

OPERATIONAL ART AND MUNITIONS SUPPLY: AN
ANALYSIS OF MUNITIONS AND THEIR INFLUENCE
ON OPERATIONAL ART PRACTICED BY
THE AMERICAN EXPEDITIONARY
FORCES DURING WORLD WAR I

A Monograph

by

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ABSTRACT

OPERATIONAL ART AND MUNITIONS SUPPLY: AN ANALYSIS OF MUNITIONS AND THEIR INFLUENCE ON OPERATIONAL ART PRACTICED BY THE AMERICAN EXPEDITIONARY FORCES DURING WORLD WAR I, by Major Paul Z. Licata, 48 pages.

How did munitions supply and distribution affect the execution of operational art by the American Expeditionary Forces (AEF) during World War I? The AEF had many logistical challenges during World War I. The majority of academic research focused on the lack of preparedness on a national level and the subsequent logistical issues caused by the difficulties in the mobilization of the industrial base. This study focuses on how the operational planners and leaders dealt with the supply of munitions and how that supply affected the operational art demonstrated by the AEF.

The campaigns at St. Mihiel and Meuse Argonne are examples of operational art by the AEF. The significant amount of munitions needed for these operations required operational art to integrate the operational plan. Both of these operations deal with the difficult task of getting munitions from the theater supply system to the point of tactical employment. This task is critical to operational art in the areas of culmination, operational reach, phasing and tempo.

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ACRONYMS

AEF	American Expeditionary Force
ADP	Army Doctrine Publication
ADRP	Army Doctrine Reference Publication
BCT	Brigade Combat Team
BSB	Brigade Support Battalion
WWI	World War One
WWII	World War Two

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INTRODUCTION

Ammunition resupply is a critical component to operationally durable formations and the understanding of its history can better inform current United States Army practices. With the eventual deployment of three field armies outside the continental U.S., World War I presented logistical challenges at all levels. The operations conducted by the American Expeditionary Forces (AEF) provide an opportunity to study the relationship between the munitions resupply and the elements of operational art. The operations at St. Mihiel and Meuse Argonne are two specific examples of operational art practiced by the AEF at the field army and corps level. Munitions resupply affected operational reach, culmination, phasing, and tempo during both of these operations.

The body of literature surrounding the operational employment of the AEF in World War I is relatively limited compared to the importance and amount of operational experience gained by the U.S. Army. World War I literature related to operational employment has undergone an evolutionary process since the end of hostilities in November 1918. These writings can be broken into three main categories: literature written immediately following World War I, literature written after the 1940s, and modern literature written from the late 1970s to the present. Following The Great War up until World War II writers published numerous official histories, memoirs, and generally congratulatory works. Critical documents of this period include General Pershing's *Final Report from the AEF* and the reports from each of the AEF General Headquarters (GHQ) staff sections.¹ These documents give the official version of AEF events in

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

Europe. Work critical of the AEF is generally limited to Sir B.H. Liddell Hart's *Reputations Ten Years After*.²

During the post-WWII era historians started to give a deeper review of the operations and contribution of the AEF in WWI. Smyth's *Pershing* is a detailed but still flattering portrayal of General Pershing's performance during the war.³ Edward Coffman's chapter titled "War isn't all brass buttons and cheering" in *The War to End All Wars* is an early example of historians describing the tremendous issues the U.S. Army had during WWI. Subsequent studies of the AEF and U.S. Army describe the poor situation of the U.S. Army going into the war and the difficulties encountered by the AEF in France.⁴

Around the same time the U.S. Army developed the concept of Air Land Battle, historians and U.S. military professionals began to take a deep critical look at WWI tactics and operational employment. In James Rainey's "The Questionable Training of AEF in World War I," he concludes that the AEF was not well trained or well led and as a result, it was not a truly effective instrument of national policy.⁵ In the historiography of AEF study, the sentiment expressed by Rainey is representative of ideas on the AEF in the late 20th Century. Here marks another transition to a study into the finer points of operational art and tactics of the AEF.

David Trask's *The AEF and Coalition War Making* provides a comprehensive look at the tactical actions of the AEF and the integration of the AEF into the Western Front. Trask covers

²Liddell B.H. Hart, *Reputations Ten Years After* (Boston, MA: Little Brown and Company, 1928).

³Donald Smythe, *Pershing, General of the Armies* (Bloomington, IN: Indiana University Press, 1986).

⁴Edward Coffman, *The War to End All Wars* (Lexington, KY: The University Press of Kentucky, 1998), 54.

⁵James Rainey, "The Questionable Training of the AEF in World War I," *Parameters* (1992): 89–102.

the strategic setting to the tactical employment of divisions. He provides a thorough analysis of the major engagements the AEF fought as well as a detailed look at Pershing's interaction with allied commanders. This work provides an excellent picture of how tactical and operational actions linked to national strategic objectives.⁶

Mark Grotelueschen's study on the evolution of combined arms tactics employment from Cantigny to Meuse Argonne is a key work in understanding the evolution of tactics, doctrine, and operational art.⁷ Grotelueschen takes an in depth look at the doctrine as described by General Pershing and compares it with the training received from the French and the actual employment of the AEF from early divisional operations through the AEF's planning and execution of the Meuse Argonne campaign.

There are very few works dealing specifically with operational art and the AEF. There are even fewer dealing with logistics. *The Neck of the Bottle* by Phyllis Zimmerman is one of the only major works that deals with logistics. This work is limited to the national industrial mobilization and only a limited study on the effects of the national mobilization on the operational employment.⁸ No discussion is given on the logistics issues faced in theater by the AEF or how theater logistics interfaced with the operational problems faced by the 1st Army AEF.

Many of the major authors listed above briefly indicate that ammunition was a significant factor in the planning and conduct of major operations. Not one of the authors has analyzed the

⁶David F. Trask, *The AEF and Coalition Warmaking*. (Lawrence, KS: University Press of Kansas, 1993).

⁷Mark E. Grotelueschen, *The AEF Way of War the American Army and Combat in World War I* (New York, NY: Cambridge University Press, 2007).

⁸Phyllis A. Zimmerman, *The Neck of the Bottle: George Goethals and the Reorganization of the U.S. Army Supply System 1917-1918* (College Station, TX: Texas A&M University Press, 1992).

relationship between the elements of operational art and munitions resupply during the two main AEF operations. This analysis will cover the relationship between the theater logistics systems, operational planners, and tactical executors. The relationship between these elements of the AEF will show how munitions resupply affected operational reach, culmination, phasing, and tempo during the St. Mihiel and Meuse Argonne operations.

The overarching methodology will be historical case study analysis of the campaigns of St. Mihiel and Meuse Argonne. This paper will investigate the aforementioned topics in three major areas: the significance of the St. Mihiel and Meuse Argonne operations, operational art displayed within the operations, and the importance of ammunition in relationship to operational art in St. Mihiel and Meuse Argonne. This analysis will cover six major subsections: Definitions and Terms, Strategic Context of Munitions Resupply, the St. Mihiel Offensive, the Meuse Argonne Offensive, and Modern Day Implications. These six sections will attempt to answer how the actions at St. Mihiel and Meuse Argonne demonstrated the relationship between munitions resupply and operational art.

DEFINITIONS AND TERMS

Army Doctrine Publication (ADP) 3-0, *Unified Land Operations*, defines operational art as “the pursuit of strategic objectives, in whole or in part, through the arrangement of tactical actions in time, space, and purpose.”⁹ This is the core of the analysis of the AEF’s actions at St. Mihiel and Meuse Argonne. The AEF arranged the tactical action at St. Mihiel and Meuse Argonne to accomplish Allied theater objectives that supported U.S. national strategic objectives. Army Doctrine Reference Publication (ADRP) 3-0, *Unified Land Operations*, specifies 10

⁹Headquarters, Department of the Army (HQDA), Army Doctrine Publication (ADP) 3-0, *Unified Land Operations* (Washington, D.C.: Government Printing Office, 10 October 2011), 4-1.

different elements to describe and evaluate operational art.¹⁰ Specific to this analysis are the elements of operational reach, tempo, phasing, and culmination. These are the four elements most related to munitions supply during WWI operations.

Operational reach is the ability of a formation to execute operations across space and time. ADRP 3-0 lists the three main subcomponents of reach as endurance, momentum and protection. Munitions resupply significantly affects all three of these areas during major combat operations. Endurance is the ability of an army to project a sustained force anywhere for a long duration. An army achieves momentum when it seizes the initiative by executing operations at an operational tempo that overwhelms the enemy. This momentum is only achieved when the tempo is sustainable. Munitions are a central planning consideration in achieving a sustainable tempo. The third subcomponent of reach is protection. Protection is a key requirement for the commander to maintain combat power in order to have endurance and maintain momentum. Here again munitions resupply is a critical component to protection, particularly in artillery intensive operations such as St. Mihiel and Meuse Argonne.¹¹

Closely related to operational reach is culmination. The primary objective of operational reach is to prevent the culmination of the operational force. ADP 3-0 defines culmination as that point in time and space when the operational force can no longer continue operations in the form it had been conducting operations.¹² Culmination can occur in all types of military operations. The operations at St. Mihiel and Meuse Argonne are primarily concerned with culmination during

¹⁰ Headquarters, Department of the Army (HQDA), Army Doctrine Reference Publication (ADRP) 3-0, *Unified Land Operations* (Washington, D.C.: Government Printing Office, 16 May October 2012), 4-1.

