The Organizational History of FIELD ARTILLERY

1775–2003

Janice E. McKenney

Field Artillery
1775–2003

Civil War Flag (nonregulation), with battle honors for Battery B, 1st Regiment of Artillery

ARMY LINEAGE SERIES

The Organizational History of Field Artillery 1775–2003

by
Janice E. McKenney

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FOREWORD

The Organizational History of Field Artillery, 1775–2003, traces the evolution of one of the U.S. Army's premier combat arms—field artillery, the King of Battle. For over 230 years, the artillery force has supported Army ground troops during the struggles to preserve and expand the fledgling nation and then during the wars abroad to provide lasting security for both the country and the larger international community. Organized initially into companies supporting infantry battalions and brigades, artillerymen—the Army's Redlegs—eventually manned battalions, regiments, groups, and brigades to support the growing number of combat divisions, corps, and armies with the battlefield fires necessary to ensure tactical victory.

Janice E. McKenney's study is a systematic account of the organization of artillery units, both field and coast (until their separation in the early twentieth century) and then field artillery alone until 2003. Tracing the development of one of the Army's most complex arms, the author highlights the rationale behind each major change in the branch's organization, weapons, and associated equipment, and lays out for all field artillery soldiers the rich heritage and history of their chosen branch. The work also complements the forthcoming revised edition of the lineage volume *Field Artillery*. In sum, today's decision-makers and force planners may find the challenges of providing a seemingly narrowly constrained military institution with the flexibility and responsiveness needed to adapt to an ever-changing and uncertain global environment both inspiring and instructive.

Washington, D.C.
9 May 2006

JEFFREY J. CLARKE
Chief of Military History

PREFACE

The volume published by 1st Lt. William E. Birkhimer on the history of artillery in the United States Army was the standard work on the subject for over one hundred years. In his preface, Birkhimer stated that he had had a desire to learn something of the artillery arm soon after joining the Army in 1870 but that the official record was sparse and, sometimes, glaringly erroneous. Experienced artillery officers could give him little information, and Birkhimer thought it strange that so little attention had been paid to the organization and administration of the arm. While much had been said and written of the military establishment as a whole during the Civil War and while considerable interest had been given to military matters in Congress, he felt that legislation would be useful and enduring if more were known of the history of the Army, especially its combat arms.[1]

Lieutenant Birkhimer's history is a valuable contribution to understanding the background of artillery in the United States through the Civil War period, but artillery has changed radically since its publication. This volume, *The Organizational History of Field Artillery, 1775–2003*, addresses the need for a modern work that records the historical structure, strength, disposition, materiel, and technical and tactical doctrine of artillery in the U.S. Army. It complements the lineage volume on Regular Army and Army Reserve field artillery regiments, published in 1985 but currently being updated to include commands, brigades, groups, and regiments in all three components. In the last thirty years, several books on field artillery have appeared, some popular histories and a few scholarly works, but the focus of this volume is on the organizational structure of U.S. Army artillery rather than its weapons or its operations. In the main, the narrative is chronological, with nuclear missiles and rockets covered separately because their history did not follow that of cannon artillery.

The term *artillery* originally referred to all engines of war designed to discharge missiles, such as the catapult, ballista, and trebuchet, among others. Toward the end of the Middle Ages, weapons employing gunpowder superseded such engines of war, and in a more restricted sense, artillery came to mean all firearms not carried and used by hand. By the mid-twentieth century, it included all manner of large guns (as distinguished from small arms), howitzers, rockets, and guided missiles, and also came to be applied to the personnel who transport and service the weapons and to the organization and branch of the Army to which the personnel are assigned.

By contrast, the term *field artillery*, which includes weapons mobile enough to accompany an army in the field, is a more recent innovation. The ancient engines of war, as well as the early cannon of the Middle Ages, were siege weapons or those

[1] William E. Birkhimer, *Historical Sketch of the Organization, Administration, Materiel, and Tactics of the Artillery, United States Army* (Washington, D.C.: James J. Chapman, 1884), p. v.

used to defend fixed positions. This volume deals with both field and position artillery in the United States Army from 1775 to 1901, after which the two concepts were recognized as sufficiently different to warrant division into branches, and with field artillery from the latter date through the 1990s. Position artillery from 1901 and its evolution into antiaircraft artillery more appropriately belongs in a history of air defense artillery.

Footnotes citing works that are included in the bibliography give the full name of the author; the complete main title (no subtitle) of the book, article, or dissertation or thesis; the publication and/or university data; and the relevant page number(s). Works not listed in the bibliography are cited in full at first mention in each chapter, with subsequent references in the same chapter shortened. Dissertations or theses are identified as such to avoid any confusion with articles. All abbreviations used in the footnotes are explained in the list of abbreviations and acronyms.

Many individuals are deserving of mention for their assistance and support over the years of researching and writing this volume. I would like to thank the late Brig. Gen. James L. Collins, USA (Ret.), who as Chief of Military History and as a former field artillery officer often shared his broad professional knowledge and experience, as well as Stanley Russell Connor, coauthor of the lineage volume *Armor-Cavalry*, who as former Chief, Organizational History Branch, and Supervisory Historian, Historical Services Division, offered excellent improvements for the narrative and provided overall guidance and inspiration for revising the entire series. I also benefited from the perceptive comments and suggestions of many colleagues in the historical community: Dr. Allan R. Millett; Lt. Col. William G. McAninch, USA (Ret.); the late Mary T. Cagle; U.S. Army Field Artillery School personnel, including Dr. Boyd L. Dastrup; the late Billy C. Mossman; Dr. Richard J. Sommers; and Dr. Daniel Beaver. Finally, I am indebted to the Center of Military History review panel—the late Dr. Robert W. Coakley, chairman, who also shared his experiences as a member of a fire direction center during World War II; the late Lt. Gen. David E. Ott, USA (Ret.); Dr. Jay Luvaas; Lt. Col. Charles R. Shrader, USA (Ret.); George L. MacGarrigle; Dr. Graham A. Cosmas; Dr. Norman M. Cary Jr.; and Joanne Fringer. The critiques were helpful and constructive, making it possible for me to improve the manuscript considerably.

Another team of professionals at the Center of Military History, Library of Congress, and National Archives assisted in readying the manuscript for publication— an intense process spearheaded by my editor Joanne M. Brignolo, who demonstrated a remarkable capacity for coming to terms with a complex subject and provided critical input for shaping the final narrative and supporting graphics to achieve overall precision and consistency, and Alisa Robinson who ushered the manuscript through its final production stages. The mutual quest for verification and accuracy of textual details and sources made it necessary to rely on the technical expertise and indispensable assistance of Walter H. Bradford, Miguel Valdez, Edgar F. Raines, Frank R. Shirer, James B. Knight, Patricia A. Ames, Darren R. Jones, Michael P. Musick, and Mitchell Yockelson. I would like to express special appreciation to John A. Paschal for his support in locating many of the illustrations and also to the production designer Gene Snyder for creating a handsome final product.

To all of those involved in the completion of the volume through their knowledge, advice, and encouragement, I am sincerely grateful. But despite their best efforts on my behalf, I alone assume full responsibility not only for the interpretations and conclusions reached but also for any errors that may be found.

Washington, D.C.
31 May 2006

JANICE E. MCKENNEY

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Field Artillery
1775–2003

CHAPTER 1

The Beginnings

Before the Revolutionary War, a few of the major towns along the North Atlantic seaboard had organized artillery units for coastal defense, but field artillery was virtually nonexistent. The regiment that fought at Bunker Hill in June 1775 had been organized only some months before the battle and reflected the inexperience of the colonists with military organization and discipline. During the fighting, five of the six artillery pieces were lost, in part because of poor leadership and training. Fortuitous circumstances allowed Henry Knox, the young Bostonian bookseller with noteworthy volunteer service, to take over the artillery in late 1775. That Knox was able to create a cohesive artillery force for the Continental Army, capable of facing one of the best armies in the world, impressed many, including the Marquis de La Fayette. As La Fayette later remarked, "The progress of artillery during the Revolution was regarded by all conversant with the facts as one of the wonders of that interesting period."[1]

Artillery Organization

The colonists used a British precedent—the Royal Regiment of Artillery's subordinate companies—for organizing their artillery units, and British officers served as instructors for several of them. In 1745, New England volunteers participated in capturing the Louisbourg fortress that the French had built as a strategic base on the eastern side of Isle Royale (now Nova Scotia's Cape Breton Island), and later some colonial units fought in the French and Indian War.[2]

In 1775, Massachusetts took the lead in preparing for armed resistance against England, and that colony's artillery became the nucleus of the Continental artillery. On 23 February, the Massachusetts Committee of Safety distributed field guns to selected militia regiments, and on 13 April of that year, the Massachusetts Provincial

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[1] William E. Birkhimer, *Historical Sketch . . . of the Artillery, United States Army* (Washington, D.C.: James J. Chapman, 1884), p. 183.

[2] Ibid., p. 1; Francis S. Drake, *Life and Correspondence of Henry Knox . . .* (Boston: S. G. Drake, 1873), p. 126; Joseph Johnson, *Traditions and Reminiscences, Chiefly of the American Revolution in the South* (Charleston, S.C.: Walker and James, 1851), pp. 206–09. Of the colonial units, both the Artillery Company of Westerly, Charlestown, and Hopkinton (organized in 1775 in the Rhode Island Militia) and the Artillery Company of Charleston (organized in 1756 in the South Carolina Militia) still survive in the Army National Guard.

Congress authorized the formation of six artillery companies, increased to ten the following month, for the already established Massachusetts Train of Artillery.[3] Richard Gridley, who had been appointed chief engineer of the Massachusetts forces in April, was commissioned as a colonel of artillery in May and took command of the ten-company militia regiment. An officer on half pay from the British army, Gridley had commanded the artillery during the siege of Louisbourg in 1745 and had taken part in the second siege in 1758. His regiment in 1775 was part of the army that General George Washington took under his command in July.[4]

Colonel Gridley's regiment was modeled on the British artillery battalion and its companies. Most European regiments contained at least two battalions, but the English regiment (and eventually the American one) contained only one, leading to the synonymous use of the terms *battalion* and *regiment*. Unlike infantry regiments, however, the Royal Regiment of Artillery, organized in 1727, consisted of four battalions of eight companies each at the outbreak of the Revolutionary War. Gridley's regiment was authorized ten artillery companies, along with a regimental staff and a company of artificers to perform maintenance functions. As in the British army, the American artillery regiment was an administrative organization. The basic tactical organization in both armies was the company (*Table 1*).[5]

The enlistments of most of the troops in New England expired at the end of 1775, and a new regiment had to be organized to replace Gridley's. Despite the success of his fortifications at the battle of Bunker Hill, Gridley was sixty-four years old and had been wounded during the fighting. His influence on the artillery regiment's discipline appears to have been poor, and the general consensus was that he should be replaced in some honorable way. On 17 November, Henry Knox, who was only twenty-five years old, was selected as Gridley's replacement, receiving a commission as colonel in the Continental artillery. Knox, the proprietor of a successful bookstore, was widely read, especially in field artillery, and was a member of the militia in Boston; he had also assisted in building the fortifications around Boston as a volunteer civilian engineer. In the meantime, Gridley, who had become the chief engineer of the Continental Army in June

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[3] Peter Force, comp., *American Archives* . . . , 4th ser., 6 vols., and 5th ser., 3 vols. (Washington, D.C.: M. St. Clair and Peter Force, 1837–53), 4/1:1362 and 4/2:759, 790, 801, 807. An artillery train was generally a regiment of artillery; it also referred to heavy guns and other pieces or ordnance belonging to an army in the field.

[4] Ibid., 4/2:1349, 1354, 1433–34, 1436, 1440; Francis B. Heitman, *Historical Register of Officers of the Continental Army* . . . , rev. ed. (Washington, D.C.: Rare Book Publishing Co., 1914), pp. 24, 262; Allen French, *The First Year of the American Revolution* (1934; reprint, New York: Octagon Books, 1968), pp. 73, 751–52.

[5] Birkhimer, *Historical Sketch*, pp. 331–32; Force, *American Archives*, 4/2:759; Francis Duncan, comp., *History of the Royal Regiment of Artillery*, 3d ed., 2 vols. (London: J. Murray, 1879), 1:436–37; Edward E. Curtis, *The Organization of the British Army in the American Revolution* (New Haven, Conn.: Yale University Press, 1926), pp. 2, 6; Robert K. Wright, *The Continental Army* (Washington, D.C.: Center of Military History, United States Army, 1983), p. 14. An artificer was a military mechanic or skilled craftsman, in this case one who primarily maintained the weapons.

Table 1—Artillery Organization, 1775–1780

	1775 Bn Royal Arty	*1775 Gridley* [a]	*1776 Knox* [a]	*1777 Harrison*	*1777 Lamb*	*1777 Crane*	*1777 Proctor*	*1778*	*1780*
Command and Staff									
Colonel	1	1	1	1	1	1	1	1	1
Lt Colonel	1	1	2	1	1	1	1	1	1
Major	1	2	2	1	1	1	1	1	1
Adjutant		1	1	1	1	1	1	1[b]	1[b]
Quartermaster		1	1	1	1	1	1	1[b]	1[b]
Paymaster				1	1	1	1	1[b]	1[b]
Surgeon		1	1	1	1	1	1	1	1
Surgeon's Mate		2	1	1	1	1	1	1	1
Chaplain			1						
Cadet		2							
Conductor [c]		4							
Storekeeper		1							
Clerk		2							
Sgt Major				1	1	1	1	1	1
QM Sergeant				1	1	1	1	1	1
Drum Major			1	1	1	1	1	1	1
Musicians							12		
Fife Major			1	1	1	1	1	1	1
Total	3	18	12	12	12	12	24	12	12
Company									
Captain	1	1	1	1	1	1	1	1	1
Capt Lt	1	1	1	1	1	1		1	1
1st Lt	2	1	1	1	1	1	1	1	1
2d Lt	2	2[c]	2	1	3	3	1	3	3
Lt Fireworker							1		
Sergeant	4	4	4	1	6	6	4	6	6
Corporal	4	4	4	4	6	6	4	6	6
Bombardier	9	6	8	4	6	6		6	6
Gunner	18	6	8	8	6	6		6	6
Drummer	2		1		1	1	1	1	1
Fifer			1		1	1	1	1	1
Matross	73	32	32	48	28	28	60	28	39
Total	116	57	63	69	60	60	74	60	71
Companies in Bn or Regt	8	10	12	10	12	12	8	12	10
GRAND TOTAL	931	588[d]	768	702	732	732	616	729	719

[a]The exact composition of Gridley's regiment in 1775 and Knox's in 1776 is unclear. For example, on 3 May 1775, ten companies of fifty men each were authorized, plus five officers, six bombardiers, six gunners, three sergeants, three corporals, and thirty-two matrosses. Documents dated 12 May 1775 show the same organization except that the number of sergeants and corporals was not specified. On 19 May, the ten companies were established, each with five officers, four sergeants, four corporals, a fifer and a drummer, and thirty-two matrosses. The returns of 26 June 1775 show five officers in each company, but widely varying numbers of enlisted men (with no breakdowns). See Force, Massachusetts Revolutionary Military Affairs, nos. 42, 78, 84, 276, Ms Div, LC.

[b]Duties performed by a company officer as an additional assignment.

[c]Also fireworkers.

[d]The artificer company is not included.

Major General Henry Knox
by Alonzo Chappel

1775, continued to serve as an engineer until 1 January 1781.[6]

After Gridley's organization was mustered out, the new regiment was formed primarily with discharged soldiers who reenlisted; it also included a company of Rhode Island artillery that had served with Gridley at Boston under the command of Maj. John Crane. The Continental Congress formally prescribed the composition of the new organization on 2 December 1775. Two additional artillery companies were authorized, bringing the total number in the regiment up to twelve. The regiment formally entered service on 1 January 1776 for one year.[7]

Although the regiment was authorized a personnel strength of over 700 and although it was augmented with two New York companies, led respectively by Capt. Alexander Hamilton and Capt. Sebastian Bauman, detachments from the main body kept the usual number of officers and men well below 600. For most of 1776, Colonel Knox had only ten companies directly under his control, two being detached for service in the north.[8] In June, Knox reported that he had 250 men fit for duty and that he would require 600 more if General Washington "should think it proper that all the artillery should be manned at the same time."[9] In July, he recommended the creation of another artillery

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[6] George Washington, *The Writings of George Washington . . . , 1745–1799*, 39 vols. (Washington, D.C.: U.S. Government Printing Office, 1931–44), 4:74, 158; Force, *American Archives*, 4/2:1079, 1477–78, 1705, 3:1921, 4:217, 263; Drake, *Life of Henry Knox*, pp. 17, 21; Christopher Ward, *The War of the Revolution*, 2 vols. (New York: Macmillan, 1952), 1:123; Noah Brooks, *Henry Knox* (New York: G. P. Putnam's Sons, 1900), p. 19; North Callahan, *Henry Knox* (New York: Rinehart, 1958), pp. 19, 34; Jared Sparks, ed., *Correspondence of the American Revolution . . .* , 4 vols. (Boston: Little, Brown, and Co., 1853), 1:91; Massachusetts Orderly Book of Adjutant [Jeremiah] Niles, Headquarters, Cambridge, 1775, pp. 37, 54–55, Ms Div, LC.

[7] Worthington Chauncey Ford et al., eds. *Journals of the Continental Congress, 1774–1789*, 34 vols. (Washington, D.C.: U.S. Government Printing Office, 1904–37), 3:399; George Washington, *The Writings of George Washington . . .* , 12 vols. (Boston: American Stationers' Co., John B. Russell, 1834–37), 3:148; Massachusetts Orderly Book, 1775, p. 57, and ibid., Nov '75 to Jan'ry 1776, p. 8, Ms Div, LC.

[8] Roll 116, Jacket 19–1, Microfilm 246, Revolutionary War Rolls, Continental Troops, 1775–1783, RG 93, NARA; Force, *American Archives*, 4/6:893, 1121.

[9] Force, *American Archives*, 4/6:920–21 (quotation) and 5/1:502; Drake, *Life of Henry Knox*, p. 121.

regiment, utilizing three independent militia companies, Captain Bauman's attached company, and eight companies drawn from men drafted from the infantry. Because of preoccupation with campaigning, however, his recommendation went unfulfilled.[10]

With enlistments due to expire at the end of 1776, preparation for reorganizing the army began in the early fall of that year. Washington wished to increase the strength of the Continental Army, and his generals agreed. Knox had asserted that five artillery regiments were necessary to support the full army, and Washington forwarded his plan to Congress, adding his own view that three regiments were sufficient to support both his main forces and those in the northern colonies. Washington also recommended that Knox be promoted to brigadier general. Congress authorized the three regiments Washington recommended and promoted Knox, designating him as Chief of Artillery.[11]

The Noble Train of Artillery
by Tom Lovell, depicting Knox and his men bringing artillery from Fort Ticonderoga to Cambridge

Washington, on his own authority, had already ordered Knox to begin recruiting three regiments to support the main army. The structure of these regiments was similar to the regiment of the previous year, although one change included regrouping the enlisted men in each company to provide crews for as many as six guns, an increase of two field pieces. The new organizations, however, unlike Knox's original regiment, were designed to last, with the men enlisting for three years or for the duration of the war.

The first of the three units was Col. John Crane's artillery regiment, which was almost a continuation of the Gridley-Knox organization. Crane had commanded the Rhode Island company that had served with Gridley, and he had been a major with Knox in 1776. In 1777 Crane, as Knox before him, had fewer companies under his control than authorized, for three of the twelve authorized companies had been formed into a separate corps under Maj. Ebenezer Stevens for service in the

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[10] Force, *American Archives*, 5/1:502; Washington, *Writings of Washington, 1745–1799*, 5:134–35, 318, 322–24; Ford et al., eds., *Journals of the Continental Congress*, 5:607.

