of 7th Regiment must move to 30th Regiment's area. The player can decide how many, or which units. 4th Regiment is defending. The player can still move units within the area, but they cannot attack or cross regimental boundaries.

The Motorized Machine Guns (MMG) are moving from 30th Regiment's area into 38th Regiment's area, but the order does not have to specify which hex. The Engineers (ENG) in 7th Regiment's area are moving into 30th Regiment's area.

7.2.3.3 Execution Phase:

7.2.3.3.1 Resolve Fires:

Fires are resolved first.

First, both players place their allocated fires cubes on the hexes they are targeting for the turn. SOS fires cubes remain in the boxes on the Fires Board until needed during Ground Combat. For Example: The 2 black cubes that 1BN targeted above are placed on hex 13.11.

The player with the initiative decides which order to resolve the fires.

Each player rolls 1 x D6 per cube on the targeted hex and adds the results together. Then, as applicable, the player determines the results by adding Attack Modifiers, subtracting Defense Modifiers from the results, and applies them to the combat results table.

7.2.3.3.2 Resolve Orders and Movement:

The Player with the initiative chooses which area to resolve orders and movement. The player starts by revealing the regimental orders on the Mini Map Targeting Board. The player selects which regimental area to resolve first and moves each individual unit of the regiment based on the unit's movement ability and the regimental order on the player's Mini Map Targeting Board.

The opponent can also start moving pieces involved in the same area at the same time. As soon as it is apparent that both players intend to move opposing pieces into the same hex with attack orders, then both pieces remain on the border of that hex and the hex from where they are moving until Resolving Ground Combat. If both players are under supporting move orders, then neither moves into the hex and there is no combat. If one player has attacking orders and the other player supporting orders, then the player with the supporting orders yields the hex to the attacking unit. Since the players are now adjacent, they can still conduct Zone of Control Combat.

Players resolve all orders and movement before proceeding to Resolving Ground Combat. Attacking units remain on the edge of the hex they are attacking. Any units following an attacking unit must also remain on the line between hexes in case the attacking unit in front is unsuccessful and must move back.

7.2.3.3.3 Resolve Ground Combat:

The Player with the initiative selects which area to resolve ground combat first. Ground combat is resolved by adding together Combat Power of the units involved in the battle and rolling 1 x D6 per combat power.

Some battles may span across multiple hexes, but each unit can engage in only one battle per turn. Players must allocate their combat power across the hexes.

Resolve supporting defense and supporting attacks before resolving the main attack.

The main attack unit must take the first losses and takes the preponderance of losses once they are evenly distributed among the other attacking units.

The defender has the advantage by getting to roll and assess damages against the attacker first.

If the defender has SOS fires, the defender can first resolve the SOS fires against the attacker in the same way that fires are resolved.

Then defender tallies the total combat power in the attacked hex and gets 1 x D6 per combat power. The defender rolls all of the D6, adding to results together and applies them on the combat results table.

The attacker can choose to assess the full losses incurred by the defender and continue the attack, or take a default of 1 Step Loss and 1 Disruption, and retreat.

If the attacker chooses to continue the attack, the attacker can also tally the remaining combat power and roll 1 x D6 per combat power. The attacker adds the results together. If applicable, the attacker may add any attack modifiers, but must also subtract any defense modifiers that the defender may have.

Then the defender can choose to assess the full losses incurred by the attacker and attempt to hold the position, or take a default of 1 Step Loss and 1 Disruption, and retreat.

The unit with the most remaining combat power occupies the hex.

Note: If the defender is going to have less combat power than the attacker based on the Combat Results Table, it is better to take the Step Loss and 1 Disruption and retreat rather than take the full loss and be forces to retreat anyway. The only exception would be if the full loss from the attacker is less than the default 1 Step Loss and 1 Disruption.

Units fighting in adjacent hexes (Zone of Control) assess all results on the combat results table one column to the left.