¹¹HQDA, Army Doctrine Publication 3-0, 4-5.

¹²Ibid., 4-8.

offensive operations of the AEF and the culmination of the German Army during defensive operations.

Tempo is the rate at which an operation occurs across time and space relative to the enemy's operations. The ability of commanders to control the tempo of an operation can influence the operational reach, and culmination of an operational force.¹³ During offensive operations like St. Mihiel and Meuse Argonne, commanders must maintain a tempo that is greater than that of the opposing force but still sustainable, thereby preventing culmination and extending operational reach. This study will demonstrate a linkage between tempo and munitions supply in the context of WWI offensive operations.

Phasing is the sequencing of tactical actions over time and space to accomplish operational tasks.¹⁴ This is mainly a planning tool to ensure the correct tactical actions are occurring at the correct time and space to facilitate the attainment of operational objectives. Phasing may break an operation down into groups of tactical actions with each phase achieving an operational objective. Phasing may also provide an operational pause to extend operational reach and prevent culmination.

Vocabulary is important to describe the role of munitions relative to the operations it supports. In the case of this study a comparison of modern doctrinal terms and common World War I logistical terms is required. Key terms of the World War I era include depot, rail head, regulating officer, ammunition train, and 4th Staff Section (G4). Comparative modern doctrinal terms are Supply Point, Single Log Command and Control, Sustainment Brigade, and Brigade Support Battalion.

¹³Ibid.

¹⁴HQDA, Army Doctrine Publication 3-0, 4-8.

The historical WWI depot was an area in the theater of operations that received, stored, and issued supplies to large tactical formations, primarily armies and corps. The depot could be located in the base, intermediate, or advance area of the theater providing support to units in the area. All depots were under the direction of the Service of Supply as a separate subcomponent of the AEF.¹⁵ The modern equivalent to the depot term is a supply point. This could be any supply support activity or ammunition supply activity under the direction of the theater sustainment command down to the sustainment brigade. This would not include the modern organizations in the BSB working directly for the maneuver commander.¹⁶

The railhead and division ammunition train as employed in WWI operations are the functional equivalent to the modern Brigade Support Battalion . The railhead and ammunition train had the final responsibility of getting the ammunition to the tactical user. In this scheme, the depot would ship ammunition to the railhead using the theater transportation system of the day (railroads), for issue to tactical units. The ammunition train would then transport the ammunition from the railhead to the unit on the front line.¹⁷

The system of ammunition delivery described above also illustrates the role of the regulating officer. This individual was a representative of the AEF G4 who controlled the issue of supplies, primarily ammunition, during operations throughout WWI. The G4 authorized the release of munitions to tactical formations (mainly corps size elements).¹⁸ The concept illustrated by the roles of the depots and function regulating officer are nearly equivalent to the modern

¹⁵Charles G. Dawes, ed., *Report of the Military Board of Allied Supply*, vol. 2 (Washington, D.C.: U.S. Government Printing Office, 1924), 295.

¹⁶Headquarters, Department of the Army, Field Manual 4-90, *Brigade Support Battalion* (Washington, D.C.: U.S. Government Printing Office, 31 August 2010), iii.

¹⁷John Coffey, “St. Mihiel Offensive the Problem of Ammunition Supply” (Group Research, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 1933), 2.

¹⁸*Ibid.*, 1

concept of single logistics command and control. Single logistics command and control is the idea that all logistics forces come under one command and control systems to enable supply chain efficiency and most importantly that the theater commander's priorities are met.

Joint Publication 4-0, *Joint Logistics*, and formerly Field Manual 4-0, *Sustainment*, divide logistics capabilities across strategic, operational, and tactical levels.¹⁹ This method of categorizing sustainment functions can potentially cause confusion on where sustainment influences operational art. ADRP 3-0 points out that operational art is not limited to one specific level of headquarters nor does one headquarters operate exclusively at one level of war. The same is true in sustainment formations. This does not mean that operational logistics occurs when there is operational art. The latest ADP 4-0 and ADRP 4-0 eliminate the discussion of levels of logistics. Sustainment function as a whole, no matter what level, will limit or enable operational art and its fundamentals.²⁰

STRATEGIC CONTEXT OF MUNITIONS SUPPLY

The AEF in WWI has been widely studied for its examples in coalition war making. The AEF was wholly dependent on the other allies, mainly France, for the logistical backbone in order to get into the fight and to sustain the AEF through operations. Two main areas heavily influenced the AEF operationally: strategic shipping from the U.S. and dependence on the French for theater level logistics. Both of these areas directly affected munitions supply in the AEF.

The entry into the war by the U.S. provided the allies with much needed combat power in the form of the raw infantryman and an expanded materiel base. What the U.S. did not bring was a ready supply of shipping or an army capable of expeditionary warfare from either a combat

¹⁹Headquarters, Department of the Army, Field Manual 4-0, *Sustainment* (Washington, D.C.: U.S. Government Printing Office, 30 April 2009), 5-1.

²⁰Headquarters, Department of the Army, Army Doctrine Reference Publication 4-0, *Sustainment* (Washington, D.C.: U.S. Government Printing Office, 31 July 2012).

arms perspective or a logistics perspective. This lack of capability led the allies to request the American contribution be that of replacement manpower to the allied armies already in the field. This was not acceptable to the leadership of the U.S. for domestic political reasons as well as long-term strategic bargaining power at conflict termination.²¹

The U.S. lack of strategic shipping allowed the allies to influence what was shipped to France from the U.S. Since the allies wanted the AEF to provide additional combat power to replace depleted French and British armies the allies would only commit sea transport to combat divisions and not the troops required to support them operating as an independent force.²² This piecemeal shipment of operational forces drove the AEF planners to a dependence on the French theater logistics system. The dependence on the French logistics system is apparent in the procurement of weapons and munitions to their employment at the front. General Pershing described the dependence on the French for munitions and arms as follows in his memoirs:

Except for four 14 inch naval guns on railway mounts, the American First Army throughout its entire service on the front did not fire an American-made cannon or shell and no American-made tank was ever available in Europe for use in battle. The AEF Service of Supply purchased in theater nearly all of the artillery, machine guns, and munitions from French manufacture or in the case of Meuse Argonne, the munitions issued from depots previously supporting French field armies.²³

At first look, the above situation appears to be a model in allied cooperation. However, it does not present how U.S. strategic interests were limited and operational employment affected. Since Secretary of War Newton Baker directed General Pershing to employ the AEF as an independent force, he was severely limited to where he employed that force. The placement of French depots combined with the time and place dependent support of the French was a

²¹John J. Pershing, *My Experiences in the First World War* (New York, NY: Da Capo Press, Inc., 1995), 192-224.

²²Pershing, *My Experiences in the First World War*, 246.

²³American Battle Monuments Commission, *American Armies and Battlefields in Europe* (Washington, D.C.: U.S. Government Printing Office, 1938), 19.

significant factor in how the First Army performed in St. Mihiel and the Meuse Argonne. These factors would later influence General Pershing in the development of a unified allied logistics system to enable the employment of an independent AEF field army.

OPERATIONS AT ST. MIHIEL

The operation at St. Mihiel highlighted the first opportunity for the AEF to demonstrate its abilities operating at the Army level towards a theater objective. In the summer of 1918, the allies had just halted the last major German offensive of the war.²⁴ The allies agreed to appoint Marshall Ferdinand Foch as the senior allied commander to unify allied actions on the western front. General Pershing and the AEF were building both combat power and experience fighting in limited capacities under British and French forces.

Marshall Ferdinand Foch and the other senior allied leaders saw an opportunity for a major combined allied offensive following the failed German assaults of early 1918. Foch envisioned a series of small offensives to take key terrain and improve the overall allied lines. He had four specific salients in mind that needed elimination. British and French armies with varied but increasing levels of AEF support carried out the first three.²⁵ The final action was the reduction of the St. Mihiel salient to the southwest of the fortress city of Metz.

At St. Mihiel General Pershing saw his opportunity for forming the AEF into a field army with control of an American sector of the front.²⁶ This was a critical element of U.S. theater strategy in having the AEF operate as an independent force against the Germans. For a multitude of reasons, it was advantageous to develop and employ the American forces as an independent

²⁴Trask, *The AEF and Coalition Warmaking*, 84.

²⁵*Ibid.*, 101.

²⁶Pershing, *Final Report of Gen. John J. Pershing, Commander-in-Chief American Expeditionary Forces (1920)*, 225-231.

field army. This is in stark contrast to how the Allies wanted the AEF amalgamated into existing French and British command structures and used essentially for replacements for other allied armies. The main strategic reason against amalgamation for the U.S. was that of improved post conflict position of the U.S. at the table of international power.²⁷ The U.S. argument against amalgamation was a strategic issue. The U.S. resistance to amalgamation is also critical to understanding the American concept of operational art in WWI – employing U.S. forces in tactical actions to achieve U.S. strategic objectives. It is this decision not to amalgamate that allowed the AEF to operate independently and in so doing provide a foundation for American operational art in the 20th century. The employment of the AEF as an independent force is the strategic foundation that allows the AEF to develop and employ its own operation art.



