AMERICAN ARTILLERISTS AND FRENCH CANNONS: FAILURE OF THE U.S. DEFENSE INDUSTRIAL BASE BEFORE WORLD WAR I

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Entry into the Great War exposed inadequacies in the ability of the U.S. to organize, train, and equip its military. These inadequacies resulted in acute shortfalls for the U.S. Field Artillery. As a result, the AEF depended primarily on the French for artillery matériel and training. This support was vital due to the decisive role of artillery in the war's firepower-centric tactics. Discovering what hindered the preparation of the U.S. Field Artillery requires investigating the effects of the country's national interest, the War Department's priorities, and the relationship between the War Department and private industry. Understanding how these factors hindered the development of the U.S. Field Artillery before the Great War will not prepare the U.S. for its next conflict. However, this knowledge enables modern artillerists to ask the right questions while preparing the U.S. Field Artillery for future conflict.

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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

AMERICAN ARTILLERISTS AND FRENCH CANNONS: FAILURE OF THE U.S. DEFENSE INDUSTRIAL BASE IN WWI, by MAJ Daniel C. Cummings, 123 pages.

Entry into the Great War exposed inadequacies in the ability of the U.S. to organize, train, and equip its military. These inadequacies resulted in acute shortfalls for the U.S. Field Artillery. As a result, the AEF depended primarily on the French for artillery matériel and training. This support was vital due to the decisive role of artillery in the war's firepower-centric tactics. Discovering what hindered the preparation of the U.S. Field Artillery requires investigating the effects of the country's national interest, the War Department's priorities, and the relationship between the War Department and private industry. Understanding how these factors hindered the development of the U.S. Field Artillery before the Great War will not prepare the U.S. for its next conflict. However, this knowledge enables modern artillerists to ask the right questions while preparing the U.S. Field Artillery for future conflict.

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ACRONYMS

A2/AD	Anti-Access, Area-Denial
AEF	American Expeditionary Force
CND	Council of National Defense
DOD	Department of Defense
LRPF	Long-Range Precision Fires
NDA	National Defense Act

CHAPTER 1

INTRODUCTION

The Field Artillery branch of the U.S. Army faced multiple challenges in the fifty years between the American Civil War and World War I. For much of this period, U.S. Field Artillery capabilities did not deliver effects against the country's primary threats. As a result, the branch toiled in obscurity as one of the War Department's lowest priorities. This low prioritization hindered the development of both the U.S. Field Artillery and its supporting defense industrial base. These challenges contributed to the failure of the United States to equip its military with domestically produced field artillery matériel required for the firepower-centric realities of World War I.

From the end of the American Civil War through the early 1890s, U.S. national interests included reuniting the country and securing the western frontier. The country's primary threats included invasion by a European power and raids against settlers by Native American adversaries on the frontier. Since neither of these threats posed an immediate danger to the country, Congress downsized the U.S. Army. Economic depressions caused additional reductions in defense spending, forcing the War Department to limit modernization efforts as it struggled to maintain readiness. A surplus of cannons from the American Civil War, deemed adequate for its needs, further curtailed investment in the U.S. Field Artillery.

After the frontier closed, the United States harnessed its vast resources and became the leading industrial power. The United States leveraged its increasing economic power to pursue interests beyond its borders. An interventionist foreign policy in the Western Hemisphere increased the probability of great power conflict, culminating in the

Spanish-American War. Victory over the exhausted Spanish forces established the United States as an imperial power, requiring a larger and more capable army for securing its interests. While developing a strong navy and seacoast fortifications remained top priorities for Congress, the War Department secured sufficient funding for modernizing its field artillery arm.

While European countries seemed perpetually on the brink of war, the United States preserved its sense of security given its geography and lack of regional threats. Therefore, while European governments grew their military forces, movements for conducting similar military expansion in the United States met stiff resistance. Once the Great War began, the United States attempted to remain neutral and maximize its profits through commerce with all belligerents. As a result, the United States limited its war preparations, such as increasing the U.S. Army's end strength and modernizing the National Guard. However, these reforms were mostly hypothetical, as the United States did not begin mobilizing its economy for mass-producing key capabilities, such as field artillery matériel. The United States feared that outright mobilization would cause a war declaration from Germany.

Throughout the war, the United States struggled to equip the American Expeditionary Force (AEF) with domestically produced field artillery matériel. Initially, the United States supplied the AEF field artillery arm with field pieces purchased from France and Great Britain. While intended as a temporary measure, the failure to establish a domestic cannon production program forced this procedure to remain active for the duration of the war.

Purpose

This study aims to add to the existing body of knowledge regarding the development of the U.S. Field Artillery before World War I. The body of knowledge for this topic includes an extensive research of the U.S. Field Artillery's matériel, comparisons to its European counterparts, and its reliance on French training and equipment during the Great War. An opportunity exists to explore how relationships between U.S. national interests, War Department prioritization, and the defense industrial base affected the U.S. Field Artillery's development between the American Civil War and World War I.

The U.S. Field Artillery's development in this era provides relevant lessons for modern members of the military-industrial complex. Analyzing this era equips modern leaders with the ability to ask the right questions as the U.S. Army transitions its focus to large-scale combat operations after decades of conducting counterinsurgencies in Iraq and Afghanistan. This thesis seeks to provide modern artillerists with a different frame of reference for viewing the current operational environment and future threats. The U.S. Field Artillery cannot be unprepared for the next conflict.

Literature Review

The existing body of knowledge provides a thorough examination of the history of the U.S. Field Artillery. The Office of the Chief of Field Artillery did not exist until 1918, which marked the first submission of the *Report of the Chief of Field Artillery* within the War Department's annual report.[1] As a result, the branch's history was

[1] Janice E. McKenney, *The Organizational History of Field Artillery 1775-2003* (Washington, DC: Center of Military History, United States Army, 2007), 101; William

primarily captured by the Ordnance Department in the *Annual Reports of the Chief of Ordnance to the Secretary of War*. Also, congressional reports such as the Secretary of War's *Annual Report*, the 1883 *Report of the Gun Foundry Board*, and the 1885 *Report on Fortifications or Other Defenses* indirectly describe the branch's development from the perspective of the War Department. In addition, Bernard Baruch's *American Industry in the War: A Report of the War Industries Board* discusses the challenges his board experienced while mobilizing the country's resources during the Great War.

Additional primary sources include memoirs and journals from the era. The seminal memoir from this era is General William Snow's *Signposts of Experience*. In his memoir, Snow describes the challenges he faced as the first Chief of Field Artillery during World War I, such as developing a domestic cannon program. Also, unit histories of field artillery units serving in the AEF complement Snow's memoirs and reports, including Richard M. Russell's *The 151st Field Artillery Brigade* and *A Brief History of the Activities of the 105th Field Artillery American Expeditionary Forces*. Also, Pershing's memoir, *General Pershing's Story of the American Army in France,* provides additional situational understanding regarding the U.S. Field Artillery's role within the AEF.

The Center of Military History provides excellent secondary source materials that deliver comprehensive overviews of the U.S. Field Artillery's history. Dr. Boyd Dastrup delivers a thorough account of the Field Artillery's evolution from the thirteenth century through the 1980s in *King of Battle: a Branch History of the U.S. Army's Field Artillery*.

J. Snow, *Signposts of Experience; World War Memoirs of Major General William J. Snow* (Washington DC: United States Field Artillery Association, 1941), 16.

In this source, Dr. Dastrup describes the evolution of the U.S. Field Artillery, its comparison to European powers, and relevant military history providing context for the reader. Another excellent secondary source is *The Organizational History of Field Artillery 1775-2003* by Janice McKenney. McKenney covers a lot of the same ground as Dastrup, with a different perspective through a narrower focus on the United States. These secondary sources offer excellent starting points for prospective historians by developing a broad understanding of the branch's past. In addition, *The Ordnance Department: Planning Munitions for War* by Constance McLaughlin Green, Harry C. Thomas, and Peter C. Roots provides historical context regarding the Ordnance Department's actions and its relationships with the U.S. defense industrial base.

Additional secondary sources include Frank Comparato's *Age of Great Guns*. Comparato's book describes the development of field artillery from gunpowder's invention through the development of the Field Artillery Digital Automatic Computer. Comparato provides detailed accounts on the development of European field artillery and the relationship between the U.S. Field Artillery and the Ordnance Department.

Secondary sources that provide general information of the U.S. Army during this era are Russell Weigley's *History of the United States Army* and Robert Utley's *Frontier Regulars: The United States Army the Indian, 1866-1890*. Weigley provides an excellent narrative that describes the relationship between the U.S. Army and the U.S. government, the factors affecting this relationship, the Congressional actions that shaped the U.S. Army, and how the U.S. Army responded to contemporaneous events. These descriptions provide an enhanced understanding of the operational environment and how this affected the prioritization of the U.S. Field Artillery within the War Department. Utley provides a

similar context within a narrower focus area, providing greater detail on how the challenges of deploying field artillery in the Indian Wars degraded the prestige of the branch.

CHAPTER 2

THE AFTERMATH OF THE AMERICAN CIVIL WAR: 1865-1890

Understanding the failure of the United States to provide the AEF with domestically manufactured field artillery pieces requires consideration of relevant historical context. Following the American Civil War, the Army performed Reconstruction and frontier missions while clashing with Congress over insufficient appropriations for manning the force and investing in new technology. The War Department's limited budget created a significant challenge for the Ordnance Department in developing matériel for the force. As a result, the Ordnance Department attempted to maximize its finite resources for the field artillery arm by conducting incremental improvements to legacy systems while mimicking the developments of Europe's "cannon kings." As the western frontier closed, the United States capitalized on its growing industrial base and began modernizing its military to protect against invasion from foreign powers. During this transition, the U.S. Field Artillery struggled to maintain relevance within the War Department while the Coast Artillery received prioritization for modernization efforts.

The Army's Dual Missions: Reconstruction and Frontier Duty

After seizing Confederate territory during the American Civil War, the Regular Army transitioned into stability operations to reestablish civil security and civil control in the South. Upon the cessation of hostilities between the Union and Confederacy, the Regular Army's presence in the South served as the basis for the U.S. government's Reconstruction effort. Conflict between a Congressional majority and President Johnson

over the Regular Army's role resulted in the Third Reconstruction Act, which effectively divided the Regular Army into two distinct entities: the "Congressional Army" enforcing Reconstruction policies in the South and the "Conventional Army." The "Congressional Army" operated until Congress ceased its funding in 1877.[2]

While the "Congressional Army" served the Reconstruction effort in the southern states, the "Conventional Army" (referred to as the Regular Army) served the nation's interests along the western frontier. Before the American Civil War, U.S. policy encouraged expansion throughout the western territories by passing two laws in 1862, the Homestead Act and the Pacific Railroad Act. These acts provided citizens with a legal mechanism for obtaining property in the West and the infrastructure for migrating in great numbers. Also, the defeat of the majority of Native American resistance before the American Civil War facilitated the settlement of the frontier. The Regular Army served to protect American settlers and defeat the remaining Native American adversarial forces in the West.[3]

The challenges experienced by the Regular Army included limited manning, limited funding, and the employment of unconventional warfare tactics by Native American adversaries. Employment of the Regular Army in the West consisted of occupying approximately two hundred posts across the frontier. The number of available forces for manning these posts decreased significantly, as the Regular Army's personnel

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[2] Russell F Weigley, *History of the United States Army* (New York, NY: Macmillan Publishing Co., Inc., 1967), 256-262.

[3] Robert M. Utley, *Frontier Regulars: The United States Army and the Indian 1866-1891* (New York, NY: Macmillan Publishing Co., Inc., 1973), 2-5.

end strength reduced from 37,313 in 1869 to 27,000 in 1874. Though the Regular Army experienced reductions in available forces, the mission requirements remain unchanged. As a result, the Regular Army's readiness deteriorated as commanders could spare no Soldiers for training while conducting all their assigned tasks.[4]

Multiple factors provided the impetus for Congress's lack of support and funding for the Regular Army in this era. The foremost concern among Congress members was the cost of a large standing army. Beginning with the "Panic of 1873," members of Congress navigated the "Long Depression," which lasted throughout the decade.[5] One Congressman, New York's Fernando Wood, argued that "the Army is too large. The cost of it is greater than the country can bear, with all our other burdens."[6] Wood displayed his distaste for the military and desire for smaller government by arguing for the dismantling of the War Department altogether and shifting its peacetime duties to the Department of the Interior. The ability of both combatants to mobilize forces in the American Civil War provided Wood with proof that local militias provided sufficient defense capability in times of peace. Also, Wood declared that the need for garrisoning Soldiers in the Southern States had elapsed.[7] Wood's final point echoed a widespread sentiment among other Congress members who condemned the employment of the

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[4] Utley, *Frontier Regulars*, 15-16.

[5] Ibid., 22.

[6] US Congress, House, *Congressional Record,* 44th Cong., 2d sess., 1876, https://www.govinfo.gov/content/pkg/GPO-CRECB-1876-pt4-v4/pdf/GPO-CRECB-1876-pt4-v4-31-1.pdf., 3780.

[7] Ibid.

Regular Army in this era. Accusations against both Presidents Ulysses S. Grant and Rutherford B. Hayes alleged that the executives abused their power by deploying the Regular Army to enforce unpopular Reconstruction policies, oversee elections, and resolve labor disputes. Congressman James A. Garfield reinforced this sentiment by stating that "the employment of the army in a service so closely related to political action produced not a little prejudice against the entire military institution."[8]

Another factor that deteriorated Congressional support for the Regular Army was the negative perception of its treatment of Native Americans. The primary reason for this perception was the Sand Creek Massacre that occurred on November 29, 1864, and the Battle of Washita River on November 27, 1868. Although this massacre merits detestation, the antagonistic party consisted of Colorado Volunteers, not the Regular Army. Nevertheless, this deplorable incident resulted in deserving scrutiny from Congress, as Senator James R. Doolittle initiated the Joint Special Committee on Conditions of Indian Tribes. Doolittle's committee determined that "the indiscriminate slaughter of men, women, and children has frequently occurred in the history of the Indian wars" and noted that military forces contributed to the "war of extermination."[9] This report reflected the growing influence of the peace movement in the East, though settlers in the West rebuked the military for not being sufficiently aggressive in defending their interests.[10]

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[8] Utley, *Frontier Regulars,* 60, 64.

[9] US Congress, Joint Special Committee Appointed Under Joint Resolution of March 3, 1865, Report, *Condition of the Indian Tribes*, 1867, 1-7.

[10] Utley, *Frontier Regulars*, 111.

By 1890, the U.S. policies encouraging its citizens to settle the western frontier appeared successful, as the superintendent of the U.S. Census declared that the frontier line no longer existed.[11] During this era, the U.S. Army felt the strain of conducting two distinct missions that required proficiency in areas beyond its core competencies: serving as an occupying police force in the South and conducting counterinsurgency operations in the West. The presence of economic depression and backlash against the use of force against Native Americans escalated tension between the U.S. Army and Congress members. As a result, the War Department struggled to convince members of Congress to authorize appropriations to maintain its size, sustain its readiness, and invest in new technology.

The U.S. Field Artillery experienced acute suffering during this period since it did not provide relevant capabilities for the U.S. Army's unconventional missions. Instead, artillerists found employment as dismounted infantry and struggled to find collective training opportunities to maintain their core competencies. Also, since the U.S. Army did not face an immediate threat requiring an upgrade to its field artillery matériel, the Ordnance Department could not justify budgeting its limited funds on manufacturing improvements to its existing equipment.

Emerging Threats: Modernizing the Navy and Seacoast Fortifications

While the United States was completing Reconstruction and consolidating its gains on the frontier, invasion from a foreign power loomed as the greatest threat to

[11] Digital History, "Closing the American Frontier," last modified 2019, accessed November 6, 2020, https://www.digitalhistory.uh.edu/disp_textbook.cfm?smtid=2.

national security. This threat grew from the increasing enforcement of the Monroe Doctrine in the Western Hemisphere by U.S. diplomats and the unilateral pursuit of U.S. national interests. As a result, the potential for conflict with European powers increased, especially with Spain or Great Britain. The possibility of conflict with a foreign power renewed Congressional investment in its seacoast fortifications and naval fleet.

The Monroe Doctrine originally served the American interest of preventing European conquest and expansion into the Western Hemisphere. By 1869, American diplomats expanded the application of this doctrine by degrading the legitimacy of European colonial claims in the Western Hemisphere and encouraging the independence of these colonies.[12] In a message to Congress on December 6, President Grant declared his support for Cuba in its hostility with Spain "in due time Spain and other European Powers will find their interest in terminating those relations, and establishing their present dependencies as independent Powers . . . when the present relation of colonies ceases they are to become independent Powers."[13] President Grant also addressed the seizure of American ships by the Spanish government in international waters, noting that diplomatic actions prevented further aggression between the two countries.[14] Expanding the Monroe Doctrine's utilization placed the national interests of the United States in

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[12] Dexter Perkins, *The Monroe Doctrine, 1867-1907* (Baltimore, MD: The Johns Hopkins Press, 1937), 2-5; the initial delivery of Monroe's message occurred on December 2, 1823.

[13] US Congress, House, Report of the Secretary of War, 41st Cong., 2d sess., 1869, H. Doc. 1, pt. 2., 11.

[14] Ibid, 11-12. The ships involved in this incident were the *Lizzie Major* and the *Mary Lowell*.

conflict with the interests of European powers, increasing the risk for incidents such as the seizure of American ships to escalate into armed conflict.

Disputes over American fishing rights in Canadian waters provided the possibility of British invasion.[15] In 1871, the Treaty of Washington expanded American rights and allowed the import of Canadian fish into American ports free of duty until the treaty's expiration in 1885. Failed negotiations increased tensions between all parties, which climaxed when Canada seized American fishing vessels in 1886. Further escalation ceased when the nations arrived at a diplomatic solution the following year.[16] Though the United States avoided war with Great Britain, the escalation over fishing rights remained a severe concern for Congress members due to the threat posed by the British navy along with inadequate measures for deterring British aggression.

The development of an interoceanic canal through the Central American isthmus provided another friction point between the United States and Great Britain. Before the American Civil War, the United States established the Clayton-Bulwer Treaty of 1850 with Great Britain. This treaty aimed to ensure that neither nation would exclusively control or gain a relative advantage over the other while utilizing the canal for

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[15] Library of Congress, "Fisheries, Boundaries, and Restoration of Slaves of October 20, 1818," accessed November 23, 2020, https://www.loc.gov/law/help/us-treaties/bevans/b-gb-ust000012-0057.pdf; Article I of the Treaty of 1818 provided American fisherman with rights to fish along the coast of Newfoundland and Labrador, as well as privileges to enter bays and harbors for shelter and repairing their ships.