8. Example of a complex attack across the river:

While most CBT will not be as complicated, this example includes the nuances to be found by terrain, combat across a river, distribution of losses, designation of CP, and ZOC support. Remember that any G or D incurred by fires will reduce effective CP.

In order to resolve combat with multiple hexes, first the attacker (or attackers if both players are attacking each other simultaneously) must determine which battalion intends to occupy the contested hex, and which units are supporting the attack from adjacent hexes.

Remember to resolve supporting defense and supporting attacks before resolving the main attack.

In this example, the German (gray) battalion of the 6th Grenadiers (6G) in the center is the main effort, attacking from hex 09.08 to seize hex 09.09 occupied by an American (blue) battalion of the 30th Regiment (30). The supporting efforts for the German player are the battalions on either side, 47 in hex 08.09 and another 6G in hex 10.09.

The following describes what is happening in the picture below. Numbers in the description correspond to the numbers in yellow circles in the picture.

1. The American defender intends to use the battalion in hex 10.10 to support the defense of 09.09 by engaging 6G in 10.09. However, since 6G is not attempting to occupy 10.10 and the American defender is not attempting to occupy 10.09, this is a ZOC combat across the river.

The defender rolls first. The 30 battalion in hex 10.10 has 4 combat power because it is not disrupted and has not incurred any step losses.

With 4 combat power, the American player rolls 4 x D6. For this example, the result is 14. Since it is a ZOC combat the result gets one column shift to the left (-3 to the results). Since it is across the river the result gets another column shift to the left (-3 again to the results).

Therefore, the result is: 14 – 3 – 3 = 8. 8 on the CRT results in 1 D and 1 S.

2. Now the 6G battalion in hex 10.09 has 1 D and 1 S, reducing its effective combat power to 2.

3. Next, the American 30 battalion in hex 09.09 rolls against the attacking German battalions.

The defender rolls the same 4 x D6 resulting in 14 again.

However, this time it is no longer a ZOC combat nor combat across the river because an attacker is coming directly into the defended hex.

Therefore, since there are no column shifts, the result remains 14, which incurs 3D and 1S on the CRT.

4. The German attacker chooses to continue the attack. The main attack unit must take the majority of the damage, but then the German player can evenly distribute the results among the other attacking units.

The main attack unit, 6G in hex 09.08 must take 1S and 1D, resulting in an effective CP of 2.

5. The German player evenly distributes the 2 remaining D.

5a. 1D to the 47 battalion in 08.09 resulting in an effective CP of 3.

5b. 1D to the 6G battalion in 10.09 resulting in an effective CP of 1.

6. Now it is the German attacker's turn to roll. First, the German player tallies the CP left to conduct the attack: 2+3+1=6. The attacker rolls 6x D6 for the attack resulting in 21.

However, since both 47 in hex 08.09 and 6G in hex 10.09 are conducting ZOC CBT across the river, they both incur cumulative column shifts. Each gets a ZOC column shift (-3) and a river column shift (-3).

The 6G battalion attacking from 09.08 has no column shifts because it is attacking 09.09 directly (not ZOC) and there is a bridge between hex 09.08 and 09.09 which negates the river column shift.

Therefore, the result is: 21 – 3 – 3 – 3 – 3 = 9. Finally, the defender has 2 DMs in hex 09.09. 9 – 2 = 7.

7 on the CRT assesses 1D and 1S to the American defender in hex 09.09.

Since the attack was concentrated on the hex 09.09, the American player cannot distribute the losses to the hex in 10.10.

Note: although at best, the 1 CP from 6G in 10.09 could roll a 6, which would break even with its cumulative column shifts, the unit nevertheless contributed in the attack by absorbing damage from the American defender in 09.09.

Since the main attacker and the defender end with the same amount of combat power, the defender retains the hex.

Figure 3: Ground Combat with Multiple Hexes.