²⁷John Mosier, *The Myth of the Great War* (New York, NY: Harper Collins Publishers, 2001), 328-331.

Figure 1. Scheme of Maneuver for 1st Army, AEF at St. Mihiel

Source: American Battle Monuments Commission, *American Armies and Battlefields in Europe* (Washington, D.C.: U.S. Government Printing Office, 1938), 109.

Munitions were a central factor in the ability of the AEF's ability to operate independently. Additionally munitions and their continual supply is a pillar in developing a campaign quality army with the ability to project power across time and space within a theater. The ability to project power across time and space is the essence of operational reach. The supply of munitions was a critical requirement in developing a durable and protected formation. This ability to supply munitions across a theater was a particular problem that the AEF needed to solve prior to any major independent AEF operations. Munitions were particularly problematic due to the dependence of the AEF on both French artillery munitions and weapons for the duration of the war. In early 1918, General Pershing began to push for a more synchronized and unified approach to allied logistics, including ammunition.

The need for a synchronized approach to allied logistics was important to General Pershing because he saw it as a critical enabling function to developing an independent AEF. As mentioned in the strategic context section, the allies and the U.S. were at odds when it came to what type of troops and equipment were shipped and when. This resulted in two separate sources of supply for the AEF: one from the U.S. and a separate source in France.²⁸ The sources of supply in Europe were critical to the operations of the AEF. General Pershing saw the potential for his operations to come unhinged logistically should there be tension with other allied procurement processes in France.²⁹

²⁸James G. Harbord, *The American Army in France* (Boston, MA: Little Brown and Company, 1936), 386.

²⁹Pershing, *My Experiences in the First World War*, 110.

The result of the need for a unified system of allied supply was the Military Board of Allied Supply. This board consisted of a senior logistics representative for each allied or associated power nation.³⁰ The Allied Board of Supply provided the needed vehicle to examine and improve the flow of munitions between allied armies and the rear areas. The problem for the AEF was its distribution system was in its infancy well into 1918.

Additionally the theater campaign plan envisioned by Marshall Foch did not have the AEF operating in an area in which its distribution system existed. Figure 2 shows the principle theater supply routes and main rail line terminuses. The most robust supply routes led to the southernmost portion of the allied lines. St. Mihiel, which lies 20 kilometers to the southeast of Verdun, was slightly north of the area best serviced by the AEF lines of communications.

³⁰Dawes, *Report of the Military Board of Allied Supply*, 3.

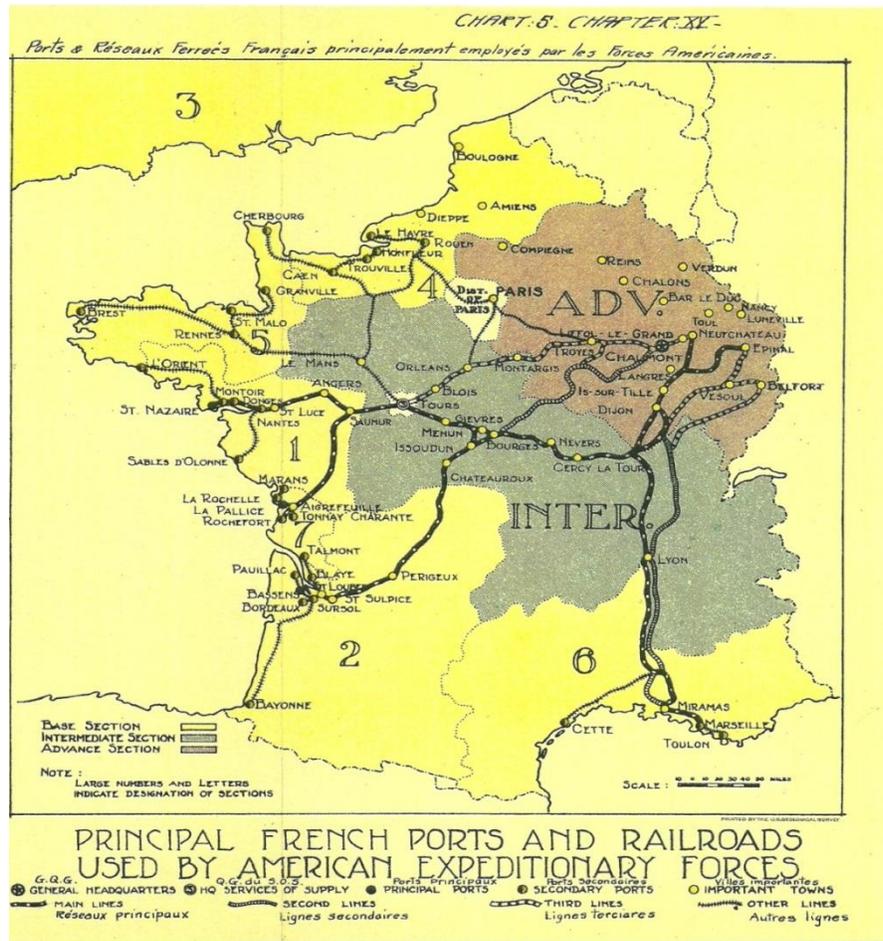


Figure 2. Principle French Ports and Railroads used by AEF

Source: Charles G. Dawes, ed., *Report of the Military Board of Allied Supply*, vol. 2 (Washington, D.C.: U.S. Government Printing Office, 1924).

Depending only on the American distribution nodes would have limited the AEF's ability to operate had it not been for a decision by Generals John Philippe Pershing and Petain and implemented through the Allied Board of Supply to allow French and American depots to support French and American forces interchangeably. This critical piece of logistics planning allowed for

the operational reach of the AEF at a sustainable tempo to avoid culmination during St. Mihiel operations and more importantly during the Meuse Argonne follow on operation.³¹

The St. Mihiel campaign exemplified how munitions resupply directly tied to operational art by allowing operational reach, maintaining operational tempo, and preventing culmination. The operational plan for the elimination of the St. Mihiel salient consisted of a two-pronged approach. V Corps would attack from the northwest with I and IV Corps attacking from the south. After the three American corps had secured their objectives, the French II Colonial Corps would secure the city of St. Mihiel itself. The northwestern and southern attack forces would converge on an army objective line running from Bois de Presle in the south to Hattonville in the center to Hannonville in the north.³² The army operational objective was directly linked to the further objective; the line of exploitation was specified in the 1st Army Field Order to facilitate follow-on operations.

This plan was tremendous in scale by modern standards. The concentration of over four corps size formations in an area no more than 50 square kilometers was particularly dense. The operation was to consist of over 3,000 pieces of artillery firing in a synchronized operation with advancing infantry.³³ Any significant disruption of artillery rounds would cause the plan to become unhinged since the movement of the infantry assault elements depended on preparatory artillery fires. In this application, artillery coupled with a constant supply of ammunition was critical in controlling the tempo of the overall operation.

³¹Pershing, *Final Report of Gen. John J. Pershing, Commander-in-Chief American Expeditionary Forces (1920)*, 168-170.

³²H. Drum, "Field Order No. 9," in *United States Army in the World War 1917-1919 Military Operation of the American Expeditionary Forces St. Mihiel* (Washington, D.C.: U.S. Government Printing Office, 1948), 203.

³³Paul F. Braim, *The Test of Battle* (Ann Arbor, MI: University Microfilms International, 1983), 111.

The amount of ammunition required for this operation was equally tremendous as the numbers of artillery pieces and personnel. In his memoirs, General Pershing noted the total amount of ammunition of approximately 40,000 tons for 12-13 September during the St. Mihiel operation. Simply possessing this large amount of ammunition was not sufficient. AEF planners would have to account for the movement from the theater depots, temporary storage at local railheads and artillery positions, and preparation to move this ammunition forward with the advancing army. This amount of ammunition was required to alleviate the major concern about the durability of their infantry formations. The AEF had learned the infantry was dependent upon artillery cover in order for formations to have the operational reach to arrive at required objectives.³⁴ Because of this, the 40,000 tons of munitions were required for the operational approach. This represents a solid example of how the operational approach influenced the munitions problem for a major operation.

Because numbers without context mean little, a deeper explanation is required to understand what it means with respect to reach and culmination. The U.S. Army's tactical truck of the era was the Liberty truck.³⁵ While the AEF used many French and British trucks, the Liberty truck was representative in capabilities of most allied trucks during the war. Its capacity was roughly 6,000 pounds, which equates to over 13,000 truckloads of ammunition alone. To compound this problem for the tactical executers of the plan, motor transport only represented a fraction of the tactical transportation of artillery and ammunition train units. Horse drawn caissons still represented the bulk of the last tactical mile of ammunition supply during this

³⁴Grotelueschen, *Doctrine Under Trial: American Artillery Employment in World War I*, 346-347.