[16] Davis R Dewey, "National Problems," in *The American Nation: A History from Original Sources,* ed. Albert Bushnell Hart (New York, NY: Harper & Brothers Publishers, 1907), 112-116, https://babel.hathitrust.org/cgi/pt?id=wu.89058346867&view=1up&seq=20.

commercial purposes upon constructing a canal.[17] In 1877, Secretary of State Hamilton Fish advanced a course of action for private businesses to construct the interoceanic canal through Nicaragua. While the United States acted unilaterally regarding the formation of the interoceanic canal, Fish's treaty remained within the spirit of the Clayton-Bulwer Treaty by ensuring the neutrality of the canal.[18] However, President Hayes sharply departed from the rhetoric of the Clayton-Bulwer treaty on March 8, 1880, when he stated:

> An interoceanic canal across the American Isthmus will essentially change the geographical relations between the Atlantic and Pacific coasts of the United States and between the United States and the rest of the world. It would be the great ocean thoroughfare between our Atlantic and our Pacific shores, and virtually a part of the coast line of the United States. Our merely commercial interest in it is greater than that of all other countries, while its relations to our power and prosperity as a nation, to our means of defense, our unity, peace, and safety, are matters of paramount concern to the people of the United States… I repeat, in conclusion, that it is the right and the duty of the United States to assert and maintain such supervision and authority over any interoceanic canal across the isthmus that connects North and South America as will protect our national interests.[19]

President Hayes' rhetoric further increased the difficulty maintaining positive relations between the United States and Great Britain. This tension, combined with

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[17] John M. Clayton and Henry L. Bulwer, "Convention between the United States of America and Her Britannic Majesty; April 19, 1850," The Avalon Project, Yale University, n.d., accessed November 23, 2020, https://web.archive.org/web/20060829131945/http://www.yale.edu/lawweb/avalon/diplomacy/britain/br1850.htm.

[18] Perkins, *The Monroe Doctrine, 1867-1907,* 69.

[19] Rutherford B. Hayes, "March 8, 1880: Message Regarding Central American Canal," Miller Center, last modified February 23, 2017, https://millercenter.org/the-presidency/presidential-speeches/march-8-1880-message-regarding-central-american-canal.

additional friction from Spain, proved troubling for Congress members. As a result, Congress approved appropriations for modernizing its navy and coast defenses.

In 1881, the Secretary of the Navy, William H. Hunt, established the Naval Advisory Board to discuss the best course of action for improving the capabilities of the U.S. Navy. Secretary Hunt convinced the Naval Committee of the House of Representatives to recommend the construction of four ships, the USS Atlanta, Boston, Chicago, and Dolphin. The construction of the "ABCD" ships and marked the beginning of a new era for the navy.[20] The successful proposal of the Naval Advisory Board resulted in the appropriation of funds in 1883 to increase the size of the U.S. Navy and construct the ships recommended by the Naval Advisory Board.[21] The substantial cost for the ABCD ships, authorized during a time of peace, affirmed that Congress members viewed the threat of invasion from a foreign power as a legitimate threat. This increase in spending did not translate to the War Department or its field artillery arm, reflecting the perception that its equipment did not provide adequate capability against the nation's primary threats.

The nation's coast defense also received increased appropriations from Congress. Following the American Civil War, the seacoast defense system required significant transformation to serve as a viable deterrent to potential adversaries. The last significant upgrade for the seacoast defense system, known as the "Third System," occurred in the

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[20] Global Security, "ABCD - The New Navy," accessed November 25, 2020, https://www.globalsecurity.org/military/systems/ship/abcd.htm.

[21] An Act Making Appropriations for the Naval Service for the Fiscal Year ending June 13, 1884, and for Other Purposes, 47th Cong., 2d sess., (March 3, 1883), ch. 97, 472-477.

1820s.[22] As the War Department shifted into its Reconstruction and frontier missions, Brigadier General Alexander B. Dyer prioritized the Ordnance Department's efforts for developing the coast artillery.[23] This effort received popular support among Americans as for deterring potential invaders without the cost or threat to civil liberties associated with a large standing army. However, the popular support for modernizing the "Third System" of seacoast defense did not result in immunity from the systemic reduction of Congressional appropriations accompanying the Panic of 1873. While the seacoast defense improved, the lack of appropriations rendered the effort incomplete.[24] The Coast Artillery also suffered from a lack of training ammunition and reassignment of its personnel to serve as infantrymen to perform more pressing needs within the War Department.[25]

The seacoast defense system became reinvigorated upon the order of President Grover Cleveland to "examine and report at what ports fortifications or other defenses are most urgently required, the character and kind of defenses best adapted for each."[26]

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[22] William C. Gaines and Bolling W. Smith, *American Seacoast Defenses: A Reference Guide*, ed. Mark A. Berhow (McLean, VA: Coast Defense Study Group Press, 2015), 424-426.; construction of the "First System" occurred in the 1790s, the "Second System" was built in advance of the War of 1812.

[23] Boyd L. Dastrup, *King of Battle: a Branch History of the U.S. Army's Field Artillery* (Fort Monroe, VA: Office of the Command Historian, U.S. Army Training and Doctrine Command and Center of Military History, 1992), 126; Brigadier General Alexander B. Dyer served as the Chief of Ordnance from 1864-1874.

[24] McKenney, *The Organizational History of Field Artillery 1775-2003*, 77-78.

[25] Gaines and Smith, *American Seacoast Defenses*, 425.

[26] Department of War, *Report of the Board on Fortifications or Other Defenses appointed by the President of the United States under the Provisions of the Act of*

President Cleveland tasked the Secretary of War, William C. Endicott, to lead the Board on Fortifications or Other Defenses and provide recommendations on the optimal manner to modernize seacoast defenses. The findings included in this report, which became known as the "Endicott Board," provided a comprehensive list of improvements for providing U.S. ports with sufficient defensive capability.[27]

The Endicott Board also endorsed the selection of steel material instead of cast iron to construct cannons for seacoast fortifications. Previously, the material of choice for the construction of American cannons was cast iron due to its cheap cost and high availability. However, the board illustrated the ubiquitous employment of steel among European powers, explicitly highlighting Mr. Friedrich Krupp's steel rifles as the model for future American coast artillery cannons to adopt.[28] Despite his prerogative for strengthening cast iron cannons, the Chief of Ordnance, Brigadier General Stephen Benét, admitted that "there is little doubt that steel is the best material for guns" due to "the enormous strains which, as rifles, they are to withstand."[29]

The board urged Congress to appropriate funds for the construction of government foundries due to the lack of domestic capability for manufacturing the large steel cannons essential for modern seacoast defense:

Congress Approved March 3, 1885 (Washington, DC: Government Printing Office, 1886), 3.

[27] Department of War, *Report of the Board on Fortifications or Other Defenses,* 3-11, 28. The board's recommendations included armor for the fortifications, guns and mortars, carriages, floating batteries, submarine mines, and torpedo boats.

[28] Ibid., 11.

[29] "American Ordnance," *The Engineer* 39 (January 8, 1875), 40 Google eBook.

> After a careful study of the extensive plant required for the production of steel-gun forgings and armor-plates of sizes, thicknesses, and qualities suitable for such manufacture, and after an inspection of our principal works and foundries, the conclusion forced upon the Board that the necessary facilities for the production of large masses of steel, and the machines for fashioning this metal into guns and armor, are not now to be found in this country.[30]

Another option available for Congress's discretion was ordering the large cannons from European manufacturers, but this option placed the nation's security at the mercy of foreign businesses who could cease importing the cannons at their discretion. Instead, the board promulgated the findings from the Gun Foundry Board of 1884, endorsing the creation of one government foundry each for the Army and Navy.[31]

The Endicott Board indirectly improved the U.S. Field Artillery. Improvements in coast artillery matériel did not immediately translate to corresponding upgrades for the U.S. Field Artillery. However, the research and development for coast artillery matériel would eventually "trickle down" to the field artillery arm.

Rise and Fall: U.S. Defense Industrial Base Parity with Europe

The War Department's organization and relationships with private manufacturers contributed to its loss of parity with its European counterparts after the American Civil War. The War Department's acquisition and development process for field artillery matériel excluded field artillery officers and private manufacturers while giving complete control of the process to the Ordnance Department. The exclusion of private

[30] Department of War, *Report of the Board on Fortifications or Other Defenses,* 26.

[31] Ibid., 25-27.

manufacturers reduced the size of the defense industrial base, as existing companies shut down and potential investors turned to other ventures.

The Ordnance Corps initially consisted of field artillery officers serving an additional duty under the commanding artillery officer of the Army. In 1832, the War Department split the Ordnance and Corps Artillery due to successful lobbying from ordnance officers claiming their duties exceeded the capability of artillerists. Artillerists opposed this split, fearing a separate Ordnance Department would exclude their interests.[32]

The Ordnance Department's approach to acquisition of materials was that the technicians contain the greatest expertise on the War Department's needs and will therefore select the materials that they deemed best.[33] The other branches had little opportunity to influence this process until the 1920s.[34] While this served as a satisfactory model in past conflicts, the increasing size and complexity of modern weapons required larger and more specialized tools, as well as more complicated fabrication processes. Due to their exclusion by the Ordnance Department, private manufacturers stopped investing

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[32] Constance McLaughlin Green, Harry C. Thomas, and Peter C. Roots, *The Ordnance Department: Planning Munitions for War* (Washington, DC: Center of Military History, 1990), 14-16. The Ordnance Department initially separated from the Corps of Artillery in 1812. After the War of 1812, Secretary of War John C. Calhoun attempted to protect the Ordnance Department from downsizing by identifying its importance to its future security, but Congress re-merged the two branches to save costs.

[33] Frank E. Comparato, *Age of Great Guns* (Harrisburg, PA: The Stackpole Company, 1965), 220.

[34] Green, Thomas, and Roots, *The Ordnance Department*, 22. The Secretary of War had the power to convene boards regarding the best matériel for the War Department to manufacture, but this power was only exercised periodically.

in these tools. This system could produce suitable matériel in small quantities, but the U.S. defense industrial base's ability to mass-produce war matériel continued to diminish.

In the 1840s, the Ordnance Department dispatched officers to study the European armament industry and adopt the best practices for its operations. As a result, the United States temporarily gained parity with European powers regarding the manufacture of field artillery matériel. This parity level eroded over the next forty years as the Ordnance Department's priorities shifted towards developing small arms following the conclusion of the American Civil War.[35]

After the war, lack of funding and poor relationships between the Ordnance Department and private manufacturers contributed to the American armament industry's stagnation. Before the war, the U.S. government operated six federal foundries under the direction of the Ordnance Department. However, private foundries manufactured nearly all field artillery matériel during the war. As a result, Congressional members believed that private foundries could meet the country's needs in any future conflict and did not appropriate funding for maintaining federal foundries for cannons.[36]

As the Army experienced downsizing, the field artillery arm possessed an excess of cannons relative to its size and post-war missions. Subsequently, both Congress and the War Department did not assess the need for investing in emerging cannon technologies from European inventors such as the breechloader. Instead, the Ordnance Department conducted incremental improvements on its legacy stock of smoothbore

[35] Green, Thomas, and Roots, *The Ordnance Department*, 17-19.

[36] Ibid., 205. Private foundries manufactured 7,892 cannons during the war.

muzzleloader cannons. The purchase of the Hotchkiss 1.65-inch mountain gun served as an exception for the Ordnance Department's acquisition process, as this breechloading, rifled gun was produced by a private manufacturer.[37]

Another legacy of the American Civil War was the development of friction between the Ordnance Department and private industry. During this period, American manufacturers observed the success of European "cannon kings," (such as Krupp and Armstrong) and hoped to parlay successful production during the war into profitable partnerships with the U.S. government. When lucrative government contracts failed to emerge, a few hopeful civilians formed a cabal and attacked the Ordnance Department. Mr. Horatio Ames and Mr. Clifford Arrick led this cabal, resulting in a Congressional investigation into allegations of corruption by the Chief of Ordnance, General Alexander B. Dyer. The "Select Committee on Ordnance" findings included a description of the Ordnance Department as a group of "pretentious innovators" who gave little regard for civilian inventors but could not substantiate Ames and Arrick's allegations. As a result, both Congress and the Ordnance Department developed distrust towards private contractors, which persisted for decades.[38]

In 1872, Congress appointed a board to examine the best course of action for maintaining parity with European advancements displayed in the Franco-Prussian War.[39] The board initiated an open competition between the Ordnance Department and private

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[37] Dastrup, *King of Battle*, 125, 132.

[38] Comparato, *Age of Great Guns*, 201-202; the "Select Committee on Ordnance" concluded in 1867.

[39] McKenney, *The Organizational History of Field Artillery 1775-2003*, 78-79.

contractors to test muzzleloaders, breechloaders, and rifled cannons. While allowed to enter the competition, private contractors faced exclusionary entry requirements, which served as a discriminatory barrier against private industry. For example, the government did not provide remuneration to private contractors to cover the cost of building prototypes, despite funding the prototypes from the Ordnance Department. Another barrier faced by private contractors was the requirement to allow an officer from the Ordnance Department to supervise the construction of their prototypes. The private contractors eventually withdrew from the competition due to their lack of private funding and no guarantees that the government would adopt their prototypes, which became problematic since the competition lasted six years.[40] After the competition, the board selected an Ordnance Department prototype known as the "Krupp breechloader" in 1878.[41] The selection of the Krupp sliding steel breech block displayed that while private contractors could influence the design of war matériel, the Ordnance Department only integrated outside innovations if they could co-opt the developments into their designs.

During the 1872 board, Benét determined that steel was the best material for constructing cannons. Benét exploited the success of the 1872 board by successfully lobbying Congress for additional appropriations to continue modernizing the field artillery arm. As a result, Congress authorized another board in 1881, known as the

[40] Comparato, *Age of Great Guns*, 205-207.

[41] Dastrup, *King of Battle*, 130.

"Light Artillery Board." The Light Artillery Board recommended the development of steel breechloaders, a radical improvement to existing field artillery matériel.[42]

To accomplish the Light Artillery Board's recommendations, the United States required collaboration with European arms manufacturers. The Ordnance Department needed to investigate foreign manufacturers to learn how to manufacture modern cannons due to the atrophy of the U.S. defense industrial base. The investigation effort, known as the "Gun Foundry Board," captured how England, France, Germany, and Russia manufactured their field artillery matériel and how their militaries collaborated with private manufacturers.

The English defense industrial base for artillery in 1884 was a joint system between government foundries and a single private company. Before 1859, all production of artillery matériel occurred in government foundries under the direction of an officer from the Royal Artillery. However, the English government's difficulty producing rifled guns resulted in an open competition among private manufacturers to innovate the best solution. William G. Armstrong's winning design led to a nearly exclusive partnership with government foundries. While the partnership between Armstrong and the English government achieved successful outcomes for manufacturing field artillery matériel, the board discovered that Armstrong's foundry charged higher prices than government foundries.[43]

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[42] Ibid., 130-131.

[43] US Congress, House, *Report of Gun Foundry Board Organized by the President, in accordance with Act of Congress, approved March 3, 1883*. 48th Cong., 1st sess., H. Doc. 97 (Washington DC: Government Printing Office, 1884), 8-10.

The French defense industrial base for artillery was a joint system between the government and multiple private foundries. Before the Franco-German War, only government foundries manufactured field artillery matériel under the direction of the Artillery Corps. However, the poor performance of French artillery in the war caused a change in this system. Unlike the English system, several private foundries in the post-war system prevented one company from exploiting the relationship and inflating costs. In the French system, the government pledged to provide participating foundries with sufficient funds for erecting specialized plants. This guarantee provided private foundries with the motivation and security to develop innovative manufacturing processes, such as the Open-Hearth Process in Siemens-type furnaces. These French innovations became the standard for manufacturing the casting of steel forgings.[44]

Unfortunately for the board, Krupp did not allow the American envoy to access his works in Germany. Therefore, the board could not determine if the German Artillery Corps had any input into the manufacture of field artillery matériel. The board determined that Krupp established a monopoly for manufacturing cannons for the German government through secondary sources. As a result, the German government became entirely dependent upon Krupp and could not restrict his sales to foreign governments.[45]

The English system served as the closest example for describing the Russian defense industrial base for artillery. The critical difference between the two systems is

[44] US Congress, House, *Report of Gun Foundry Board*, 22-30.

[45] Ibid., 34-35.

that the Russians became investors in its version of Armstrong's foundry, the Aboukhoff Steel Works. Consequently, the Russian government paid a premium for products from the Aboukhoff foundry compared to the cost of production from its government foundry. The Russian government's solution was to invest in the Aboukhoff foundry progressively until the government gained a controlling share of the foundry. A unique feature of the Russian system endorsed by the Board is the utilization of steel linings within the cannon tubes, which decreased the cost of retubing unserviceable cannons.[46]

The board concluded its investigation with an internal audit of the U.S. defense industrial base for artillery. Before steel became the prime metal for cannons, U.S. cast-iron pieces served as "the models for imitation and the standards for comparison of all nations. While the rest of the world has advanced with the progress of the age, artillery of the United States has made no step forward."[47] While the American industry was unable to manufacture steel forgings for cannons, the board provided assurances that the U.S. steel industry could achieve parity with European powers once its foundries constructed modern plants, pending sufficient appropriations from Congress. The board described this issue and recommended the following solution:

> At present the steel manufacturers of our country are not prepared to produce the material required for the larger calibers, and the important question arises, what means shall be adopted to induce them to study the subject and embark in the manufacture on a large scale. They cannot be expected to do this at a sacrifice of their own interests. This object can only be achieved by holding out a fair prospect of ultimate remuneration for the expenditures necessary to undertake the work, and this can only be done by the action of Congress . . . that a sum of money shall be fixed as a permanent yearly appropriation to be expended for this

[46] US Congress, House, *Report of Gun Foundry Board*, 35-38.

[47] Ibid., 39. The most famous U.S. field artillery manufacturers were Rear Admiral John A. Dahlgren and General Thomas J. Rodman.

> purpose, the amount to be assigned proportionally between the War and Navy Departments.[48]

The board further recommended adopting the French model to maximize Congress's investment in the U.S. defense industrial base for artillery due to its assessment that reliance on one private manufacturer placed the government at a disadvantage.[49]

In addition to a federal foundry and a system that included multiple private contractors, the United States required a cultural change in its approach to manufacturing artillery matériel to regain parity with European powers. An editorial in an issue of the *Army and Navy Journal* from 1878 described how private American contractors turned to European clients for their products:

> Professor Treadwell's system of gun construction, of 1840, is known as Armstrong's, of 1856, but no one has seen Armstrong's patent for it. Krupp has appropriated the Broadwell system bodily, and Eastman's slotted screw breech plug is known as the French breech-loading gun. The Russian government built a great foundry at Perm to carry out Rodman's design, and took his powder and experience along… Mr. Hotchkiss has gone to France and established a large factory near Paris, where he has very extensive orders, and had become, in his line, the main reliance of the French government.[50]

In 1884, Captain O. E. Michaelis cited this article to express his support for the Gun Foundry Board's recommendations. Michaelis provided a call to action for Congress to fund American private contractors. Also, Michaelis expressed his opinion that the American armament industry "has gone so far that we are in danger of becoming servile;

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[48] Ibid., 48.