[11] Washington, *Writings of Washington, 1745–1799*, 6:266, 279–82, 401; Ford et al., eds., *Journals of the Continental Congress*, 6:1043; Wright, *Continental Army*, pp. 98, 101–03; Knox Plan, [18 Dec 1776], encl to Ltr, Washington to Continental Congress, [20 Dec 1776], George Washington Papers, Microfilm Roll 39, Ms Div, LC. The plan is also reproduced in George Washington, *The Papers of George Washington*, Revolutionary War Series Vol. 7, *October 1776–January 1777*, ed. Philander D. Chase (Charlottesville: University Press of Virginia, 1997), pp. 386–87.

north. Stevens's corps operated as a separate unit for almost twenty months before it was incorporated into Crane's regiment in the fall of 1778.[12] After a reorganization that same year, recruits came from the states at large, but throughout the war, Massachusetts provided most of the regiment's experienced officers and men.

Col. John Lamb, who had led his independent New York company to Canada during the first year of the war, commanded the second artillery regiment. Lamb had been wounded and captured during the assault on Quebec in December 1775. Although Congress appointed him major of artillery in the Northern Department the following month, he did not return to duty until an exchange of prisoners took place a year later. Upon his exchange, Lamb became colonel of the new artillery regiment and appointed members of his old New York company and officers from Hamilton's and Bauman's companies to key positions in the organization, which also included companies from Connecticut, New Jersey, and Pennsylvania.[13]

Because of various political and economic constraints, the third regiment desired by Washington was never organized, and in 1777, he adopted an artillery battalion from Pennsylvania commanded by Col. Thomas Proctor. Proctor had originally commanded an independent artillery company in Philadelphia and later a two-company battalion from Pennsylvania. This battalion provided the colonel, lieutenant colonel, major, and four captains to the eight-company battalion the state authorized on 6 February 1777.[14]

Two other artillery regiments supported the forces in the south. In November 1776, Congress had authorized an artillery regiment in Virginia under the command of Col. Charles Harrison. Harrison formed the regiment around a nucleus of two Virginia artillery companies and recruited from that state and Maryland.[15] The 4th South Carolina Regiment, which had been organized in 1775 from Charleston's militia artillery, manned fortifications in that beleaguered city. The South Carolina regiment served only in defense of Charleston and fell with the city to the British in 1780. It was never considered to be a Continental Army artillery regiment like Crane's, Lamb's, Harrison's, and Proctor's.[16] Individual states raised other artillery units. Although some received Continental pay, they were not expected to move beyond their immediate state boundaries, and Knox never exercised any control over them.

The four Continental regiments were at first designated by the names of their colonels, but in August 1779, they received numerical designations based on the

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[12] Ford et al., eds., *Journals of the Continental Congress*, 10:150; Birkhimer, *Historical Sketch*, pp. 336–40.

[13] Isaac Q. Leake, *Memoir of the Life and Times of General John Lamb . . .* (1857; reprint, Glendale, N.Y.: Benchmark Publishing Co., 1970), pp. 149–50; Sparks, ed., *Correspondence*, 1:157; Washington, *Writings of Washington, 1745–1799*, 10:279; Roll 103, Item 29688 ("Present State of the Corps of Continental Artillery, With Proposals for Augmentation, 2 January 1778"), Microfilm 859, Miscellaneous Numbered Records (The Manuscript File), Revolutionary War Records, 1775–1790s, RG 93, NARA.

[14] Force, *American Archives*, 5/1:1293, 1317; Washington, *Writings of Washington, 1745–1799*, 8:414–15; Birkhimer, *Historical Sketch*, p. 345; Wright, *Continental Army*, p. 102.

[15] Roll 116, Jacket 20–1, Microfilm 246, Revolutionary War Rolls, Continental Troops, 1775–1783, RG 93, NARA; Ford et al., eds., *Journals of the Continental Congress*, 4:212, 365 and 6:981.

[16] Wright, *Continental Army*, pp. 72–73.

relative seniority of their commanders. In October 1780, Congress assigned each regiment to the quota of regiments maintained by the states, each of which, to some extent, furnished its troops with food and clothing. Harrison's Virginia regiment became the 1st; Lamb's New York regiment, the 2d; Crane's Massachusetts regiment, the 3d; and Proctor's Pennsylvania battalion, the 4th.[17]

Of these four Continental artillery regiments, only two were organized in the same manner. The Continental Congress authorized Harrison's regiment ten companies, Lamb's and Crane's twelve companies each, and Proctor's eight. Washington prepared on 8 January 1778 to bring all four to the standard of Lamb's and Crane's to promote uniformity and to provide much needed artillery forces. Congress then authorized each of the four regiments twelve companies. Two Maryland companies were assigned to Harrison's regiment to bring it up to twelve, but Proctor's regiment remained with only eight.[18] The Continental Congress made another attempt to standardize the four regiments by the acts of 3 and 21 October 1780, establishing the number of companies in each regiment at ten and increasing the strength of each company by the addition of eleven *matrosses*—the term used for artillery privates who assisted in loading, firing, and sponging cannon and in manning dragropes. Two companies were reassigned from Lamb's regiment to Proctor's, while the remaining reductions were made through attrition.[19]

Artillery regiments in the Revolutionary War were administrative organizations. When first organized, each regiment controlled its own promotions, and a litany of complaints surfaced when those of less experience were promoted in one regiment before others in other regiments. Eventually, the four Continental regiments came to be considered a brigade under Henry Knox. Field-grade officers, originally promoted within their own regiments, were later promoted within the brigade at large, whereas company officers continued receiving their promotions within their respective regiments.[20]

The standard crew for a 6-pounder field gun or 5.5-inch howitzer during the Revolutionary War numbered fifteen men. In 1777, Washington declared that twelve men per piece were sufficient.[21] In practice, the size of the crew depended upon the

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[17] Ford et al., eds., *Journals of the Continental Congress*, 28:893–94; Washington, *Writings of Washington, 1745–1799*, 20:157–64.

[18] Ford et al., eds., *Journals of the Continental Congress*, 11:540; Washington, *Writings of Washington, 1745–1799*, 10:279; Roll 103, Item 29688 ("Present State of the Corps of Continental Artillery . . ."), Microfilm 859, Miscellaneous Numbered Records (The Manuscript File), Revolutionary War Records, 1775–1790s, RG 93, NARA.

[19] Washington, *Writings of Washington, 1745–1799*, 20:157–64, 177–280; Ford et al., eds., *Journals of the Continental Congress*, 28:893–94, 960.

[20] Precise information concerning the brigade as a legal entity is lacking. Available sources, however, imply that it was considered as such. See "Ledger of Military Stores, 1780–1783," Entry 36, RG 93, NARA; Washington, *Writings of Washington, 1745–1799*, 26:35–36; Birkhimer, *Historical Sketch*, p. 15.

[21] Washington, *Writings of Washington, 1745–1799*, 8:456. According to Harold L. Peterson, *Round Shot and Rammers* (Harrisburg, Pa.: Stackpole Books, 1969), p. 66, the ideal number of men for the 6-pounder gun crew was fifteen, while Birkhimer, *Historical Sketch*, p. 312, gives seventeen. In William Stevens, *A System for the Discipline of the Artillery . . .* (New York: William A. Davis, 1797), p. 48, eight men served as the standard crew for the favored 4-pounder gun.

size and type of the artillery piece as well as the number of men available. Gunners were supposed to be versed well enough in mathematics to calculate distances and elevations. They also rammed, aimed, and sponged the cannon. Bombardiers, artillerymen employed with mortars and howitzers, tended the vents at the top of breeches; handled the final assembly of ammunition; and placed the ammunition in the muzzles for the gunners to fire. Loading and firing were slow, as the barrel had to be swabbed after each round to prevent any residue of burning gunpowder from exploding prematurely. Matrosses, besides managing the dragropes, passed ammunition. A commissioned officer, a sergeant, and a corporal normally supervised each piece.[22]

Artillery Weapons

The Continental Army used a variety of muzzleloading smoothbore artillery pieces during the Revolutionary War, but their number and types were not uniform among the regiments. Classified as guns, mortars, and howitzers, cannon were made of either bronze or cast iron. Most cannon in American service during the Revolutionary War were made of bronze, with the exception of the largest—the 32-pounder gun. Bronze was more resistant to corrosion and metal fatigue. The only limitation was the short supply of the constituent elements of copper and nickel, foreign metals that had to be imported into America. Bronze cannon were lighter than iron, which made them more maneuverable in the field. For siege weapons or for those in permanent fortifications, where weight was not an issue, cast iron was more often used.[23]

The artillery pieces were carried on carriages, consisting of a framework of timbers bolted together, built after English models. A small quantity of ammunition was kept in side boxes on the carriage, but most of it was carried in tumbrels, carts, or wagons.[24] Civilians served as drivers for the artillery teams of horses or oxen, either under contract for a period of time or hired for temporary service. Horses were sometimes purchased for the artillery and sometimes were impressed into service.[25]

Guns, which fired with low and relatively flat trajectories, were designated by the weight of solid shot they fired, for example, a 4-pounder. Solid shot was favored for use against cavalry, troops in column, and flanked infantry lines, but not recommended for use at very long ranges unless the ground was suitable for ricochet fire and the enemy was densely massed. Accuracy tended to decrease with range, and identifying targets beyond 1,000 to 1,200 yards was difficult.[26]

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[22] Ralph Willett Adye, *The Bombardier and Pocket Gunner*, 1st American ed. (Boston: Printed for E. Larkin by William Greenough, 1804), pp. 100–103; Stevens, *System for the Artillery*, pp. 45–56.

[23] Birkhimer, *Historical Sketch*, pp. 257–59; Jac Weller, "The Artillery of the American Revolution," pt. 1, *Military Collector and Historian* 8 (Fall 1956): 62; Albert Manucy, *Artillery Through the Ages* (Washington, D.C.: U.S. Government Printing Office, 1949), pp. 38, 44–46; Peterson, *Round Shot*, p. 72.

[24] Weller, "Artillery," pt. 1, pp. 100–101.

[25] Birkhimer, *Historical Sketch*, p. 228; Peterson, *Round Shot*, p. 66; Manucy, *Artillery*, p. 10.

[26] Weller, "Artillery," pt. 1, pp. 62, 64; Manucy, *Artillery*, pp. 31, 32, 63.

Mortars, short and squat in appearance, fired explosive shells with high-curved trajectories from fixed positions. Because shells of the same diameter could be of various weights, mortars were designated by the diameters of their bores. One advantage shells had over solid shot was that their noise and flash unnerved both men and horses. Shells were used primarily on field fortifications and large targets, such as enemy artillery emplacements.[27]

Howitzers, introduced in the seventeenth century, shared some characteristics of both the gun and mortar. Lighter than guns in proportion to their projectiles, howitzers used smaller charges but fired projectiles larger than those shot by field guns of similar weight. Like mortars, they were designated by the diameter of their bores, for those of the period were not designed to fire solid shot. Although both were designed for catapulting explosive shells behind enemy fortifications, howitzers were more mobile. Unlike mortars, they could also fire grapeshot and canister directly against enemy soldiers.[28]

The Continental Army depended primarily upon old British artillery pieces, either imported during the colonial period or captured during the first two years of the war. Some iron guns were manufactured domestically, but most of these were heavy pieces limited to fortifications. Most of the cannon used in the field were 3- and 6-pounder guns and 5.5-inch howitzers, although artillerists sometimes employed larger weapons. Congress established a foundry at Philadelphia, and General Washington relied upon its production and foreign imports to provide lighter cannon. The imported weapons came primarily from France, with the 4-pounder, originally produced in Sweden, being the most widely regarded because it combined both power and mobility better than other field guns. For mounting these weapons and for casting their own cannon, the Continental Army adopted as a handbook the work *A Treatise of Artillery* by John Müller of the Royal Academy of Artillery. Published in London in 1757, the book had greatly influenced the British artillery system and, in turn, the American artillery. The treatise was reprinted in Philadelphia in 1779 and dedicated to George Washington, Henry Knox, and the officers of the Continental artillery.[29]

Artillery Employment

During the eighteenth century armies used linear tactics, whereby two or three ranks of infantry soldiers in long lines could cover a wide front with continuous fire within ranges of 50 to 100 yards. Mass fire could then compensate for the inherent deficiencies in the infantry muskets of the period.[30] The maximum range of

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[27] Manucy, *Artillery*, pp. 31, 32, 58; Peterson, *Round Shot*, p. 33; Weller, "Artillery," pt. 1, p. 64.

[28] Peterson, *Round Shot*, p. 36; Weller, "Artillery," pt. 1, pp. 62, 64; Manucy, *Artillery*, pp. 31, 32, 56. Grapeshot, or grape, was a group of iron balls clustered around a central wooden spindle or disc held together by a canvas cover and lashings. Canister, or case shot, was a metal cylinder containing metal fragments that were scattered when the cylinder broke, causing injury or death to enemy personnel.

[29] Wright, *Continental Army*, pp. 104–05, 150.

[30] B[asil] P. Hughes, *Open Fire* (Chichester, Sussex, England: Antony Bird Publications, 1983), pp. 7–10; idem, *Firepower* (1974; reprint, New York: Sarpedon, 1997), pp. 26–28.

field artillery cannon, depending upon size, was from 1,200 to over 2,000 yards; however, with untrained soldiers and imperfect weapons, the effective range was actually about 400 yards.[31] Gun batteries were distributed along the lines of the defense at points where their objectives were clearly visible. Gunners aligned their targets visually, using designated marks on the cannon; gun sights were rare. Because of the limitations of direct fire (where the gunner could see the target) and means of communication and the necessity of relaying the piece after each firing due to recoil, guns and their detachments were more often decentralized rather than grouped together for mass fire. Cannon, often employed in pairs, were normally placed on the flanks to maximize enfilade fire, enabling them to sweep across the line of opposing infantry or cavalry.[32]

Commanders used field cannon to protect an army's deployment and to prepare for the advance of troops by firing on enemy formations. During the battle artillerists aimed at the advancing infantry or cavalry; artillery was not very productive at knocking out enemy guns. Firing from the flanks of the infantry, the artillery could produce a cross fire over their front until the infantry was within 100 yards of the objective. By then the enemy would be within small-arms range. Although the artillery could not fire without hitting their own troops, they could guard the flanks and intervene with firepower given the opportunity.[33]

Cognizant of prevailing European practice, Washington at the beginning of the war recommended that Congress authorize the procurement of enough field guns to supply two for each infantry battalion. King Gustavus Adolphus of Sweden (1594–1632) usually dispersed two light guns to each infantry regiment, and such decentralized employment at the regimental or battalion level continued in Europe from the Thirty Years War through the French Revolution. By 1775, however, given serious shortages in personnel and weapons, Congress adopted a plan to attach a detachment of artillery with two or three field pieces to each infantry brigade. In this situation, tactical control over the artillery fell to the local commander, and only administrative control remained with the parent artillery regimental commander.[34]

Any cannon not being used by detachments attached to infantry brigades or those in garrison furnished general support as part of the artillery park. A park attached to an army in the field was supposed to have twice as many pieces as the army had infantry battalions. Knox's estimate in 1778 was for the artillery park to have two heavy 24-pounders, four medium 12-pounders, four large 8-inch and eight smaller 5.5-inch howitzers, ten 6-pounders, and ten 3- or 4-pounders. An unmanned reserve of about thirty-five field pieces was also authorized. While each artillery detachment

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[31] Weller, "Artillery," pt. 1, p. 62.

[32] Hughes, *Open Fire*, pp. 11–13; idem, *Firepower*, p. 33. Enfilade fire is gunfire directed from either flank along the line of troops.

[33] Hughes, *Firepower*, p. 106; idem, *Open Fire*, p. 20; Birkhimer, *Historical Sketch*, p. 10; Weller, "Artillery," pt. 1, p. 97; Adye, *Bombardier*, pp. 21–27.

[34] Washington, *Writings of Washington, 1745–1799*, 5:37–38 and 406–07, 7:234–35, 8:70–71, 15:187, 28:59; Force, *American Archives*, 5/3:1590; Matti Laurema, *L'Artillerie de campagne française pendant les Guerres de la révolution* (Helsinki, 1956), pp. 39, 65.

supported its battalion or brigade, the artillery park supported the army as a whole and retained a reserve consisting of about one-sixth of the park.[35]

Few Continental Army officers had a clear understanding of the proper role of artillery, and Knox struggled throughout the war to create a unified system of organization and employment. He and a few others had gained some experience prior to the war in the Massachusetts Train of Artillery, which had drilled under British instructors with both siege and field pieces. Members of the few units organized in the larger coastal cities had also received some training, but otherwise the officers and men had little practical experience. One of Knox's greatest contributions was his insistence on the highest standards for his artillery officers. To attain this goal, he suggested in a letter to a congressional committee on 27 September 1776 the establishment of artillery schools. Although not enacted during the war, Congress on 13 February 1779 authorized that the commander of artillery should send artillery officers to visit laboratories, foundries, and factories with the intent of learning about the mechanical aspects of their profession. In addition, while stationed with the artillery park, the men received training, a situation that was reinforced each winter when all artillery commanders that could be spared were relieved from the brigades and concentrated in the park for schooling.[36]

Despite the difficulties in organizing a new technical arm, the Continental artillery served well during the Revolutionary War. The brisk fire of the artillery at Trenton in December 1776 cleared the streets of Hessian troops attempting to form and accounted for the quick decisive outcome of the battle.[37] The artillery arm also distinguished itself at Monmouth on 28 June 1778. The two-gun detachments usually attached to the infantry brigades were borrowed for mass fire and afterwards returned to their own units. After the battle, Washington expressed his approval: "It is with peculiar pleasure . . . that the Commander-in-Chief can inform General Knox and the other officers of the Artillery that the enemy have done them the justice to acknowledge that no artillery could be better served than ours."[38]

The service of the Continental artillery was distinguished in the northern campaigns, but the nature of the fighting in the south limited the effectiveness of field artillery. Operations in the southern campaigns were conducted over greater distances and over roads that made movement of even light artillery extremely difficult.

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[35] Adye, *Bombardier*, pp. 8–9; Stevens, *System for the Artillery*, pp. 147–50; Peterson, *Round Shot*, p. 57. An artillery park was a place to encamp army artillery, equipment, and ammunition, as well as the unit for its defense.

[36] Birkhimer, *Historical Sketch*, pp. 112–13, 120–21; Don Higginbotham, *The War of American Independence* (New York: Macmillan, 1971), p. 93.

[37] Ward, *War of the Revolution*, 1:291–305; William S. Stryker, *The Battles of Trenton and Princeton* (Boston: Houghton, Mifflin and Co., 1898), pp. 145, 151–52, 155–78, 356–58; Jac Weller, "Guns of Destiny," *Military Affairs* 20 (Spring 1956): 1–15; "Battle of Trenton, December 26, 1776," *Freeman's Journal*, 21 January 1777, reprinted in Frank Moore, ed., *Diary of the American Revolution From Newspapers and Original Documents*, 2 vols. (New York: Charles Scribner, 1858), 1:364–66.

[38] Washington, *Writings of Washington, 1745–1799*, 12:131 (quotation); William S. Stryker, *The Battle of Monmouth* (Princeton: Princeton University Press, 1927), pp. 193, 200–201, 212–14, 234, 278.