³⁵U.S. Army Transportation Museum, "Army Transportation in World War I," U.S. Army Transportation Corps, <http://www.transchool.lee.army.mil/museum/transportation%20museum/LibTrucks.htm> (accessed 22 October 2013).

operation.³⁶ The situation of the last tactical mile for munitions resupply was a recurring theme for the AEF. Operational planners continually faced the problem of how to get munitions from the railhead to the point of employment so the artillery could have the desired results.

Colonel George C. Marshall explained the significance of ammunition and artillery in determining the overall approach used at St. Mihiel in his memoirs. The German line was a series of defensive lines defended with “numerous broad belts of wire entanglements.”³⁷ The allied answer to the German defensive belts and the wire obstacle in particular, had been a massive preparatory artillery fire. AEF planners estimated it would take 500 75mm rounds to cut a five-meter wide gap in a wire obstacle. In truckloads, this equaled one truckload of ammunition per five-meter gap. In spite of the massive numbers of munitions already in position for this offensive, there was not enough ammunition to use artillery to cut the gaps in the wire. George Marshall remarked in his memoirs that, “The large amount of ammunition required for such a fire of destruction or demolition was not available, as it could not have been brought up in time.”³⁸

This fact drove the operational planners to give General Pershing the following three options: 18 hours of preparatory fire, five hours of preparatory fire, or none at all.³⁹ The statement by Colonel Marshall and the options offered to General Pershing demonstrate the specific kinds of influence munitions had on the operational planners.

Marshall’s statement also highlights how time and munitions supply interrelate to influence operational art. Artillery munitions are both heavy and bulky when compared to other

³⁶Mark E. Grotelueschen, *Doctrine under Trial : American Artillery Employment in World War I* (Westport, CT: Greenwood Press, 2001), 137.

³⁷George Marshall, *Memoirs of My Service in the World War* (Boston, MA: Houghton Mifflin Company, 1976), 13.

³⁸Ibid., 135

³⁹Ibid., 136.

supply commodities. They take a significant amount of time to move into position and take additional time and planning to move with an advancing army. The AEF staff did not have this time in preparation for St. Mihiel. This tension between munitions supply on hand and the future capability of munitions on hand had a significant impact on determining the operational approach for the artillery preparation.

To tackle the problem of operational ammunition for the reduction of the St. Mihiel salient, AEF planners located nine railheads as close to the tactical units as possible. This is similar to the modern concept of throughput using the theater logistics systems to deliver ammunition as close to the point of employment as possible. This solved the initial problem for the beginning of the assault, ensuring the artillery units had enough ammunition on hand provide the synchronized rolling barrage required for the advance of the infantry. The main issue at hand was how to advance the artillery units as the infantry advanced to maintain momentum and expand the AEF's operational reach. The near total lack of paved roads coupled with wet weather during the operation significantly reduced the ability of the AEF to project ammunition stocks forward of their jump off line of 12 September.⁴⁰

The battle that ensued accomplished the operational and theater strategic objectives. The northern and southern assault forces linked up at 2 a.m. on 13 September and eliminated the salient. First Army reached the army objective line later the same day with consolidation and reorganization happening through 16 September.⁴¹ The AEF planners had set operational objectives referred to above as "army objectives" that each corps formation needed to achieve.⁴² The operational objectives effectively reduced the salient, which accomplished Marshall Foch's

⁴⁰Coffey, "St Mihiel Offensive The Problem of Ammunition Supply", 3.

⁴¹American Battle Monuments Commission, 111.

⁴²Drum, "Field Order No. 9," 203.

theater strategic objective. Finally, the AEF had operated for the first time as an independent force providing a strategic victory for the U.S. and improving their standing among the allies. Throughout, munitions resupply provided a foundation to accomplish objectives and was a deciding factor as to what approach the AEF selected. This brief explanation is only to highlight the linkage and accomplishment of operational actions, attainment of operational objectives, and the meeting of theater strategic goals accomplished by the AEF at St. Mihiel.

The AEF mitigated their initial ammunition issues by the forward positioning of ammunition to the nine railheads activated for the operation down to the battery level. While this was effective for the initial preparatory fires and ensuring the infantry was able to make their initial advance it limited the further operational reach of the formations. This is an interesting tension in munitions supply. In this case, the massive amounts of ammunition delivered to the railheads and artillery units at the jump off line demonstrated the operational reach of the AEF to concentrate an army for an attack. However, it also demonstrated how the same actions limited the further operational reach and hastened the culmination of the operation due to the inability of tactical formations to further advance the ammunition supply. In this example, the later statement is supported by the fact that it took over three weeks to remove the propositioned ammunition from the corps and divisional artillery positions.

Senior leaders of the AEF debated if AEF had culminated at the close of the St. Mihiel offensive. There were many senior officers, General Pershing included, who believed the St. Mihiel offensive was the gateway to a single and decisive blow to the fortress of Metz and the cutting of critical German transportation links. General Pershing believed that the First Army AEF had not yet culminated. However, Lieutenant General Hunter Liggett recognized the situation as it was. Liggett offered this response to those who believed in further offensive action at St. Mihiel. "The possibility of taking Metz and the rest of it, had the battle been fought on the original plan, existed, in my opinion, only on the supposition that our army was a well-oiled fully

coordinated machine, which it was not as yet.”⁴³ Marshall Foch made the discussion moot by issuing a new plan that did not have the AEF further penetrating towards Metz.⁴⁴

Though the AEF had performed well at St. Mihiel, it would likely have culminated not far beyond St. Mihiel due to the tremendous difficulties in supplying munitions and other critical supplies to advancing forces. The importance of the operational planning and integration munitions supply was not yet evident in the AEF. The field orders for this operation reflect minimal considerations for munitions supply. Annex No. 4 demonstrates the minimal instruction by only instructing regulating officers to issues ammunition “as required.”⁴⁵

The size and shape of the battlefield at St. Mihiel reduced the issues experienced by the AEF during the operation. Since the St. Mihiel operation was a salient it allowed the AEF to position munitions on two sides of the salient and was not required to advance much beyond the range of their initial artillery positions. However, they also illustrate several potential problems the AEF might have encountered with operational reach and tempo. The inability of the AEF to move their huge amounts of forward positioned ammunition with the artillery as it advanced reduced its operational reach. This lack of reach contributed to what would have been a culmination had the AEF been required to advance on fortress Metz. These issues would represent future learning points in the development of operational art in the AEF. Additionally this situation shows how munitions resupply influences reach and culmination as elements of operational art.

OPERATIONS AT MEUSE ARGONNE

⁴³Hunter Liggett, *AEF: Ten Years Ago in France* (New York, NY: Dodd, Mead and Company, 1928), 159.

⁴⁴Trask, *The AEF and Coalition Warmaking*, 53.

⁴⁵Drum, “Field Order No. 9,” 223.

With the salient at St. Mihiel reduced, the allies would continue with Marshall Foch's theater strategy of a grand offensive. The overall allied offensive divided the western front between the British, French, and American armies. The British and French armies controlled the front to the north and at the southern tip the AEF massed on the roughly 40 kilometers between Beaumont and the Argonne Forest. The AEF's objective as part of Marshall Foch's theater strategy was to render the railroad at Sedan unusable to the German Army. This rail line was a critical link for the German Armies operating in the north against the British and French.⁴⁶ The capture of Sedan and its rail hub would enable British and French operations in the north. This operation would commence on 26 September.

Figure 3 on the next page depicts the allied western front and opposing German positions. The main line of communications for the German army ran westward out of Germany through Metz then to Sedan and northwest toward to the German field armies opposing British and French forces. As shown on the map the reduction of the St. Mihiel salient (circled in red), followed by AEF operations in the Meuse Argonne would most definitely threaten the German line of communication. This was central to Marshall Foch's plan to enable the defeat of the German armies opposing the French and British armies to the north.

⁴⁶Mosier, *The Myth of The Great War*, 333.