[49] US Congress, House, *Report of Gun Foundry Board*, 47-48.

[50] "American Contributions to Modern Artillery," *Scientific American* 39, no. 23 (December 7, 1878), 353, Google eBook.

we shrink from carrying out purely American ideas, unless they have been examined and approved by sagacious foreigners."[51]

From the end of the American Civil War to the western frontier's closing, the U.S. defense industrial base for artillery experienced stagnation. A surplus of Civil War cannons and lack of urgency to develop modern field artillery matériel resulted in limited funding from Congress. The Light Artillery Board, Gun Foundry Board, and Endicott Board re-energized the U.S. defense industrial base for artillery as the United States took steps to regain parity with European powers. As the 1880s drew to a close, the United States began constructing a federal foundry for artillery and adopted steel as the material for its cannons.[52]

The U.S. Field Artillery's "Lost Years"

While the U.S. defense industrial base for artillery experienced stagnation between 1865 and 1890, the U.S. Field Artillery struggled to maintain relevancy within the War Department. During this period, limited training opportunities and employment as maneuver forces degraded the ability of artillerists to maintain proficiency in their craft. Also, field artillery doctrine remained consistent with its application in the American Civil War despite changes in combined arms maneuver doctrine.

One obstacle that degraded the readiness of the U.S. Field Artillery during this period is insufficient training opportunities. The War Department recognized the need for

[51] O. E. Michaelis, "The Heavy Gun Question," *American Society of Civil Engineers* 13 (July 1884): 215-236, 216.

[52] Comparato, *Age of Great Guns*, 210-212.

creating a system to analyze the needs of the artillery arm and provide recommendations. As a result, the Artillery Board was established in 1866 to fulfill this need and promulgate changes to capability, force, and matérial. While the intention for this board was to convene annually and deliberate on the developmental needs for the field artillery arm, the committee dissolved after its 1867 meeting and never met again. Despite a short lifespan, the Artillery Board managed to successfully lead lasting change by establishing the Artillery School of Practice at Fort Monroe, Virginia, in 1868.[53]

The following year, the War Department established an institutional training facility for its field artillery arm in Fort Riley, Kansas. Initially, the Secretary of War demonstrated commitment to the School of Instruction for Light Artillery by stationing four batteries to Fort Riley for training.[54] This allocation accounted for forty percent of the entire field artillery arm in 1869.[55] However, operational requirements disrupted the school's program of instruction. While constructing facilities on the post for basing its personnel and equipment, the school received orders to cease these efforts and deploy as

[53] McKenney, *The Organizational History of Field Artillery 1775-2003*, 76. This school served as an institutional training facility for heavy or seacoast artillery, remaining in service until 1907.

[54] US Congress, House, Report of the Secretary of War, 24.

[55] William E. Birkhimer, *Historical Sketch of the Organization, Administration, Materiel, and Tactics of the Artillery, United States Army* (Washington, DC: James J. Chapman, 1884), 72; the War Department possessed five artillery regiments. In each regiment, two batteries served as light (or field) artillery. The remaining forces served as seacoast artillery companies.

cavalry in support of the Department of the Missouri's operational needs.[56] Eventually, the School of Instruction permanently closed in 1871 and remained inactive until 1893.[57]

Artillerists attempted to compensate for the lack of institutional training opportunities through doctrine. Before the American Civil War, Brevet-Major Samuel B. Ringgold led efforts to modernize existing artillery doctrine, publishing instructions in 1845. These instructions assisted battery commanders in the Mexican-American War as they maneuvered their batteries aggressively and played a decisive role in the U.S. victory. However, as small arms matériel improved, these aggressive tactics became untenable. Revisions to artillery instructions in 1860 and 1862 reflected this reality, as the increasing range of small arms prevented batteries from maneuvering within close range of enemy infantry without sustaining massive casualties. As a result, the primary employment of artillery shifted from offensive to defensive operations.[58]

The next significant change to U.S. Field Artillery doctrine occurred in 1876. This modification occurred as part of an effort to assimilate cavalry and artillery doctrine within the framework of Emory Upton's 1867 *A New System of Infantry Tactics Double and Single Rank Adapted to American Topography and Improved Fire-Arms*. The updated doctrine provided little change to artillery tactics used in the American Civil War, corresponding to a lack of development in artillery matériel. Birkhimer describes the impact of the assimilated doctrine of 1876 on the field artillery arm:

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[56] US Congress, House, Report of the Secretary of War, 69.

[57] McKenney, *The Organizational History of Field Artillery 1775-2003*, 77.

[58] Birkhimer, *Historical Sketch of the Organization, Administration, Materiel, and Tactics of the Artillery, United States Army*, 307.

> It is taught that the safety of the pieces depends upon the advantage that is taken of accidents of the ground; that the increased range and effect of infantry fire has impaired the utility of guns at short ranges, and made cover more necessary than ever for the protection of batteries; that the latter can no longer move up within short range of troops and open fire with cannister—the use offensively of which is entirely ended; that artillery fire is apt to become inefficient at a greater range than 2,500 yards; that if a battery remains within 900 yards of the enemy's infantry the chances are, particularly if there be no cover, that it will be disabled.[59]

The insignificant role of field artillery on the frontier also contributed to its decreased importance within the War Department. For example, in 1878, General Wesley Merritt stated that "artillery cannot be used to advantage against Indians: should we therefore abandon artillery as an arm of service?"[60] Also, the extent of Lieutenant Colonel George A. Custer's use of field artillery was for guarding his camps; artillery did not accompany Custer during offensive operations.[61] General Nelson Miles' use of the Hotchkiss 1.65-inch mountain gun served as an exception, noting that he effectively integrated the mountain gun without hindering his cavalry.[62]

The observations of American officers abroad also provided mixed reviews on the importance of field artillery on European battlefields. One opinion from an anonymous observer of the Franco-Prussian War noted that the Prussian artillery provided a decisive advantage in Strasbourg. The observer noted that Prussian artillery:

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[59] Birkhimer, *Historical Sketch of the Organization, Administration, Materiel, and Tactics of the Artillery, United States Army*, 308-309.

[60] Wesley Merritt, "Arms and Equipment," *The Army and Navy Journal, and Gazette of the Regular and Volunteer Forces* 15, no. 39 (May 4, 1878): 628-629, 628.

[61] Dastrup, *King of Battle*, 124.

[62] Utley, *Frontier Regulars,* 75.

> Was bad in the Danish war, not good in the Austrian, and is good now, though the accounts of observers say it is not excellent. However that may be, it is better in every way than the French, and it has been seen in more than one battle both holding the enemy far beyond his own striking distance and soundly punishing him there.[63]

In addition, First Lieutenant Francis V. Greene provided observations on the Russian field artillery arm's performance in the Russo-Turkish War. Greene noted that during Russian attacks on fortified positions, the artillery achieved successful results while during artillery duels with the Turks. However, Russian preparation fires provided inadequate effects against fortifications due to the limited power of their projectiles. As a result, some Russian commanders decided to conduct their assaults without preparation fires and achieve their objectives through surprise and audacity, persevering through high casualty rates. Greene summarized that the Russian artillery, "with these few exceptions, it contributed to no victory and averted no defeat. It consumed several thousand tons of ammunition, transported with enormous difficulty and expense, it hammered away earthworks without producing any substantial result, and the total losses inflicted by it were probably a little over one percent."[64]

The U.S. Field Artillery experienced irrelevance between the American Civil War and the closing of the western frontier. While the seacoast artillery developed at Fort Monroe, continuous disruption at the School of Instruction for Light Artillery prevented organizational growth. Also, the artillery's lack of decisive contributions, both on the

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[63] "The Loss of the Captain," *The Army and Navy Journal, and Gazette of the Regular and Volunteer Forces* 8, no. 11 (October 29, 1870): 165-167, 165, Google eBook.

[64] Francis V. Greene, *The Russian Army and Its Campaigns in Turkey in 1877-1878* (London, UK: W. H. Allen & Co., 1880), 441-454.

frontier and in Europe, diminished the importance of the field artillery arm within the War Department.

After the American Civil War, U.S. Army readiness and modernization programs degraded while performing dual unconventional missions during periods of fiscal austerity. The belief that a combination of strong navy and seacoast fortifications provided suitable protection from foreign invasion limited the need to invest in the field artillery arm. Exclusionary research and development processes by the Ordnance Department exacerbated the dearth of appropriations, as domestic manufacturers either took their business to Europe or went out of business altogether. The parity gap between U.S. and European field artillery matériel grew to such an extent that the War Department sent investigators to Europe to learn the best practices for manufacturing modern cannons.

CHAPTER 3

AN EMERGING IMPERIAL POWER: 1890-1914

Constructing railroads, settling the frontier, and pacifying Native American adversaries enabled the United States to exploit its natural resources and become a leading industrial power. The United States capitalized on domestic peace and increased economic power by aggressively enforcing the Monroe Doctrine to support national interests. An interventionist application of the Monroe Doctrine increased the probability of war, yet the influence of pacifists and economic conservatives limited the growth of the U.S. military and its defense industrial base. In the aftermath of the Spanish-American War, the United States required more capability from the military to meet the demands of its new colonial empire. However, confidence in the security of the country degraded efforts to prepare the United States for future conflicts. The European powers, persistently on the brink of war, did not share this sense of security and actively prepared for conflict. Once the Great War began, every nation entered the conflict unprepared for the demands of the quantity and types of material required to fight a firepower-centric war to varying degrees. The division between the War Department and Congress on the direction of the U.S. military resulted in a lower state of readiness than other world powers. The lack of readiness impacted the U.S. Field Artillery severely, as the branch lacked a representative in the War Department or a mature defense industrial base for preparing the arm for the realities of the modern firepower-centric war.

Rise of Intervention and Imperialism

As the strength of the United States increased, its application of the Monroe Doctrine became more aggressive. Alfred Thayer Mahan's *The Influence of Sea Power upon History: 1660-1783* influenced U.S. leaders to project power throughout the Western Hemisphere and protect their commercial interests by building a stronger navy.[65] Mahan's theory fell on receptive ears in Congress, as Senator Shelby Cullom declared:

> Not a sail of American commerce enters the Gulf of Mexico except by the tacit consent of foreign powers . . . one thing, however, is manifest—that the United States must look after the United States. We are old enough and strong enough to stand alone, to walk alone, and to hold our ground against the nations of the earth.[66]

U.S. determination to increase its influence in the Western Hemisphere met resistance from the British. The British stoked resentment in the United States by temporarily seizing control of a Nicaraguan port and became mired in a territorial dispute with the Venezuelan government. In response, the Venezuelan government cited the

[65] Peter Paret and Philip A. Crowl, "Alfred Thayer Mahan: The Naval Historian," in *Makers of Modern Strategy: from Machiavelli to the Nuclear Age* (Princeton, NJ: Princeton University Press, 1986), 444-477, 451, 467. Published in 1890, Mahan posited that England achieved success as a world power by dominating the sea, enabling the English to pursue their national interests by controlling global commerce. Mahan argued that the U.S. needed to apply this paradigm to the Western Hemisphere to achieve similar success.

[66] US Congress, *Congressional Record: Containing the Proceedings and Debates of the Fifty-fourth Congress, First Session,* vol. 28, pt. 1 (Washington, DC: Government Printing Office, 1896), 112.

Monroe while seeking assistance from the United States to settle the matter in their favor.[67]

In response, Senator Henry Cabot Lodge castigated British actions and warned Congress that "there is nothing to prevent her taking the whole of Venezuela, or any other South American state. If Great Britain can do this with impunity, France and Germany will do it also."[68] Secretary of State Richard Olney reinforced Lodge's call to action by expressing that the United States possessed adequate strength and ability to assert its dominance over the Western Hemisphere, stating:

> To-day the United States is practically sovereign on this continent, and its fiat is law upon the subjects to which it confines its interposition. Why? . . . It is because, in addition to all other grounds, its infinite resources combined with its isolated position render it master of the situation and practically invulnerable against any or all other powers.[69]

The British bristled at Olney's assertion but acquiesced to U.S. demands during the Venezuelan crisis.[70] Despite the favorable outcome for U.S. national interests,

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[67] Perkins, *The Monroe Doctrine, 1867-1907*, 140-149. The British seized the Nicaraguan port of Corinto in 1895 to coerce the Nicaraguan government to pay an indemnity.

[68] John Bigelow, *American Policy: The Western Hemisphere in Its Relation to the Eastern* (New York, NY: Charles Scribner's Sons, 1914), 115 Google eBook. Lodge's contentious rhetoric likely recalled the French invasion of Mexico in 1862 during the American Civil War. The U.S. was not strong enough to deny the invasion of a bordering country in 1862, but leaders like Lodge felt that the U.S. was now strong enough to prevent European meddling in the affairs of countries in the Western Hemisphere.

[69] Department of State, *Papers Relating to the Foreign Relations of the United States, with the Annual Message of the President, Transmitted to Congress December 2, 1895,* part 1, (Washington, DC: Government Printing Office, 1895), 558.

[70] Perkins, *The Monroe Doctrine, 1867-1907*, 224. The U.S. served as mediator and ruled in favor of the Venezuelan government's claims.

historian Dexter Perkins notes that if the situation deteriorated into an armed conflict, the potential existed for a negative outcome for the United States since:

> The disparity between the armed forces of the United States and that of Great Britain was enormous. The American navy had just one battleship to pit against the great navy of Britain. The army was about one sixth the size of the British. American finances had just passed through a most critical period, and new difficulties might have been expected if matters had come to a clash of arms.[71]

The favorable outcome in Venezuela emboldened the United States to continuously enforce the Monroe Doctrine aggressively, contributing to conflict with Spain three years later. The Cuban Revolution captured American public interest, as popular sentiment called for Congress to declare war on Spain. President William McKinley sought a diplomatic solution, but once the USS *Maine* exploded in Havana harbor, negotiations ceased, and Congress declared war.[72] The ensuing victory placed the United States among the ranks of global imperial powers. The War Department supervised the transition of self-government for the Cubans while simultaneously combating an insurgency in the Philippines.[73]

During this period, Germany supplanted Great Britain as the primary threat to U.S. national interests. An incident known as the "Lüders Affair" violated U.S. interpretation of the Monroe Doctrine, as the Germans coerced the Haitian government

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[71] Perkins, *The Monroe Doctrine, 1867-1907*, 200.

[72] John L. Offner, "McKinley and the Spanish-American War," *Presidential Studies Quarterly* 34, no. 1 (March 2004): 50-61, https://www.jstor.org/stable/27552563, 50-60. A report from Senator Redfield Proctor condemned the Spanish prosecution of the war, confirming sensational "yellow journalism" reports and inciting U.S. public opinion in favor of war with Spain. Congress declared war on Spain on April 19, 1898, although investigators could not determine what caused the *USS Maine* to explode.

[73] Weigley, *History of the United States Army*, 308.

by dispatching a warship to Port-au-Prince. This action caused resentment within the United States, but the pending war with Spain prevented the United States from acting against the German government.[74] The Germans provoked further outrage in the United States by sinking the Haitian gunboat the *Crête-à-Pierrot*. U.S. critics deemed Germany's actions disproportionately severe and seethed at how the Germans acted without consulting the United States first.[75]

Anti-German sentiment increased during a joint blockade of Venezuela by Germany and Great Britain in 1902. The Germans and British notified the U.S. government of its intentions before commencing the blockade and perceived that they received its consent. However, the United States deemed that the Germans were testing the U.S. resolve to enforce the Monroe Doctrine by executing an excessively aggressive campaign. U.S. leaders also believed that Germany's purpose for instituting the blockade was to acquire territory in Venezuela.[76]

German activity in the Western Hemisphere and a naval arms race between Germany and Great Britain impacted U.S. military spending. Lodge represented members of Congress that supported increased appropriations to expand the navy:

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[74] Perkins, *The Monroe Doctrine, 1867-1907*, 226-259. In 1897, the Germany coerced Haiti to release a German resident living in Haiti, Emile Lüders, from jail.

[75] Ibid., 331-332.

[76] Ibid., 337. Germany sunk two Venezuelan ships after seizing them without resistance. Also, a German attack on a Venezuelan port resulted in negative perceptions among the American public. American pundits believed that Germany's plan was to forgive Venezuela's debts to acquire territory. There were also rumors that Germany was attempting to acquire the island of St. John from Denmark. Acquiring territory in either scenario violated the Monroe Doctrine.

> I am by no means convinced that some European power, perhaps one of those whose navy is just now receiving such a rapid increase, may want to test that doctrine and that we may find ourselves called upon to protect Brazil or some other South American State from invasion, and to see to it that no new European state is established in the continent to the south . . . I am sure that the way to prevent any such test of the Monroe doctrine, the way to prevent peaceably the seizure of any part of the South American continent or of the West Indian islands by any European power, is to have an American navy which no power in the world can afford to disregard.[77]

Otto von Bismarck offered a particularly harsh reply:

> You in the United States are like the English in that respect; you have profited for ages from dissensions and ambitions on the continent of Europe. That insolent dogma, which no single European power has ever sanctioned, has flourished on them. And how will you enforce it? And against whom? The powers most interested, now that Spain is out of the way, are England and France, the two leading naval powers. Will you drive them off American waters with your pigmy navy? The Monroe Doctrine is a spectre that would vanish in plain daylight. Besides, the American interpretation of this presumptuous idea has itself varied constantly, and has been buried out of sight for many years at a time.[78]

Although most European countries opposed the Monroe Doctrine, Great Britain praised this U.S. foreign policy. Great Britain assessed that appeasing the United States served its interests, as the increasingly powerful country would provide a powerful ally in future conflicts. Also, the aggressive implementation of the Monroe Doctrine by the United States limited the ability of other European countries to extract resources from South America. Great Britain provoked the United States to accept greater responsibility

[77] US Congress, *Congressional Record,* 56th Cong., 1st sess., 1900, vol. 33, pt. 6, 5403.

[78] Ibid., 302.

for settling disputes between European and South American countries by influencing the United States to update the Monroe Doctrine officially.[79]

In response to British provocations, the United States officially promulgated the Roosevelt corollary. As a result, the United States assumed the role of an international police force in the Western Hemisphere. However, Roosevelt enforced his corollary with precision and tact, limiting its use for acute circumstances with care to prevent the United States from becoming overextended.[80] The Roosevelt corollary forced Congress to increase U.S. naval capability.

Another circumstance that elevated the importance of growing naval capability was the construction of the Panama Canal. The acquisition of territory following the Spanish-American War increased the importance of establishing an interoceanic canal. The United States exploited the Panamanian Revolution to develop an agreement with the Panamanian rebels for the U.S. control of the canal in exchange for its support against Colombia. A naval blockade against Colombia resulted in recognition of Panama's independence.[81] Acquiring the Panama Canal increased the need for the United States to expand its military and protect its territorial gains.