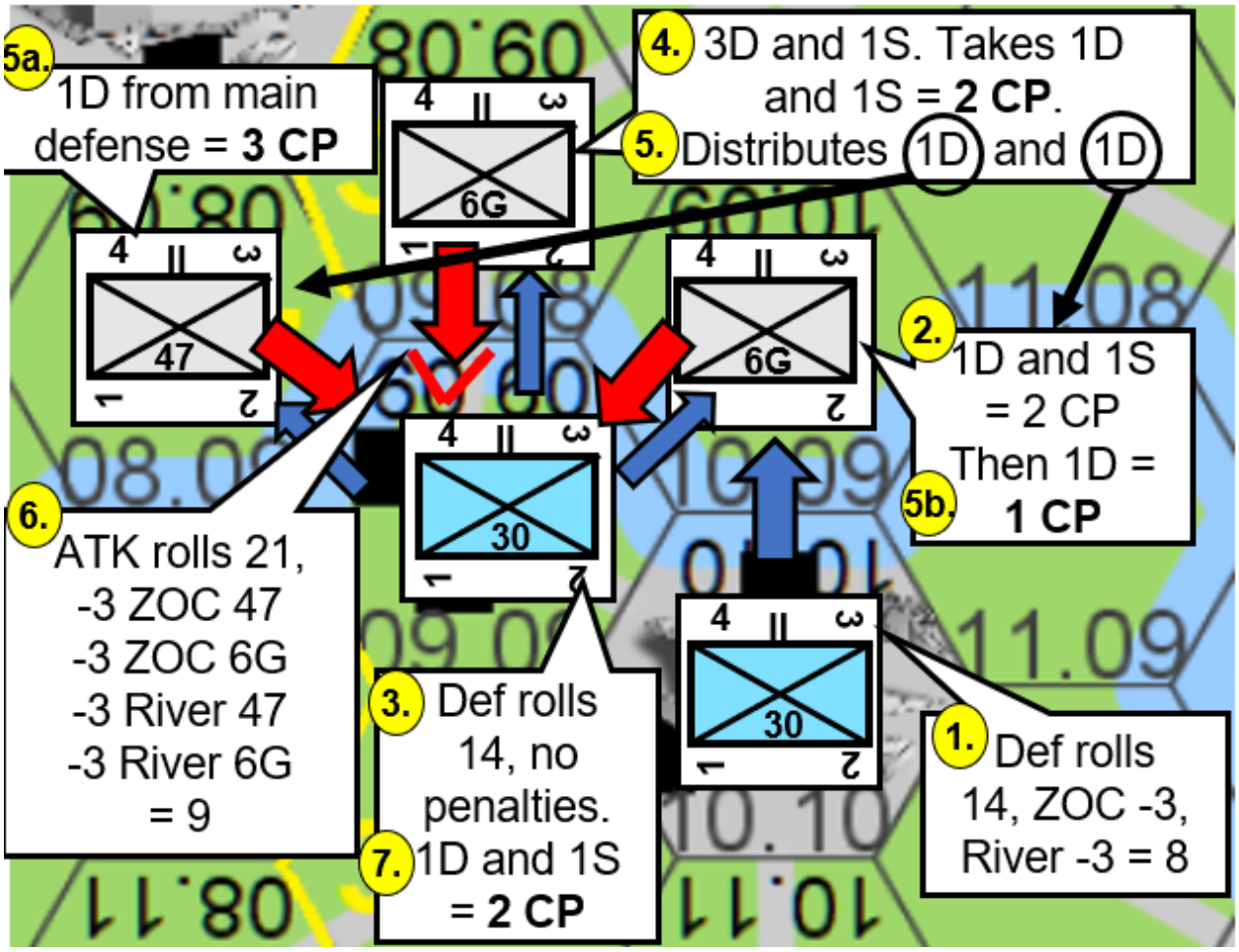


Figure 3. Example of Ground Combat with Multiple Hexes

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