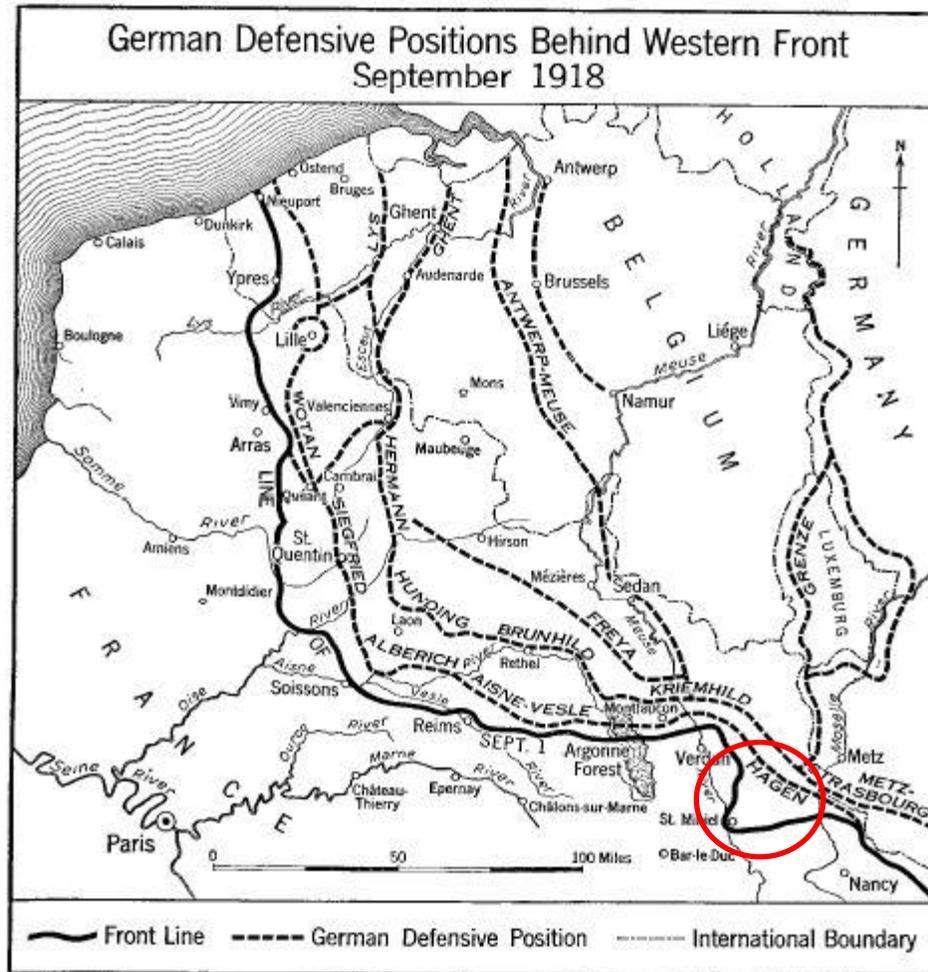


Figure 3. German Defensive Positions

Source: American Battlefield Monuments Commission, *American Armies and Battlefields in Europe* (Washington, D.C.: U.S. Government Printing Office, 1938), 169.

The Meuse Argonne sector was significantly different in terms of terrain from the St. Mihiel sector. The St. Mihiel operation was the reduction of a salient, which enabled the AEF to attack from the west and south simultaneously. The geographic shape of the salient allowed for the placement of railheads in relatively close proximity to the final limit of advance of AEF units. Since the Meuse Argonne area of operations was essentially a solid front with no salient, a different approach would be required. Furthermore, the Meuse Argonne sector had some very

distinct key terrain features. The westernmost feature was the Argonne Forest consisting of rocky terrain and densely wooded areas. The high ground of Montfaucon dominated the central portion of the area. This 300-meter tall mountain provided a commanding position for all the ground from the Argonne Forest to the Meuse River. The Meuse River represented the easternmost significant terrain feature dividing the eastern half of the AEF's overall area of operations.

In addition to the natural terrain features, the four previous years of combat operations affected the terrain. Figure 4 below shows the German defensive belts throughout the depth of the battlefield. This combined with general destruction of the previous four years meant there were no routes through the area that would be the first phase of the operation. The AEF planners would have to solve this problem to move the large amount of munitions forward to prevent culmination and extend operational reach.



Figure 4. German Defensive Belts

Source: American Battlefield Monuments Commission, *American Armies and Battlefields in Europe* (Washington, D.C.: U.S. Government Printing Office, 1938), 170.

General Pershing described the overall plan in three separate phases. His plan began with an advance of approximately 10 miles to clear the Argonne, then an additional 10 miles to clear ground for the final advance on Sedan, and a third advance to clear the east bank of the Meuse River to deny the enemy the use of the high ground.⁴⁷ Figure 5 below depicts the 1st Army objectives by for the first and second phases. This is significantly different from the comparatively simple double envelopment of the St. Mihiel salient. The Meuse Argonne operations demonstrate successive operations each with numerous tactical and operational objectives. This is significant due to the increased depth of the battle area and the need to relocate artillery forward for each successive operation.

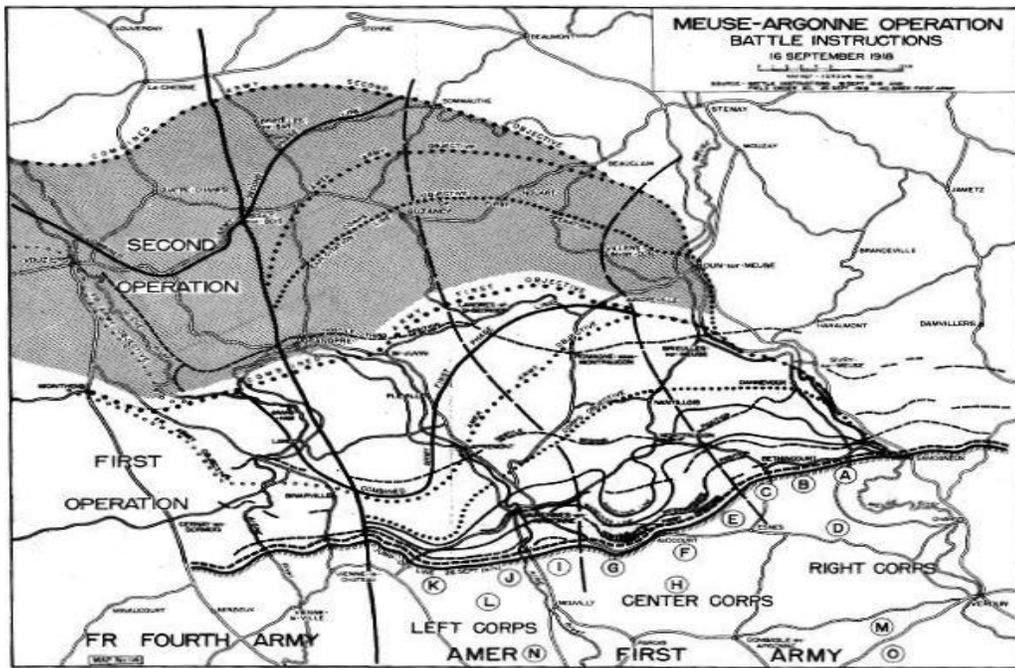


Figure 5. Phase One and Two Objectives

Source: H. Drum, *United States Army in the World War 1917-1919* (Washington, D.C.: U.S. Government Printing Office, 1948), 81.

⁴⁷Pershing, *My Experiences in the First World War*, 292.

This plan of successive operations demonstrated a more fully developed form of operational reach. Field Order No. 20 Initial Attack of Meuse-Argonne Operation gave considerable forethought to follow on operations. Annex No. 6 of the order gives direction for the extension of both roadways and light railways into the battle area. Of particular interest is the direction to immediately extend and connect the existing French light rail system to the captured German light rail system. The execution of this portion of the plan allowed the AEF to extend its lines of supply far past the jump off point. This allowed for the transport of both heavy artillery and ammunition of all calibers forward. In effect, this moved the railhead forward with the advancing army.⁴⁸

Movement into the Meuse Argonne Sector

The AEF had to reposition itself from the St. Mihiel area to the Meuse Argonne area in the shortest time practicable to be in position for the Meuse Argonne operation. Colonel George Marshall provided one of the best descriptions of the problem in his memoirs. Colonel Marshall stated that it would take 900 trucks one night to move one division of infantry along with their motorized equipment but would take three to six days for the transit of horse drawn equipment.⁴⁹ This movement of forces in order to concentrate for an operation was one of the largest examples of operation reach within a theater during WWI. The preparations for the Meuse Argonne campaign saw the movement of over 500,000 AEF personnel into sector and movement of over 200,000 French personnel out of the sector. Further compounding this movement were the operational security issues to conceal the concentration of troops from the German Army.⁵⁰

⁴⁸H. Drum, "Field Order No. 20," in *U.S. Army in the World War Military Operations*, vol. 9 (Washington, D.C.: U.S. Government Printing Office, 1990), 82.

⁴⁹Marshall, *Memoirs of My Service in the World War*, 149.

⁵⁰*Ibid.*, 150.

The First Phase

The initial phase of this plan consisted of the IV Corps, II French Colonial Corps, and the XVII French Corps holding the section of the front to the east of the Meuse River and conducting deep raids and artillery fires in demonstration. Simultaneously the V Corps attacked to capture the key terrain feature of Montfaucon. I and III Corps would attack and secure the ground to the east and west of V Corps attack on Montfaucon.⁵¹ In all five corps size formations artillery and the consistent and reliable flow of ammunition was required for either the destructive effects or the synchronization and support of advancing infantry. Figure 6 represents the scheme of maneuver for the first phase of the Meuse Argonne operations.