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[79] United Kingdom of Great Britain and Ireland, *The Parliamentary Debates*, 4th Series, 27th Parliament, 1st sess., vol. 1018, Pt. 1 (London: Wyman and Sons Ltd., 1903) 1903, 25-26, Google eBook.

[80] Perkins, *The Monroe Doctrine, 1867-1907*, 424-456.

[81] Perkins, *The Monroe Doctrine, 1867-1907*, 412; Charles D. Ameringer, "Philippe Bunau-Varilla: New Light on the Panama Canal Treaty," *The Hispanic American Historical Review 46*, no. 1 (January 1966): 28-52, https://www.jstor.org/stable/1904536, 43-47. The U.S. initially established the Hay-Hérran Treaty in 1903 with Colombia for a similar deal, but the Colombian government did not ratify the treaty. The

While the United States constructed the Panama Canal, Roosevelt displayed the result of years of increased naval appropriations and launched the "Great White Fleet" in 1907. The demonstration of U.S. power projection likely served to rebuff Bismarck's remark that the United States possessed a "pygmy navy" that could not enforce its foreign policy. The Great White Fleet provided a warning for potential adversaries, particularly Germany and Japan, that the United States indeed had a "big stick" at its disposal.[82] The Great White Fleet sent a powerful message to the globe.

While the fleet projected U.S. power internationally, the United States experienced domestic strife during the Panic of 1907.[83] The economy recovered, but the panic served the interests of Congress members who wished to reduce military spending. A period of relative peace contributed to the belief that a large army was unnecessary to enforce U.S. policies. Also, despite nearly entering the Mexican Revolution as a combatant, popular opinion persisted that U.S. involvement in a large war was unlikely.[84]

Panamanian rebels offered broader concessions, resulting in the Hay-Bunau-Varilla Treaty in 1903.

[82] Mike McKinley, "Cruise of the Great White Fleet," Naval History and Heritage Command, last modified April 1, 2015, https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/c/cruise-great-white-fleet-mckinley.html.

[83] Andrew J. Jalil, "A New History of Banking Panics in the United States, 1825–1929: Construction and Implications," *American Economic Journal: Macroeconomics* 7, no. 3 (July 2015): 295-330, https://www.jstor.org/stable/24739337, 318.

[84] Weigley, *History of the United States Army*, 347. On April 9, an incident known as the "Tampico Affair" nearly resulted in war between the U.S. and Mexico upon the arrest of American sailors conducting a resupply operation in Tampico. In response, American forces occupied the city of Vera Cruz. The incident was eventually resolved peacefully but caused resentment among the Mexican populace.

Between 1890 and 1914, the U.S. transition into a global imperial power and police force of the Western Hemisphere correlated to an increase in its military size. Following the Spanish-American War, Congress retained a large portion of the army.[85] However, the navy remained the country's priority, as the Navy Department received larger disbursements from Congress than the War Department.[86] The navy provided the United States with global power projection, protection of economic interests in foreign markets, and the ability to prevent foreign invasions by interdicting potential adversaries on the oceans. The Spanish-American War highlighted the need for improving the Field Artillery, but seacoast artillery remained the top priority for the Ordnance Department. The department developed significant innovations for the Coast Artillery, such as disappearing carriages and rapid-fire guns, while field artillery matériel received incremental improvements to existing cannons.[87]

Transition to Firepower-Centric Warfare

By the end of World War I, field artillery established its reputation as the "King of Battle" by serving as the war's highest casualty-producing weapon. Between sixty-five

[85] An Act for Increasing the Efficiency of the Army of the United States, and for Other Purposes, 55th Cong., 3d sess., (March 2, 1899), ch. 352, 977.

[86] Department of Commerce and Labor, *Statistical Abstract of the United States: 1910, Thirty-third Number* (Washington, DC: Government Printing Office, 1911), 626-627. The Navy Department received $191,057,138 more than the War Department from 1902 to 1911.

[87] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1899* (Washington, DC: Government Printing Office, 1899), 12-17.

to eighty-five percent of all casualties during the conflict resulted from artillery fire.[88] The destructive power of field artillery and machine guns contributed to long periods where the combatants struggled to execute pre-war doctrine based on mobility.[89] In the two decades before World War I, conflicts such as the Boer War, Russo-Japanese War, and the Balkan Wars previewed the increasing importance of modern firepower. However, conservativism prevented senior leaders from adjusting their doctrine based on the capabilities of modern firepower. This conservatism constrained peacetime innovation in the years before World War I.

One peacetime innovation that changed military doctrine before World War I was smokeless powder. Smokeless powder increased visibility on battlefields. As a result, artillery batteries utilizing direct fire without cover became exposed to enemy fire. Conversely, batteries firing from behind cover became more challenging to locate and subsequently engage with counterfire.[90]

Since artillery batteries could no longer use smoke to conceal their positions, the employment of indirect fire increased. The concept of utilizing indirect fire for field

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[88] Comparato, *Age of Great Guns*, 55.

[89] Shelford Bidwell and Dominick Graham, *Fire-Power: British Army Weapons and Theories of War 1904-1945* (London, UK: George Allen & Unwin, 1982), 61.

[90] J. T. Dickman, "Modern Improvements in Fire Arms and Their Tactical Effects" (Lecture, Course in Organization and Tactics, School of Application for Infantry and Cavalry, Fort Leavenworth, KS, September 26, 1902), 11. The combination of smokeless powder and effective use of cover and concealment contributed to early success for the Boers against the British during the Boer War fought between 1899 and 1902.

artillery existed as early as 1882, but artillerists preferred the simplicity of direct fire.[91] During the Boer War, the British and the Boers utilized indirect fire to engage targets unseen from the firing battery over intervening obstacles.[92]

Despite the effective use of indirect fire in the Boer War, the technique remained neglected by other world powers until the Russo-Japanese War. Russian artillery entered the war employing direct fire techniques. As an observer with the Russian army noted:

> The early practice was to put the batteries in position for direct fire, and often, as on the Yalu and Telissu and in the eastern passes, the gun emplacements were conspicuous objects in the landscape and the guns in consequence subjected at once to heavy fire. This was due, not only to the ignorance of modern artillery practice, but to the traditions of the Russian army, the use of cover not being understood nor its importance appreciated.[93]

Conversely, the Japanese army gained a decisive advantage against the Russians by employing indirect fire. Captain Peyton March noted that even though the Russians possessed superior field artillery pieces, "the Japanese artillery, however, makes up for its deficiency in equipment by a superb morale and extremely accurate gunnery and by

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[91] Dastrup, *King of Battle*, 129.

[92] Tenney Ross, "Characteristics of the Three Arms." (Lecture, Course in Organization and Tactics, Fort Leavenworth, KS, December 12, 1904, 19. Ross further classified *curved fire* as fire "when delivered from guns with reduced charges, and from howitzers with reduced charges at short ranges and service charges at long ranges, at angles not exceeding fifteen degrees." Early use of indirect fire consisted of firing flat trajectories either on a ridgeline or far enough away to clear intervening crests.

[93] Walter S. Schuyler, "Report of Lieut. Col. Walter S. Schuyler, General Staff, Observer with the Russian Army," in *Reports of Military Observers Attached to the Armies in Manchuria during the Russo-Japanese War (1906-1907)*, vol. 1 (Washington, DC: Government Printing Office, 1907), 101-182, 112.

taking every advantage of the character of the country it is operating in."[94] The Japanese artillerists overcame inferior equipment by utilizing indirect fire to engage their Russian counterparts from cover, and the Russian artillerists responded by adopting indirect fire themselves. An observer with the Russian army described a Russian officer that, "Transmitted by telephone from the signal station after each shot. After considerable firing the Russian battery was able to break shrapnel over the Japanese position, but the range seemed too great for accuracy. It was, however, an interesting exhibition of indirect fire."[95]

U.S. Army observers in Manchuria recognized the significance of field artillery, as Captain Reichmann stated, "maneuvering of troops within artillery range very dangerous in the absence of cover . . . the importance of artillery has powerfully increased."[96] Reichmann also provided a comparative analysis between the Japanese and U.S. Field Artillery, including recommendations for preparing the U.S. Field Artillery for modern warfare:

> The power of artillery being so great it would be foolish indeed for a government not to avail itself of the advantage thus offered, and I believe that as a result of this war there will develop everywhere a tendency to relatively increase rather than to decrease the proportion of artillery and its supply of ammunition. A nation that enters today upon war with palpable inferiority in artillery incurs the gravest risks…To derive the full benefit from artillery it is necessary that it be properly

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[94] Peyton C. March, "Reports of CPT Peyton C March, General Staff," in *Reports of Military Observers Attached to the Armies in Manchuria during the Russo-Japanese War (1906-1907)*, vol. I (Washington, DC: Government Printing Office, 1907), 1-57, 20.

[95] Schuyler, "Report of Lieut. Col. Walter S. Schuyler," 115.

[96] Carl Reichmann, "Report of Capt. Carl Reichmann, Seventeenth Infantry, Observer with Russian Forces," in *Reports of Military Observers Attached to the Armies in Manchuria during the Russo-Japanese War (1906-1907)*, vol. I (Washington, DC: Government Printing Office, 1907), 183-270, 269.

> organized and trained. All artillery officers, without exception, should be instructed at artillery firing schools where they can see the effect of this fire under various conditions and become thoroughly practical gunners . . . after what I have seen in the Far East I am so thoroughly convinced that our present artillery organization, or rather lack of organization, is bound to be a source of weakness that, though not an artillerist, I venture to express the belief that our own field artillery stands in need of both a thorough reorganization and substantial increase.[97]

Fellow military professionals ascertained similar conclusions for improving the U.S. Field Artillery. Ross concurred with increasing the size of the field artillery arm by stating that "one of the greatest weaknesses in the regular army of the United States today, lies in the strength of the field artillery. Our thirty batteries, when organized in accordance with recent War Department order will comprise of 120 guns."[98] In contrast, the Japanese army boasted 468 guns,[99] and the Russian army possessed 280.[100] However, not all observers shared the conclusion that field artillery provided a decisive advantage during the conflict. One observer noted that artillery only caused eight percent of casualties in one battle, noting that artillery fire "does not appear to be great enough to stop an infantry attack or greatly check it."[101]

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[97] Reichmann, "Report of Capt. Carl Reichmann," 270.

[98] Ross, "Characteristics of the Three Arms," 17-18.

[99] Edward J. McClernand, "Report of Lieut. Col. Edward J. McClernand, First Cavalry, Observer with the Japanese Forces in Manchuria," in *Reports of Military Observers Attached to Armies in Manchuria During the Russo-Japanese War (1906-1907),* vol. 5 (Washington, DC: Government Printing Office, 1907), 34.

[100] Reichmann, "Report of Capt. Carl Reichmann, Seventeenth Infantry, Observer with Russian Forces," 183.

[101] John F. Morrison, "Report of Capt. John F. Morrison, Twentieth Infantry (Now Major Thirteenth Infantry), Observer with the Japanese Army," in *Reports of Military Observers Attached to the Armies in Manchuria during the Russo-Japanese War (1906-1907)*, vol. 1 (Washington, DC: Government Printing Office, 1907), 58-100, 83;

Assessments from the Russo-Japanese War elevated the role of firepower in contemporary military doctrine. However, alternative opinions minimized the importance of firepower while postulating that gallantry remained the decisive element for winning battles. In the British army, Launcelot Kiggell stated:

> After the Boer War the general opinion was that the result of the battle would for the future depend on fire-arms alone, and that the sword and bayonet were played out. But this idea is erroneous and was proved to be so in the late war in Manchuria. Everyone admits that. Victory is won actually by the bayonet, or by the fear of it, which amounts to the same thing as far as the actual conduct of the attack is concerned.[102]

The significance placed on gallantry presented a vital obstacle for artillerists in this era. Namely, that firing from concealed positions was cowardly and damaged the morale of the other arms. The call for artillerists to assume their proper place on the battlefield, next to their supported infantry, grew louder following instances of ineffective fire support or fratricide. While receiving praise for their adaptability and innovation, artillerists simultaneously suffered criticism for hiding in concealed positions during the battle.[103]

Major General Douglas Haig denounced the development of indirect fire tactics in the British artillery and promoted the conventional use of direct fire in the British army. Haig argued that artillery is most effective when its trajectory is flat and that coordinating

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Morrison noted the casualty rates of 91.35% infantry fire, 7.99% artillery fire, and 0.66% bayonet, saber, etc.

[102] Bidwell and Graham, *Fire-Power*, 52.

[103] Ibid., 10.

indirect fire and maneuver was too complicated.[104] Conservative thinkers such as Haig prioritized the simplicity of proven direct fire techniques over more complicated indirect fire techniques. Despite organizational resistance, the British field artillery embraced high-powered guns and limited indirect fire techniques based on their experiences in the Boer War.[105]

Meanwhile, the two paradigm artillery systems following the Russo-Japanese War emerged in France and Germany. The French prioritized speed and surprise while employing their artillery. Their tactics minimized the need for precision by achieving high rates of fire from short range. While some advocates railed for heavier artillery, the General Staff determined that firing at longer ranges was unnecessary since the artillery could use the terrain for protection while maneuvering closely with its supported infantry.[106]

In contrast, the German army adopted heavy artillery and developed field artillery to deliver accurate fire at longer ranges. German artillerists developed innovative techniques to achieve maximum accuracy at these longer ranges by accounting for non-standard conditions. While the French optimized their field artillery to provide close

[104] Bidwell and Graham, *Fire-Power*, 24.

[105] Ibid., 18. In Great Britain, prioritizing the navy and maintaining an agile colonial force stunted the growth of its field artillery arm.

[106] Ibid., 14. The French conducted neutralization fires by delivering short and rapid bursts of fire know as *rafales*.

supporting fires to the infantry, the Germans centralized their artillery at higher echelons for massing fire at the decisive time and place on the battlefield.[107]

The United States developed its field artillery based on the French system. Following the Russo-Japanese War, Captain Oliver Spaulding Jr. noted that:

> Our own regulations are provisional, and what their final form may be is not certain. But the French model, rather than the German, will be followed, probably modified in some of the more radical points. From what has already been done, it appears probable that indirect fire from concealed positions will be prescribed as the preferable, though by no means invariable course; and that the rapid volley fire will be used, not constantly and indiscriminately, but in those cases, numerous enough, where other methods seem inadequate.[108]

The selection of a simpler system for the field artillery was preferable for the U.S. Army, as its artillerists lacked the expertise required for executing complicated systems.[109] As a result, the 1908 U.S. Army Field Service Regulations closely resembled French doctrine. Although these regulations acknowledged that artillery could engage targets from increased ranges, the regulations did not specifically mention employing indirect fire. The regulations did prescribe firing artillery over the heads of the infantry, if necessary, during advances and directed that the artillery must advance behind the infantry while providing close supporting fires. Another tactic dictated in the regulations was to engage the enemy at longer ranges with artillery. The purpose of this fire was to

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[107] Bidwell and Graham, *Fire-Power*, 17-18.

[108] Oliver Spaulding, "Weapons and Munitions of War Part 3: Artillery Weapons," (Lecture, Department of Military Art, Infantry and Cavalry School, Fort Leavenworth, KS, 1907, 41-42.

[109] McKenney, *The Organizational History of Field Artillery 1775-2003*, 102. The School of Fire for field artillery did not exist until 1911. During this period, local commanders were responsible for training their artillerists.

force the enemy to deploy and then maneuver artillery within close ranges to provide enfilade and oblique fires.[110]

The Boer and Russo-Japanese Wars left a complicated legacy for the field artillery. Although military theorists accepted the expanding role of firepower, conservative thinkers extracted the lesson that "the progress and development in killing capacity of the modern rapid-fire field gun and rifle have forced the attack, if it desires to live at all, to return to the old methods of a century ago when the individual man and his bayonet was the winning factor."[111]

The 1913 Field Service Regulations clearly describe the mission of the field artillery is to support the infantry. The regulations call for placing artillery at the head of the main body during movements to expedite its entry into action. Once in action, "the principal work during an attack is done by the *infantry*. Assisted by the artillery, it works its way from point to point toward the assigned objective."[112] The regulation also states that firing from concealed positions provides the most effective protection from hostile artillery fire.[113] The practice of firing from concealed positions may infer employing indirect fire, but indirect fire is never explicitly mentioned. Recommending the

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[110] US War Department, *United States Army Field Service Regulations* (Washington, DC: Government Printing Office, 1908), 58, 104, 107, 115.

[111] March, "Reports of CPT Peyton C March," 43.

[112] US War Department, *United States Army Field Service Regulations* (Washington, DC: Government Printing Office, 1913), 121.

[113] Ibid., 175.

withdrawal of guns at night implies the close proximity of field artillery batteries to the firing line.[114]

Despite the increased ranges and rates of fire for field artillery, U.S. doctrine continued to primarily employ its artillery as a direct fire weapon in support of the infantry. The U.S. Army recognized the growing importance of firepower on the battlefield but continued to view the artillery as a supporting arm of the infantry. As a result, programs such as developing the Coast Artillery remained higher in priority than the Field Artillery within the War Department.

Development of the Field Artillery and the Defense Industrial Base

The U.S. effort to attain supremacy in the Western Hemisphere, the growing power of the Japanese, and the perpetual competition between European powers established the possibility for large-scale combat operations across the world. Continuous improvement and growth of industrial capability enabled world powers to prepare for war by building larger militaries with deadlier armament. As a result, from 1890 to 1914, European powers invested heavily in their respective defense industrial bases.

In the United States, the policies aimed at constructing railroads, populating its territory, and pacifying Native Americans set the conditions for an economic boom in the 1890s. Between 1890 and 1900, the United States passed Great Britain in total manufacturing output and became the world leader in industrial output per capita in 1913. The low cost of internal transportation within the country, the abundance of available mineral resources, and access to cheap energy and heat sources gave the United States an

[114] US War Department, *United States Army Field Service Regulations* (1913), 78.

immense advantage over other industrial powers. As a result, the United States produces higher quantities of material at lower costs, especially with steel.[115]

The U.S. defense industrial base did not experience a corresponding increase in capability than the country's increased industrial capacity due to a lack of appropriations from Congress. The lack of funding negatively impacted the field artillery, as the Army Inspector General declared that:

> Some of the light artillery is still plodding along with the same guns they had at the close of the war of the rebellion, although the Prussians learned from the Austrians at Nachod, nearly a quarter of a century ago, that such guns would not meet modern requirements. It is anxiously waiting for the new steel breech-loading guns.[116]

Members of Congress responded to this report by providing the Ordnance Department with increased appropriations for improving the field artillery arm. As a result, the Ordnance Department equipped the field artillery with the M1890 3.2-inch field gun. The Chief of Ordnance also requested appropriations for investing in smokeless powder, noting that the department needed to construct laboratories and hire scientists to "for conducting experiments and making improvements in these powders and explosives in order that the Department may keep pace with the advance in these regards made by other nations."[117]

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[115] Gavin Wright, "The Origins of American Industrial Success, 1879-1940," *The American Economic Review* 80, no. 4 (September 1990): 651-668, https://www.jstor.org/stable/2006701, 652, 661.