Merry Christmas 1776 *by Charles McBarron, depicting Continental artillerymen firing during the battle of Trenton*

The artillery experienced its greatest success in the south during the battle of Yorktown in 1781. There the French and Americans conducted the siege in accordance with accepted siege warfare techniques handed down during the previous century by military engineer and fortification/siege-craft master Sébastien Le Prestre de Vauban (1633–1707). Vauban had conducted numerous sieges, forty of which he directed without a single failure. No innovator, he improved on and modified existing ideas with such consummate skill that his system continued practically unchanged into the nineteenth century. His most important work was in the attack of fortified positions, which he reduced to a scientific method. The whole problem of siege craft centered around artillery. The besiegers had to bring up enough cannon to overpower those of the defense and breach the walls while protecting themselves and their weapons.[39]

Vauban's methods introduced order into the previously chaotic methods used in sieges. Although the effective range of artillery was 600 to 700 yards, it had been customary to establish batteries at 1,000 yards from the objective. But at that range cannon made little more than noise. Vauban's first object was to establish batteries within cannon range of the attacked fortification for enfilading fire. After

[39] John W. Wright, "Notes on the Siege of Yorktown in 1781 . . . ," *William and Mary Quarterly Historical Magazine*, 2d ser. 12 (October 1932): 229–49.

the defender's artillery had been subdued, if not silenced, it was necessary to push the trenches forward so that the guns might be moved into breaching positions. For this purpose, Vauban devised parallels, first used in 1673 at the siege of Maastricht in the Netherlands. Parallels were simply trenches dug parallel to the line of the defense and connected by approach trenches, or saps, dug in a zigzag pattern. The effect was to provide successive protective positions for cannon and assault troops. The first parallel, a trench 12 to 15 feet wide and nearly 3 feet deep, was dug within cannon range of the objective, while the excavated earth was thrown forward to make a parapet 3 to 4 feet high. The batteries of the first artillery position were placed in front of the parallel behind the excavated earth. While these batteries were engaged in silencing enemy artillery, saps were dug further forward. Another parallel with connecting saps was dug, and then another, until the guns and troops were in breaching positions. Sieges became highly formalized, and the success of such tactics reinforced the trend toward limited warfare.[40]

At Yorktown, the artillery of the French army comprised twenty large guns and sixteen howitzers and mortars for siege use, as well as thirty-two large guns and four howitzers for field use. By comparison, the American train of artillery had French cannon and some cast in the colonies, but most were guns with which the British had armed the colonies or that the rebels had captured. The American artillery included twenty-three large guns, twelve light guns, and twenty-one mortars and howitzers. From casualties and hard service, the artillery was below strength, even though every effort had been made to muster the number of men authorized by the reorganization of 1780.

The Americans, directed by General Knox and Brig. Gen. Louis Duportail, a French engineer, began constructing parallel entrenchments on 6 October 1781 to secure the peninsula, and three days later, they opened fire with tradition crediting Washington as touching off the first American piece. After over a week of constant firing by the American forces and their allies, the battle ended on 17 October. In the following month, Knox was promoted to major general.[41]

Artillery forces, along with the rest of the Continental Army, gradually disbanded after the battle of Yorktown. The 1st and 4th Artillery Regiments remained in the south, where they ceased to exist as organized units by the end of 1783. The 2d and 3d Artillery Regiments, which remained in the West Point area, were slightly more active. In April 1783, the two regiments reported a total of 862 artillerists.

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[40] Ibid.; John Keegan, *A History of Warfare* (New York: Alfred A. Knopf, 1993), pp. 326–27; T. Harry Williams, *The History of American Wars From 1745 to 1918* (New York: Alfred A. Knopf, 1981), pp. 6–7.

[41] Information on the battle of Yorktown is compiled from George Washington, *The Diaries of George Washington, 1748–1799*, 4 vols. (Boston: Houghton, Mifflin and Co., 1925), 2:263–69; Ltr, Henry Knox to John Jay, in Drake, *Life of Henry Knox*, pp. 70–72; and Henry P. Johnston, *The Yorktown Campaign and the Surrender of Cornwallis, 1781* (1811; reprint, New York: Da Capo Press, 1971), pp. 105–09, 113, 119, 125, 130–50. According to Wright, "Siege of Yorktown," p. 249, the battle concluded without an American attack advancing beyond the stage of constructing the second parallel and its batteries.

By July, only five artillery companies remained, two from the 2d and three from the 3d.[42]

On 24 September 1783, Congress authorized Washington "to discharge such parts of the Federal Army that remained in service as he deemed proper and expedient."[43] Washington informed the president of Congress on 21 December that he had directed Knox to reduce the size of the army to one infantry battalion, consisting of 500 men and about 100 artillerymen.[44] On 3 January 1784, Knox reported to the president of Congress that he had retained "one regiment of infantry . . . and a corps of artillery under the command of . . . [Maj. Sebastian] Bauman of about one hundred and twenty" (actually a total of 12 officers and 126 enlisted men remained in the artillery).[45] This action marked the first instance of what was to become a familiar occurrence at the end of every major war undertaken by the United States until the mid-twentieth century—the reduction of troops to the barest minimum when there was no longer the immediate danger of war.

General Washington Firing the First Gun at the British Works *by H. A. Ogden*

While artillery units in the Continental Army were rarely manned to full strength and while the cannon were seldom uniform, they performed reasonably well. The organizational structure proved sound. The assignment of an artillery company to each infantry brigade increased cooperation among the arms, and the massing of artillery in battles such as Monmouth demonstrated the potential of artillery firepower. This potential was neglected, however, for over fifty years as the country struggled to organize itself into a new nation and protect its borders from attack.

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[42] Charles H. Lesser, ed., *The Sinews of Independence* (Chicago: University of Chicago Press, 1976), pp. 250–51, 254–55; Washington, *Writings of Washington, 1745–1799*, 27:32–35.

[43] Ford et al., eds., *Journals of the Continental Congress*, 25:606.

[44] Washington, *Writings of Washington, 1745–1799*, 27:256, 279–80; Ford et al., eds., *Journals of the Continental Congress*, 25:807. Knox was to be in command of the peacetime army after Washington stepped down in November 1783.

[45] Roll 45, Item 38 (Ltr, Henry Knox to George Washington, 3 Jan 1784), Microfilm 247, Papers of the Continental Congress, pp. 375–95 (quoted words, p. 375), RG 360, NARA.

CHAPTER 2

Reorganizing the Arm

After the Revolutionary War, the new nation viewed security from foreign aggression and Indian depredations as the main missions of its armed forces. The United States, while spending more effort on harbor defense programs to protect the coastline against enemy assault, paid scant attention to field artillery because it was expensive to maintain and not usually necessary on the frontier. As the dramatic successes of Napoleon Bonaparte's artillery corps became well known, Army leaders made a concerted effort to increase the effectiveness of their own field artillery, and a small number of such units fought with great distinction during the Mexican War.

Organizational Experimentation

The period from the end of the Revolutionary War through the early years of the nineteenth century was one of experimentation with organizational structures for the artillery. While most of the artillery units were foot[1] rather than field organizations during this period, Army leaders periodically expressed interest in creating a mobile field artillery force. But not until 1821 did the War Department finally create an artillery regimental organization, a structure that would continue with few modifications for eighty years.

Before this development, however, much turmoil took place regarding the existence of the new army and its components. On 2 June 1784, Congress passed a resolution to discharge most of the troops then in service, retaining only twenty-five privates to guard military stores at Fort Pitt in Pennsylvania and fifty-five more for like duty at West Point with a few officers, none above the rank of captain.[2] This action brought the authorized strength of the standing army to the lowest point in its history.

Despite the reduction, Congress was aware of the necessity for a regular military establishment. The British still held forts and maintained garrisons in the Northwest Territory, military stores could not be left unguarded, and soldiers were needed as security on the frontier. On 3 June, one day after the mandated reduction of troops

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[1] The term *foot artillery* was any artillery that was not mounted for use in the field, as differentiated from light or mounted artillery, and was often referred to as "heavy artillery." These troops were to man guns at fixed installations and siege artillery but were often used as infantry instead.

[2] Ford et al., eds., *Journals of the Continental Congress*, 25:715, 752–53 and 2:27:512–24.

to under a hundred, Congress passed legislation recommending that four states furnish a total of seven hundred men to serve as garrison troops and to provide general protection to the country north of the Ohio River. The resolution called for a hybrid regiment of eight infantry and two artillery companies to fulfill twelve months of duty. Pennsylvania was to supply 260 men; Connecticut and New York, 165 men each; and New Jersey, 110. The regiment was to include a lieutenant colonel (from Pennsylvania), two majors (one from Connecticut and one from Pennsylvania), eight captains, ten ensigns, a chaplain, a surgeon, and four surgeon's mates.[3]

Having a large unprotected border, Pennsylvania quickly began to raise its quota of three infantry companies and part of one artillery company, selecting the newly commissioned Lt. Col. Josiah Harmar as the regimental commander. Capt. Thomas Douglass recruited fifty men of the seventy-man artillery company and went with the rest of the regiment to the Pennsylvania frontier. This company, together with Capt. John Doughty's New York company added in July 1785, constituted the two artillery units authorized by Congress for Harmar's First American Regiment. The other states made little effort to raise their quotas.[4]

In April 1785, Congress resolved to continue the First American Regiment for three years, adopting the same arrangements under which it was formed the year before.[5] State quotas remained unchanged, and most of the men and officers of the former regiment were retained. The addition of two companies from Connecticut, two from New Jersey, and one from New York completed the eight infantry companies authorized for the First American Regiment. Capt. William Ferguson, also from Pennsylvania, succeeded Douglass. Harmar continued in command and concentrated the regiment in the Fort Pitt area. There the 3-pounders and 6-pounders were placed

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[3] Ford et al., eds., *Journals of the Continental Congress*, 27:530–31; Roll 31, Item 24 (3 Jun 1784 entries), Microfilm 247, Papers of the Continental Congress, p. 103, RG 360, NARA. Planning for the peacetime army had begun in April 1783. But Congress had declined to decide on a peace establishment in May, directing Washington to use men enlisted for fixed terms as temporary garrisons, and once again in October. In 1784, it also rejected an alternative plan submitted in April and subsequently another proposal. On 2 June, Congress authorized the discharge of most of the Army and the following day created a peace establishment that was acceptable to all interests. See Wright, *Continental Army*, pp. 180–82.

[4] Ltr, Joseph Carleton to President of Pennsylvania, 28 Jul 1784, in *Pennsylvania Archives*, 1st ser., 12 vols. (Philadelphia: Joseph Severns and Co., 1852–56), 10:302–03; regimental returns, in ibid., 1/10:309–23, 337–38; Jonathan Heart et al., *Journal of Capt. Jonathan Heart* . . . (Albany, N.Y.: J. Munsell's Sons, 1885), pp. 27–40; Roll 74, Item 60 (Ltr, Joseph Carleton to President of Congress, 1 Nov 1784), Microfilm 247, Papers of the Continental Congress Papers, p. 91, RG 360, NARA. The other twenty men for Douglass's artillery company apparently were never recruited, the returns recording only fifty men in the unit. The two artillery companies in the First American Regiment are perpetuated by the 1st Battalion, 5th Field Artillery. In addition to the troops from Philadelphia, New Jersey provided a company, and Connecticut began recruiting the following spring. Massachusetts, in the throes of a dispute with New York over the Oswego and Niagara land claims, did not want to cause additional problems by sending troops. New York wanted to use its own militia and make its own treaties with the Indians. See James Ripley Jacobs, *The Beginnings of the U.S. Army, 1783–1812* (Princeton: Princeton University Press, 1947), p. 18.

[5] Ford et al., eds., *Journals of the Continental Congress*, 28:223, 239, 247; John F. Callan, comp., *The Military Laws of the United States* . . . , 2d ed. (Philadelphia: G. W. Childs, 1863), p. 78.

in the blockhouses of the log forts and stockades built along the rivers by the troops. Activities consisted mostly of marching, dispossessing squatters on public lands, building and garrisoning new forts, and participating in talks with the Indians.[6]

An economic depression in 1786 spurred Massachusetts farmers, led by Daniel Shays, into resistance against foreclosures and taxes. Declaring that the rebellion posed a threat to the security of the new nation, Congress increased the Army on 20 October 1786 to 2,040 men. Shays's Rebellion ended in early 1787, with Congress resolving on 9 April that two artillery companies be formed from the Massachusetts troops raised during the crisis. These companies, one commanded by Capt. Joseph Savage and the other by Capt. Henry Burbeck, were ordered to Springfield, Massachusetts, to guard the arsenal there.[7]

General Josiah Harmar
by Raphaelle Peale

Because a regiment composed of both infantry and artillery had been found to be administratively inconvenient, the two new artillery companies were added to the existing ones to form a separate artillery battalion. Maj. John Doughty received command of the battalion, its four companies led respectively by Capt. James Bradford and Captains Burbeck, Ferguson, and Savage. These organizations, however, served as separate units and never united as a battalion. Bradford's and Ferguson's companies continued to provide frontier security, Burbeck's went to West Point, and Savage's remained at Springfield.[8]

Henry Knox, who became Secretary at War in 1785, received authority to reorganize the Army into a legion of combined arms—infantry, cavalry, and

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[6] Orderly Book of Captain Jonathan Heart's Company, First American Regiment, USA, From September 7, 1785, to May 2, 1788, RG 98, NARA; *The Public Records of the State of Connecticut* From May, 1785, Through January, 1789, vol. 6 (Hartford: State of Connecticut, 1945), pp. 35–36; Heart et al., *Journal*, pp. 60–61, 87–88; *Pennsylvania Archives*, 1/10:448, 525.

[7] Ford et al., eds., *Journals of the Continental Congress*, 31:891–93 and 32:158–59, 255–56, 349; Jacobs, *Beginnings*, p. 35. Savage's company is perpetuated by the 1st Battalion, 5th Field Artillery, and Burbeck's by the 1st Battalion, 4th Air Defense Artillery.

[8] Ford et al., eds., *Journals of the Continental Congress*, 32:255–56 and 33:544–45, 596–97, 602–04; Callan, comp., *Military Laws*, p. 83; *American State Papers*, Class 5, *Military Affairs*, 7 vols. (Washington, D.C.: Gales and Seton, 1832–61), 1:5–6; Birkhimer, *Historical Sketch*, pp. 24–25; Jacobs, *Beginnings*, p. 287. Ferguson's and Bradford's companies are perpetuated by the 1st Battalion, 5th Field Artillery.

artillery—in 1786, but the failure of Shays's Rebellion and the relative calm on the frontier reduced the need for such a force. Within a few years, however, the situation changed, especially after Brevet Brig. Gen. Josiah Harmar and Maj. Gen. Arthur St. Clair had suffered defeats in their Northwest Territory campaigns against the Indians respectively in 1790 and 1791. Prompted by public concern, Congress instituted the Legion of the United States in 1792.

The new organization consisted of a legionary staff and four sublegions. Each sublegion included a troop of dragoons, an artillery company, and one rifle and two infantry battalions with four companies each. The old artillery battalion ceased to exist, each subordinate company becoming part of one of the sublegions. The internal organization of the companies remained relatively undisturbed. Although those of the old artillery battalion each had an authorized aggregate strength of up to seventy-nine officers and men, the actual number was usually around fifty because of extra details, sickness, and underrecruitment. The new companies were each authorized an aggregate strength of sixty-three officers and men (*Table 2*).[9] Numerically the artillery accounted for a little less than 5 percent of the legion's authorized strength. Because the companies remained separated at widely scattered posts, the reorganization had little effect on the employment of the artillery.

As the United States was concentrating on the defense of the frontier, the revolution in France and the ensuing European war had resulted in a coalition of Great Britain and other nations against France. The rivalry between Great Britain and France, both with their colonies and economic interests in the western hemisphere, increased the danger of war. In response, Congress on 9 May 1794 created, as a new organization, the Corps of Artillerists and Engineers. The corps was organized into four battalions, each with four companies.[10]

One reason for the amalgamation of artillerists and engineers was the need for similar training in preparing for the attack and defense of fortifications. Distinguished French officers were appointed to the corps primarily because of their engineering skills. Stephen Rochefontaine became the corps commandant, receiving the rank of lieutenant colonel, and Louis de Tousard and John Jacob Rivardi were two of the authorized majors to command the battalions. Rochefontaine and Rivardi were already employed as civilian engineers by the government, and Tousard was an artillerist. Since the ranks contained sappers and miners, the new corps was suited to building as well as manning the fortifications. The authorization also included the provision for two cadets per company, thus creating a new grade in the Army.[11]

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[9] *American State Papers*, Class 5, *Military Affairs*, 1:40–41; Callan, comp., *Military Laws*, pp. 92–94; Legion of the United States Orders, 28 Mar 1793, Legionville, p. 123, vol. 499/401, RG 98, NARA. The rifle battalion was armed with rifles; the infantry, with standard infantry muskets (generally, 1777 French models or similar ones).

[10] Callan, comp., *Military Laws*, p. 104.

[11] Ibid.; Alexander Hamilton, *The Papers of Alexander Hamilton*, 27 vols. (New York: Columbia University Press, 1961–87), 3:382.

Table 2—Artillery Organization, 1784–1792

	1784	*1787*	*1790*	*1792*
Battalion Staff				
Major		1	1	1[a]
Adjutant		1	1[b]	
Quartermaster		1	1[b]	
Paymaster/Clothier		1	1[b]	
Sergeant Major		1		
Quartermaster Sergeant		1	1	
Surgeon's Mate			1	
Total		6	6	1
Company				
Captain	1[c]	1	1	1
Lieutenant	1	2	2	2
Sergeant	4	4	4	4
Corporal	3	4	4	4
Bombardier	3			
Gunner	3			
Musician	2	2	2	2
Private		60	66	50[d]
Matross	35			
Total	52	73	79	63
Companies Authorized	2	4	4	4
GRAND TOTAL	104	298	319	253

[a]Act provided for a major commandant of artillery.
[b]Duties performed by a company officer as an additional assignment.
[c]Douglass's company used as example.
[d]Includes ten artificers.

Because of the increased emphasis on the technical aspects for fortification, the War Department acted upon George Washington's recommendation and established a school for the artillerists and engineers and for the cadets attached to the corps at West Point in 1794. West Point had been suggested as a site for a military academy as early as 1776, and by 1781 an engineer school, a laboratory, and a library had been set up there. Practical experiments in gunnery had also taken place at the post. A fire destroyed the buildings in 1796, causing the school to close. In early January 1800, Secretary of War James McHenry pushed for a military academy to be founded at West Point, recommending that it include the "Fundamental School," the "School of Engineers and Artillerists," the "School of the Navy," and the "School of Cavalry and Infantry." Realization finally came in September 1801, when West Point was reopened as an academy to fulfill Secretary of War Henry Dearborn's July order that all cadets of the corps should report for instruction.[12]

Shortly before augmenting the artillery, Congress had authorized the construction of twenty-one coastal fortifications from Portland, Maine, to St. Mary's, Georgia. Congress also authorized artillery pieces for those fortifications, but many of the cannon and much of the shot were never provided. Nevertheless, these harbor programs reflected the emphasis on a defensive military policy that was to continue until after World War II, which stressed the geographic requirements for defending the coastline. But U.S. leaders remained opposed to the large regular army that would have been necessary to engage in large-scale land warfare. In addition, the resources of the new nation would not have permitted such an army. The harbor programs, by contrast, seemed both economical (in cost as well as in personnel) and practical for self-defense.[13]

The old artillery companies remained occupied on frontier posts, and the ones authorized in 1794 were slow in organizing. In 1796, only 224 artillerists of approximately 750 (actual strength of artillery rank and file) were stationed on the seacoast, where in an emergency militia were to reinforce the regulars in the coastal forts. The threat of war in France in 1798 prompted Congress to increase the size of the Army and to appropriate more than one million dollars for fortifications and arms. The Corps of Artillerists and Engineers was authorized an additional regiment, to be raised by voluntary enlistment for the term of five years unless sooner discharged. The new unit started with three battalions, each with four companies, and in 1799 received congressional approval for a fourth. The old Corps of Artillerists and Engineers became the 1st Regiment and the new organization the 2d Regiment.[14] Lt. Col. John Doughty, who had left the service in 1792, returned to command the 2d

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[12] *Official Register of the Officers and Cadets, United States Military Academy, for 1917* (West Point, N.Y.: United States Military Academy Printing Office, 1917), p. 3; Jacobs, *Beginnings*, pp. 236–237 (quoted words), 238, 285–91, 297–98. An act of Congress on 16 March 1802 formally established the United States Military Academy at West Point, which had been operating informally there since September of the previous year.