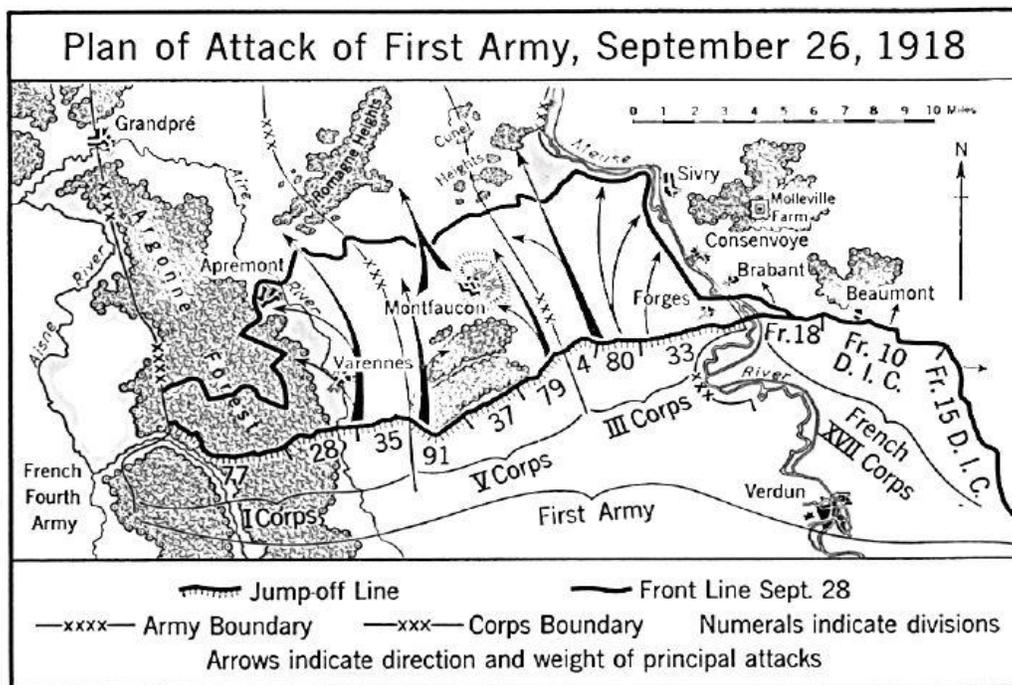


Figure 6. Scheme of Maneuver for 1st Army, AEF, 26 September

Source: American Battlefield Monuments Commission, *American Armies and Battlefields in Europe* (Washington, D.C.: U.S. Government Printing Office, 1938), 172.

⁵¹Drum, "Field Order No. 20," 83–84.

For this operation, the AEF planned for the use of nearly 4,000 pieces of artillery. The artillery had the tasks of neutralizing observation and firing from key terrain in the AEF sector. The targets listed in the field order are the heights east of the Meuse River, Montfaucon, and the eastern edge of the Argonne Forest.⁵² This target list is significant for the amount of artillery required for the neutralization of these targets to support the advance of the infantry.

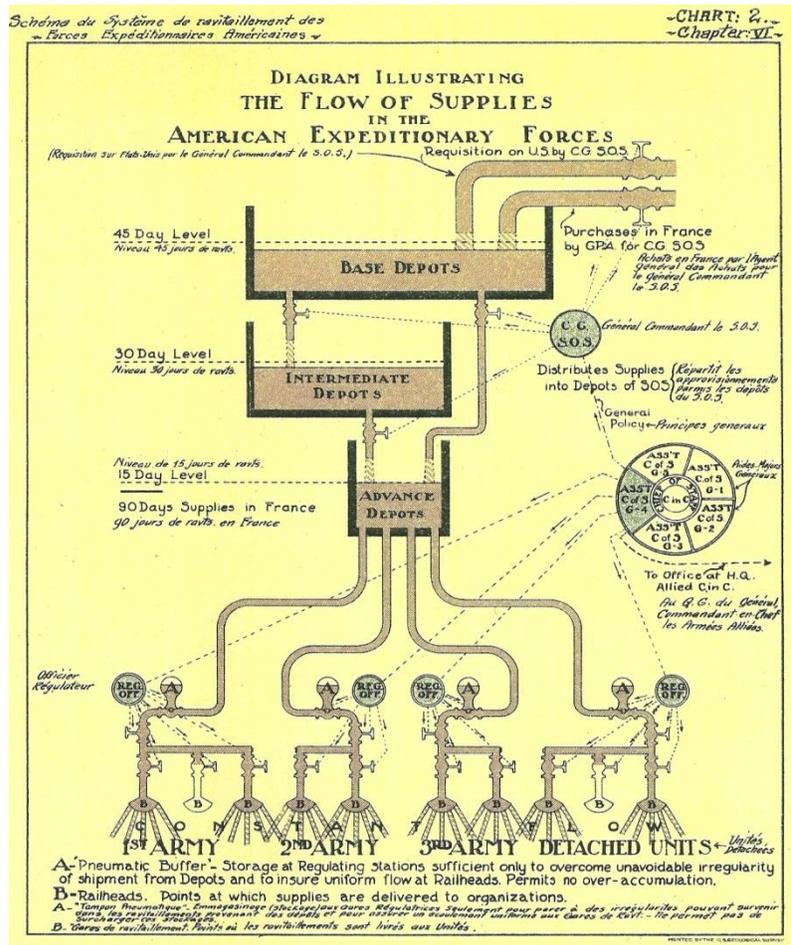


Figure 7. The Flow of Supplies in the AEF

Source: Charles G. Dawes, ed., *Report of the Military Board of Allied Supply*, vol. 2 (Washington, D.C.: U.S. Government Printing Office, 1924).

⁵²Drum, "Field Order No. 20," 86.

This operation required 40,000 tons of ammunition per day delivered to the area of operations. The Service of Supply accomplished this by establishing 19 railheads in the area immediately behind the jump off line of 26 September.⁵³ Regulating officers issued ammunition during the operation by a system of credits controlled by the AEF G4. Figure 7 shows the Service of Supply's graphical representation of how supplies flowed from the ports to the operational units. Note that from the advance depot forward, the focus was on delivering supplies to farthest point forward permissible by rail, which was the main mode of transportation. The diagram shows the relationship between the AEF G4 and the various regulating stations. This is where the AEF employed the system of credits to meter the issue of ammunition according to the commander's priorities. Footnote A of the diagram correlates to A on the flow diagram. The Service of Supply described this as a "Pneumatic Buffer" and intended it as a minimal stockage at the regulating stations to compensate for shipping problems. This method is conceptually similar to the ammunition transfer and holding point used in today's Brigade Combat Team (BCT). This concept enables a limited number of munitions to be stocked to enhance operational durability while maintaining maximum mobility to enhance operational reach. This system of providing munitions from the theater to the operational commander was largely successful in getting the required munitions to the correct positions at the theater level.⁵⁴

During the first operation in the Meuse Argonne, operational commanders had access to the required munitions, but getting them employed at the right place in time proved more challenging. The operation to take Montfaucon illustrates the issues inherent with the operational to tactical ammunition distribution link. During this portion of the operation, I Corps tasked 79th Division with the capture of the key terrain on and around Montfaucon. Even prior to H-hour

⁵³Braim, *The Test of Battle*, 133.

⁵⁴Charles G. Dawes, ed., *Report of the Military Board of Allied Supply Boxed Chart Set* (Washington, D.C.: U.S. Government Printing Office, 1924).

ammunition issues were apparent. The division had to halt operations due to a lack of ammunition in the division area. The division had not properly synchronized the clearance and construction of roads to facilitate the movement of the division artillery and the division ammunition train. This caused a delay in the seizure of an army level operational objective.⁵⁵

The ammunition problems experienced by the 79th Division affected tempo and operational reach. The munitions resupply problems delayed the taking of an operational objective. This slowed the overall operation of the 1st Army. This also demonstrated how shortages in munitions at critical junctures can significantly reduce the ability of an army to project force in terms of operational reach.

After reprioritizing engineer assets to repair the road network, the attack proceeded. This was only a temporary fix in this case. The amount of ammunition required for the specified tactical tasks given to the division artillery was not available in the division area and had to be supplied from the railhead. This seems to be a routine task but rough calculations indicate that the number of Liberty truckloads of artillery ammunition to be upwards of 1,000 truckloads of 75mm and 155mm shell to a forward area. This is significant for two reasons. The number of trucks presented a challenge due to the chronic truck shortage in the AEF and across the allied theater.⁵⁶ Secondly, the state of the roads was still fragile after the engineer effort. This was perhaps a critical factor since the extreme amount of concentrated traffic required to transport the munitions would have caused additional problems.⁵⁷

⁵⁵T. Emmerson, "G-3 Report File, First Army, Messages Recd.: 107.03 Operations Report," in *U.S. Army in the World War Military Operations*, vol. 9 (Washington, D.C.: U.S. Government Printing Office, 1990), 174.

⁵⁶Harbord, *The American Army in France*, 442.

⁵⁷*Ibid.*, 444.

Montfaucon is significant for both its value as a key piece of terrain that controls the terrain around it and as a major artillery target and thereby a large consumer of artillery ammunitions. The attack of First Army hinged upon the artillery at various levels to neutralize the enemy fire on Montfaucon and the ability of the 79th to seize and hold it from counter attack. All of these key tasks were dependent upon having the requisite amounts of ammunition for the tactical artillery tasks assigned in the right place on the battlefield sequenced at the correct time. Here the ammunition supplied to the artillery is a critical requirement as a protection function for the fielded forces. Without the timely supply of munitions, the fielded forces, the 79th division in the case, were unnecessarily exposed to the enemies' artillery and machine gun fire.