[116] Department of War, *Annual Report of the Secretary of War for the Year 1888,* vol. 1 (Washington, DC: Government Printing Office, 1888) 104.

[117] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1891* (Washington, DC:

The M1890 3.2-inch field gun served as an incremental improvement for existing field artillery matériel in the United States but remained inferior to its European counterparts due to its use of black powder, separate-loading ammunition, and lack of a recoil system.[118]

Unfortunately, an economic crisis limited modernization efforts, as the Panic of 1893 resulted in lower appropriations for the War Department. As a result, the Ordnance Department temporarily ceased construction on the Army Gun Factory ceased production of the new M1890 field gun. The department maximized its limited funding for producing artillery matériel by retrofitting legacy M1885 field guns. However, neither field gun integrated smokeless powder; the lack of a viable smokeless powder for its field guns remained a major obstacle for achieving parity with European powers.[119]

Since the government relied on civilian suppliers for its smokeless powder, the Ordnance Department attempted to energize the American smokeless powder industry by collaborating with the Du Pont Powder Company. The department provided Du Pont with a 3.2-inch field gun and an 8-inch rifle to enable instant feedback during the testing process. This collaborative effort resulted in the development of a suitable smokeless powder in 1894. However, the ballistic characteristics of smokeless powder required the dimensions of the 3.2-inch guns to change. Thus, the Chief of Ordnance decided to cease

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Government Printing Office, 1892), 9, 16. The department produced 100 M1890s in 1891.

[118] Dastrup, *King of Battle*, 134-138.

[119] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1893* (Washington, DC: Government Printing Office, 1894), 8, 44.

production on 3.2-inch guns until the department could update their designs and complete testing on an updated model.[120]

Despite initial success at Du Pont, the department struggled to develop a smokeless powder that survived the rigors of long-term storage. As a result, the Chief of Ordnance declared that "test of a new type gun delays of a year or more might occur in obtaining quantities of powder sufficient for the test of the same, or of equal ballistic properties with the sample of which design of the gun was based."[121]

In part, the difficulties for developing smokeless powder for the 3.2-inch field gun stemmed from the lack of expertise in the American defense industrial base. Despite its collaboration with the Ordnance Department, the Du Pont Powder Company carried a negative reputation from the European armament community. In one instance, a commission of observers from the Ardeer works of the Nobel Explosive Company published their criticisms of the "unscientific" methods utilized by the Du Pont Company for manufacturing smokeless powder.[122]

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[120] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1894* (Washington, DC: Government Printing Office, 1895), 24-25, 44. The department dispatched Captain S.E. Stuart to the Du Pont Powder Company in 1893 for this partnership.

[121] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1895* (Washington, DC: Government Printing Office, 1896), 25, 51.

[122] Clive Trebilcock, "British Armaments and European Industrialization, 1890-1914," *The Economic History Review* 26, no. 2 (1973): 254-272, https://www.jstor.org/stable/2594252, 257. The commission expressed their horror at watching the "kneading of nitroglycerine paste by workmen in hobnailed boots, who jumped upon it."

The Ordnance Department expressed frustration with the lack of expertise of private contractors in the U.S. defense industrial base. In 1898, the Chief of Ordnance, Brigadier General Daniel W. Flagler, highlighted that when his department needed to produce material in mass, they had to "resort to private establishments not accustomed to the fabrication of war material, and in either case the delays are disastrous."[123] The inability of private manufacturers to supply quality materials in a timely manner remained a source of frustration, as Flagler noted two years later that:

> As a nation we devote little energy to the manufacture of war material. Our private corporations are infant industries in this line, unable to compete successfully in the world's market with their great European rivals, and our home demand has not been sufficient to develop them . . . in ordnance manufacture, we are deficient in the energy applied, in the dollars invested, and in the number of experts employed.[124]

Despite the limitations of an immature defense industrial base, the Ordnance Department continued steady progress and finally developed a suitable smokeless powder field piece in 1897. However, by the time the Ordnance Department completed its 3.2-inch gun, advances in European field artillery matériel, such as the M1897 French 75mm, rendered the 3.2-inch gun obsolete. The Chief of Ordnance noted:

> At the time the present 3.2-inch field gun was designed and introduced into service some fifteen years ago, it was thought to meet all essential requirements, and was proved to be, in fact, equal to the best gun extant at that period. Since that time, however, the introduction of smokeless powder and some improvements in

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[123] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1898* (Washington, DC: Government Printing Office, 1899), 11.

[124] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1901* (Washington, DC: Government Printing Office, 1902), 9.

> the construction of the gun and its carriage, have made it practicable to increase the power and efficiency of this piece.[125]

The Spanish-American War exposed the slow progress in modernizing the U.S. Field Artillery. One participant in this conflict, Brigadier General Dwight Aultman, recalled:

> In the early nineties the light batteries had been equipped with the then new 3.2-inch gun, which was the latest, and last, development of the old non-recoil material, firing unfixed ammunition with black powder charges and unprovided with any of the laying apparatus for indirect fire. It seems strange and almost inexplicable that the adoption of this gun anteceded by only a few years the French 75, with its fixed ammunition, rapid fire and indirect laying. Yet such was our backwardness in military science that the whole Army was ignorant of the tremendous advance in Field Artillery that in 1898 was an accomplished fact.[126]

While serving as a Platoon Leader during the assault on San Juan Hill, Aultman noted that the smoke from U.S. batteries obscured friendly units while simultaneously marking their location to the Spanish batteries. Also, U.S. batteries executed direct fire during the assault. Due to the terrain, the U.S. batteries maneuvered within direct fire range of enemy infantry. As a result, the U.S. batteries retrograded to rear areas and could not support friendly maneuver since they were not proficient at conducting indirect fire. Aultman summarizes:

> That the Artillery obtained little credit or renown during the campaign cannot be charged to that arm alone. Modern Artillery, indirect laying, the close support of Infantry, rapid fire, all were unknown. The quota of guns, sixteen guns to approximately fifteen thousand rifles, was pitifully inadequate when contrasted

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[125] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1897* (Washington, DC: Government Printing Office, 1898), 31, 39.

[126] Dwight E. Aultman, "Personal Recollections of the Artillery at Santiago, 1898," in *The Santiago Campaign: Reminiscences of the Operations for the Capture of Santiago De Cuba in the Spanish-American War, June and July, 1898* (Richmond, VA: Williams Printing Company, 1924), 182-194, 183.

with a major action in the World War, when the proportion rose at times to as many as twenty guns per thousand infantry.[127]

The war concluded with a U.S. victory over Spain. However, the decisive factor contributing to this victory was Spanish exhaustion, not superior U.S. military might. Sustaining a two-front war, with both theaters at a great distance from its homeland, provided a significant logistical challenge for Spain. Also, fighting a prolonged insurgency against the Cuban rebels degraded the combat power of Spanish forces on the island.[128]

Nevertheless, the victory established the United States as an imperial power. As an imperial power, the United States required a larger standing military to secure its national interests. As a result, Congress expanded the military and improved its organization by passing the Act of February 2, 1901. Provisions in this act included the Coast Artillery and Field Artillery's separation into independent branches under the Artillery Corps. The act also increased the size of the Field and Coast Artilleries and established a Chief of Artillery to oversee the Artillery Corps. Also, rotating officers between Coast Artillery companies and Field Artillery batteries ceased, allowing officers in the Field Artillery to increase their expertise in the branch.[129]

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[127] "Personal Recollections of the Artillery at Santiago, 1898," 191-194.

[128] Weigley, *History of the United States Army*, 307.

[129] An Act to Increase the Efficiency of the Permanent Military Establishment of the United States, 56th Cong., 2d sess., (February 2, 1901), ch. 192, 748-749. The act authorized 30 batteries of Field Artillery and 126 Coast Artillery batteries under the Artillery Corps.

Separating the Field and Coast Artilleries provided the initial step for the Field Artillery to develop a stronger identity as a branch. Although the Coast Artillery remained the dominant branch, the separation reduced the extent that Coast Artillery interests overpowered those of the Field Artillery.[130] The Field Artillery's need for an improved field piece and more trained artillerists caught the attention of the Secretary of War:

> This great increase in the effectiveness of field artillery is of special value to the United States, because we are always weak in artillery in proportion to our infantry. A well-organized army calls for a due proportion between artillery and infantry. When we go to war, we can raise a volunteer infantry with great rapidity, but we can not increase our artillery proportionally.[131]

The Ordnance Department responded to this call for action by developing the M1902 3-inch field gun. The M1902 utilized smokeless powder, modern sights, and a recoilless carriage. For the first time since the American Civil War, the U.S. Field Artillery could claim parity with its European counterparts. As Russell Weigley noted, "with subsequent variations, this gun was virtually as good as the French 75-mm and the American Army was to adopt the latter in World War I mainly because the country could not produce enough American three-inch guns fast enough."[132]

Though the Ordnance Department produced an excellent field piece, developing a reserve of trained artillerists proved to be a more difficult task. The War Department

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[130] McKenney, *The Organizational History of Field Artillery 1775-2003*, 92.

[131] Department of War, *Annual Report of the Secretary of War for the Fiscal Year ended June 30, 1902*, vol. 1 (Washington, DC: Government Printing Office, 1903), 274-275. The Secretary of War in 1902 was Elihu Root.

[132] Weigley, *History of the United States Army*, 318.

experienced friction with Congress regarding the best method for organizing, training, and mobilizing the nation's military reserves. The War Department argued for a system that maintained regional Regular Army units tasked with developing a pool of trained citizens that formed the federal reserve. However, Congress members resisted this plan as they believed that the National Guard already served this role.[133]

Advocates for the National Guard acknowledged that the organization required significant reform if operating as the national reserve for combat power. As a result, Congress passed the Militia Act of 1903, known as the "Dick Act." The Dick Act established the National Guard as the nation's military reserve, detailed Regular Army instructors to train the National Guard, and "provides for arming the Guard with the latest pattern army rifle."[134]

While the Dick Act improved the National Guard's overall readiness, the reforms had little effect on developing a field artillery reserve. In 1903, the preponderance of units in the National Guard was infantry. The War Department encouraged the National Guard to transition a portion of their infantry companies into field artillery batteries, but neither organization allocated funds for furnishing the National Guard with M1902 3-

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[133] Weigley, *History of the United States Army*, 277-278. The War Department supported Emory Upton's concept, which sought to establish a system similar to the Germans. Upton argued for a regionally aligned system with skeleton Regular Army units serving as trainers for conscripts. In times of war, mobilizing the conscripts would enable the rapid filling of Regular Army units to wartime levels.

[134] An Act to Promote the Efficiency of the Militia and for Other Purposes, 57th Cong., 2d sess., (January 21, 1903), 4. The act was named after its proponent, Representative Charles Dick. Before the Dick Act, the last law that update for militia laws occurred in 1792.

inch field guns.[135] This oversight hindered the National Guard's ability to modernize its existing field artillery batteries and reduced the motivation for its infantry companies to make the transition into field artillery batteries.

Though the War Department failed to increase the National Guard's reserve of field artillery, the Act of January 25, 1907, increased the number of field artillery batteries in the Regular Army. The act added six field artillery batteries and reorganized the U.S. Field Artillery into six regiments with 126 field artillery batteries.[136] In comparison, the French Army included 1,079 field artillery batteries in 1914.[137] The act also permanently separated the Field Artillery and Coast Artillery, including the Chief of Artillery ceding control of the Field Artillery. As a result, the Field Artillery lost representation in the War Department, a shortfall that endured until 1918.[138]

A positive reform occurring in this period was the creation of the School of Fire in 1911. In 1908, Roosevelt wrote that "our artillery was still very inferior in training and practice to the artillery arm of any one of the great powers such as Germany, France, or Japan – a condition which we only then began to remedy."[139] The remedy for this issue

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[135] Weigley, *History of the United States Army*, 321-324.

[136] An Act to Reorganize and to Increase the Efficiency of the Artillery in the United States Army*,* 59th Cong., 2nd Sess., (January 25, 1907), 861-862.

[137] Bruce Gudmundsson, "The French Artillery in the First World War," in *King of Battle: Artillery in World War I,* vol. 108, ed. Sanders Marble (Boston, MA: Brill, 2016), 62-100, 63.

[138] Snow, *Signposts of Experience,* 16.

[139] Riley Sunderland, *History of the Field Artillery School,* vol. 1, *1911-1942* (Fort Sill, OK: U.S. Army Field Artillery School, 1942), 28.

included sending Captain Dan T. Moore to the German Artillery School at Jüterbog to study their methods and implement their best practices in an American field artillery school.

While serving as commandant of the School of Fire, Moore observed a lack of expertise among the U.S. artillerists, exclaiming that "the average student officer was so deficient in elementary knowledge that it was impossible for him to derive commensurate benefit from the expenditure of ammunition."[140] The lack of knowledge included calculating firing data, emplacing an observation post, and adjusting fire by bracketing the target. Moore's program of instruction for fixing these deficiencies included sketching the firing area, plotting targets on a map, using observation instruments, operating the M1902, ballistics, simulated fire, and tactical exercises. In the first year, only 64 percent of students graduated from the course.[141]

During the School of Fire's first year, instructors improved existing tactics, techniques, and procedures. As a result, the school improved the quality of the U.S. Field Artillery by promulgating simpler and more accurate methods for conducting fire. Instructors noted that new students arrived with increased skill than their predecessors due to graduates transferring their knowledge to their batteries. The school trained 285 artillerists from 1912 to 1916. However, the school closed in 1916 as the Mexican Revolution spilled across the border into the United States.[142]

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[140] Sunderland, *History of the Field Artillery School,* vol. 1, *1911-1942*, 38.

[141] Ibid., 38-44. The School of Fire trained 144 students in its first year, with only 92 graduating the course.

[142] Ibid., 45-51.

During this period, the U.S. defense industrial base remained stagnant compared to its European counterparts. Most Americans felt secure due to the presence of oceans, relatively non-threatening border countries, and a navy now ranking among the most powerful in the world. Andrew Carnegie expressed this popular sentiment:

> I have always said that if at any time any country was foolish enough to attempt invasion the best possible plan would be to make their landing as easy as possible, point out to them the best possible roads, and allow them to go as far as they desired to go inland. Then warn them to look out, and turn a million of our 16,000,000 of militia loose upon them . . . there is no other country in the world so well equipped to repel invasion or make it so hot for an enemy should he land as to make him exceedingly sorry he ever tried it.[143]

The opposing view argued that U.S. foreign policy required increasing investment in the defense industrial base to prepare for conflict. Proponents of this view believed that the United States could not maintain its dominion of the Western Hemisphere without improving its military. General Homer Lea opined that expecting the other great powers to remain confined to limited spheres of power despite their military strength was fallacious, declaring that: "The Monroe Doctrine, if not supported by naval and military power sufficient to enforce its observance by all nations, singly and in coalition, becomes a factor more provocative of war than any other national policy ever attempted in modern or ancient times."[144]

While U.S. factions argued over the necessity of military spending, European governments lacked a similar security sense and engaged in arms races to bolster their

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[143] Maxim Hudson, *Defenseless America* (New York, NY: Hearst's International Library, 1915), 70-71.

[144] Homer Lea, *The Valor of Ignorance* (New York, NY: Harper & Brothers Publishers, 1909), 106-109, Google eBook.

military capabilities. A series of conflicts between European powers threatened to erupt in a continental war. A British journalist, Henry Noel Brailsford, noted that: "Since the century opened, five wars in thirteen years have reminded us how distant is still the dream of enduring peace. In three of these wars Great Powers were engaged . . . A war that has just been averted leaves behind it its legacies of alarm and revenge."[145]

The constant threat of war caused a boom for the European armament industry. Private manufacturers of war materials thrived from purchases by traditional military powers and exporting their processes to nations vying to improve their defense infrastructure. Before this period, smaller nations typically utilized foreign sales to equip their militaries. However, the increasing need for military equipment caused these nations to contract private manufacturers to construct factories in their countries. Private contractors such as Vickers, Armstrong, Brown, and Schneider-Creusot established factories in Russia, Italy, and Spain.[146] The heavy investment by European governments in the armament industry prepared their respective defense industrial bases to manufacture specialized weapons in the large quantities required for World War I.

By 1914, the U.S. Field Artillery emerged from its "lost years" following the American Civil War. The United States emerged as the leading global industrial power and became increasingly assertive in its application of the Monroe Doctrine. Modernization efforts for the U.S. Field Artillery occurred at a gradual rate, as the navy

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[145] Henry Noel Brailsford, *The War of Steel and Gold: A Study of the Armed Peace* (New York, NY: The MacMillan Company, 1914), 13, https://babel.hathitrust.org/cgi/pt?id=pst.000008687999&view=1up&seq=9.

[146] Trebilcock, "British Armaments and European Industrialization, 1890-1914," 255-263.

and seacoast fortifications remained the primary tools for defending the United States from a foreign invasion.

After emerging as an imperial power following the Spanish-American War, the country required a stronger military to protecting its newfound global empire. As a result, military appropriations increased along with the urgency to modernize the Field Artillery. The Ordnance Department equipped the Field Artillery with a modern field gun, and Congressional reforms improved its organization by separating the Field Artillery and Coast Artillery. However, a lack of commitment to the School of Fire and the dearth of field artillery batteries in the National Guard limited the War Department's ability to generate combat power for the field artillery arm.

The constant threat of war in Europe caused its governments to participate in arms races, setting conditions for the capacity to mass-produce specialized heavy weapons. Meanwhile, feelings of security and economic panics in the United States resulted in calls to limit military spending. These debates set the stage for opposing views regarding how to prepare the United States for contingency operations to protect national interests. In 1914, the European conflict feared by many finally took form as the Great War began. Consequently, debates raged within the United States on appropriate actions for preparing the military for possible entry into the war.

CHAPTER 4

PREPARATION FOR WAR: 1914-1917

With the beginning of World War I in Europe, popular sentiment among Americans was that remaining neutral served the national interest. While the United States struggled to remain neutral, the possibility for U.S. involvement as a belligerent caused members of the War Department to demand reforms for preparing the U.S. military for this contingency. Reforming the military and systems for mobilizing the country's combat power served as critical issues to the "preparedness campaign." The preparedness campaign resulted in a stalemate between the War Department and proponents of limiting military spending. Difficulties experienced while mobilizing the military and conducting offensive operations into Mexico broke the stalemate, providing the impetus for resolving the debate and initiating reforms. Although Congress provided sensible reforms, the debate cost valuable time for preparing the massive scale of personnel and matériel required on European battlefields. The U.S. Field Artillery experienced acute hardship during this period, as the War Department continued to view it as an auxiliary arm. In the end, the combination of lost time and the low priority of the Field Artillery contributed to the Ordnance Department's decision to purchase its field artillery matériel from France and Great Britain. The United States planned to replicate the French cannon program indigenously.