[13] Callan, comp., *Military Laws*, pp. 102–03; Emanuel Raymond Lewis, *Seacoast Fortifications of the United States*, rev. ed. (Annapolis, Md.: Leeward Publications, 1979), pp. 4–6; Walter Millis, *Arms and Men* (New York: New American Library, 1956), p. 44.

[14] Callan, comp., *Military Laws*, pp. 119–20, 133–39; *American State Papers*, Class 5, *Military Affairs*, 1:45–116, 175.

Regiment. To strengthen the Army even further, Congress authorized the president to raise a temporary army of 10,000 men for a period not exceeding three years, but no artillery troops were ever organized under this authority.[15]

By 1801, fear of war with France had abated, and on 16 March 1802 Congress passed an act "fixing the military peace establishment of the United States." The organizations in the Army were reduced to one regiment of artillery and two of infantry. The same act empowered the president "to establish a corps of engineers," thus again separating them from the artillery.[16] The Regiment of Artillerists was to comprise twenty companies organized into five battalions for a total of 1,627 officers and men.[17] But regimental control of the artillery companies remained virtually nonexistent because of the continued separation of the companies from each other and regimental headquarters.

Because the Regular Army did not have enough artillerymen to fight a full-scale war or even to man the fortifications already built, the state militia resources were essential. An act of Congress on 8 May 1792 provided the basis for a militia system that directed the state legislatures to arrange their troops into divisions, brigades, regiments, battalions, and companies. The size of a division was not specified, and there were various interpretations of the wording "to each division, there shall be at least one company of artillery." The act did make clear, however, that artillery units were not to exceed one company for each infantry regiment. The organization of a militia artillery company differed only slightly from that of one in the Regular Army, generally allowing more privates. The act exempted "sundry corps of artillery . . . [that] now exist in several of the said states, which . . . have not been incorporated with, or subject to, the general regulations of the militia . . . such corps retain their accustomed privileges, subject, nevertheless, to all other duties required by this act in like manner with other militia."[18]

Some of these volunteer organizations were of long standing, predating the Revolutionary War, and some had more social than military functions. Typical examples were the Charleston Artillery of South Carolina, organized in 1756, and the German Fusiliers, organized in Charleston in 1775; the Newport Artillery of Rhode Island, organized in 1741; and the United Train of Artillery, organized in Providence in 1775.[19] In 1804, the militia returns showed slightly fewer than 7,000 men in the artillery, a third of whom were in Massachusetts alone. By 1812, militia artillery had increased to 12,195 men, and over half were located in New York, Massachusetts, and Virginia.[20] Lack of supplies and ordnance and laxity in enforcing attendance on

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[15] Callan, comp., *Military Laws*, pp. 122–25.

[16] Ibid., pp. 141–49 (quoted words, pp. 141 and 148).

[17] Ibid., p. 142; Roll 1, Statement, 2 Dec 1807, encl to Ltr, SecWar to John Dawson, 20 Nov 1807, Microfilm 220, Reports to Congress, 3 Feb 1803–13 Apr 1818, pp. 46–59, RG 107, NARA.

[18] Callan, comp., *Military Laws*, pp. 95–100 (quotations).

[19] Johnson, *Traditions and Reminiscences*, pp. 206–15; Christopher Gadsden, *The Writings of Christopher Gadsden, 1746–1805* (Columbia: University of South Carolina Press, 1966), pp. xviii, 13; Charter of Arty Co of Newport, 1741, copy in CMH files. On chartered military organizations, see copy of "Report of Militia of the United States" in CMH files.

[20] *American State Papers*, Class 5, *Military Affairs*, 1:169, 331.

the few required muster days, however, limited the use of militia artillery to the firing of salutes and participation in parades.

Mobile artillery for use in the field had been neglected after the Revolutionary War, but Napoleon's successes with field artillery captured the attention of senior Army leaders. During Thomas Jefferson's administration, Secretary of War Dearborn publicly commented on articles written in Europe that argued for the clear advantages of mobility in field artillery and the ways of obtaining it.[21]

The foremost artillerist of the eighteenth century had been Jean-Baptiste Vaquette de Gribeauval, who had reorganized the French artillery after serving with the outstanding Austrian artillery against Frederick the Great during the Seven Years War. Although he began to innovate while working with the French in 1765, he did not fully implement his novel ideas until after he became Inspector General of Artillery in 1776. Creating distinct materiel for field, siege and garrison, and coast artillery, Gribeauval lightened the cannon, standardized a relatively small number of calibers, mounted the cannoneers, and replaced civilian drivers with soldiers, making artillery a more valuable asset in the field. He also introduced interchangeable parts in carriage manufacturing and militarized transport. For siege and garrison artillery, he adopted 12- and 16-pounder guns, an 8-inch howitzer, and 8-, 10-, and 12-inch mortars; for coastal fortifications, used a platform with rear wheels for traversing a track, which greatly simplified the task of aiming the weapon at a moving target; and for field artillery, reduced the types of guns to the 4-pounder, 8-pounder, and 12-pounder and introduced the 6-inch mortar. Gribeauval's innovations came too late to affect American artillery during the Revolutionary War, but they had a profound effect on Army leaders during the early nineteenth century.[22]

Adopting the Gribeauval system would have facilitated maneuvers and the servicing of artillery in the field. Secretary Dearborn recognized the advantages of the Gribeauval carriages, but he could not bring himself to adopt an entire European system at once, mainly because of the expense. He did introduce several changes in carriage design, however, but missed the more important feature of interchangeable parts.[23]

In 1808, when war with England seemed imminent, President Jefferson recommended that Congress increase the strength of the Army. In response, Congress authorized five additional infantry regiments and one regiment each of riflemen, light dragoons, and light artillery for use in the field.[24]

The Regiment of Light Artillery was authorized ten mounted companies equipped with light field guns, but men and equipment were scarce. The Army had reported that there were enough cannon, but none was properly mounted for field

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[21] Birkhimer, *Historical Sketch*, pp. 33–34, 228–29.

[22] Ian V. Hogg and John H. Batchelor, *Armies of the American Revolution* (Englewood Cliffs, N.J.: Prentice-Hall, 1975), pp. 138–39; Peterson, *Round Shot*, pp. 51, 54; Manucy, *Artillery*, p. 11; O[liver] F. G. Hogg, *Artillery* (Hamden, Conn.: Archon Books, 1970), p. 103.

[23] Birkhimer, *Historical Sketch*, pp. 228–31.

[24] *American State Papers*, Class 5, *Military Affairs*, 1:222–23; Callan, comp., *Military Laws*, pp. 200–03. *Light artillery* in this instance means field artillery in which the guns are horse-drawn and the men are mounted. The terms *horse artillery* and *flying artillery* were also used.

use. Another problem was that the companies were mustered at widely scattered posts, creating difficulties in assembling them as a regiment. Many of the officers were drawn from the companies of the existing artillery regiment and had no concept of how light artillery was moved and employed. Only one company, that of Capt. George Peter, was even partially equipped on an experimental basis with two 6-pounders and sixteen horses. The unit marched in a parade through Washington on 4 July 1808 and made an impressive demonstration to Congress. Soon thereafter, it conducted a march from Baltimore to Washington with great success before being sent to New Orleans.[25] In 1809, the War Department wrote to Brig. Gen. James Wilkinson, the Army commander in New Orleans:

> The charges for . . . forage and other articles are such if admitted must soon devour our appropriations. . . . Horses for the Artillery cannot be maintained at such an expense, they must either be sent to some part of the country where they can be maintained at one-fourth the present Expense, or they must be sold. . . . Imagine for a moment the whole regiment of Light Artillery on this scale of expense—Consider the prejudice against the Army in general which an inspection of such charges by members of the Government is calculated to impress on their minds.[26]

As a result, the horses were sold and the Regiment of Light Artillery was dismounted. Captain Peter resigned in disgust. No other company of the regiment was mounted before the War of 1812, and few were then. It was not until February 1812 that officers, even when mounted, were authorized to draw forage for their horses. The officers had previously paid for their forage from their own pockets.[27]

The increasing threat of war with Great Britain prompted Congress on 11 January 1812 to authorize two artillery regiments in addition to the Regiment of Artillerists**,** which was redesignated as the 1st Regiment of Artillery, and the Regiment of Light Artillery. The twenty companies in each of the new regiments were divided into two battalions rather than five, and each company had fourteen more men than did the 1st Regiment.[28] The same act also added ten infantry regiments and one of dragoons to the Regular Army, bringing the total number of regiments up to seventeen of infantry, one of riflemen, two of dragoons, three of artillery, and one of light artillery.[29]

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[25] Henry J. Hunt, "Our Experience in Artillery Administration," *Journal of the Military Service Institution of the United States* 12 (March 1891): 205; Jacobs, *Beginnings*, pp. 274–76. Captain Peter's company is now designated as the 2d Battalion, 2d Air Defense Artillery.

[26] Ltr, WD to James Wilkinson, 22 Jun 1808, in WD Sec's Office, Ltrs Sent, Mil Affairs, bk. 4, p. 103, RG 107, NARA. There was a change in administration, and on 5 March 1809, William Eustis replaced Dearborn as Secretary of War.

[27] Callan, comp., *Military Laws*, p. 212.

[28] Ibid.

[29] In June 1812, the number of infantry regiments was increased to twenty-five and, in January 1813, to forty-five. In 1814, three more rifle regiments were authorized, and volunteer units were declared eligible to enroll for five years or the duration of the war. The total then was forty-eight infantry regiments and four rifle regiments.

When Congress declared a state of war between Great Britain and the United States on 18 June 1812, the authorized standing Army was, on paper, respectable. In reality, however, approximately half the units had been legislated into being less than six months before, and none was up to strength. In July, the entire Army numbered only 6,744 men, just slightly more than the authorized strength of the artillery regiments.[30]

Major George Peter

During the War of 1812, Congress reorganized the three artillery regiments. On 2 January 1814, Secretary of War John Armstrong, who served from January 1813 to September 1814, recommended to both the House and Senate "that the three Regiments of Artillery (1st, 2d, and 3d) be consolidated and formed into Battalions, under the title Artillery of the United States."[31] An act approved his recommendation on 30 March. The law provided that the "first, second and third regiments of artillery be joined in one corps, and organized into twelve battalions . . . [divided into] forty-eight companies."[32] The Corps of Artillery was no more than an appellation describing the group of battalions, for neither a commander nor a staff was authorized. The strength of the companies was increased by the addition of thirty-four enlisted men and two lieutenants, one of whom was to be a "conductor of artillery" responsible for ordnance equipment and supplies (*Table 3*).[33] Each company in the corps was to maneuver either four guns of the same caliber and two howitzers or six guns of not more than two calibers. A company (or division) of artillery comprised two half divisions, each consisting of two guns of the same caliber and one howitzer or three guns of the same caliber. One ammunition wagon or caisson was allotted to each pair of 3-pounders, one to each 6-pounder, and two to each howitzer. Two, or at most three, were allotted to each gun larger than a 6-pounder. Three wagons for equipment and stores supported each company and one each half division. A

[30] *American State Papers*, Class 5, *Military Affairs*, 1:320.

[31] Roll 1, Ltr, John Armstrong to [Chairman, Mil Affairs Cmte, Senate], 2 Jan 1814, Microfilm 220, Reports to Congress, 3 Feb 1803–13 Apr 1818, pp. 289–91 (quoted words, p. 289), RG 107, NARA.

[32] Callan, comp., *Military Laws*, pp. 252–55 (quoted words, p. 252).

[33] Ibid.

traveling forge was authorized for each company of light artillery and for every two companies of foot artillery.[34]

During most of the period since 1784, procurement and development of materiel had been functions of the artillery, but on 14 May 1814, Congress established the Ordnance Department. The Commissary-General of Ordnance, the title of the department chief, was charged with not only inspecting and approving all ordnance pieces, cannon balls, shot, and shell but also directing the construction of carriages and other apparatus for field and garrison service. Col. Decius Wadsworth, a former artillery company commander, was appointed to this position and was later designated as Chief of Ordnance on 8 February 1815.[35]

The principal fighting strength on both sides during the War of 1812 lay in the infantry. During the war, most of the artillerists manned various ordnance pieces wherever they might be posted and fought as infantry when necessary. The 3d Artillery Regiment served primarily as infantry on the New York–Canadian frontier, with some companies performing as foot artillery along the Atlantic coast. Many of the line officers were detached as district commanders or as staff officers in other departments. Few artillerymen were capable of employing artillery in a battlefield environment, fewer yet understood the value of "field" artillery, and infantry commanders had even less knowledge of field artillery tactics. There was little hope of salvaging the situation, for the Army had no senior artillery officers to direct any emphasis toward the arm. During the war, a few companies of the 1st and 2d Regiments served as true field artillery and were occasionally effective—the 12-pounder batteries at the battle of Chippewa, for example—but they never concentrated their efforts. The infantry battle lines usually formed just beyond effective artillery range (about 500 yards), and accompanying artillery was employed primarily as "position artillery," its use limited to repelling the opposing force's attack.[36]

The War Department had intended to mount the Regiment of Light Artillery, but within six months of the declaration of war, only half the companies were equipped as such. The regiment seldom operated as light artillery, however, and when it did, it was by small detachments. Light artillery was a new institution in the United States, and the officers and men lacked peacetime, much less wartime, experience. Because the terrain did not favor massed cavalry, many viewed horse artillery as unnecessary. By the end of the war, most of the companies in the Regiment of Light Artillery had been reequipped as infantry.[37]

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[34] Military Laws, and *Rules and Regulations for the Army of the United States* (Washington City, December 1814), p. 84.

[35] Callan, comp., *Military Laws*, pp. 226–27, 263–66; Francis B. Heitman, *Historical Register and Dictionary of the United States Army* . . . , 2 vols. (Washington, D.C.: U.S. Government Printing Office, 1903), 1:43–44.

[36] Birkhimer, *Historical Sketch*, pp. 193–200; *American State Papers*, Class 5, *Military Affairs*, 1:439–512; H[enry] M. Brackenridge, *History of the Late War Between the United States and Great Britain* . . . , 6th ed. (Philadelphia: James Kay, Jun. and Brother, 1836), pp. 180–86; Nathaniel Herbert Claiborne, *Notes on the War in the South* . . . (Richmond, Va.: W. Ramsey, 1819), pp. 21–23; Robert S. Quimby, *The U.S. Army in the War of 1812* (East Lansing: Michigan State University Press, 1997), pp. 521–27.

[37] Birkhimer, *Historical Sketch*, pp. 192–99.

Table 3—Artillery Organization, 1794–1815

	Arty & Engrs	*2d Regt Arty & Engrs*	*Regt Arty & Engrs (2)*	*Regt Arty*	*Regt Light Arty*	*2d & 3d Regts Arty*	*Corps of Artillery*	
	1794	*1798*	*1799*	*1802*	*1808*	*1812*	*1814–1815*	
Regimental Staff								
Colonel				1	1	1		
Lt Colonel	1	1	1	1	1	2		
Adjutant	1	1	1[a]	1	1[a]	2		
Major				4	1[b]	2		
Surgeon	1	1	1		1	1		
Quartermaster			1[a]		1[a]	1		
Paymaster			1[a]		1[a]	1		
Surgeon's Mate			2		1	2		
Sgt Major					1	2		
QM Sergeant					1	2		
Chief Musician			1	[c]	2	2		
Musicians			10					
							1814	*1815*
Battalion Staff								
Lt Colonel							6	4
Major	1	1	1				6	4
Adjutant	1[d]	1[d]					12	8[a]
Surgeon's Mate	1	1						
Quartermaster								
QM Sergeant			1					
Sgt Major			1					
Battalions in Each Regiment	4	3	4	5		2	12[e]	8[e]

Continued

Table 3—*Continued*

	Arty & Engrs	*2d Regt Arty & Engrs*	*Regt Arty & Engrs (2)*	*Regt Arty*	*Regt Light Arty*	*2d & 3d Regts Arty*	*Corps of Artillery*
	1794	*1798*	*1799*	*1802*	*1808*	*1812*	*1814–1815*
Company							
Captain	1	1	1	1	1	1	1
Lieutenant	2	2	2				
1st Lieutenant				1	1	1	1
2d Lieutenant				1	1	1	2[f]
3d Lieutenant					[g]		1
Cadet	2	2	2	2	2	2	
Sergeant	4	4	4	4	4[g]	4	5
QM Sergeant							1
Corporal	4	4	4	4	4	4	8
Private	42[h]	42[h]	48[h]	56		72	100
Artificer	10	10	8	8	8	8	
Matross					58		
Musician	2	2		4	2	2	4
Total	67	67	69	81	81[g, i]	95	123
Companies in Each Battalion	4	4	4	4		10	

[a]Duties performed by a company officer as an additional assignment.
[b]Additional major authorized on 20 January 1813.
[c]Two music teachers added in 1803.
[d]Adjutant and paymaster.
[e]Authorized strength for twelve battalions in 1814 and eight battalions in 1815. Not broken down further.
[f]Also to be a "conductor of artillery."
[g]3d lieutenant and sergeant added to each company on 20 January 1813. Deleted in 1815.
[h]Includes sappers and miners.
[i]One saddler and one farrier added only when a company was mounted, effective 24 February 1812; twelve drivers added on 16 May 1812. All deleted in 1815.

Battle of New Orleans *by Kurz & Allison*

Artillery did play an important part against the British at New Orleans in January 1815, but as siege artillery rather than as mobile artillery accompanying an army in the field. The conditions there were optimum for the employment of artillery in its traditional defensive role. After both sides had received reinforcements, Maj. Gen. Andrew Jackson's troops numbered only 6,000 in comparison to the British force of 15,000. Using every available man, General Jackson emplaced eight batteries, consisting of thirteen to fifteen guns of different calibers.[38] Regulars commanded or commanded and manned four of the eight batteries; militia and privateers, two batteries; and the Navy, two batteries. On the opposite (west) bank of the Mississippi River, Commodore Daniel Patterson erected naval batteries to fire across the river in support of Jackson's forces. With their commander dead and their ranks depleted, the British abandoned the disastrous campaign on 18 January and withdrew to their ships.[39] The battle of New Orleans did not affect the outcome of the war as the peace treaty had been signed three weeks earlier, but the victory did prove to the Americans that they could defeat a major European power in battle.

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[38] The battle of New Orleans is described in Brackenridge, *History of the Late War*, pp. 283–88; Claiborne, *Notes on the War*, p. 78; Quimby, *War of 1812*, ch. 23; John K. Mahon, *The War of 1812* (Gainesville: University of Florida Press, 1972), pp. 361–68; Wilburt S. Brown, *The Amphibious Campaign for West Florida and Louisiana, 1814–1815* (University: University of Alabama Press, 1969), pp. 101–51.

[39] Some controversy exists as to the numbers and types of guns as well as to who manned them.

On 3 March 1815, in an act "fixing the military peace establishment of the United States," Congress authorized the retention of the Corps of Artillery as prescribed in 1814, but reduced the Regiment of Light Artillery to the strength authorized in 1808.[40] Although the various acts of Congress specified the internal structures of artillery companies, returns rarely showed any unit organized precisely along these lines. Officers were frequently absent on long leaves, on recruiting service to fill their depleted organizations, or performing other duties. During the war, a disproportionate number of officers had been detailed for duty in Washington and in the ten military districts, the administrative divisions of the Army. The units were thus generally severely understrength. Indeed, the postwar Corps of Artillery was approximately 40 percent understrength, and on 17 May 1815 Congress reduced it to eight battalions.[41]

The Army returned to its former duties of patrolling the frontier and guarding the coastline. Some of the artillery units served in the field with the troops on the frontier, but most of the companies were in scattered detachments along the seaboard to serve the guns emplaced in the numerous fortifications built to defend the coastal cities.