The situation around Montfaucon between 28 and 29 September shows a linkage between ammunition supply and several elements of operational art. This difficulty with transportation and movement of ammunition and artillery is indicative of a phasing problem in the overall operations. ADRP 3-0 refers to phasing as the division of an operation by durations or activity. In this case, the phasing did not occur and it resulted in the inability of the engineer troops to complete the required roads for the transport of ammunition as required for the artillery to accomplish their tactical tasks. The phasing problem caused a degradation of operational reach and reduced the endurance of the formation.⁵⁸

During the same period the 79th Division was having its ammunition issues the 35th Division was having considerable issues in its sector. The 35th was responsible for advancing the line at the eastern edge of the I Corps sector to the east of the Argonne Forest. The 35th was also the flank of the I Corps responsible for maintaining contact with V Corps.⁵⁹ The 35th Division's ammunition problems were part of larger leadership and training issues causing the replacement

⁵⁸HQDA, Army Doctrine Publication 3-0, 4-8.

⁵⁹American Battle Monuments Commission, 172.

of the division on the line just several days into the first operation. On 29 September, the 35th's attack was already experiencing significant difficulty. The 137th Regiment had collapsed and the 139th Regiment was near its breaking point. The 138th Regiment had extended its line to fill the holes left by the two weakened regiments.⁶⁰ This put the overall division attack in a position dependent on artillery. The division artillery brigade commander set a rate of fire that was not sufficient to achieve the tactical tasks given the division artillery. The artillery brigade commander, Brigadier General Lucien G. Berry, stated after the operation that he did not have sufficient ammunition to increase the rate of fire. However, post-conflict War College studies contradict this and indicate there was sufficient ammunition on hand for an increased rate of fire.⁶¹ Despite these conflicting stories, this situation shows several effects of munitions supply (or possibly the perceived munitions supply) affecting the execution of the operation.

The issues experienced by the 35th with their artillery brigade highlight the importance of artillery and the sustainability of its rate of fire to prevent culmination. In this case, the inability of the artillery to suppress the enemy fires aided in the culmination of the division attack. Subsequently this culmination of the 35th Division resulted in a sequencing problem that caused the 1st Division to be brought up to replace the 35th, and the resulting delay caused phasing problems for the operation. Colonel Marshall said the following on moving the 1st to relieve the 35th:

. . . the artillery trains of the First Division were not to be permitted to cross No-man's-land until the next day or the day following in order to avoid blocking the movement of the ammunition, rations and wounded on the sole road at the disposal of the First Corps.⁶²

⁶⁰Robert H. Ferrell, *Collapse at Mesue Argonne the Failure of the Missouri-Kansas Division* (Columbia, MO: University of Missouri Press, 2004), 86.

⁶¹Ibid., 87.

⁶²Marshall, *Memoirs of My Service in the World War*, 164.

The 35th Division's problems also highlight a success in ammunition supply at the army and corps level. When the 35th collapsed, it became dependent upon the large caliber corps and army artillery for protection and defense. The supply chain sufficiently provided these units with 155mm howitzer ammunition due to their close proximity to the nearest railhead and their relatively static position on the battlefield. This demonstrates the operational durability of the First Army. The failure of a major combat unit, like the 35th Division, did not mean failure for the whole army. This instance demonstrates the importance of a good supply of munitions to key artillery units to prevent culmination and enhance operational durability.

By 3 October, First Army had secured a new front line to the north of Montfaucon running from Briulles on the Meuse River to Apremont on the edge of the Argonne. From 3 to 31 October, First Army would continue their attack into sector. This attack represented the close of the first operation in the Meuse Argonne.⁶³ The first operation presented two supporting cases in the 79th and 35th division on how munitions resupply affected operational reach, culmination, phasing and tempo during both of these operations. Additionally Field Order No. 22 showed the beginnings of an improvement in the considerations of the operational planners for the supply of munitions to support the arrangement of tactical actions over time and space.

The Second Phase

By mid-October, the AEF had reached its operational objectives laid out in Field Order No. 20. Plans were constructed for the second AEF operation in the Meuse Argonne area. Figure 8 shows the overall scheme of maneuver for the second phase. Field Order No. 88 issued on 27 October 1918 explained the plan for the second phase of the Meuse Argonne operation. This operation consisted of the III, V, and I American Corps attacking in their respective zones to seize

⁶³R. McCleave, "G-3 Report File, First Army, File 116.01.: Operations Report," in *U.S. Army in the World War Military Operations*, vol. 9 (Washington, D.C.: U.S. Government Printing Office, 1990), 213–214.

and retain key terrain with two French corps holding the line east of the Meuse. The order gave three ammunition intensive artillery tasks that were critical in allowing the assault formations to advance. This order gave specific instructions to the corps commanders to designate and direct the flow of traffic for both the artillery trains and the ammunition trains.⁶⁴

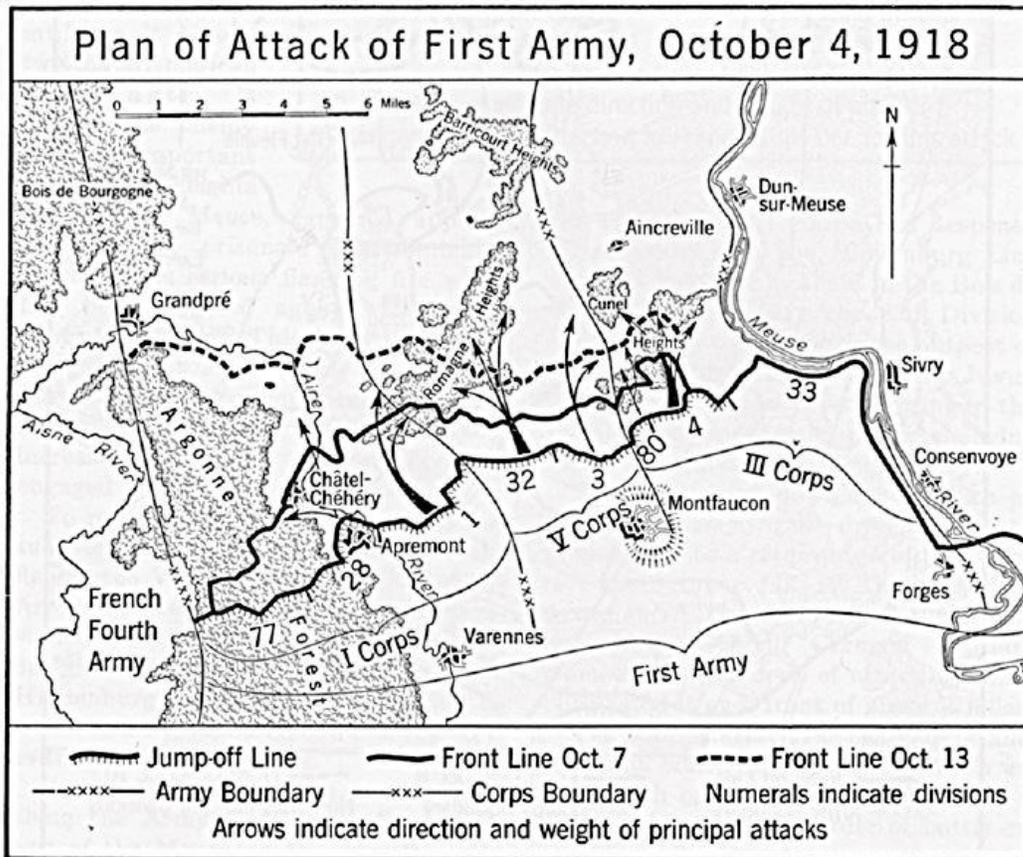


Figure 8. Scheme of Maneuver for the Second Phase of the Meuse Argonne Operation

Source: American Battlefield Monuments Commission, *American Armies and Battlefields in Europe* (Washington, D.C.: U.S. Government Printing Office, 1938), 177.

⁶⁴H. Drum, "Field Order No. 88," in *U.S. Army in the World War Military Operations*, vol. 9 (Washington, D.C.: U.S. Government Printing Office, 1990), 333.

These instructions are representative of the organizational learning that had occurred within the AEF with respect to the importance of the movement of munitions to the point of employment in the operational environment. This is demonstrative of the phasing, tempo, and operational reach elements of operational art. The inclusion of these specific instructions in a major field order such as Field Order No. 88 indicates the AEF was learning and demonstrating some of the principles now considered operational art.