The Preparedness Campaign

Foreign policy ultimately dominated Wilson's presidency, which focused on preventing the United States from joining hostilities in both the Great War and the Mexican Revolution.[147]

In response to declarations of war in Europe, Wilson issued his proclamation of neutrality, stating the United States "must be impartial in thought as well as in action; must put a curb upon our sentiments as well as upon every transaction that might be construed as a preference of one party to the struggle before another."[148] The struggle to remain neutral in the Great War became increasingly precarious as both the Allies and Germans escalated their aggression towards neutral parties using economic warfare. The British instituted a blockade that exceeded accepted norms of international law by searching and seizing vessels for contraband, even for vessels traveling to neutral ports.[149] Extravagant profits from Allied commerce curbed negative reactions within the United States toward such actions, and the U.S. economy continued to boom from

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[147] H. W. Brands, "Woodrow Wilson and the Irony of Fate," *Diplomatic History 28*, no. 4 (September 2004): 503-514, https://www.jstor.org/stable/24914872, 504-506. During the 1912 presidential campaign, the candidates' platforms were centered on domestic issues such as anti-trust laws, anti-corruption, and banking reform. Foreign policy existed as an inconsequential matter during this election cycle, as Wilson defeated seasoned statesmen Roosevelt and Taft.

[148] US Congress, Senate, "President Wilson's Declaration of War Message to Congress, April 2, 1917." Records of the United States Senate, Record Group 46, National Archives and Records Administration, n.d. Accessed November 7, 2020. https://www.archives.gov/historical-docs/todays-doc/?dod-date=402, 14406.

[149] Carlton Savage, *Policy of the United States toward Maritime Commerce in War: 1914-1918*, vol. 2 (Washington, DC: Government Printing Office, 1936), 12, Google eBook.

lucrative contracts with the Allies.[150] The reciprocal action from the Germans was the creation of a "war zone" around the British Isles and the initiation of unrestricted submarine warfare. German U-boats sunk vessels entering the war zone, including American ships, without warning to stop the flow of material to the Allies. The United States coerced the Germans to cease unrestricted submarine warfare in 1915 by threatening to sever diplomatic relations if the U-boat attacks continued.[151] Wilson overlooked violations to American neutrality by both the Allies and the Germans during the first two years of the Great War, hoping he could serve as a mediator and end the war.

Wilson feared significant war preparations would trigger further escalation and constrained measures to increase military readiness for possible involvement in the war.[152] Despite this restrictive guidance, the War Department launched the preparedness campaign, seeking to initiate reforms for increasing the military's readiness for contingency operations in Europe. The War Department's plan included expanding the Regular Army and developing a reserve of trained soldiers known as the "Continental Army." Proponents of this plan claimed the volunteer system failed in the past and was inadequate to organize military forces on the same scale as contemporary European

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[150] David M. Kennedy, *Over Here* (New York, NY: Oxford University Press, 2004), 39. During neutrality, Americans profited not only from selling food and war matériel (primarily to the Allies), but also by offering loans to the belligerents. These loans reversed historic U.S. subserviency to Europe. Also, Americans exploited markets previously dominated by Europeans. The Great War lifted the U.S. from an economic recession and improved U.S. position as a world economic power.

[151] Herman H.B. Meyer, *The United States At War: Organizations and Literature*, vol. 1 (Washington, DC: Government Printing Office, 1917), 8-11.

[152] Weigley, *History of the United States Army*, 352.

powers.[153] This plan's leading opponent, Senator James Hay, believed the National Guard provided a sufficient reserve of combat power for future conflicts. Hay believed the War Department's plan was expensive and unnecessary, echoing the timeless argument that "isolated we are here, safe in our vastness, protected by a great navy, and possessed of an army sufficient for any emergency that may arise, we may disregard the lamentations and predictions of the militarists."[154] From 1914 to 1916, Hay successfully stymied the War Department's effort to have Congress increase appropriations for the War Department, expand the Army, and develop a federal reserve of combat power.

The stalemate between the opposing factions broke as the Mexican Revolution spilled into U.S. territory. In 1916, Pancho Villa launched a series of raids to instigate a U.S. invasion and destabilize the current Mexican regime. Villa's raid on Columbus, NM, caused the United States to mobilize the National Guard to protect the border and organize the Regular Army to launch the "Punitive Expedition" into Mexico.[155] This

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[153] Weigley, *History of the United States Army*, 343-344. Secretary of War Lindley M. Garrison led the War Department's effort. He resigned when his efforts did not enact into law, and Newton D. Baker continued this endeavor.

[154] George C. Herring, "James Hay and the Preparedness Controversy," *The Journal of Southern History* 30, no. 4 (November 1964): 383-404, https://www.jstor.org/\stable/2204278, 386.

[155] Julie Irene Prieto, *The Mexican Expedition 1916-1917* (Washington, DC: Center of Military History, 2016), 10-63. Despite alliances with both the U.S. and Venustiano Carranza at earlier stages of the Mexican Revolution, Villa felt betrayed when Wilson officially recognized Carranza as the legitimate president of Mexico. When Villa could not defeat Carranza, his strategy shifted to undermine Carranza by inciting an American invasion into Mexico. The Punitive Expedition failed to capture Villa, but Pershing and the U.S. Army gained valuable experience.

mobilization exposed weaknesses in the National Guard, forcing the opposing parties on the preparedness debate to reach a compromise, the National Defense Act of 1916.[156]

The National Defense Act (NDA) increased the size of the Regular Army and National Guard while establishing the National Guard as the nation's primary reserve of force. The allocation of federal funding and Regular Army trainers to the National Guard facilitated the relationship between the two organizations. The act facilitated interoperability by requiring that Regular Army and National Guard units have the same organization and equipment.[157] This measure provided the impetus for increasing appropriations for equipping the National Guard with the same field artillery matériel as the Regular Army.

Congress did not immediately increase appropriations to the military due to the concurrent 1916 presidential election campaign. The NDA diminished the preparedness debate between the candidates; however, both the Democrats and Republicans promoted neutrality in their respective party platforms during the presidential election campaign.[158] Wilson balanced the implementation of military reforms without aggravating relations with the Germans. As a result, Congress passed authorizations for modernizing the National Guard's artillery matériel without appropriating funds to the War Department.

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[156] Weigley, *History of the United States Army*, 351.

[157] National Defense Act, H. Res. 12766, 64th Cong., 1st sess. (June 3, 1916), 166, 187, 197-199, 203, 206.

[158] James Langland, *The Chicago Daily News Almanac and Year-Book for 1917* (Chicago, IL: Chicago Daily News Company, 1916), 257, 261, Google eBook.

The Ordnance Department could make plans for accomplishing this program but could not execute these plans until Congress passed appropriation bills.

Soon after winning the 1916 presidential election, Wilson appeared to finally have his chance to serve as a mediator and negotiate a truce between the Allies and the Central Powers. In December, Germany announced its willingness to enter peace negotiations, but the Allies refused.[159] This refusal, combined with German losses in 1916, caused the Germans to resume unrestricted submarine warfare to change the direction of the war. German leaders calculated this would cause the United States to join the Allies as a belligerent but determined that this change was inconsequential since U.S. foreign policy heavily favored the Allies.[160] In addition to resuming unrestricted submarine warfare, the Germans attempted to form an alliance with Mexico by exploiting resentment towards the Punitive Expedition in a communication infamously known as the "Zimmermann Telegram." However, the British deciphered this telegram and relayed it to the United States, and the Punitive Expedition ceased the following month. Despite these nefarious actions by Germany, Wilson cautiously attempted to remain neutral; however, after German U-boats sunk seven U.S. vessels from February to April, Wilson's patience ran

[159] Meyer, *The United States At War: Organizations and Literature*, 11.

[160] Brands, "Woodrow Wilson and the Irony of Fate," 507.

out.[161] On April 6, 1917, the United States declared war on the Imperial German Government.[162]

Two-and-a-half years elapsed between the initiation of the Great War in Europe and the U.S. declaration of war against Germany. During this period, the NDA initiated reforms for preparing the U.S. military to enter the war as a belligerent. However, delays in appropriating funds degraded the War Department's ability to implement reforms. These delays placed the Ordnance Department in a bind to equip the military. The Field Artillery suffered acutely in this regard, as its matériel "can not possibly be improvised and which can not be handled by untrained men."[163]

The Fall of the 3-inch Field Gun

Equipping the War Department to meet the requirements in the NDA required more resources than the Ordnance Department possessed. Fortunately, the act provided the means for mobilizing the nation's economy to support future war efforts. The primary mechanism for accomplishing this was the Board on Mobilization of Industries Essential for Military Preparedness. The board conducted assessments to determine which civilian companies possessed plants capable of manufacturing war matériel. Another function of the board was nominating civilian companies capable of transforming to support the war

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[161] Meyer, *The United States At War*, 11. The Zimmermann Telegram offered Mexico "generous financial support and an understanding on our part that Mexico is to reconquer the lost territory in Texas, New Mexico, and Arizona."

[162] US Congress, Joint Resolution Declaring that a State of War.

[163] Department of War, *Annual Reports of the War Department for the Fiscal Year ended June 30, 1900,* vol. 1 (Washington, DC: Government Printing Office, 1900), 137.

effort.[164] This board served as the nucleus for the War Industries Board, which formed a year later.[165]

An assessment of the U.S. defense industrial base revealed that civilian companies had already responded to supply and demand economics by producing war matériel for the Allies. Before the United States entered the war, the production capacity of the U.S. defense industrial base more than doubled as businesses fulfilled contracts with the Allies. The contracts primarily consisted of shells, rifles, bayonets, and fuses. The lack of expertise for manufacturing artillery resulted in few Allied contracts for cannons by American companies. The future leader of the War Industries Board, Bernard M. Baruch, noted: "the instruments of trench warfare had never been produced in this country and no one was familiar with the processes of their manufacture."[166]

American manufacturers lacked familiarity with the "instruments of trench warfare" due to a lack of investment in the industry by Congress. In 1915, the Chief of Ordnance, General Crozier, identified this problem,

> I have favored the practice of employing the private industries of this country in order that these might be prepared to serve the Government's needs in case of emergency calling for greatly increased production, which would then be facilitated by the existence of a number of establishments possessing the initial installation and the technical knowledge required for rapid expansion . . . A contradictory policy has been followed, and practically all the appropriation of this department have been accompanied, in recent years, by legislation requiring

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[164] National Defense Act, 213-215.

[165] Bernard M. Baruch, *American Industry in the War: A Report of the War Industries Board (March 1921)* (New York, NY: Prentice Hall, 1941), 287. The War Industries Board served a similar purpose as its predecessor, with increased authority for coordinating domestic industries and resources deriving directly from the president.

[166] Ibid., 260.

that the material covered by these appropriations should be manufactured by the Government itself.[167]

Crozier's report demonstrated a shift from his predecessors in the Ordnance Department regarding its attitude towards the private industry. The system adopted following the Gun Foundry Board in 1884, which called for the manufacture of all cannons in government foundries, remained intact in 1917. However, Crozier correctly identified that the scale of artillery for the Great War exceeded the capacity of government foundries.

Crozier also identified that appropriation bills prohibited him from outsourcing the manufacture of artillery matériel to private industry. This constraint reduced costs, as government foundries produced matériel at lower costs than private foundries. One course of action for Congress to consider was expanding the number of plants in government foundries to meet the increased demand for artillery. Crozier responded to this issue while testifying to Congress in 1917, stating, "I do not think there is a chance of Congress making those plants as large as would be necessary to provide for our war-time needs, and I do not know of any other way of providing for our war-time needs than to give some encouragement to private manufacturers, to keep them in business and in a position to supply us."[168]

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[167] Department of Ordnance, *Report of the Chief of Ordnance to the Secretary of War 1915* (Washington, DC: Government Printing Office, 1915), 24-25.

[168] US Congress, House, *Statement of General William Crozier, Chief of Ordnance, U.S.A., before the Committee on Military Affairs on December 31, 1917,* 64th Cong., 2nd sess., 865, https://babel.hathitrust.org/cgi/pt?id=hvd.hx4ipt&view=1up&seq=7.

In this response, Crozier suggested the investment required for enlarging plants in government foundries was not practical since the foundries would become idle after the war. Instead, the more prudent course of action was investing in private industry, as Congress could scale the production by modifying plants already in existence in the private sector. This course of action also relieved Congress from the burden of maintaining extensive facilities of limited value following the war.

The lack of existing plants for manufacturing artillery matériel caused a shortage of 3-inch guns within the War Department. In 1917, the War Department possessed 574 3-inch field guns.[169] This quantity equipped 9 Field Artillery regiments, well short of the 21 Field Artillery regiments authorized by the NDA.[170] In 1912, Crozier expressed pessimism regarding his department's ability to mass-produce artillery matériel, stating, "I do not think that we could count on getting a battery delivered in less than a year from the time the order was given."[171] Crozier's estimate pre-dated the measures for increasing appropriations and mobilizing the economy included in the NDA. However, as Crozier pointed out, these measures still served more as hypothetical goals than realized solutions at the outbreak of war.

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[169] Department of War, *Annual Reports*, vol. 1, pt. 4, *Report of the Chief of Field Artillery* (Washington, DC: Government Printing Office, 1919), 5055.

[170] McKenney, *The Organizational History of Field Artillery 1775-2003*, 116. One infantry division requires 108 artillery pieces. Equipping 42 divisions requires 4,536 field pieces. These figures do not account for training units or attrition.

[171] US Congress, House, *Statement of General William Crozier, Chief of Ordnance, U.S.A., before the Committee on Military Affairs on December 31, 1917.* 64th Cong., 2nd sess. https://babel.hathitrust.org/cgi/pt?id=hvd.hx4ipt&view=1up&seq=7, 8.

Crozier correlated Congressional delay in passing appropriations with the shortage of artillery matériel. In his testimony to Congress, Crozier stated, "in explanation of why we have not made any great progress . . . up to the present time I will first remind you that the army bill, which contained a good deal of this encouraging legislation, did not become a law until about the 1st of September."[172] While the preparedness campaign initiated necessary reforms, these reforms only existed in theory until Congress passed appropriations authorized in the NDA. Consequently, the War Department lost precious time setting conditions for mobilizing the defense industrial base for mass-producing artillery matériel.

This lost time contributed to a sense of urgency within the Ordnance Department after the U.S. declaration of war. Shortages of artillery matériel and limited production capacity in the United States caused Crozier to seek assistance from the French. Crozier arranged to bridge the initial artillery shortfall by purchasing 75mm and 155mm cannons from France in May 1917. Crozier cited how establishing common calibers between the AEF and French Army provided the quickest solution for equipping the AEF with artillery and simplified logistics. The French Commission supported Crozier's decision, noting "the double certainty of rapid production and uniformity of munitions, decided by the United States Government despite the incontestable value of its own matériel, especially that of the 3-inch field gun, of which the superior qualities are universally recognized."[173]

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[172] US Congress, House, *Statement of General William Crozier*.

[173] US Congress, House, *Statement of General William Crozier,* 3.

The Ordnance Department's decision to cease production on the domestically produced M1902 3-inch field gun was contentious among American artillerists. Since the majority of cannons purchased from the French government stayed in France to support AEF requirements, American artillerists continued to train with their preferred 3-inch field gun at the School of Fire. The School of Fire continued to lobby to re-establish the 3-inch field gun program of record as late as 1918. In a report to the Chief of Field Artillery, the commandant of the School of Fire reported: "We find that we can do anything with the 3" gun on our latest model carriage that the French officers here can do with the 75 . . . Unless arrangements have gone so far that very serious delay would result, the School recommends most decidedly that the American light gun, and not the French, be adopted as standard."[174]

While the U.S. defense industrial base mobilized to support the war effort, French industry operated at peak capacity in 1917 (especially concerning the production of artillery matériel). The French government apportioned its resources to balance the needs of the AEF and the French army. Although only a portion of the French defense industrial base supported the AEF, the French government delivered 155mm guns at the rate of one battalion (12 guns) per month, far surpassing U.S. production capacity.[175] In total, the French supplied the AEF with 3,128 field pieces from May 1917 through November 1918.[176]

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[174] Snow, *Signposts of Experience,* 198-199.

[175] Ibid., 4.

[176] McKenney, *The Organizational History of Field Artillery 1775-2003*, 116.

Relying upon foreign manufacturers to supply artillery matériel for the AEF caused consternation in Congress, with Crozier receiving much of the body's criticism for the situation. In December 1917, Crozier stated, in his own defense:

> I am not excusing or trying to explain away the state of affairs under which we are dependent upon our Allies for the early supply of our troops with artillery and artillery ammunition. This condition ought not to have existed, but the responsibility for it must rest upon the whole country. In common with all other officers who were in a position to recommend, I have, in my annual reports and in my hearings before committees of Congress, persistently urged that better provision be made in appropriations, especially for the field artillery and field artillery ammunition.[177]

Crozier's claims were genuine. As early as 1906, Crozier lobbied Congress for appropriations to expand the field artillery arm, noting "this materiel is of a class that can not be procured on short notice. It takes a great while to build these guns and to build the carriages."[178] In 1916, the Secretary of War directed Crozier to reduce by 50 percent his $1,200,000 appropriation request for procuring cannons. The House of Representatives further reduced the requested amount, appropriating a mere $310,000 for procuring cannons. Crozier estimated that equipping the field artillery arm with the quantity of cannons authorized in the NDA with the current appropriations would be complete in 1923.[179]

While Crozier was correct that he advocated for increased spending on artillery matériel, his claims were disingenuous. Field artillery matériel is the last entry in every Chief of Ordnance Annual Report from the 1890s to 1917, displaying its low level of

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[177] US Congress, House, *Statement of General William Crozier*, 5-6.

[178] Ibid., 6.

[179] Ibid., 7.

priority within the department. When Congressional members requested a reallocation of funding appropriated to the Ordnance Department for developing anti-aircraft guns, Crozier cut funding from field artillery matériel.[180]

Until creating the Chief of Field Artillery, no one within the army advocated expanding the Field Artillery. As a result, low priority within the War Department left the branch chronically underfunded and insufficiently equipped. Also, lack of investment in private industry resulted in a defense industrial base incapable of mass-producing artillery matériel. Equipment shortfalls contributed to difficulties in preparing the U.S. Field Artillery for operations in France.

Preparation of U.S. Field Artillery for War

The importance of firepower, particularly field artillery and machine guns, increased during the Russo-Japanese War. However, world powers applied different lessons from this conflict in the preparation of their respective armies. The French and British armies emphasized mobility, and their pre-war doctrine focused on using artillery fire to engage objectives that presented a danger to the infantry. German doctrine, conversely, stated that "to attack is to push the fire forward," which displayed a greater appreciation for firepower than its contemporaries.[181] U.S. Army doctrine aligned with the French and British, with all three powers relegating their field artillery arms into

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[180] US Congress, House, *Statement of General William Crozier*, 885.