During the first quarter of the nineteenth century, some 12,000 miles of seacoast, lake, and inland frontier had to be defended, and the War of 1812 had renewed interest in these defenses. Most of the principal harbor cities had defenses of some kind dating from the colonial period, and during the 1790s—when the threat of war with both England and France loomed large—the majority of these had been strengthened. But before the War of 1812, these fortifications had fallen into neglect; immediately after the war, Congress attempted to correct this weakness. In late 1817, Secretary of War John C. Calhoun reported to the House of Representatives on the status of national defense:

> The military establishment . . . is sufficiently extensive to keep the fortifications in a state of preservation, but it is wholly inadequate to defend them against a regular attack. . . . To garrison the forts in the maritime frontier alone would require . . . more than thrice our present number alone to repel the assaults. . . . The portion of the army stationed in the fortifications now erecting is employed to aid in constructing them. . . . It has been employed . . . in the construction of roads, arsenals, and other public works connected with the defense of the country. The existing fortifications are thought to be wholly insufficient in the event of future war.[42]

As a result, Calhoun proposed a series of fortresses to be built under the supervision of the Corps of Engineers. Congress ignored these requests and neglected to fund fully a fortification program. Moreover, appropriations for ordnance lagged far behind construction, and completed casemates were thus without guns.

In the years immediately following the War of 1812, the Army underwent several administrative changes. In May 1815, for purposes of command and administration, it established two geographical divisions—the Northern Division commanded by Maj. Gen. Jacob Brown, and the Southern Division commanded by General

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[40] Callan, comp., *Military Laws*, pp. 252–55, 266–67 (quoted words, p. 266).
[41] *American State Papers*, Class 5, *Military Affairs*, 1:535.
[42] Ibid., 1:669.

Jackson. The artillery was divided among the divisions, four battalions in the Northern Division and four in the Southern. One year later, the system of designating companies by the names of their commander gave way to a system of lettered designations, which greatly simplified administrative work within the Army.[43]

The Army underwent a major reorganization in 1821. The framework of the law that Congress passed on 2 March of that year was based upon proposals of Secretary Calhoun, who wanted to retain the existing units of the Army at reduced strength and use the officers as cadres upon which the Regular Army could be expanded in times of war. He suggested that ordnance, light artillery, and heavy artillery be reorganized to form five regiments with 247 officers and 2,950 men. He was specific in his recommendations about artillery for field use:

> The present regiment of light artillery being organized to manoeuvre 60 guns [6 per company] is stronger than our occasions require. . . . It is proposed to convert it into an additional regiment of foot artillery and to add a company of light artillery to each of the five regiments of artillery . . . to raise companies to 100 men in time of war [from 64 in peacetime], so that the whole corps will be able to manoeuvre 90 guns, viz 30 by light artillery and 60 by 10 companies of foot; and 900 or even 1800 guns in forts and batteries by aid of militia, to serve alternately two guns.[44]

Congress followed most of Secretary Calhoun's suggestions. In the act, which became effective on 1 June 1821, the Corps of Artillery and the Regiment of Light Artillery were consolidated to form the 1st, 2d, 3d, and 4th Regiments of Artillery. One of the nine companies authorized to each of the four regiments was to be equipped as light artillery, and a supernumerary captain was assigned to each regiment to perform ordnance functions. The number of artillery companies was reduced from forty-two (thirty-two in the Corps of Artillery and ten in the Regiment of Light Artillery) to thirty-six in the four artillery regiments (*Table 4*).[45] Calhoun's reorganization, which reduced the entire Army from an authorized strength of 12,664 to 6,183, gave the artillery 192 officers and 1,988 enlisted men, resulting in a ratio of one artilleryman to every two other soldiers.[46]

The companies were assigned to depots in the interior in addition to their traditional postings at various forts along the coast. In spite of the consolidations, all companies averaged about 20 percent understrength. None was equipped as horse artillery, that is, with enough horses to mount the men, and none was well suited for field service.[47]

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[43] William A. Gordon, *A Compilation of the Registers of the Army of the United States* . . . (Washington, D.C.: James C. Dunn, 1837), p. 71. On the redesignation orders, see copies in CMH files.

[44] *American State Papers*, Class 5, *Military Affairs*, 2:189–92 (quotation).

[45] John C. Calhoun, *The Papers of John C. Calhoun*, 2–9 vols. (Columbia: University of South Carolina Press for the South Caroliniana Society, 1959–73), 5:328–29, 560; Callan, comp., *Military Laws*, pp. 306–09. These four regiments are currently designated as the 1st, 2d, 3d, and 4th Air Defense Artillery.

[46] *American State Papers*, Class 5, *Military Affairs*, 2:194, 452.

[47] Ibid., 2:380–450, 452–56; William Addleman Ganoe, *The History of the United States Army*, rev. ed. (New York: D. Appleton-Century, 1942), pp. 159, 170.

Table 4—Artillery Organization, 1821–1848

	1821	*1838*	*1842*	*11 Feb 1847*	*3 Mar 1847*	*1848*
Regimental Staff						
Colonel	1	1	1	1	1	1
Lt Colonel	1	1	1	1	1	1
Major	1	1	1	2	2	2
Sgt Major	1	1	1	1	1	1
QM Sergeant	1	1	1	1	1	1
Captain (Ord)	1[a]					
Quartermaster			1[b]	1[b]		
Principal Musician					2	
Principal Teamster					1	
Adjutant	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]
Company						
Captain	1	1	1	1	1	1
1st Lieutenant	2	2	2	2	2	2
2d Lieutenant	2	1	1	1	1	1
Sergeant	4	4	4	4	4	4
Corporal	4	4	4	4	4	4
Artificer	3	3	2	2	2	2
Musician	2	2	2	2	2	2
Private	42	58	42	64[c]	64[c]	42
Teamster						
Total	60	75	58	80[c]	80[c]	58
Companies in Each Regiment	9	10	10	10	12	12

[a]Supernumerary captain deleted in 1832.
[b]Performed by a company officer as an additional assignment.
[c]President authorized on 13 May 1846 to increase the number of privates in each company not to exceed 100 and to reduce the number to 64 when the extra men were no longer necessary for the Mexican War. The total in each company would change to 116 in February 1847 and to 118 in March 1847.

Also included in the reorganization of 1821 was the provision that "the ordnance department shall be merged with the artillery."[48] Although the Ordnance Department still existed as a separate entity, its head was an artillery officer, as were all officers on ordnance duty. Ordnance officers as such were eliminated, and the ordnance enlisted ranks were reduced to fifty-six men. The measure greatly weakened the Ordnance Department but had little real effect on the artillery. Not until 1832 was ordnance once again established as a separate branch with ordnance officers. At the same time, the provision for an ordnance captain in each artillery regiment was abolished.[49]

Because the troops remained widely scattered in small detachments, Calhoun felt that they would become undisciplined and would not train and drill as effectively as when stationed as part of larger organizations.[50] In April 1824, as a result of a proposal by Calhoun, the Army's first specialist school—the Artillery School of Practice—was established at Fortress (later Fort) Monroe, Virginia. Ten artillery companies were to be drawn from the four regiments and assembled as the Artillery Corps for Instruction. The faculty was to be selected from the artillery at large. Through a plan of rotation, all artillery companies were eventually to pass through the school. Cadets assigned to the artillery after graduating from West Point were to receive a year's instruction at the school before joining their regiments. The goal of the school was to provide technical training in gunnery, artillery tactics, and various other artillery duties.[51] In a letter to Secretary Calhoun on 20 November 1824, Commanding General of the Army Jacob Brown wrote: ". . . an important accession of scientific and experimental knowledge is to be expected from the school of practice at Fortress Monroe."[52] The school continued in operation for the following ten years when it closed because of the increasing demand for artillerists to man the fortifications on the seacoast.[53] The last of the artillery companies stationed at Fort Monroe as part of the Artillery School departed for Florida in 1835 when the Second Seminole War threatened.[54]

During the next six years of hostilities, the Army maintained an average of 3,000 regulars in Florida, about one-fourth of whom were artillerymen. For the most part, the artillerists were limited in employment to manning the numerous stockades erected to confine the Indians to the Everglades.[55] Pressured by the war, Congress in 1838 increased the number of artillery companies from nine to ten and the number of privates in each company from forty-two to fifty-eight. At the same time, however,

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[48] Callan, comp., *Military Laws*, pp. 306–09 (quoted words, p. 307).

[49] Ibid., pp. 322–23.

[50] *American State Papers*, Class 5, *Military Affairs*, 3:603–05.

[51] Ibid., 2:699; WD GO 10, 13 Jul 1814; WD GO 11, 8 Feb 1832; WD GO 18, 5 Apr 1824; *General Regulations for the Army . . .* (Washington, D.C.: Davis and Force, 1825), pp. 398–402.

[52] *American State Papers*, Class 5, *Military Affairs*, 2:701.

[53] Robert Arthur, *History of Fort Monroe* (Fort Monroe, Va.: Printing Plant, Coast Artillery School, 1930), p. 154; WD GO 31, 19 Apr 1834.

[54] WD GO 5, 14 Feb 1835.

[55] John T. Sprague, *The Origin, Progress, and Conclusion of the Florida War* (1848; reprint, Gainesville: University of Florida Press, 1964), pp. 104–05.

Fortress Monroe, Old Point Comfort, & Hygeia Hotel, Va., in 1861 & 1862
by E. Sachse & Company

the number of second lieutenants was decreased from two to one.[56] During the long conflict, almost all artillery units served in Florida, but because of the difficult terrain and the character of the opposing forces, they generally performed their service as infantry, gaining little experience in the proper employment of their arm.

Another major reduction in forces occurred in 1842 following the end of the war. Congress cut the number of privates in each artillery company back to the strength of 1821 and reduced the number of artificers from three to two. The reductions were accomplished through attrition.[57]

The Rise of Field Artillery

Although the Army had made little use of field artillery during the early years of the nineteenth century, its leaders were slowly becoming increasingly aware of its potential. Much of this developing awareness can be attributed to a growing interest in European methods of conducting warfare, which simplified employment and gave field artillery significance if not predominance on the battlefield. The Gribeauval system in the French army had contributed to the evolution of artillery as a decisive arm for mobile warfare, but its adoption in the United States in 1809 had been limited to the design of field carriages—ironically, just when they were becoming obsolete in Europe. Following the Napoleonic wars, the British began improving upon the Gribeauval system, and the French, in turn, copied the British design, calling it the *Système anglais modifié*. For the U.S. Army to develop an

[56] Callan, comp., *Military Laws*, pp. 341–49; WD GO 25, 20 Jul 1838.
[57] Callan, comp., *Military Laws*, pp. 358–61; WD GO 57, 27 Aug 1842.

effective, formal system of artillery, standard characteristics and distribution of weapons had to be determined. Until the mid-1800s, the Army had been fighting with a hodgepodge of artillery pieces, varying in caliber, type, and manufacture. This situation exacerbated ammunition and spare parts supply and complicated training. As the Chief of Ordnance, Colonel Wadsworth in 1816 had announced a system of artillery materiel, but it was simply a list of weapons categorized by type and caliber. Wadsworth did, however, make a study of the British system and in 1818 recommended that the plan for adopting the Gribeauval system be discarded in favor of the British system. Before making a decision, Secretary of War Calhoun sought the advice of a board of artillery and ordnance officers. The board rejected Wadsworth's recommendations. It subsequently put forth its own proposals based largely upon the Gribeauval system, which became the first and complete artillery system to be adopted for the Army.[58]

Lt. Daniel Tyler, a young artillery officer, went to France in 1828 to make a complete study of the Gribeauval system. After translating the Gribeauval manual and making detailed drawings, he discovered that the French had admitted the superiority of the British designs of weapons and accoutrements and were in the process of adopting them. Tyler's report to the War Department, made upon his return to the United States in 1830, recommended the adoption of the French artillery system, which was similar to that proposed by Wadsworth twelve years before. At his own expense, Tyler had translated copies of the French evaluations and also had obtained complete drawings and specifications of the *Système anglais modifié*, which the Americans later named the "stock-trail system" after the design of the carriage. The new trail consisted of a solid block of wood, simpler and stronger than the old split-trail then in use by the American army, and was significantly superior in maneuverability. Because sufficient studies and tests had been completed, Secretary of War Lewis Cass in 1835 called for a new board of artillery and ordnance officers to convene. The following year, Cass approved the board's proposal to adopt the stock-trail system, which remained in use with only slight modifications until after the Civil War.[59]

Another problem discussed by the various ordnance boards was the controversy between the use of iron and bronze for artillery pieces. Until the nineteenth century, bronze was predominantly used. Bronze was light and strong but expensive—its constituent elements of copper and nickel had to be imported. Iron was readily available, but it was heavier and not as strong. Because of new techniques introduced in the late eighteenth and early nineteenth centuries in manufacturing iron cannon, that metal became more efficient as well as more economical. Therefore, in 1801, Secretary Dearborn had directed that artillery pieces be made of cast iron.

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[58] Stanley L. Falk, "Artillery for the Land Service," *Military Affairs* 28 (Fall 1964): 97–99; Birkhimer, *Historical Sketch*, pp. 226–48.

[59] Ibid., pp. 99–110; Birkhimer, *Historical Sketch*, pp. 226–48; Stephen V. Benét, *A Collection of Annual Reports and Other Important Papers Relating to the Ordnance Department (1812–1889)*, 4 vols. (Washington, D.C.: U.S. Government Printing Office, 1878–90), 1:53–54, 185–86; 202–03, 212–13, 273–74; WD GO 50, 24 Aug 1835; WD GO 63, 12 Sep 1835.

Not until 1832 did the question arise again, and successive ordnance boards all moved in the direction of returning to bronze. The one that met in January 1841 unanimously recommended that bronze be used for manufacturing light artillery pieces, and Secretary of War Joel Poinsett concurred. This decision remained in effect until rifled field pieces replaced smoothbores. It was not until the latter part of the century that the combination of available high-quality steel, industrial facilities, and improved production techniques made it possible to manufacture large numbers of light, strong steel weapons.[60]

In 1839, Secretary Poinsett had appointed a board to devise a system of artillery weapons for the Army. After ten years of studies and visits to foreign countries to examine other artillery systems and manufacturing methods, board member Capt. Alfred Mordecai prepared the report, which was approved and published in 1849. It listed the artillery materiel available with exact detail and specifications and included drawings. The cannon, as they had been in the past, were classified according to use: field, siege and garrison, and seacoast (*Table 5*).[61]

Brigadier General Tyler in his Civil War uniform

The board had considered European developments in the use of light or horse artillery. Under the 1821 reorganization, one company in each regiment was supposed to have been organized and equipped as light artillery, but until 1838, the only significance of being designated as horse artillery had been that each company was equipped with four bronze 6-pounders (light artillery guns) instead of heavier cannon, and each drilled using a light artillery manual. The units were not authorized

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[60] Benét, *Collection of Annual Reports*, 1:363 and 2:35–36, 76, 183–84, 240–41, 281–82, 364, 500, 527, 552, 594, 597, 600–03, 611–12, 646, 667, 668, 671–72, 678–79, 687, 690; Falk, "Artillery for the Land Service," pp. 101–03; Field Artillery School, *History of the Development of Field Artillery Materiel* (Fort Sill, Okla.: Printing Plant, Field Artillery School, [1941]), pp. 31–32; Lewis, *Seacoast Fortifications*, p. 75.

[61] Falk, "Artillery for the Land Service," pp. 104–10.

Table 5—Artillery Materiel Specified by the Ordnance Board, 1849

Type	*Weapons*
Field	6- and 12-pounder guns (bronze)
	12-, 24-, and 32-pounder howitzers (bronze)
	12-pounder mountain howitzer (bronze)
Siege and Garrison	12-, 18-, and 24-pounder guns (iron)
	8-inch and 24-pounder howitzers (iron)
	8-inch and 10-inch mortars (light) (iron)
	Coehorn[a] 24-pounder mortar (bronze)
	16-inch stone mortar (bronze)
Seacoast	32- and 42-pounder guns (iron)
	8-inch and 10-inch Columbiads[b] (iron)
	8-inch and 20-inch howitzers (iron)
	10-inch and 13-inch mortars (heavy) (iron)

[a]Coehorn mortars, named after the Dutch inventor Baron van Memmo Coehoorn, were used by both sides during the Civil War.
[b]Columbiads were heavy guns invented by Maj. George Bomford.

Source: Alfred Mordecai, *Artillery for the United States Land Service, as Devised and Arranged by the Ordnance Board* (Washington, D.C.: J and G. S. Gideon, 1849), p. 3.

horses, and the guns, not having caissons, were hauled with dragropes. During the Second Seminole War, Company C, 3d Regiment of Artillery, and Company B, 4th Regiment of Artillery, were authorized horses in 1837, but only the latter actually took part in any combat operations.[62]

Using surplus horses from the war, Secretary Poinsett decided in 1838 to mount the four light companies. The first company to receive six new field pieces and the appropriate number of horses was Company C, 3d Regiment of Artillery, commanded by Brevet Maj. Samuel Ringgold.[63] Each man was mounted on horseback, with a six-horse team drawing each gun. The three remaining companies, organized a year after Ringgold's, were equipped as mounted units rather than as horse batteries, meaning that although the guns were horse-drawn, the cannoneers rode on the carriages or caissons or they walked. In theory, the mounted units were to be employed with infantry

[62] Augustus Buell, "*The Cannoneer*" (Washington, D.C.: National Tribune, 1890), p. 12. Company B, 4th Artillery, served briefly as light artillery in the summer of 1837.
[63] WD GO 49, 5 Nov 1838.

as regular field artillery and the horse (or light) artillery was to be employed with cavalry. Ringgold's company had six 6-pounder guns, and each mounted unit had three 6-pounder guns and one 12-pounder howitzer. As initially designated, each of the four companies was to have had six field pieces. When the number of men per company was reduced in 1842, however, it was possible to man only four field pieces, so the remaining ones were placed in storage. The cannoneers themselves carried pistols or sabers as side arms.[64]

Major Samuel Ringgold
by Currier & Ives

Few field artillery textbooks or field manuals existed during the period. Although John Müller's *Treatise of Artillery* (1779), William Stevens's *System for the Discipline of Artillery of the United States* (1797), Tousard's *American Artillerist's Companion* (1809–13), and an adaptation of a manual originally prepared by Thaddeus Kosciuszko were widely used, none had ever been officially adopted by the War Department. During the War of 1812, the artillery had depended mostly upon Tousard's and Kosciuszko's writings. After the war, General Henri Lallemand, a veteran of the Napoleonic wars, who had come to the United States after Waterloo, also published an artillery treatise.[65]

Publications prepared in some of the states in the early 1800s that were designed for training militia artillery were neither uniform nor used by other than the individual states for which they were written.[66] In 1826, Secretary of War John Barbour authorized the preparation of a complete system of exercises and

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[64] Hunt, "Experience in Artillery," p. 207; WD SO 96, 11 Oct 1842; G. W. Van Deusen, "Our Artillery in the Mexican War," *Journal of the Military Service Institution of the United States* 17 (July 1895): 87–96.

[65] The War Department may have officially adopted the manual prepared by William Stevens, but there is no record of it.