The supporting appendices covering supply and engineer activities gave additional instructions regarding ammunition. The engineer annex gave specific instruction to repair and extend both light rail and highways. The order specified the light rail repair and extension along the Domasle-Montfaucon line and the Aubrevill-Apremont line, which correspond to the major axes of advance of the AEF. The rail mission became, in effect, specified tasks to engineer troops at the field army level. The highway tasks were broken out according to the linear battlefield model found in current U.S. Army doctrine. The Field Army was responsible for main trunk lines and the area behind the corps rear boundary, the corps headquarters responsible for corps routes in behind the division rear boundary, and the division responsible for routes forward of their rear boundary.⁶⁵

These specific instructions show an attempt to build an operation that had improved operational reach by extending lines of communication into the battle area. This extension of the lines of communication into the battle area improved the durability and protection of the forces specifically by enabling the throughput of munitions from the advanced depots to the extended railheads. The proper planning with phasing ensured that the engineer troops were located at the right time and place on the battlefield to accomplish the extension of the lines of communication. Referring back to figure 2, this had the effect of lengthening the conceptual pipe between the

⁶⁵H. Drum, "Field Order No. 88," 343–344.

regulating station (node A) and the unit railhead (node B) as indicated on the diagram. This extended the First Army's culmination point.⁶⁶

The supply annex however is not nearly as robust in its instructions. It consists of only two entries concerning small arms to the artillery and the other giving a controlled supply rate for the Hotchkiss machine gun used in anti-aircraft defense. In combination with the extensive transportation network instructions, this seems to indicate the AEF staff perceived little issue with the amount of ammunition available for issue in the overall army area of operations but had great difficulty in getting it to where it needed to be.⁶⁷

As the second phase unfolded reports of ammunition problems are virtually nonexistent at the operational level. Tactical reports from the division and below indicate there was an amount of friction in tactical ammunition resupply but these issues did not translate into operational problems, as did the 79th Division's ammunition problem in and around Montfaucon.⁶⁸ The lack of apparent munitions issued overlaid with the large geographic area covered by the second operation is indicates that the better sequencing of forces to did improve munitions resupply and artillery movement.

Remarks from Colonel Marshall's memoirs also support the above conclusion. In reference to the Meuse Argonne operations, he states the following:

The SOS furnished the army with the necessary supplies and the army, in turn, placed these according to custom, at the railhead of each division. It was within the division that the trouble lay.⁶⁹

⁶⁶Dawes, *Report of the Military Board of Allied Supply Boxed Chart Set*, fig. Flow of Supplies.

⁶⁷Drum, "Field Order No. 88," 343.

⁶⁸ Ibid 343-363. Field Order No 88 and its subsequent correspondence between coprs and field army staffs a destincly devoid of any discusion of operational munitions problems.

⁶⁹Marshall, *Memoirs of My Service in the World War*, 164.

This statement highlights the importance of linking the logistics structures to the field army. The theater logistics system delivered sufficient munitions to the operational headquarters but the difficulty was in getting the munitions to the correct space in time during the operation.

The Third Phase

The final phase of the Meuse Argonne operation occurred during the first two weeks of November 1918 right up to the armistice on 11 November. This phase would bring First Army from the second phase objective line to the heights controlling the city of Sedan. This would effectively cut the German line of communication by putting the key rail lines within artillery range. Additionally this phase would enable the taking of the city by the adjacent French forces. The ability of the First Army to extend its operation reach hinged on its ability to move itself across the newly occupied terrain. The planning and execution done during phase one and phase two to extend the operational lines of communication was now critical to accomplishing the strategic objectives in phase three.

First Army commander Lieutenant General Hunter Liggett noted the tremendous effort by the supporting functions, ammunition in particular, in facilitating the second operation in Meuse Argonne. He remarked that the ability for the First Army to make the 90 degree turn to pursue the retreating German Army was only made possible by the supporting service troops.⁷⁰ The “90 degree turn” alluded to by Lieutenant General Liggett exemplifies the operational reach enabled by the extension of the lines of communication described previously. This remark by Lieutenant General Liggett shows the awareness that Army’s ability to project supplies and munitions forward on the battlefield was critically important to the attainment of operational

⁷⁰Hunter Liggett, *Commanding an American Army; Recollections of the World War* (New York, NY: Houghton Mifflin Company, 1928), 125.

objectives, 1st Army objectives and in phase three the theater strategic objective of cutting the German lines of communication.

CONCLUSION AND MODERN DAY IMPLICATIONS

The operations at St. Mihiel and Meuse Argonne contain many lessons that present day operational and logistics planners can learn. These lessons cover several areas: the linkages between distribution systems, force development, and future research and development. Focusing on these three areas can help the U.S. Army develop better operational forces with enhanced operational reach, decrease the effects of culmination, and the ability to sustain a tempo required to achieve objectives.

The linkages between distribution systems cover a large body of knowledge and area of execution. The present operating practices of the U.S. logistics systems break down into three main parts: the industrial base, elements operating under the Theater Sustainment Command, and tactical sustainment units operating under the maneuver commander. The actions by the AEF at St. Mihiel and Meuse Argonne demonstrate how each of these three parts effects operational art on the battlefield. The overall theater strategy and employment of the AEF was constrained by the capabilities of the U.S. industrial base at entry into the war. This effected how Pershing interacted with Allied leaders to employ the AEF and support it. The Service of Supply as the theater sustainment element enabled every action taken by the AEF in France and was significant in mitigating shortfalls of the industrial base. The tactical logistics actions of the 1st Army are comparative in function to today's tactical logisticians in U.S. Army BCTs. The seams between these levels are as critical today as they were in 1918.

Modern logisticians and operation maneuver planners must manage the seams between modern distribution networks to avoid the same kind of frictions experienced by the AEF. This management of the seams is the justification for modern concepts like total asset visibility and just in time logistics. These systems if used properly provide the force the ability to see problems

and overcome the challenges in getting munitions to the warfighter at the correct time in space while putting the minimal amount on the ground and providing the commander flexibility. These concepts have similarities to the AEF's distribution network as described in figure 2. The "pneumatic buffer" at the regulating station is representative of how the AEF attempted to provide flexibility and insurance to the operating force.

The seam between the tactical executers and the theater is the area where the AEF experienced the most friction. In today's Army that seam is between the BCT and the Theater Sustainment Command through the Sustainment Brigade and Brigade Support Battalion. In the receiving half of that seam is the BSB. This is where the logistics coordination efforts of the Sustainment Brigade and Brigade Support Battalions are most critical. In terms of the AEF, this seam was between the railhead and the division trains. With the railhead being similar to the Sustainment Brigade as the end of the theater supply system and the BSB being similar to the division trains of WW I. The AEF did not adequately resource corps and division trains with truck transportation to fulfill munitions distribution requirements. As the Army reviews BCT tactical truck requirements it is critically important that the U.S. Army resources its BSB's either organically or by task organization to ensure the seam between the Sustainment Brigade and BCT does not look like the seam between the railheads of the AEF and the divisional artillery.

The seams between distribution systems also require the attention of both logistics and maneuver operational planners. The considerations for the maneuver of logistics support must be coordinated into the operation and integrated across warfighting functions. The requirement for specific considerations and instructions in the plan is shown by the correlation between the instructions regarding the ability to move supplies and forces and munitions problems reported by commanders. As the AEF's planning and orders process matured more specific instruction and considerations were given to road construction, traffic control, and munitions issue.

The need for the operational pause to allow the Army to extend its lines of communications and enhance its operational reach is also a consideration for operational planners. As the U.S. Army moves out of a decade of fighting from static locations during the conflicts of the early 21st century the institutional knowledge needed understand the mobility limitations found during maneuver warfare have decreased. The historical experiences of the AEF can provide a reference point for how and where large American armies have used operational pauses to extend operational reach. The pause between the first and second Meuse Argonne operations exemplifies such a pause.

Planners also need to consider the capabilities of units to move ammunition in a maneuver centric operation. Planners must not assume that the BSB has the organic capability to distribute the required ammunition to BCT units to accomplish the tactical tasks given to artillery and maneuver elements. As the situations faced by the 79th and 35th divisions illustrate, the ability of a tactical unit to link to the theater logistics system to accomplish operational objectives must be considered during the planning stages. If short falls exist in capabilities, they must be mitigated by shifting resources or, as Colonel Marshall noted, the approach must be changed.

The final area for consideration is future research and developments that would enhance the operational reach, phasing, tempo and culminating qualities of U.S. Army operational formations. There have been many significant developments in aids to transportation since WWI. The 20' container and roll out flat rack are two of the more significant advances in munitions resupply. This development eliminated the need for trans loading and excess cargo handling that the AEF experienced at its theater depots and railheads. Further developments in munitions shipping could give the Army an enhanced ability to execute operational art.

When thinking of munitions shipment it is worthy to note that the main munitions used today have changed little in size and weight since WWI. Current artillery systems fire both 75mm and 155mm rounds of nearly the same shipping size and weight as those procured from the

French by the AEF in 1917-1918. The same three tons of ammunition carried on a Liberty truck has been unchanged since 1918. The main developments have focused on the ability to ship ammunition. Future developments in weapons systems should consider the ammunition footprint required. Reducing the ammunition footprint would enhance the Army's ability to execute operational art.

This study has shown the linkage between elements of operational art and the supply and distribution of munitions across the operating environment. The linkage demonstrated between munitions and operational art should serve as a guide to operational logistics planners where they may have the most influence on the potential outcome of an operation. Operational logistics planners can do this best by ensuring the concept of support enhances the ability of the deployed force to practice operational art. The examples in this case study illustrate that potential problems can arise from a lack of synchronization with other warfighting functions and between seams in the logistics structure, often between the theater distribution systems and the tactical executors. This is where the science of logistics can improve operational art.

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