[181] George W. Griner, Memorandum For The Director, Second Year Class, The Command and General Staff College, Fort Leavenworth, KS, Subject: The Evolution of Field Artillery Tactics, Techniques, and Organization on the Western Front During the World War, Fort Leavenworth, KS, May 12, 1933, 1-3.

auxiliary roles. This perception contributed to the War Department underfunding the Field Artillery branch before entering the war.

Before closing in 1916 to shift combat power to the Punitive Expedition, the School of Fire nested its training program within the 1913 Field Service Regulations. The curriculum generated artillerists capable of map reading, reconnaissance, target identification, selection and occupation of positions, preparation of firing data, and conduct of fire.[182] The School of Fire's curriculum does not mention engaging targets with indirect fire. Descriptions of field training in the curriculum imply that the students can see the target from the gun, implying that targets were within close range of the gun. The lack of emphasis on indirect fire, both in the Field Service Regulations and the School of Fire, conforms to pre-war practices.

Reports from military observers in France described U.S. pre-war doctrine as obsolete. Early reports indicated that artillery was engaging targets from greater ranges and was inflicting a higher proportion of casualties than in any previous war. One observer remarked artillery batteries "seldom see their enemy at whom they are firing" and that the belligerents replaced shrapnel with high explosive shells.[183] Another observation from the front was a conversation recorded by Major Spencer Cosby, who recalled two French officers stating:

> The present phase of the war is a battle between artillery and engineers. The French field artillery is so superior to that of our adversary that it is nearly always

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[182] Sunderland, *History of the Field Artillery School,* vol. 1, *1911-1942*, 48.

[183] Spencer Cosby, "Conversation with a French Artillery Officer," in *Reports by U.S. Military Attachés in France 1914-1917,* RG 165, Correspondence of War College Division, 1903-1919, finding aid M1024, file 8698, roll 219, National Archives and Records Administration, College Park, MD, 1-2.

> able to break up the German formations, while they are preparing for an attack… the infantry for the moment are acting chiefly as supports for the other two arms.' Neither of the above officers had belonged to either the engineers or the artillery.[184]

The observations from military observers in France provided clear evidence that modern firepower altered tactics on French battlefields. Liaison officers in the French Commission reinforced these reports from U.S. military observers. Major Édouard Réquin reported fire from artillery and machine guns decreased mobility on the battlefield, affirming "the necessity of very largely increasing the proportion of artillery . . . You must have a battery of 3-inch guns for each battalion."[185] This ratio of maneuver battalions to artillery batteries is more than double the authorization from the NDA, which is alarming because the United States had only manufactured enough artillery to supply nine of the twenty-one authorized Field Artillery regiments at that time.

Reports from U.S. military observers and the French Commission described that Field Artillery should no longer be considered an auxiliary arm of the infantry. However, U.S. doctrine failed to embrace the primacy of the field artillery arm in the war. The 1917 Field Service Regulations still stated, "the artillery is the close supporting arm of the

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[184] Cosby, "Engineer Notes on the War," 2.

[185] "Statement of Major Requin with reference to the organization of the division as required by the conditions on the French front and particularly with reference to the infantry component of the division," in *Reports by U.S. Military Attachés in France 1914-1917,* Correspondence of War College Division, 1903-1919, finding aid M1024, file 8698, roll 219, National Archives and Records Administration, College Park, MD, 1-2.

infantry."[186] This description provides evidence of the Field Artillery's increasing relevance within the army compared to its position in 1913. Also, the 1917 regulation determined that the focus of artillery should first be neutralizing hostile artillery and then shifting to responding to the demands of troops in contact.[187]

The United States was not the only country to consign its field artillery to an auxiliary role in pre-war doctrine. An observation from Brigadier General Edmond James regarding the BEF could easily describe the AEF: "The Old Army was unready for trench warfare in 1914 . . . the Liberal Governments between 1906 and 1914 had been unwilling to spend money on the Army . . . It took the wartime governments until the middle of 1916 to provide the Army with the means to fight a war of position effectively."[188]

From 1914 to 1917, the United States attempted to remain neutral while preparing for war simultaneously. The Germans' increasing aggressiveness and the unwillingness of the Allies to negotiate a peace treaty made this position untenable. As modern firepower dominated European battlefields, equipping the U.S. Field Artillery remained a low priority due to the persistent perception of its existence as an auxiliary arm. Crozier correctly identified that the entire country was to blame for the lack of American field pieces available for equipping the AEF. Wilson feared that increased military spending threatened the ability of the United States to remain neutral, which every political party supported. The preparedness debate and the Punitive Expedition distracted both Congress

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[186] War Department, *United States Army Field Service Regulations* (Washington, DC: Government Printing Office, 1917), 74.

[187] Ibid., 86-87, 201.

[188] Bidwell and Graham, *Fire-Power*, 39.

and the War Department from focusing on the Great War. As a result, the Ordnance Department required assistance from France and Great Britain to equip the AEF with artillery pieces while the U.S. defense industrial base mobilized. The Ordnance Department's cannon program never recovered from this lack of time and resources, and the pursuit of short-term solutions to cover this production gap hindered the cannon program throughout the war.

CHAPTER 5

THE GREAT WAR: 1917-1918

On April 6, 1917, following nearly three years of neutrality, the United States entered the Great War.[189] After declaring war on Germany, the United States began mobilizing its national resources for deployment to France. Despite initiating reforms during the neutrality period, friction during mobilization exposed an unprepared military and defense industrial base. The government and industry attempted integration on an unprecedented scale for manufacturing sufficient war matériel. However, inexperience and partisan politics obstructed efforts to empower executive agencies with authority to lead the country's economic mobilization.[190] Delays in equipping private companies with specialized tools for ramping up production hindered their ability to manufacture artillery matériel. Also, failed attempts to develop an upgraded American artillery piece caused additional delays, resulting in shortages of artillery matériel for training and equipping the AEF. As a result, American artillerists completed training in French schools and fought with cannons supplied by the French and British governments. Ultimately, AEF offensives in the St. Mihiel and Meuse-Argonne contributed to the exhaustion of German reserves and the ensuing German surrender. The strategic success of the AEF occurred

[189] US Congress, Joint Resolution Declaring that a State of War Exists between the Imperial German Government and the Government of the People of the United States and Making Provision to Prosecute the Same.

[190] Kennedy, *Over Here*, 85-88.

despite reliance upon the French for supplying the majority of its artillery pieced and training its artillerists.[191]

Economic Mobilization: The War Industries Board

Congress proactively addressed economic mobilization in the NDA by establishing the Council of National Defense (CND). The council provided recommendations for government clients, civilian suppliers, and the President to prioritize resources and produce products.[192] However, the council lacked legal authority for enforcing its recommendations, relying instead on stakeholders to comply voluntarily. Initially, private industry prioritized profits over the council's recommendations. Also, the War and Navy Departments disregarded the council and competed against each other for resources.[193]

Not surprisingly, U.S. inexperience regarding large-scale mobilizations caused delays in preparing the defense industrial base. Since previous mobilizations occurred on smaller scales, leaders who "marshal the country's money and matériel and manpower went to work without the benefit of comprehensive collections of data, without guiding

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[191] David F. Trask, *United States Army in the World War 1917-1919: Organization of the American Expeditionary Forces*, vol. 1 (Washington, DC: United States Army Center of Military History, 1988), xii-xxv. The German surrender occurred earlier than anticipated, as Pershing submitted requests to increase the number of American divisions from 42 to 100 in anticipation of offensive operations in 1919.

[192] Baruch, *American Industry in the War,* 5, 287. The Council of National Defense combined the Munitions Standards Board and the General Munitions Board to create the War Industries Board on July 28, 1917. The Overman Act of May 20, 1918 increased the board's power by establishing it as an executive agency reporting directly to the President.

[193] Kennedy, *Over Here*, 102, 112.

precedents from the past, even without assurance that the other belligerents' experience could serve as models for American mobilization."[194] As a result, the United States did not develop efficient systems for mobilizing the country's economic resources until nearly a year after entering the war as a belligerent.

Partisan politics prevented the Wilson Administration from providing organizations such as the CND with sufficient legal authority for enforcing its recommendations. Wilson's own party opposed policies that increased legal authority for executive agencies, viewing these relationships as trusts. Simultaneously, critics from the Republican Party castigated the Wilson Administration's policies, arguing these policies furnished insufficient control. Partisan politics delayed legislation for increasing the authority of executive agencies until 1918, with the passage of the Overman Act.[195]

The Overman Act increased Wilson's ability to reorganize executive agencies and delegate increased authority to these agencies without Congressional approval. One reorganization was the creation of the War Industries Board. The board operated with increased authority to coordinate demand between the Allies and the U.S. government, establish a system of priorities, and organize the supply of munitions.[196]

Before the United States entered the war, limited appropriations correlated to low demand for private industry to produce war matériel for the U.S. government.

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[194] Kennedy, *Over Here*, 88.

[195] Ibid., 86, 102, 109, 112. Congress passed the Overman Act on February 6, 1918.

[196] Randall B. Kester, "The War Industries Board, 1917-1918; A Study in Industrial Mobilization," *The American Political Science Review* 34, no. 4 (August 1940), https://www.jstor.org/stable/1947819, 662.

Conversely, the Allies' high demand caused the U.S. defense industrial base to expand to meet their needs. As a result, the U.S. government faced significant competition for establishing contracts with American companies. The board resolved this issue by receiving estimates from both the Allies and the U.S. government and then prioritizing requests for contracts based on the availability of production capacity and resources.[197]

Another issue that the board solved was rating the priority of orders based on their importance to the war effort. For every order to a civilian company, the board attached a certificate stating the urgency of fulfilling that order had on the military. These certificates ensured that more urgent orders received priority for raw materials such as fuel and transportation. This system aspired to prevent non-essential industries from delaying the production of immediate needs. Centralizing the apportionment of resources also limited over-production of one type of material if different agencies created duplicate requisitions.[198]

The board also aimed to maximize the country's production capacity by organizing supplies using a holistic approach. Before the board implemented control measures, inefficient government contracting processes resulted in wasteful practices. One example was two plants wasting fuel, transportation, and time by shipping raw materials to each other instead of finishing the process in their factories: "A Buffalo steel plant was manufacturing projectile steel to be shipped to Cincinnati for forging and to be

[197] Kester, "The War Industries Board, 1917-1918," 663-664.

[198] Ibid., 665-667, 671. The board also implemented price-fixing schedules in September 1917, to stave off inflation.

returned to Buffalo for final machining, while a Cincinnati plant was making projectile steel which was being sent to Buffalo for forging and machining."[199]

Nearly six months after entering the war, the War Industries Board implemented a system that facilitated the mobilization of the country's economy for the war effort. The board's system reduced duplication of effort and prioritized raw materials for the military's urgent needs. However, the delayed response for enacting these reforms cost the Ordnance Department time for preparing the defense industrial base to mass-produce cannons. The delay intensified the department's problem: how can the department design a new cannon while simultaneously assembling the means to manufacture this cannon with an inexperienced defense industrial base in a resource-constrained environment?

The "Crime of 1916"

Initially, the challenges for mass-producing cannons caused the Ordnance Department to cease producing the M1902 3-inch gun and purchase cannons from the French and British governments. The department intended for this to serve as a temporary measure until the United States could produce cannons domestically. Available options included replicating a foreign design or producing an American field piece for the war effort. Opting for the latter, the department believed that it could finalize its experimental M1916 design and begin production rapidly. However, the department's ambitious plan failed due to flaws in its design process and inability to develop a functional recuperator. The department's failure to design a functional recuperator and carriage during the war resulted in the M1916 earning the ignominious title of the "Crime of 1916."

[199] Kester, "The War Industries Board, 1917-1918, 664, 668-670.

Unwarranted optimism contributed to the Ordnance Department's belief that it could complete the experimental M1916 field piece and contribute superior artillery to the war effort. The department identified an opportunity to conduct an incremental improvement to the French 75 by placing a 75mm cannon on a split-trail carriage. Split-trail carriages increased lateral traverse and enabled the cannon to fire at higher angles than the single-trail carriages used by the French. Snow articulated the department's motivation for this decision:

> The idealism (and I suppose egotism) characteristic of the American people, we hoped and expected to make a real contribution to the war of something better in arms than was then in use by the Allies. Certain officers in the Ordnance Department settled on the "Model M1916" to fill this role. Both France and England were using a single-trail carriage; if we could develop a split-trail, it would mark a real advance, hence the tremendous effort put on this gun and carriage, an amount out of all proportion to the results attained.[200]

The Ordnance Department initiated production on the M1916 before the United States entered the war. Once Crozier adopted 75mm as the standard caliber for American light artillery, the department issued contracts to replace all 3-inch cannons and their carriages. This change did not affect the production of the M1916 carriage since the platform provided compatibility for both cannon calibers. Despite placing orders for M1916 carriages nearly a year before entering the war, the first delivery did not occur until February 1918.[201]

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[200] Snow, *Signposts of Experience*, 209-210. The recuperator is part of the artillery piece's recoil assembly. Recuperators absorb shock during fire missions and returns the cannon to its firing position.

[201] Ibid.

The Ordnance Department's failure to design a functional recuperator contributed to the delay in completing the M1916 carriage. In December 1917, the department placed a contract for a large number of carriages. Since the department's recuperator was still an experimental model, this order did not include recuperators. Over a year later, the department still lacked a finalized design for its recuperator. This failure caused officers within the department to recommend the cancellation of the M1916 program and allocation of all available resources toward replicating the French 75.[202]

The Ordnance Department's gun program contained concurrent efforts to produce its M1916 and the French 75. However, the department's effort to replicate the French 75 also experienced setbacks. During negotiations with the French Commission, Crozier secured a promise for French assistance in adopting French methods for manufacturing artillery matériel.[203] The French Commission cooperated with the Ordnance Department and allowed an American officer to study the construction of recuperators in France. Upon return to the United States, this officer stored these drawings within the Ordnance Department. However, the level of classification assigned to the drawings prevented their distribution to contractors. As a result, the contractors wasted time and resources attempting to replicate the French recuperator.[204]

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[202] Snow, *Signposts of Experience*, 211. Captain C.B. Goodspeed wrote a memorandum on January 8, 1918, and Lieutenant Colonel Everett S. Hughes reinforced Goodspeed's recommendation on January 16, 1918.

[203] US Congress, Senate, *Statement of Major General William Crozier*, 3.

[204] Snow, *Signposts of Experience*, 232-233.

By the end of the war, the United States produced 233 M1916s.[205] The Ordnance Department never ceased its attempts to construct the M1916, eventually developing a suitable version in 1918 that incorporated the French recuperator into the M1916 carriage.[206] Snow describes how the nature of the development process contributed to the Ordnance Department's failure to manufacture the M1916 during the war:

> Up to December 31, 1918, six weeks *after* the end of the war, only 249 Model M1916 carriages had been completed . . . Some people no longer referred to it as the "Model 1916" but the "Crime of 1916." The whole trouble with this carriage was that it had been put into production without sufficient development work first. The result was that development work took place concurrently with production.[207]

The Ordnance Department and private contractors attempted to erect plants, produce specialized tools, and finalize designs while fighting for resources amid the country's economic mobilization. As a result, the U.S. defense industrial base possessed no margin for error in executing the domestic cannon program. Unfortunately, the mixture of inexperience and blunders induced protracted delays in fulfilling orders for the M1916.

The department made a gamble to finalize the experimental M1916 and assume the role of supplier of artillery matériel to the Allies. While this gamble backfired, the capability of the French and British industries to continuously produce artillery matériel mitigated the risk. If the Chief of Field Artillery existed at the outset of the war, the

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[205] Department of War, *Annual Reports,* vol. 1, pt. 4, *Report of Chief of Field Artillery*, 5198. In comparison, the French produced 4 M1897s per day throughout the war.

[206] Snow, *Signposts of Experience*, 237, 240, 255.

[207] Ibid., 219-220.

United States might have selected a safer option and produced the M1902. The circumstances confronting the defense industrial base during World War I served as a hindrance to the domestic production of any field piece, regardless of the model. However, attempting to replace any legacy system during a conflict contains risk, as artillerists may not gain proficiency on the weapon systems they will employ in combat.

The U.S. Field Artillery in the Great War

The U.S. Field Artillery entered the Great War at a significant disadvantage compared to its European counterparts. The branch lacked sufficient field pieces for equipping its batteries, impeding its ability to train its artillerists. Additionally, the School of Fire remained closed until the War Department issued orders for reopening the school three months after declaring war.[208] The first rounds fired by U.S. artillerists in the Great War occurred while the School of Fire was training its first class.[209]

Units at all echelons, even the School of Fire, lacked artillery matériel for training its students.[210] Few French or British field pieces were shipped to the United States since the AEF received priority. As a result, artillerists trained on any field piece they could

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[208] Sunderland, *History of the Field Artillery School,* vol. 1, *1911-1942*, 54. Snow received orders to reopen the School of Fire on July 19, 1917. Snow's program of instruction was not approved by the War Department until September 12, 1917. The first students did not arrive until September 27, 1917.

[209] Comparato, *Age of Great Guns*, 51. C Battery, 6th FAR fired the first shot by American artillerists on October 23, 1917. 11th FAB fired the last shot on November 11, 1918.

[210] Snow, *Signposts of Experience*, 142. Snow: "As I remember, there were no guns, two rounds of ammunition… it seemed that the plan to start the School had been first to send the students, then the instructors, and equipment from time to time afterwards!"

find. When no field pieces were available, units constructed replicas of field artillery matériel out of wood, referring to these models as "Liberty guns" or "Bryan howitzers."[211] The 55th Field Artillery Brigade's unit history stated:

> The brigade had no artillery material except such as had been improvised, and no fire control equipment . . . The first battery of 1902 Model 3-inch guns was received on November 1st (1918), but fire control instruments did not arrive until later and wooden boards calibrated for instruction in the use of instruments were made and gave the cannoneers their first impression of the technical features of field artillery.[212]

At the institutional level, the Field Artillery branch lacked the infrastructure for generating individuals and units proficient in their mission-essential tasks within the War Department's deployment schedules. The War Department attempted to accelerate the generation of trained artillerists by converting cavalry regiments to artillery regiments. In theory, Soldiers from the cavalry regiments would complete training rapidly since they had already completed initial training. Colonel Guy H. Preston, commanding a converted cavalry regiment, noted that "the theory that all of the 212 officers of the brigade can qualify to conduct fire directed at the Germans over the heads of our own infantry is fallacious . . . Only a few can become competent battery commanders in the first year."[213]

The AEF could not wait this long to receive artillerists, especially since this training did not include certification on field pieces employed on the front. As a result,

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[211] Snow, *Signposts of Experience*, 60.

[212] Richard M. Russell, *History of the Fifty-Fifth Field Artillery Brigade* (Memphis, TN: William J. Bacon, 1920), 6, 17.