[66] Calhoun, *Papers*, 5:36, 46–47, 74, 83, 361, 389, 418–19; WD GO 22, 18 Aug 1821; Jan Pachonski, "Kosciuszko's Links With America . . . ," in *Military Technique, Policy and Strategy in History* (Warsaw: Ministry of the National Defence Publishing House, 1976), pp. 468–519; Birkhimer, *Historical Sketch*, pp. 300–304. Examples of manuals prepared for state militia units include Amasa Smith's *A Short Compendium of the Duty of Artillerists* . . . (1800) for the Massachusetts militia; Pierce Darrow's *The Artillerist* (2d ed., 1821) for the Connecticut militia; James H. Nesmith's *The Soldier's Manual* . . . (1824) for the Pennsylvania militia; and John L. Wilson's *Abstract of a System of Exercise and Instruction of Field Artillery* . . . (1834) for the South Carolina militia.

instruction for field artillery for use by both the militia and regular artillery and convened a board. Headed by Brig. Gen. Winfield Scott, the board recommended the *Manual for Artillery of the Garde Royale*, translated by Lieutenant Tyler.[67] Upon the adoption of the stock-trail system, Capt. Robert Anderson translated the French work *Instruction for Field Artillery, Horse and Foot*, adapting it for American artillery. The Army officially used his translation from 1841 until 1845.[68] In the latter year, at Major Ringgold's suggestion, the Army adopted the publication entitled *Instruction for Field Artillery, Horse and Foot*. This treatise, in effect during the Mexican War, was based on an Anglicized-Americanized revision of the French system.[69] Practical instruction for artillery units as field artillery took place for the first time in the summer of 1839, when the so-called Grand Camp of Instruction was held at Trenton, New Jersey. The four Regular Army companies present borrowed horses from the dragoons for combined maneuvers as light artillery. Each had four bronze 6-pounders, forty draft horses, and twelve saddle horses. To expand expertise to those not assigned to the light artillery batteries, the Army arranged to have all junior artillery officers serve a tour of duty with the light units.[70]

The Mexican War

Napoleonic tactics inspired the actions of the field artillery units in the Mexican War, which began in 1846. Because of the mobility of his field pieces and because cannon fire outranged musket fire, Napoleon was able to mass his artillery forward of the infantry lines and fire on the enemy with direct fire. After the artillery weakened the enemy with heavy shelling, the infantry could move through the guns and fight with musket and bayonet. American artillerists used these same tactics with great success against the Mexican forces that made little use of light field artillery. Many of the Mexican artillerists were proficient gunners, but their weapons were obsolete. The carriages were mostly of the old Gribeauval model with limited mobility. On the other hand, American light batteries could move to where they were needed, giving the U.S. Army the advantage in flexibility.[71]

In the spring of 1844, the Army ordered Brevet Brig. Gen. Zachary Taylor, then in command at Fort Jesup, Louisiana, on the Texas frontier, to march a so-called corps of observation to the Texas boundary. His force, later known as the Army

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[67] Birkhimer, *Historical Sketch*, pp. 303–04.

[68] Ibid., pp. 59–60, 305; WD GO 46, 19 Aug 1841.

[69] Birkhimer, *Historical Sketch*, p. 306.

[70] Ibid., pp. 54–61; Ganoe, *History*, p. 186; WD GO 28, 20 May 1839; *Army and Navy Chronicle*, 23 May 1839, pp. 335, 412; Buell, "*Cannoneer*," pp. 12–13; R[oswell] S. Ripley, *The War With Mexico*, 2 vols. (New York: Harper, 1849), 1:93. Field artillery units were still officially designated as companies, but use of the word *battery* to describe a company organized as light or horse artillery came into use in the early 1800s. The term was not officially applied to any of the units in the first four regiments but was used in orders organizing the 5th Regiment of Artillery in 1861. Field artillery companies were officially redesignated as batteries in 1883. From this point on, however, artillery units will be referred to as *batteries* if they were organized as field artillery and as *companies* if they were organized as foot artillery units.

[71] Ripley, *Mexico*, 1:88; Justin H. Smith, *The War With Mexico*, 2 vols. (New York: Macmillan, 1919), 1:156.

of Occupation**,** reached its destination in June of that year. In mid-1845, Taylor's troops included sixteen artillery companies from the four artillery regiments and two field batteries from Louisiana. He formed all the artillery units, except for three Regular Army field batteries and the two Louisiana batteries, into an infantry battalion, which fought as such during the entire war.[72]

During the War of 1812, as in the Revolutionary War, detachments of artillery with one or two field pieces each had been assigned to infantry brigades, and Taylor continued the practice by attaching one of the field batteries to each infantry brigade (an actual strength of about 1,200 men). He deviated from previous practice, however, by not using an artillery reserve or park. The batteries operated largely without centralized control, frequently deploying by section to meet diverse threats. Batteries and sections reinforced each other as necessary.[73]

The first battle of the war, Palo Alto, fought by Taylor on 8 May 1846 to preserve his line of communication to the Gulf of Mexico, was a small engagement, but it marked a turning point in the history of American field artillery. Taylor believed that infantry was the only decisive element in combat and had little regard for field artillery. On the morning of the battle, he apparently referred to artillery as "mere gun wagons," but Major Ringgold and Capt. James Duncan, supported by Taylor's adjutant Capt. W. W. S. Bliss, persuaded him to let the artillery have a chance.[74] The batteries, placed in line with and sometimes in front of the infantry in accordance with Napoleonic concepts, fired mainly at the Mexican infantry, cutting great gaps in their lines, while the Mexican batteries fired in vain at the American artillery. The small bronze 6-pounders and cast-iron 12- and 18-pounders outranged the Mexican artillery, and Palo Alto became almost entirely an artillery action. The Mexican army took about 300 to 400 casualties, caused mostly from cannon fire; the Americans had few losses. Among the wounded, however, was Ringgold, who died two days after the battle. Taylor reported that "our artillery, consisting of two 18-pounders [siege guns] and two light batteries, was the arm chiefly engaged, and to the excellent manner in which it was maneuvered and served is our success mainly due."[75] The battle foreshadowed the important role artillery and massed fire was to play in the Civil War.

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[72] *Message From the President of the United States to the Two Houses of Congress . . .* , 29th Cong., 1st sess., 1845, H. Doc. 2, p. 193; Lester R. Dillon, Jr., "United States Artillery in Taylor's Army of Occupation, 1845–1847," copy in FA School files. An artillery company from South Carolina was also present, but it was equipped as infantry.

[73] Birkhimer, *Historical Sketch*, pp. 79, 97. A section was two field pieces and their caissons.

[74] Smith, *Mexico*, 1:465–66.

[75] Ltr, Taylor to TAG, 9 May 1846, in *Messages of the President . . . on the Subject of the Mexican War*, 30th Cong., 1st sess., 1848, H. Doc. 60, p. 295 (quoted words); James Duncan, "The Artillery in the Mexican War," *Journal of the United States Artillery* 29 (May–Jun 1908): 313–16; Ltr, Taylor to TAG, 16 May 1846, reproduced in T[homas] B. Thorpe, *Our Army on the Rio Grande . . .* (Philadelphia: Carey and Hart, 1846), pp. 74–83, 197–201, 216–18, 225–28; Bernard de Voto, *The Year of Decision, 1846* (1943; reprint, Boston: Houghton Mifflin Co., 1961), pp. 194–95. Official Mexican losses were recorded as 252 but were probably much higher. American losses varied in reports but were generally cited as being near 60. The first seventy-eight of Napoleon's maxims were published in Paris in 1830 and translated into English soon thereafter. Maxim 54 begins: The batteries should be placed in the most advantageous positions and as far as possible in advance of the lines of infantry and cavalry, without, however, compromising their safety.

Battle of Palo Alto *by Klauprecht & Menzel, depicting U.S. infantrymen standing in ranks as the American artillery wreaks havoc on the Mexican lines*; *below*, The Death of Major Ringgold *by Kellogg & Taylor*

At the outbreak of the Mexican War, Congress had authorized an increase in the strength of the Army. On 13 May 1846, it raised the number of privates in each artillery company from forty-two to any number that was needed up to a maximum of one hundred; however, when a situation dictated that the excess strength was no longer necessary, the number was to be reduced to sixty-four.[76] The four field batteries were each to have six cannon (four 6-pounders and two 12-pounder howitzers or six guns of the same caliber) and associated equipment. In June, however, Taylor decided to reorganize the field batteries with four cannon rather than six in order to increase the number of light units, and throughout most of the war, the field batteries each operated with four field pieces.[77]

On the same day that Congress increased the strength of the Regular Army, it called for up to 50,000 volunteers for twelve months, appropriated ten million dollars for the war effort, and made provisions for calling up the militia for six-month periods. There was no authorized increase in the number of Regular Army units, however. At this juncture, the Army consisted of eight infantry regiments, two dragoon regiments, and four artillery regiments with approximately 5,300 officers and men, which was about 40 percent understrength.[78]

On 11 February 1847, Congress authorized the Regiment of Voltigeurs and Foot Riflemen, which included a battery of mountain howitzers and rockets manned by Ordnance Department troops. This battery was not linked with the riflemen tactically, nor were the rockets and howitzers used in a mutually supporting role. The battery employed both Congreve rockets and models improved from the Congreve by William Hale. The advent of rifled cannon, which were superior in range and accuracy, rendered the rockets obsolete soon after war.[79]

Finally, on 3 March 1847, Congress added three companies to each artillery regiment. One of these companies was to be organized as light artillery, making a total of eight light batteries in the Regular Army. Of the newly authorized light batteries, one had already been serving as such since July 1846 and one was not organized in time to fight in the war.[80]

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[76] Callan, comp., *Military Laws*, p. 369.

[77] Benét, *Collection of Annual Reports*, 2:99, 101, 103, 158; Lester R. Dillon, Jr., *American Artillery in the Mexican War, 1846–1847* (Austin, Tex.: Presidial Press, 1975), pp. 22, 23.

[78] Callan, comp., *Military Laws*, pp. 367–68; Ganoe, *History*, p. 196.

[79] Callan, comp., *Military Laws*, pp. 379–82; Benét, *Collection of Annual Reports*, 2:148, 156; WD GO 4, 12 Feb 1847. Half the Regiment of Voltigeurs and Foot Riflemen was to be mounted, the other half on foot. Each horseman was paired with a foot soldier who was to get up behind him for rapid movement. The regiment was never used in this manner, and the Voltiguers and Foot Riflemen became a regiment of foot riflemen, armed with the same rifle as the mounted riflemen. See John K. Mahon and Romana Danysh, *Infantry* (Washington, D.C.: Office of the Chief of Military History, United States Army, 1972), p. 17. The British had introduced the Congreve rocket (named for an Englishman who had made numerous improvements in rockets in the early eighteenth century) to American troops at the battle of Lundy's Lane in 1814. The rocket was supposed to fill the gap between the musket and the 12-pounder field gun. For additional information, see Frank H. Winter, *The First Golden Age of Rocketry* (Washington, D.C.: Smithsonian Institution Press, 1990).

[80] Callan, comp., *Military Laws*, pp. 383–87; WD GO 9, 10 Mar 1847; WD GO 16, 15 Apr 1847; Army of Occupation SO 102, 12 Jul 1846, in *Messages of the President on the Mexican War*, p. 531.

The civilian teamsters that had performed so unsatisfactorily in previous wars continued to serve accordingly during the Mexican War. Col. Trueman Cross, assistant quartermaster general with Taylor's Army of Occupation, recommended the use of enlisted drivers, and in the act of 3 March 1847, one principal enlisted teamster was added to each regiment and two enlisted teamsters to each company. These positions were deleted at the end of the war.[81]

When assigned missions within its capabilities, the artillery performed magnificently during the Mexican War, but its improper or inadequate use caused great difficulties in some actions, such as at Monterey in the fall of 1846. Taylor, failing to consider the fortified nature of Monterey, did not take any heavy artillery other than one mortar. Although the light batteries gave outstanding service, they contributed little to the American victory. Adequate supporting artillery fire could have reduced American losses considerably. In addition, the field batteries were ill equipped for the street fighting that ensued.[82]

At Buena Vista, on the other hand, artillery dominated the field as it had at Palo Alto. The battle demonstrated the skillful use of artillery defending from a strong position, a role for which the arm was particularly suited. As successful as the action was, siege cannon would have been even more effective. Outnumbered by 15,000 men, the American army, 5,000 strong, won the battle on 23 February 1847. In his report Brig. Gen. John E. Wool, Taylor's second in command, commented that "without our artillery we could not have maintained our position for a single hour."[83]

General Scott, who led the southern campaigns and took the Mexican capital, used artillery somewhat differently from General Taylor. In the south, the terrain—mountains, lakes, and marshy ground—hindered the movement of artillery, and most actions were against fortified positions rather than on open battlefields. The light artillery pieces, deprived of their maneuverability and lacking sufficient punch, were not very effective. Instead Scott planned to employ a substantial siege train of heavy guns, howitzers, and mortars, centralized under his control, for fire support, attaching one field battery to each division (with an actual strength of about 2,500 men).[84] Artillery dominated the critical siege at Vera Cruz; however, because a large percentage of the siege train had not arrived, Scott was forced to rely on heavy guns and crews supplied by the Navy. The artillery continued to play a prominent role in subsequent engagements, coordinating its actions with those of the infantry at Cerro Gordo, Chapultepec, and Mexico City to defeat the Mexican army.[85]

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[81] Callan, comp., *Military Laws*, pp. 393–94; WD GO 9, 10 Mar 1847; WD GO 16, 15 Apr 1847; WD GO 39, 20 Jul 1848; Ltr, T. Cross to QMG, 23 Nov 1845, in *Messages of the President on the Mexican War*, pp. 646–48.

[82] Smith, *Mexico*, 1:249–61, 497, 499–504; Ripley, *Mexico*, 1:200, 204–37.

[83] Edward J. Nichols, *Zach Taylor's Little Army* (Garden City, N.Y.: Doubleday, 1963), p. 231. For accounts of the battle of Buena Vista, see Smith, *Mexico*, 2:384–400; 555–63; Ripley, *Mexico*, 1:396–427; K. Jack Bauer, *The Mexican War, 1846–1848* (New York: Macmillan, 1974), pp. 209–18.

[84] Birkhimer, *Historical Sketch*, p. 79.

[85] Smith, *Mexico*, 2:21–34, 337–42; Ripley, *Mexico*, 2:9–39.

Battle of Buena Vista *by Currier & Ives*;
below, A Little More Grape Capt Bragg *by Currier & Ives, depicting Brevet Maj. Braxton Bragg's Battery C, 3d Regiment of Artillery, at Buena Vista*

Occupation duty and guerrilla fighting in the countryside kept the Army busy for months after the battle for Mexico City, but the major campaigns were over, the volunteer units went home, and the men were discharged. The Regular Army units, as soon as they could be spared, returned to stations in the United States. On 20 February 1848, five companies of the 1st Regiment of Artillery departed Mexico, the last of Scott's army to leave.[86]

The Army in the Mexican War did not begin to approach the mass artillery tactics used by Napoleon, but the spirit was there and the lessons were to have a heavy influence in the Civil War. Artillerymen gained profitable experience in the Mexican War, both in siege warfare and in field tactics against horse and foot troops. The excellent service of the few field batteries proved that mobile artillery could be a crucial factor on the battlefield. Even though only ten of the forty-eight companies in the Regular Army had served in this capacity, these swift and highly mobile artillery units became the pride of the Army. The Mexican War also served as a training ground for artillery officers, many of whom would later distinguish themselves during the Civil War.

The end of the Mexican War marked an era of artillery tactics and materiel growth. Through the initiative of its officers, through an increased emphasis on training both at the Artillery School and in the field, through the development of a sound organizational structure and a standardized artillery system, and through the knowledge gained in fighting the Mexican War, the U.S. Army was stronger organizationally and now had a solid foundation upon which to build a credible artillery force.

[86] Smith, *Mexico*, 2:240.

CHAPTER 3

The Civil War

At the end of the Mexican War, the Army returned to its peacetime strength and its prewar duties of guarding the coastline and frontier. Although the years between the Mexican and Civil Wars were largely uneventful for artillerymen, who served chiefly as infantry at scattered posts and stations, new weapons developed during that interim period had a dramatic effect on fighting in the Civil War. As in previous wars, artillerists continued to use low-trajectory cannon and direct fire, line-of-sight aiming techniques, but the infantry's increasing use of rifles soon restricted the older manner of employment, for the batteries could no longer be safely positioned within the 500-yard range of enemy rifles. In addition, the widespread use of hasty field fortifications further reduced the effects of artillery fire. By the end of the Civil War, trenches had become a common form of defense, and mass attacks proved costly.[1]

The Civil War campaigns provided the American armies critical artillery experience in large-scale warfare. The older manner of employing artillery in small groups had been the result of small armies, restricted battlefield maneuverability, and line-of-sight cannon fire. The rapid expansion of the Army led to a series of reorganizations, and the employment of a field artillery battery in support of an infantry brigade gave way to the use of division and corps artillery as well as the use of reserve artillery in support of an army as a whole.

The Prewar Years

After the Mexican War, artillery companies were restricted to their prewar strength of fifty-eight officers and enlisted men, although the number of regiments, four, remained the same. In addition to the artillery units, the Regular Army in 1848 included eight infantry regiments and one of mounted riflemen.[2] Elements of the 1st

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[1] Paddy Griffith, *Battle Tactics of the Civil War* (New Haven, Conn.: Yale University Press, 1987), discounts the widespread use of infantry rifles as precipitating the shift from offensive to defensive tactics; however, contemporary documents show that soldiers on the battlefield believed the rifles indeed made a difference. See Grady McWhiney and Perry D. Jamieson, *Attack and Die* (1982; reprint, University: University of Alabama Press, 1984), pp. 60, 117–25; U.S. War Department, *The War of the Rebellion*, 1st ser., 53 vols., and 4th ser., 3 vols. (Washington, D.C.: U.S. Government Printing Office, 1880–1901), 1/2:385, 394, 406–07, 1/19(pt.1):845, 956, and 1/36(pt.1):336, 539, 669; John Gibbon, *The Artillerist's Manual* (1860; reprint, New York: Benchmark Publishers, 1970), pp. 220–22.

[2] Callan, comp., *Military Laws*, p. 399.

and 4th Regiments of Artillery deployed to Florida to hold the Seminoles in check and to the Rio Grande to patrol the Mexican border. Most of the companies from the 3d Regiment of Artillery went to scattered posts along the Pacific coast; the 2d Regiment of Artillery and the remaining elements of the 1st and 3d moved to posts on the Atlantic. The majority were armed and equipped as infantry, and rarely did their duties extend beyond policing fortifications and firing a few rounds of artillery at targets two or three times a year.[3]

Only three light batteries of the former eight remained at the end of the Mexican War, but in September 1848, the Adjutant General's Office directed that one company in each regiment be equipped as light artillery, and the four original companies of 1838 were so organized. Four additional companies were authorized to be equipped as light batteries the following year, each battery to receive four field pieces and forty-four horses.[4] In 1851, all the light batteries except two were ordered dismounted. Referring to this action in his annual report for that year, Secretary of War Charles Conrad noted that although light artillery was extremely effective "in a regular war," it was utterly useless in the kind of service in which the Army was then engaged.[5] Despite this, two additional light batteries were organized the following year, and in 1853, three more batteries were authorized.[6]

Of the eight batteries authorized during the Mexican War, only Company I, 1st Regiment of Artillery, remained without horses or proper equipment. Three of the mounted batteries went to the frontier, where they did not prove effective. In October 1856, they were dismounted and, along with the above company, ordered to Fort Monroe, Virginia, to reconstitute the Artillery School of Practice as seacoast, garrison, and siege artillery. Maj. Gen. Winfield Scott objected, and within a year, three of the batteries were remounted, leaving only G of the 4th Regiment without light artillery equipment. In June 1855, that company had been reorganized as cavalry and served as such in actions against the Sioux Indians. It was not again equipped as field artillery until the Civil War.[7]

During the years between the Mexican and Civil Wars, the Army focused on protecting the nation's borders and improving the effectiveness of heavy rather than field artillery. Drill regulations issued in 1851 covered the service of heavy howitzers, mortars, and guns. In the same year, new drill regulations were also issued for mountain artillery, which consisted of a 12-pounder mountain howitzer that had been added for service against the Indians. The adoption of the stock-trail

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[3] Benét, *Collection of Annual Reports*, 2:422, 435. Some of the companies on the frontier also served as cavalry.

[4] WD Cir 30, 30 Sep 1848; WD GO 22, 21 Apr 1849; WD GO 19, 12 May 1849.

[5] *Message From the President to the Two Houses of Congress . . . ,* 31st Cong., 3d sess., 1851, H. Doc. 2, p. 111 (quoted words); WD GO 18, 31 Mar 1852.