[213] Snow, *Signposts of Experience*, 173.

field artillery brigades deployed overseas in degraded forms of readiness. By May 1918, eleven field artillery brigades arrived in France. The French Commission only rated three as "prepared for overseas duty." The other brigades contained various faults, prompting the recommendation for extensive training before conducting combat operations.[214] Since France possessed the relevant field pieces and experienced artillerists, U.S. Field Artillery units completed their training in French schools.

Upon arriving in France, field artillery units received their equipment from the AEF and received training from a network of French artillery schools. These schools generated combat power for the AEF by conducting a "train the trainer" program. Artillery units sent a vanguard to France to receive training in the French artillery schools. These vanguards, referred to as the "Advance Schools Detachment," subsequently trained the rest of their units upon arrival to France. Following initial instruction from the Advance Schools Detachment, units completed their training by deploying to a quiet sector on the front. After this tour of duty, U.S. artillery units reconsolidated and awaited their final assignment within the AEF. A historian from the 151st Field Artillery Brigade described how that unit completed this training cycle:

> We arrived on August 6th (1918) and Brigade Headquarters was established August 7th at Gradignan . . . While the regiments were en route from the United States to France, the Advance Schools Detachment of the Brigade were wandering around Europe . . . While in Gradignan and vicinity our days consisted largely in getting acquainted with our guns . . . On September 5th and 8th the two regiments… moved to Souge for the final six weeks firing before going to the front.[215]

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[214] Snow, *Signposts of Experience*, 64-65.

[215] Russell, *The 151st Field Artillery Brigade*, 21-27. The 151st arrived at St. Mihiel on October 19, 1918.

The performance of American artillery units during combat operations received mixed evaluations. Pershing praised the "skillful use of artillery" among the factors contributing to a successful attack during the Battle of Soissons.[216] The artillery received additional praise from Pershing following the St. Mihiel offensive as he recalled how the AEF attacks were "breaking down all defense of an enemy demoralized by the great volume of artillery fire."[217] Pershing also extolled the artillery's role during the Meuse-Argonne offensive, stating that "our increased artillery force acquitted itself magnificently in support of the advance, and the enemy broke before the determined infantry."[218]

Although Pershing praised the U.S. Field Artillery's contributions, the branch experienced struggles during the war. The U.S. Field Artillery provided effective fire support during the initial phases of attacks while firing on registered targets. However, artillery units struggled to maintain adequate support upon shifting from these initial targets. U.S. Field Artillery units also struggled to provide effective fire support while displacing and maneuvering forward to support successful attacks.[219]

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[216] John J. Pershing, *My Experiences in the War,* vol. 2 (Pickle Partners Publishing, 2013), 224, Google eBook.

[217] John J. Pershing, *General Pershing's Story of the American Army in France* (New York, November 20, 1918), 14, https://babel.hathitrust.org/cgi/pt?id=loc.ark:/13960/t0pr8g92d&view=1up&seq=6, 22.

[218] Ibid., 30.

[219] Trask, *United States Army in the World War 1917-1919*, xxiii.

The U.S. Field Artillery's counterparts in the other belligerent armies faced similar challenges. A French infantry officer described how he could not communicate with his supporting artillery during the attack. This lack of communication enabled enemy machine gunners to block friendly advances beyond the first lines of trenches due to the lack of responsive fire support.[220] An AEF commander developed a tactic for mitigating this issue by maneuvering his artillery in close support of his infantry. This tactic enabled his artillery to maintain communication with its supported infantry and suppress enemy machine guns.[221]

Ultimately, the U.S. Field Artillery's success in the Great War occurred despite its country's inadequate support. The U.S. government's policies attempted to prevent provoking a German war declaration by moderating mobilization activities. Also, deploying forces to Mexico and debating with Congress during the preparedness campaign diminished the War Department's ability to develop readiness for operations in Europe. Although the NDA provided measures for mobilizing the economy, the government did not test these measures until after the declaration of war. As a result, the government lost valuable time surmising the best methods for engaging with the private industry. The loss of time placed increased pressure on the Ordnance Department to produce its experimental M1916. However, restricting the manufacture of artillery

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[220] Andre Laffargue, "The Attack in Trench Warfare: Impressions and Reflections of a Company Commander," *Infantry Journal* 13, no. 2 (1916): 101-134, 116, https://www.gutenberg.org/files/60197/60197-h/60197-h.htm.

[221] Weigley, *History of the United States Army*, 390. Colonel Charles P. Summerall is credited for developing this tactic. Summerall served as the brigade commander for the 67th FAB and 1st FAB before being promoted to Major General and commanding the 1st Division and V Corps.

matériel to government foundries before entering the war caused a dearth of private industry capability. The Ordnance Department's gamble that it could overcome these obstacles did not lead to a positive outcome.

Consequently, the department could not equip the Field Artillery, and therefore the Field Artillery could not generate combat power for the AEF without French support. The Field Artillery overcame these obstacles with vital assistance from the French. The French manufactured the field pieces for the AEF and trained American artillerists on their use. While the U.S. Field Artillery experienced similar struggles as their counterparts in the other participating armies, their support contributed to the Allied victory.

CHAPTER 6

CONCLUSIONS

The American entry into the Great War exposed inadequacies in the ability of the United States to organize, train, and equip its Field Artillery. As a result, the AEF depended primarily on the French for artillery matériel and training. This support was vital due to the decisive role of artillery in the war's firepower-centric realities. The roots of the U.S. Field Artillery's unreadiness for war were linked to the country's changing national interests, the shifting priorities of the War Department, and the defense industrial base in the fifty years before the Great War.

Effects of U.S. National Interest

Every government has limited means for accomplishing its ends. As a result, governments must prioritize their national interests and allocate resources accordingly. In the period between the American Civil War and the Great War, internal and external circumstances caused U.S. national interests to shift. Understanding these shifts provides context regarding the U.S. Field Artillery's role in accomplishing the country's ends. Throughout this period, the country's geography supported arguments to limit military spending. Proponents of fiscal austerity declared that oceans on both coasts, the country's large size, and non-threatening border countries provided adequate protection. Therefore, the United States did not require a large standing army to protect itself from foreign invasion.

The U.S. Field Artillery provided little impact in securing U.S. national interests during this period. Before the frontier closed, the field artillery arm played an

insignificant role in the War Department's Reconstruction and frontier missions. Forces within Congress aiming to downsize (or disband) the standing army altogether, not surprisingly, decreased appropriations for the entire War Department. Also, economic depressions limited defense spending, forcing hard decisions during deliberations for Congressional appropriations.[222] Even after defense spending increased in the 1880s, the only military organizations immune from fiscal austerity were the U.S. Navy and seacoast fortifications. Congressional members believed a strong navy and seacoast fortifications provided deterrence from invasion at a reasonable cost (compared to fielding a standing army) during times of peace.

This perception shifted following the Spanish-American War, as the United States became an imperial power and world leader in the industry. U.S. imperialism increased the possibility of great power conflict, which drove the need for a larger standing army to protect its interests. Congressional appropriations for the War Department grew accordingly but contained cost-saving measures, such as restricting the manufacture of field artillery matériel in government foundries.[223] Since the American Civil War, these restrictions adhered to established procedures, as the Ordnance Department dominated the domestic artillery industry.[224]

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[222] Jalil, "A New History of Banking Panics in the United States, 1825–1929," 295-330.

[223] Department of Ordnance, *Annual Report of the Chief of Ordnance to the Secretary of War for the Fiscal Year Ended June 30, 1916* (Washington, DC: Government Printing Office, 1916), 20.

[224] Comparato, *Age of Great Guns*, 195.

Before entering the Great War, Congress approved increasing the military's size, but this growth occurred slowly.[225] U.S. leaders feared the German reaction to a rapid U.S. mobilization and attempted to find a balance between neutrality and mobilization. Remaining neutral served national interests since commerce with the belligerents lifted the United States from an economic recession and provided Americans with soaring profits.

Also, the American public distrusted coordination between the government and private industry. This distrust manifested itself through stiff political resistance to organizations like the Council of National Defense.[226] Developing mechanisms for coordinating between large businesses and the government served the national interest during the war. The war ended by the time the United States developed effective systems for mobilizing its resources.

Analyzing U.S. national interests provides context for factors influencing the U.S. Field Artillery's development in this era. The U.S. Field Artillery's relative insignificance for securing national interests corresponded to a relatively low Congressional priority.

War Department Priorities

Another factor hindering the development of the U.S. Field Artillery between the American Civil War and the Great War was its priority within the War Department.

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[225] US Congress, Senate, *Statement of Major General William Crozier*, 6. Crozier estimated the U.S. Field Artillery would not be fully equipped until 1923 based on low appropriations.

[226] Kennedy, *Over Here*, 112. This coordination was viewed as contempt for antitrust laws.

Throughout this period, the Field Artillery existed as a supporting arm for the infantry and cavalry. The branch lacked advocacy within the War Department, which impeded its ability to organize, equip, and train the field artillery arm.

The War Department's administrative structure constrained the U.S. Field Artillery's ability to shape departmental policy successfully. For example, the U.S. Field Artillery did not exist as an independent branch until 1907. Furthermore, the branch lacked a Chief of Field Artillery until 1918. These circumstances placed the branch at the mercy of external organizations, particularly the Ordnance Department, for support. While the Ordnance Department worked diligently to develop modern field artillery matériel, this line of effort was low in the department's priorities. During times of fiscal austerity, the Ordnance Department generally sacrificed its field artillery projects to ensure adequate funding elsewhere.

The U.S. Field Artillery's low priority within the War Department also hindered its ability to train its artillerists. For example, the School of Fire for Field Artillery did not open until 1911 and closed in 1916 to support the Punitive Expedition. Subsequently, three months elapsed after the war declaration before the War Department published orders to reopen the school.[227] The War Department consistently displayed a lack of urgency in developing and maintaining an institutional learning facility for its field artillery arm. As a result, the U.S. Field Artillery relied on French artillery schools for generating trained artillerists for the AEF.

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[227] Sunderland, *History of the Field Artillery School,* vol. 1, *1911-1942*, 28, 53. The War Department sent a warning order for the Commanding Officer of Fort Sill to set conditions to reopen the School of Fire for Field Artillery on July 10, 1917.

The War Department regarded the U.S. Field Artillery as lower in its hierarchy because the branch did not provide a high-value capability for army commanders during most of this era. As the importance of firepower increased, the War Department enacted reforms to improve the field artillery arm. However, these reforms were reactive and did not set conditions to prepare the U.S. Field Artillery for the firepower-centric warfare realities of the Great War.

The Defense Industrial Base

Another factor hindering the U.S. Field Artillery's development between the American Civil War and the Great War was its relationship with the defense industrial base. The branch's low priority for Congressional funding and War Department resources negatively impacted the defense industrial base's ability to mass-produce field artillery matériel during the Great War.

After the American Civil War, the U.S. government policies stymied growth in its defense industrial base. Congressional appropriations limited investment in private industries since government foundries produced the same matériel at a lower cost. The scarcity of funding from government contracts caused private contractors to abstain from the cannon business and focus on more profitable ventures.

This system provided adequate manufacturing capacity on a small scale but was inadequate for supporting the AEF's requirements. The Ordnance Department recognized this shortfall and attempted to procure Congressional appropriations for cultivating capacity in the private sector. Congress eventually passed these appropriations, but the defense industrial base lost valuable time to establish required plants, acquire specialized tools, and train skilled workers. As a result, the Ordnance Department purchased cannons

from the French and British, while the U.S. defense industrial base transformed to support the war effort. Despite the immaturity of its defense industrial base, the Ordnance Department attempted to design and manufacture a new cannon during the war. This project, the "Crime of 1916," failed, resulting in U.S. reliance on the French and British for its field artillery matériel for the duration of the war.

Modern Application: Long-Range Precision Fires

Modern artillerists face similar struggles as their World War I counterparts. The U.S. Field Artillery has fought to maintain relevance for most of the past three decades. Employing conventional field artillery has not been vital for securing national interests and has received low priority in Congressional appropriations and Department of Defense (DOD) budgets. Recently, modernizing U.S. Field Artillery matériel has developed as a top priority for the U.S. Army. However, "flat" defense budgets threaten this modernization effort.[228]

Following the Cold War, the George H.W. Bush and Clinton Administrations reduced military spending. During this period, the U.S. military mobilized and decisively defeated the Iraqi Army in the Gulf War. The U.S. Field Artillery's equipment, originally fielded in the 1980s, performed well during Operation Desert Storm. However, shifting

[228] Paul McLeary, "No Growth, No Big Cuts Likely For First Biden Defense Budget," *Breaking Defense*, last modified February 23, 2021, https://breakingdefense.com/2021/02/no-growth-but-no-big-cuts-likely-for-first-biden-defense-budget/.

priorities during the Global War on Terror resulted in the cancellation of modernization efforts in the 2000s.[229]

Modernizing military capabilities to deter the country's primary threats, rival autocratic states such as China and Russia, is among President Joseph Biden's strategic guidance.[230] The U.S. Army's top modernization effort for deterring the country's adversaries is the long-range precision fires (LRPF) program. Presently, the Russian Field Artillery enjoys an advantage in range and lethality over its U.S. counterpart. Also, the U.S. Army requires long-range artillery to affect anti-access, area-denial (A2/AD) systems that restrict U.S. military freedom of movement.[231] In addition to delivering effects against enemy A2/AD systems, the LRPF program seeks to equip the U.S. Field Artillery with capabilities to "improve the range and lethality of cannon artillery and increase missile capabilities to ensure overmatch at each echelon."[232]

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[229] Andrew Feickert, *U.S. Army Long-Range Precision Fires: Background and Issues for Congress,* Congressional Research Service Report for Congress R46721 (Washington, DC: Library of Congress, March 16, 2021), 1-5, 24.The Crusader, a replacement for the M109A6 self-propelled howitzer, was cancelled in 2002 due to its excessive cost. This issue also caused another replacement for the M109A6, the Non-Line-of-Sight-Cannon, to be cancelled in 2009.

[230] US President, *Interim National Security Strategic Guidance* (Washington, DC: The White House, March 3, 2021), 3-6, https://www.whitehouse.gov/wp-content/uploads/2021/03/NSC-1v2.pdf., 3-6.

[231] Feickert, *U.S. Army Long-Range Precision Fires*, 24.

[232] US Congress, Senate, *Statement by the Honorable Mark T. Esper Secretary of the Army and General Mark A. Milley Chief of Staff of the Army before the Senate Armed Services Committee on the Posture of the United States Army,* 116th Cong., 1st sess., March 26, 2019, 6. Elements of the LRPF program include: Extended Range Cannon Artillery (ERCA), Precision Strike Missile (PrSM), Strategic Long Range Cannon (SLRC), and the Army Long Range Hypersonic Weapon (LRHW).

Despite providing relevant strategic capabilities and receiving strong support from the U.S. Army, the LRPF program faces similar threats as previous failed modernization efforts. The United States faces economic challenges following twenty years of continuous counterinsurgency operations and the COVID-19 pandemic. As a result, "flat" defense budgets provide the Department of Defense (DOD) with less funding than anticipated. All services face difficult decisions while balancing force strength, readiness, and modernization. However, DOD prioritization for the U.S. Navy foists heavier burdens onto the other services.[233] Consequently, the curtailment of expensive programs, such as LRPF, are being considered.[234]

Curtailment of the LRPF program will severely degrade the U.S. Army's ability to fight and win its nation's wars during large-scale combat operations. The U.S. Field Artillery is currently operating at both a range and quantity overmatch compared to the nation's primary threats. One solution for mitigating risk during future conflicts while balancing budgetary limitations, is verifying the defense industrial base's capacity to manufacture LRPF matériel domestically. The United States must ensure supply chain resiliency to mitigate the risk of enemy forces restricting access to materials needed to produce field artillery matériel.[235] Verification of domestic production capacity enables

[233] McLeary, "No Growth, No Big Cuts Likely For First Biden Defense Budget," 2021.

[234] Feickert, *U.S. Army Long-Range Precision Fires*, 26-27.

[235] US Congress, House, *Future of Defense Task Force Final Report,* 116th Cong., 2d sess. (Washington, DC: Government Printing Office, 2020), 7-9.

the U.S. Army to modernize its Field Artillery rapidly if a large-scale combat operation becomes inevitable.

The current operational environment provides different challenges for the United States than the variables it faced before World War I. However, analyzing the factors that hindered its ability to organize, train, and equip the AEF's field artillery arm during the Great War provides relevant lessons for current members of the military-industrial complex. The United States cannot justify funding every military modernization program during times of peace. However, investing in Research, Development, Test, and Evaluation for key capabilities develops expertise in the defense industrial base. This process sets the conditions for the DOD to develop solutions during peacetime that are scalable for mass-production during wartime. This approach enables the United States to respond to emerging requirements within shifting budgetary priorities.

GLOSSARY

Breechloader. Type of cannon in which the ammunition is loaded from the rear end of the barrel.[236]

Cannon. A generic term covering all tube artillery pieces.[237]

Carriage. The wheeled structure supporting the cannon which provides mobility for the piece.[238]

Charge. The packaging of solid propellant which provides energy for the expulsion of projectiles from the cannon.[239]

Curved fire. Artillery fire where the firing unit adjusts its range by reducing the charge.[240]

Defense industrial base. The total productive capacity of a country including government and private facilities.[241]

Direct fire. Artillery fire where the firing unit observes the target it is engaging.[242]

Field piece. Any complete system consisting of a cannon and its carriage.[243]

Gun. Type of cannon that fires a flat trajectory.[244]

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[236] Dastrup, *King of Battle,* 83.

[237] Ibid., 318.

[238] Ibid.

[239] Headquarters, Department of the Army, Field Manual 6-40, *Field Artillery Manual Gunnery* (Washington, DC: Government Printing Office, 1999), Glossary-3.

[240] Ross, "Characteristics of the Three Arms," 19.

[241] Headquarters, Department of the Army, Field Manual 4-0, *Sustainment Operations* (Washington, DC: Government Printing Office, 1999), Glossary-6.

[242] Ross, "Characteristics of the Three Arms," 19.

[243] Dastrup, *King of Battle,* 6.

[244] Ibid.

Howitzer. Type of cannon capable of both low and high trajectories.[245]

Indirect fire. Artillery fire where the firing unit cannot observe the target it is engaging.[246]

Military-industrial complex. The relationship between a nation's military and its supporting defense industrial base.[247]

Muzzleloader. Type of cannon in which the ammunition is loaded from the front end of the barrel.[248]

Recuperator. A mechanism that manages recoil after a round is fired and returns the cannon back to its firing position.[249]

Trajectory. Flight path of the projectile.[250]

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[245] Dastrup, *King of Battle,* 6.

[246] Ross, "Characteristics of the Three Arms," 19.

[247] Wikipedia, "Military-industrial Complex," accessed June 17, 2021, https://en.wikipedia.org/wiki/Military%E2%80%93industrial_complex#:~:text=The%20military%E2%80%93industrial%20complex%20(MIC,interest%20which%20influences%20public%20policy).

[248] Dastrup, *King of Battle,* 83.

[249] Ibid., 318.

[250] Ibid.

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