[6] WD GO 15, 26 May 1853.

[7] HQ Army GO 9, 30 Oct 1856; Ltr, Scott to SecWar John B. Floyd, 22 May 1857, quoted in Birkhimer, *Historical Sketch*, pp. 66–67; WD GO 6, 29 May 1857; Troops Serving in Kansas SO 70, 18 Sep 1857; HQ Army GO 15, 29 Dec 1857; WD GO 5, 18 May 1858; HQ Army SO 52, 10 Apr 1858.

carriage system necessitated changes in maneuvers that were included in both sets of regulations.[8]

In 1857, the School of Practice for heavy gun service reopened at Fort Monroe, and classes began in the fall of 1858.[9] The instructional classes were to consist of two companies from each regiment. Each company was to have a two-year tour of duty, with one company from each regiment being relieved each year. The school was active for about three years, when it closed because of the outbreak of the Civil War. General orders issued in 1859 directed the establishment of a complete and systematic course of practical and theoretical instruction for all artillery, as well as annual inspections.[10] Despite the diversity in existing artillery organizations and equipment, these measures promoted more uniformity in training than had previously been possible.

During the years prior to the Civil War, European armies had been experimenting with both rifled and breechloading cannon. As Secretary of War, Jefferson Davis decided to increase American awareness of military developments in Europe, and he was primarily responsible for sending a commission to observe the Crimean War and European armies in general. Based on extensive travels abroad, Maj. Alfred Mordecai presented the commission's views on artillery, recommending that the new French 12-pounder gun-howitzer be obtained for testing. The Ordnance Department concurred, and in 1857, the Army adopted for light artillery batteries the bronze muzzleloading Napoleon, named after Napoleon III of France. The piece remained standard until the 1880s.[11] The report also cited the success of the British in using large caliber cannon and indicated that wrought iron for field service might be a moderate expense in connection with introducing rifled weapons for such batteries. A suggestion also surfaced that horse (field) artillery be separated from foot (heavy) artillery, the way units in France were divided.[12]

The Napoleon, which proved to be the most popular field piece during the Civil War, was effective with solid shot or shell and most effective with canister against personnel at close ranges. Within its range, canister was more deadly against infantry than any other ammunition. Batteries composed wholly of Napoleons were almost as mobile as the light batteries of 6-pounder guns and 12-pounder howitzers. Although artillerists highly regarded the latter early in the Civil War, the howitzers

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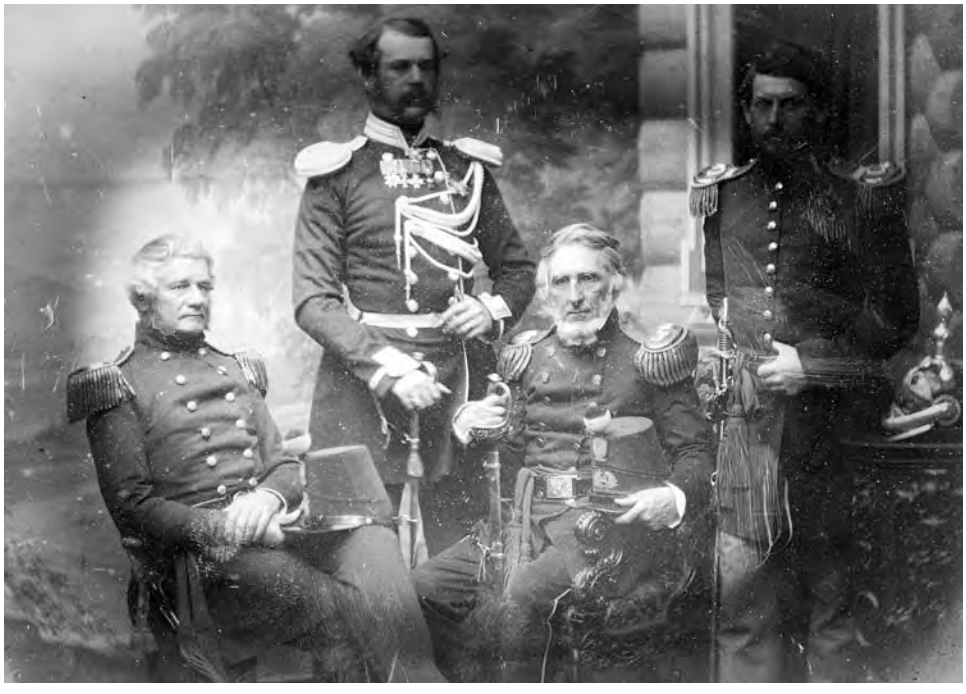
[8] See *Instruction for Heavy Artillery* (Washington, D.C.: Gideon and Co., 1851) and *Instructions for Mountain Artillery* (Washington, D.C.: Gideon and Co., 1851).

[9] HQ Army GO 9, 30 Oct 1856; WD GO 5, 18 May 1858; HQ Army GO 13, 18 May 1858; Arthur, *History of Fort Monroe*, p. 76.

[10] WD GO 10, 9 May 1859.

[11] Alfred Mordecai, *Military Commission to Europe in 1855 and 1856* (Washington, D.C.: G. W. Bowman, 1861), pp. 141, 145; *Message From the President to the Two Houses of Congress . . .* , 34th Cong., 3d sess., 1856, H. Doc. 1, p. 16.

[12] Mordecai, *Military Commission to Europe*, pp. 119, 137–38. Field artillery equated to both horse and mounted—cannoneers on horseback operating with cavalry and cannoneers operating with infantry while marching or, when necessary, mounted on ammunition chests. Foot artillery included siege and garrison, seacoast, mountain, and rocket artillery. The same recommendation was put forth after the Civil War, but the two types of artillery were not separated until 1901.



Major Mordecai (seated, left) *with fellow members of the U.S. Military Commission to Crimea*

lacked the range and the 6-pounders the effectiveness in close fighting that made the Napoleons so deadly.[13] In addition, the heavily wooded and rough terrain of many Civil War battlefields meant that much of the fighting was conducted at short ranges where the Napoleon, with its heavier shell and case shot, was often more destructive than other artillery.

American engineering and manufacturing ingenuity was also at work during the prewar years. In the mid-1840s, 1st Lt. Thomas J. Rodman, while serving as an Army officer superintending construction of heavy seacoast guns known as Columbiads, began to experiment with new manufacturing techniques based on developments in French and naval gun making. He devised a new method of casting iron guns by cooling them from the interior, which gave them additional strength in firing, and the War Department directed that large ordnance pieces be cast in accordance with his theories. In the mid-1850s, experiments with the forerunners of rifled cannon began at Fort Monroe. In 1860, a board of artillery and ordnance officers was established to make further tests on rifling, and the board submitted its report

[13] Jac Weller, "The Field Artillery of the Civil War," pt. 1, *Military Collector & Historian* 5 (June 1953): 29–32; Jennings C. Wise, *The Long Arm of Lee* (New York: Oxford University Press, 1959), pp. 65, 75, 340–41. For detailed information on the ordnance used during the Civil War, see Warren Ripley, *Artillery and Ammunition of the Civil War*, 4th ed. (Charleston, S.C.: Battery Press, 1984).

late that year. It recommended that at least 50 percent of the guns at forts and arsenals be converted into rifles. The recommendation was approved, but this attempt to obtain rifled pieces by converting guns already on hand never proved entirely satisfactory because the older bronze guns, once grooved, could not withstand the strain of firing.[14]

Parrott guns, rifled pieces made of cast iron, appeared in the winter of 1860–61. Manufactured in a variety of calibers, the 10-pounder Parrott was the most popular for field use. Capt. Robert Parker Parrott of the 3d Regiment of Artillery had developed the muzzleloading cannon with a reinforcing hoop on its breech, the point of greatest strain. The 10-pounder Parrott, originally 2.9 inches in diameter, was later manufactured with a 3-inch bore to take the same ammunition as the 3-inch Ordnance Department rifle. The 3-inch rifles became standard ordnance after their introduction in 1861.[15]

Napoleon gun from Capt. Alonzo H. Cushing's Battery A, 4th Regiment of Artillery, at Antietam, Maryland

The ten field pieces listed in Table 6 were all in service by the end of 1861 and accounted for more than 90 percent of the rounds fired in the Civil War.[16] The mountain howitzer used in the Mexican War and against the Indians saw little action in the Civil War. Light batteries were authorized four 6-pounder guns and two 12-pounder howitzers, but 6-pounders were rarely employed after the first couple of years of the war, and two different calibers were seldom used together in a battery. Heavy field batteries were each authorized four 12-pounder guns and two 24- or 32-pounder howitzers.[17]

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[14] Benét, *Collection of Annual Reports*, 2:364, 668, 679, 690; Birkhimer, *Historical Sketch*, pp. 264–67; Manucy, *Artillery*, p. 17; L. VanLoan Naisawald, *Grape and Canister* (New York: Oxford University Press, 1960), p. 36; Phillip H. Stevens, *Artillery Through the Ages* (New York: Franklin Watts, 1965), p. 62.

[15] Weller, "Field Artillery," pt. 1, p. 34. The weight of the elongated projectiles used in rifled artillery varied with the length of the shell, and the term *pounder* was eventually superseded by the bore measurement as a means of designating the size of rifled artillery.

[16] Weller, "Field Artillery," pt. 1, p. 65.

[17] Gibbon, *Artillerist's Manual*, p. 341; *The Ordnance Manual . . . United States Army* (Philadelphia: J. B. Lippincott and Co., 1861), p. 362. The heavy batteries used the 24-pounder more often than the 32-pounder in the field.

Table 6—Standard Field Pieces Used During the Civil War

Designation	*Diameter of Bore (inches)*	*Length of Piece* (inches)*	*Weight of Piece (pounds)*	*Weight of Carriage (pounds)*	*Weight of Projectile (pounds)*	*Weight of Charge (pounds)*	*Muzzle Velocity (ft/sec)*	*Range at 5° Elevation (yards)*	*Chambered*
U.S. Model 1841–1844 Bronze Smoothbores									
6-pounder gun	3.67	60.0	884	900	6.10	1.25	1,439	1,525	No
12-pounder howitzer	4.62	53.0	788	900	8.90	1.00	1,054	1,072	Yes
24-pounder howitzer	5.82	65.0	1,318	1,128	18.40	2.00	1,060	1,322	Yes
12-pounder gun	4.62	78.0	1,757	1,175	12.30	2.50	1,486	1,663	No
32-pounder howitzer	6.40	75.0	1,920	1,175	25.60	2.50	1,100	1,504	Yes
12-pounder mtn howitzer	4.62	32.9	220	180	8.90	.50	650	900	Yes
U.S. Model 1857 Bronze Smoothbores									
12-pounder Napoleon	4.62	66.0	1,227	1,218	12.30	2.50	1,440	1,619	No
Field Rifles, Iron (or Steel)									
10-pounder Parrott	3.00	74.0	890	890	9.5	1.0	1,230	1,850	No
3-inch ordnance gun	3.00	69.0	820	900	9.5	1.0	1,215	1,830	No
20-pounder Parrott	3.67	84.0	1,750	1,175	20.0	2.0	1,250	1,900	No

*Not including the cascabel (a projecting part behind the breech of muzzleloading cannon).

Source: Jac Weller, "The Field Artillery of the Civil War," pt. 1, *Military Collector & Historian* 5 (June 1953), p. 30.

As shown in Table 6, all but three of the standard field pieces were bronze smoothbores. The problems of using rifled cannon were numerous. Proper metals and sufficiently sturdy carriages were needed. The development of the James elongated expanding projectile in 1859 did much to further the use of rifled cannon. The Minié ball (a cone-shaped bullet with a base cavity that expanded when fired, making the projectile fit the rifling in the bore) for small arms furnished the principle that led to this advance in artillery. The bore diameter of the cannon limited the size of a spherical shell, but rifling allowed the use of elongated ammunition, which gave a greater projectile weight for a given caliber. Rifled ammunition could usually be depended upon to hit the ground on its "nose," which meant that a single mercury fulminate cap could detonate it. Since the single forward-facing cap could be more easily protected during loading and discharge, the danger of a premature explosion within the tube was reduced.[18] Another advance in artillery that permitted faster fire was the friction primer, a mercury fulminate that detonated when a lanyard was pulled. This invention replaced the portfire, the priming and firing device that had been applied to the vent by hand. Although some breechloading artillery weapons were manufactured, their large-scale adoption was delayed until the invention of recoil mechanisms and improved breechblocks. Muzzleloaders were still quicker and easier to reload and reposition for firing.

Artillery Organization

At the outbreak of the war, a presidential proclamation on 3 May 1861 announced that the Regular Army was to be expanded significantly with a fifth regiment of artillery and with an additional regiment of cavalry and eight of infantry. Congress adopted the proclamation into law on 29 July 1861.[19] The new law used the term *batteries* for the twelve companies contained in the new artillery regiment and prescribed an organization different from that of the four older regiments. The maximum authorized strength for the 5th Regiment of Artillery was 1,909 compared to a maximum authorized strength of 1,086 for each of the first four artillery regiments.[20] Because the majority of artillery units in the Union army operated in the field rather than manning coastal defenses, steps were taken to reorganize most of the companies in the first four regiments as field artillery. About half the batteries

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[18] *Message From the President of the United States to the Two Houses of Congress . . . ,* 36th Cong., 2d sess., 1860, S. Doc. 1, p. 7; Vardell E. Nesmith, Jr., "The Quiet Paradigm Change" (Ph.D. diss., Duke University, 1977), pp. 21–22. Mercury fulminate, a crystalline compound $Hg(CNO)_2$ that when dry explodes upon the slightest vibratory shock, is used as a high explosive.

[19] Callan, comp., *Military Laws*, pp. 473–76; WD GO 16, 4 May 1861; WD GO 48, 31 Jul 1861. The proclamation specified eight infantry regiments, as did the general order issued the following day, but a total of nine regiments was recorded in the list of officers published six weeks later. When Congress met, it sanctioned the nine regiments, but research has failed to reveal the implementing authority for this increase. See John K. Mahon's "Infantry" draft, in CMH files.

[20] Prior to this time, artillery units not organized as light artillery were called companies. Light artillery organizations used the terms *battery* and *company* interchangeably. See HQ Army Cir 9, 12 Oct 1883. The 5th Regiment of Artillery is now designated the 5th Air Defense Artillery.

10-pounder Parrott from Capt. Rufus D. Pettit's Battery B, 1st New York Light Artillery, near Fair Oaks, Virginia

in the Regular Army were brought into the Army of the Potomac; most of the rest served at one time or another with the other field armies. Only four Regular Army companies were never organized as field artillery between 1861 and 1865, and they served at fixed installations as foot artillery throughout the war.[21]

On 22 July 1861, Congress authorized the President to accept volunteers for service in the Army, and the vast bulk of the Union army consisted of volunteers recruited and organized by the states. The volunteers were not to exceed 500,000 in number, they were to serve not less than six months or more than three years, and they were to be disbanded at the end of the war. They were to be divided into regiments of infantry, except that companies of cavalry and artillery could be raised in numbers not to exceed one company of each arm for each infantry regiment. The artillery units were to be organized in the manner outlined for the 5th Regiment of Artillery.[22] Under this and subsequent calls made during the war, the states furnished approximately thirty-five regiments, one battalion, and ten companies of heavy artillery, along with approximately eleven regiments, two battalions,

[21] Birkhimer, *Historical Sketch*, pp. 69–71.
[22] Callan, comp., *Military Laws*, pp. 466–71; WD GO 49, 3 Aug 1861.

Friction primer

Primer pouch

Gunner's haversack

Lanyard

Civil War artillery implements

and two hundred four batteries of light artillery for federal service.[23] In addition to these units, one light and thirteen heavy artillery regiments were raised for the United States Colored Troops and Corps d'Afrique. Although all were black units, most of the officers were white.[24]

The Confederate States Army, established by acts passed on 28 February and 6 March 1861, gave the president control of military operations in the South. The government also authorized the acceptance of state forces and 100,000 volunteers for a period of one year. On 8 May, enlistments were extended for the duration of the war. The total number of Confederate forces has been estimated to be between 800,000 and 900,000.[25]

The act of 6 March 1861 called for a Confederate artillery corps, one that would also be charged with ordnance duties. It was to consist of forty companies of artillerists and artificers and to have as staff one colonel, one lieutenant colonel, and ten majors. In addition, the colonel could appoint one adjutant and one sergeant major from the officers and enlisted men of the companies. In August, three additional personnel—a lieutenant colonel and two majors—were assigned to the staff. Each company was authorized four artillery pieces, except that a provision was made for as many six-gun light artillery batteries as the president deemed expedient but not to exceed four in peacetime. In 1862, the organization of the batteries was established as that shown in Table 7. Heavy artillery companies (those at permanent batteries) were organized along the lines of infantry units and were usually authorized between six and nine heavy guns.[26]

In the Union army, state and volunteer units entered federal service in various states of organization, training, and equipment. About one-fourth of them brought a few guns and carriages, but the weapons lacked uniformity. Only one-sixth of the units arrived with their own horses, and less than one-tenth of the state batteries came fully equipped for service. An artillery training camp was set up a few miles east of Washington, D.C., where the units assembled, equipped, trained, and refitted when necessary. Some later manned the fortifications from which Regular Army

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[23] Frederick H. Dyer, comp., *A Compendium of the War of the Rebellion*, 3 vols. (1908; reprint, New York: T. Yoseloff, 1959), 1:37–39, 3:997–1723. The figures for the number of units can only be approximated because of possible duplications in designations and terms of service. Many of the same units enlisted more than once during the war. Some militia units, such as the Pennsylvania troops in the summer of 1863, also served on active status, but they are not included in the numbers listed.

[24] In addition to the black units in the United States Colored Troops and Corps d'Afrique, several states furnished such organizations. Some black enlisted soldiers had served in the Revolutionary War and a few had aided in the defense of New Orleans during the War of 1812, but no record exists of any others since that time. The Union army contained approximately 200,000 black soldiers. While the Confederate States Army did include black soldiers, none performed as artillery troops. See Russell F. Weigley, *History of the United States Army* (New York: Macmillan, 1967), pp. 211–13.

[25] War Department, *War of the Rebellion*, 4/1:117, 126–31, 302; Richard P. Weinert, "The Confederate Regular Army, 1861–1865" (Master's thesis, American University, 1964), pp. 6–7.

[26] War Department, *War of the Rebellion*, 4/1:128, 580, 964–65 and 4/2:153. See also M. W. Humphreys, "Notes on Confederate Artillery Instruction and Service," *Journal of the United States Artillery* 2 (October 1893): 560–88.

Table 7—Artillery Organization, 1861–1865

	Regimental Staff 5th Artillery United States Army, 1861	*Artillery Corps Staff Confederate States Army, 1862*
Colonel	1	1
Lt Colonel	1	2
Major	3	12
Adjutant	1[a]	1[a]
Quartermaster	1[a]	1[a]
Sergeant Major	1	1[a]
Commissary Sergeant	1	
QM Sergeant	1	
Principal Musician	2	
Hospital Steward	1	
Band	24	
Chief Musician		1

	Battery 5th Artillery United State Army, 1861	*Four-Gun Battery Confederate States Army, 1862*
Captain	1	1
1st Lieutenant	1[b]	2
2d Lieutenant	1[b]	2
1st Sergeant	1	1
QM Sergeant	1	1
Sergeant	4[b]	4[c]
Corporal	8[b]	8[c]
Musician	2	2 (buglers)
Artificer	2[b]	2
Wagoner	1	
Guidon		1
Private	58–122	64–125

[a]To be taken from the line.

[b]Provisions were made for increasing each battery by one first lieutenant, one second lieutenant, two sergeants, four corporals, and four artificers.

[c]For a six-gun battery, the number of sergeants was increased to six and the number of corporals to twelve.

units had been withdrawn or the temporary ones that encircled the capital. Most, however, were employed in the field, where their lack of training was at least partially overcome by their enthusiasm and by the assistance of the regular artillery.[27]

Except for the few Regular Army companies organized as garrison artillery, heavy artillery came from volunteer and state organizations. The soldiers were armed and equipped as infantry and were used to guard the trains and perform other camp duties either with the active field armies or as garrison troops and guards at fortified places and depots. A number of heavy regiments were also called to the front to perform as infantry.[28]

As in the Mexican War, artillery batteries were at first distributed to infantry brigades, and none was retained as a reserve. At the battle of Bull Run in the summer of 1861, the field artillery batteries served at the brigade level with unsatisfactory results. Nine incomplete Regular Army batteries, along with a volunteer battery, manned forty-nine artillery pieces of varying types and calibers. The artillery, however, was badly managed. Although the Union army commander, Brig. Gen. Irvin McDowell, had appointed Maj. William F. Barry as his artillery chief, he retained tactical control over the batteries and only used Barry to pass on any orders to the artillery. Given the initial unhappy experience with decentralization and the increasing influence of the Napoleonic model, which called for artillery to be placed with divisions and corps and the retention of a reserve to throw forward in an offensive operation, the Union army eventually reorganized the arm.[29]

When Maj. Gen. George B. McClellan took over the Army of the Potomac after Bull Run, he selected Major Barry as his artillery chief and Maj. Henry J. Hunt as head of the Artillery Reserve and aide-de-camp, earning a promotion to colonel in the Volunteers. McClellan proceeded to reorganize his force into eleven divisions, each comprising three infantry brigades, a cavalry regiment, and four six-gun batteries. This divisional structure was generally accepted for other Union armies as well. Barry immediately established some principles for organizing the artillery. The proportion of guns to other troops was to be at least 2.5 and preferably 3 to each 1,000 men, and field batteries were to contain six pieces if practicable. No battery was to have fewer than four guns, and all guns in the same battery were to be of the same caliber. With a few exceptions, field guns were to be restricted to Ordnance Department and Parrott rifles and the Napoleons. A reserve artillery of one hundred cannon was to be organized and a fifty-piece siege train procured.

Each division was to have four field artillery batteries. Of the four divisional batteries, one was to be formed from the Regular Army and the remainder from the Volunteers. The captain of the Regular Army battery was to command the divisional artillery, and he was to direct the instruction of the volunteer batteries in gunnery

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[27] Naisawald, *Grape and Canister*, p. 35; George B. McClellan, *Letter of the Secretary of War, Transmitting Report on the Organization of the Army of the Potomac . . .* (Washington, D.C.: U.S. Government Printing Office, 1864), p. 4.

[28] See Dyer, *Compendium*.

[29] War Department, *War of the Rebellion*, 1/2:314–15, 345–48; Naisawald, *Grape and Canister*, pp. 23–25; McClellan, *Letter*, p. 13; Birkhimer, *Historical Sketch*, pp. 78–80.

and tactics. This principle proved to be the best feature of McClellan's organization as it spread the expertise of the regular cannoneers among the volunteer batteries, a practice that was not followed in the infantry. Barry's principles comprised the first comprehensive plan in the Army for organizing artillery to accompany large forces in the field.[30]

For the first two years of the war, artillery batteries in the Confederate States Army were attached to infantry brigades (one battery to each brigade) as had been done initially in the Army of the Potomac. The same results occurred. An infantry brigadier general who usually had little knowledge of artillery controlled the guns; if he were knowledgeable, he could not supervise both his infantry and artillery at the same time. Although the infantry brigades were organized into divisions, the division commander's artillery chief had difficulty supervising the batteries. The brigade commanders resented the artillery chief's intervention, and the entire system created divided authority and responsibility. In battle, such an organization scattered the batteries along the line of battle and prevented concentrated firepower. Massed fire could be obtained from the reserve artillery (under control of the army artillery chief), but because its commander was not in direct support of any specific command or because it was in the rear, the reserve was rarely available in an emergency.[31]

In the Union army, Barry sought to have two brigadier generals authorized for the artillery—one to command the arm and the other to command the Artillery Reserve. Prevailing opinion, however, held that the battery was the primary tactical and administrative unit of the arm, and most Union generals drew the conclusion that there was nothing about the service of artillery higher than a battery that could justifiably be the subject of command. Because acts calling for volunteer units specified that artillery would be received from the states by batteries, higher echelons were considered unnecessary.[32]

Well qualified, Colonel Hunt succeeded Barry in September 1862 as artillery chief with the Army of the Potomac. Concurrent with his selection, he was promoted to brevet brigadier general in the Volunteers. Hunt had graduated from West Point in 1839, a time when that institution had a decided artillery influence. In the mid-1830s, a large percentage of its instructors and administrative personnel had served in artillery units, and upon the arrival of Maj. Richard Delafield as the

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[30] McClellan, *Letter*, pp. 12–13; J[ohn] G. Barnard and W[illiam] F. Barry, *Report of the Engineer and Artillery Operations of the Army of the Potomac* . . . (New York: D. Van Nostrand, 1863), pp. 105–06; John C. Tidball, "Remarks Upon the Organization, Command, and Employment of Field Artillery During . . . the Civil War, 1861–5," n.d., copy in FA School files.

[31] E[dward] P. Alexander, *Military Memoirs of a Confederate* (Bloomington: University of Indiana Press, 1962), p. xxvii; idem, "Confederate Artillery Service," *Southern Historical Society Papers* 11 (February-March 1883): 98–113; Wise, *Long Arm of Lee*, p. 155; Robert Stiles, *Four Years Under Marse Robert* (New York: Neale Publishing Co., 1903), p. 53; War Department, *War of the Rebellion*, 1/40:625; John Bigelow, Jr., *The Campaign of Chancellorsville* (New Haven, Conn.: Yale University Press, 1910), pp. 45–46.

[32] War Department, *War of the Rebellion*, 1/9(pt.3):40; Naisawald, *Grape and Canister*, pp. 34–35; Birkhimer, *Historical Sketch*, p. 85; Hunt, "Experience in Artillery," p. 217; WD GO 126, 6 Sep 1862.

new superintendent in 1838, artillery instruction received greater emphasis. Hunt had also assisted in revising a manual on field artillery tactics for the War Department, published in 1860, and was now prepared to command. However, General McClellan, taking the traditional view of artillery command, wanted his artillery chief to perform solely administrative and staff duties, exercising command only upon receipt of specific orders from the commanding general. Although Hunt finally persuaded McClellan to broaden his authority over the artillery, his powers and responsibilities would vary greatly according to the whims of succeeding army commanders.[33]

Colonel Hunt

With the battery as the primary organizational unit, Union artillery suffered from the lack of field-grade officers. When artillery captains were promoted, most were promoted in the Volunteers and given command of regiments, brigades, and divisions. Sergeants were then commissioned to take over the batteries, and the ranks were filled with recruits. Promotions and transfers into volunteer organizations, where opportunities for advancement were plentiful, weakened the Regular batteries. In 1863 two colonels, a major, three captains, and a lieutenant commanded the artillery of seven corps. Two captains commanded two horse artillery brigades, and there was one field-grade officer in the reserve. Hunt believed that most of these commands in any other army would have been considered proper for general officers. Twenty-one field-grade artillery officers in the Regular Army became generals in the Volunteers, but only two remained with the artillery branch.[34] In 1865, Hunt described the problem as follows:

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[33] Edward G. Longacre, *The Man Behind the Guns* (New Brunswick, N.J.: A. S. Barnes and Co., 1977), pp. 18, 67–69, 99, 119, 261. In 1856 Hunt, along with Barry and William G. French, was directed to serve on a board tasked with revising Robert Anderson's 1839 field artillery instruction text (including revisions of 1845). The revision took until March 1860, and it was published later that year as *Instruction for Field Artillery* by J. B. Lippincott. The new work and the French-based text *Evolution of Field Batteries of Artillery*, translated by Robert Anderson, were widely used during the war.

[34] War Department, *War of the Rebellion*, 1/27(pt.1):242; Tidball, "Remarks Upon Field Artillery," pp. 15–16, FA School files; *Annual Report of the Secretary of War, 1913*, 1:207–08.

Not only has the service suffered from the want of officers absolutely necessary to the highest efficiency and economy, but this system has stopped promotion in the artillery, and as a consequence nearly every officer of promise . . . has been offered that promotion in the infantry, cavalry, or staff, which no amount of capacity, gallantry, or good conduct could secure him in our arm. The result is that, with a few marked exceptions, in which our officers were willing to sacrifice their personal advancement and prospects to their love of the arm, the best and most distinguished of the officers of the artillery accepted positions elsewhere or left the service in disgust as opportunities offered. . . . I do not hesitate to say that the field artillery of this army, although not inferior to any other in our service, has been from one-third to one-half less efficient than it ought to have been, whilst it has cost from one-third to one-half more the money than there was any necessity for. This has been due primarily to the want of proper organization, which has deprived it of experienced officers required for its proper command, management, and supervision, and is in no respect the fault of the artillery itself.[35]

The situation in the artillery of the Confederate States Army was considerably different. In response to a suggestion by Confederate Secretary of War Judah Benjamin, the Confederate Provisional Congress authorized the appointment of "officers of artillery above the rank of captain, without reference to the number of batteries under the actual command of the officers so appointed, not to exceed in number, however, one brigadier general for every eighty guns, and one major for every sixteen guns." Additional officers of the rank of captain and first lieutenant (not to exceed eighty) were authorized in April 1862. The law gave the Confederate States Army a large corps of field-grade artillery officers, with a much larger pool of leadership of appropriate rank—often two field officers per battalion—than the Union army had.[36]

As the Union army gained experience in maneuvering and fighting with large forces, its commanders realized that centralizing artillery at the corps level would improve its administration and tactical effectiveness. In the Army of the Potomac, from the battle of Gettysburg on, artillery was principally organic to corps rather than to divisions. A corps usually contained three divisions and one artillery brigade. From 1862 forward, the senior artillery officer in the corps, often a field-grade officer whose commission derived from rank in an artillery regiment, was established as the chief of corps artillery.[37] Each artillery brigade commander was authorized a staff consisting of an adjutant, quartermaster, commissary officer, ordnance officer (an artillery officer on ordnance duty), medical officer, and artillery inspector, with each staff officer having one or more assistants. In addition, the brigade artillery chief was to have a couple of officers as aides. The staff officers had to be detailed from the batteries, thereby reducing the number of officers present with those units. Although artillery officers considered the brigades equal in importance and

[35] War Department, *War of the Rebellion*, 1/46(pt.1):662.

[36] Ibid., 4/1:761–867 (quoted words), 1080. This system used by the Confederate States Army was similar to the modern one in that the officer corps existed independently of the units the officers commanded.

[37] Callan, comp., *Military Laws*, pp. 531–35; WD GO 9, 29 Jul 1862.

Colonel Alexander
Confederate States Army

in fighting power to infantry divisions, the latter were still commanded by generals and the former more often by captains or even lieutenants. The number of batteries in each artillery brigade varied according to the strength of the higher-level corps. The number of batteries in a corps present at the battle of Gettysburg, for example, ranged from four to eight, except for the nine batteries in the Cavalry Corps. Eighty percent of the batteries had six guns, the rest four, and each brigade had at least one Regular Army battery.[38]

These artillery brigades were not authorized by legislation but created from necessity, supplanting the battery in tactics and to considerable degree in administration. Supply and maintenance were improved, and more efficient employment and promptness and facility of movement resulted. In addition, the concentration of batteries was favorable for instruction, discipline, and firepower. Fewer guns were needed, and in 1864, the number of recommended field pieces per 1,000 men was reduced from 3 to 2.5.[39]

The organization of artillery in armies other than the Army of the Potomac depended on the terrain, the size of the operation, and the judgment of the commanding general. Nevertheless, the trend was toward centralization, withdrawing units from the control of subordinate commanders and placing them under division and corps commanders. In August 1861, Brig. Gen. Nathaniel Lyon in Missouri assigned his batteries to brigades, and in October of that year, Brig. Gen. Ulysses S. Grant did the same. In the Shiloh campaign of 1862, the Army of the Tennessee (officially designated as such only after the battle) had six divisions with eighteen brigades and eighteen field batteries, which were, for the most part, assigned to the brigades. At Murfreesborough in the winter of 1862–63, the XIV Corps (Army of the Cumberland) had the majority of its batteries attached to infantry brigades, with very little held in reserve. During the battle, some of the brigade batteries concentrated themselves and delivered massed fire that helped save the Union army. Maj. Gen. William Rosecrans noted the deficiencies of his artillery organization and soon after

[38] Birkhimer, *Historical Sketch*, pp. 84, 89–90; Tidball, "Remarks Upon Field Artillery," pp. 22–24, FA School files; Fairfax Downey, *Sound of the Guns* (New York: D. McKay Co., 1956), p. 147; Maurice Matloff, ed., *American Military History*, rev. ed. (Washington, D.C.: Office of the Chief of Military History, United States Army, 1973), pp. 247–48.

[39] Birkhimer, *Historical Sketch*, p. 84.

General Pendleton
Confederate States Army

the battle took remedial measures. In the Chickamauga campaign of October 1863, the Army of the Cumberland had transferred control of the artillery to the divisions, and in July of that year, the artillery was transferred to the corps level. In sum, the same evolutionary organization of command that had occurred in the Army of the Potomac was eventually repeated in the Army of the Cumberland and in other western commands.[40]

In determining the most efficient means of organizing artillery units for field service, the Confederate States Army faced problems and confusion similar to those encountered by the Union army. Col. Edward Porter Alexander, one of the Confederacy's outstanding artillery officers, had advocated a battalion organization for field artillery as early as the summer of 1861, when he was only a captain. But it was not until the early months of 1863 that Colonel Alexander and the Army of Northern Virginia's artillery chief, Brig. Gen. William Pendleton, worked out a plan for a reorganization to improve that arm's mobility and firepower. One brigade of six artillery battalions, each containing between four and six batteries, was attached to each of the two corps in the army. Two of the six battalions in each corps were designated as corps reserve artillery. All the battalions of each corps were under the command of the corps artillery chief, and the artillery of both corps were under the army artillery chief. A medical officer, an ordnance officer, and an assistant quartermaster and commissary officer were assigned to each artillery brigade.[41] In Alexander's words, "It would have been a decided step in advance had we inaugurated, so soon, a battalion organization of several batteries. We came to it in about a year, but meanwhile our batteries had been isolated and attached to infantry brigades. So they fought singly, and in such small units artillery can do little."[42]

In June 1863, the Army of Northern Virginia was reorganized into three corps, each with five artillery battalions attached (one for each division and two in reserve). Each battalion contained an average of four batteries, usually comprising four guns each. There was no general reserve artillery for the army. The cavalry division had

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[40] Tidball, "Remarks Upon Field Artillery," pp. 94–95, 140–41, 166, FA School files; Larry J. Daniel, *Cannoneers in Gray* (University: University of Alabama Press, 1984), p. 132; Griffith, *Battle Tactics*, pp. 66, 166.

[41] War Department, *War of the Rebellion*, 1/25(pt.2):625–26.

[42] Alexander, *Military Memoirs*, p. 14.

three attached horse artillery batteries. A lieutenant colonel (or sometimes a major) commanded each battalion, and brigadier generals or colonels served as corps artillery chiefs.[43]

The tactical battalion organizational structure was slow in evolving in the western Confederate armies. Ordnance at the beginning of the war was nearly nonexistent in the West; most was concentrated in the eastern theater. What artillery that was available could be found in batteries attached to infantry brigades. The nature of the terrain, the inexperience of the officers, and a doctrine that gave artillery a counter-battery[44] primary mission militated in favor of decentralization. As elsewhere, commanders feared that concentrated, unlimbered batteries presented a far more vulnerable target than an infantry line. As late as 1863, batteries were thus still being assigned to infantry brigades. However, in April of that year, a new structure based on the organization of artillery in the Army of Northern Virginia went into effect. Artillery battalions (generally four batteries each) were assigned to divisions, and the division artillery chiefs received increased executive and administrative authority. Receiving orders directly from division and corps commanders, they could control the tactical maneuver of the batteries. In the Army of the Tennessee, efforts were made to organize an artillery reserve as well as a horse artillery organization.[45]

The creation of the Artillery Reserve in the Army of the Potomac was a significant breakthrough in organization and tactics. Major Barry had established the principle that when divisions were serving together in a corps, at least half of the divisional artillery was to be withdrawn to form a corps reserve. In addition, the artillery reserve of an army was to consist of one hundred pieces and comprise, besides "light mounted batteries," all the horse artillery until the cavalry massed. In 1862, the Army of the Potomac's Artillery Reserve consisted of eighteen batteries of one hundred guns in fourteen regular and four volunteer units. All the regular batteries had six guns each, of which about half were Napoleons, the remainder being rifles. Three volunteer batteries were armed with 20-pounder Parrott rifles and the other with six old 32-pounder bronze howitzers. The eighteen batteries were formed into four battalion-size brigades, one with four horse batteries, one with four volunteer batteries, and the other two with the remaining ten batteries. The senior captain commanded each of the four brigades, and the whole reserve was under General Hunt's command. A staff of an adjutant, a quartermaster, an ordnance officer (an artillery officer on ordnance duty), a chief medical officer, and a commissary officer assisted Hunt. The quartermaster was in charge of the trains, consisting of its own wagons as well as others carrying supplies and ammunition. Each of the batteries had two (or three for the horse batteries) wagons for forage, rations, and baggage.[46]

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[43] War Department, *War of the Rebellion*, 1/25(pt.2):850–51 and 1/27(pt.2):338–56. Although six-gun batteries were the "ideal," there were not enough guns to provide six to all batteries.

[44] Counterbattery fire is fire specifically directed against enemy artillery or control stations.

[45] Daniel, *Cannoneers in Gray*, pp. 25, 32, 87–88, 134.

[46] Tidball, "Remarks Upon Field Artillery," pp. 2 (quoted words), 8–10, FA School files; War Department, *War of the Rebellion*, 1/5:19 and 1/11(pt.3):184.

Artillery park at Yorktown, Virginia

The primary advantage of the army artillery reserve was the flexibility it gave the commander, making it unnecessary to go through the division or corps commanders. The reserve batteries could be used whenever or wherever needed. At Yorktown in 1862, the Artillery Reserve assisted the engineers in constructing fortifications, and at Malvern Hill, the federal batteries were resupplied with ammunition from the reserve train, a practice repeated frequently during the war. Although other Union field armies at times maintained artillery reserves, none was organized on the scale of that in the Army of the Potomac.[47]

Civil War leaders recognized horse artillery as being part of a properly organized cavalry organization. Company A, 2d Regiment of Artillery, was reorganized for that service in the fall of 1861 at Washington, D.C., making it the first horse artillery unit since Brevet Lt. Col. Braxton Bragg's battery had been dismounted at Santa Fe after the Mexican War. The 2d's Battery B/L (consolidated because of lack of personnel) and Battery M, as well as Battery C, 3d Regiment of Artillery, soon followed, thus making four batteries in one brigade. Up to the end of the Peninsula campaign of 1862, these batteries were attached to the Army of the Potomac's Artillery Reserve. When divisions or brigades of cavalry were detached for special service, one or

[47] For a different view of the Artillery Reserve, see Arthur L. Wagner, "An Antiquated Artillery Organization," *Journal of the Military Service Institution of the United States* 17 (July 1895): 41–57.

Battery C, 3d Regiment of Artillery, near Fair Oaks, Virginia

more horse artillery batteries were assigned to them. These units were so successful that after the battle of Chancellorsville in the spring of 1863, four more Regular Army batteries were organized into another horse artillery brigade. Service with the cavalry was extremely hard on the units, and to mitigate this situation somewhat, the two brigades alternated duties.[48]

The horse artillery brigades were increased in personnel and fighting power so that by May 1864 each consisted of six batteries. The 1st Brigade had eight Napoleons and twenty-four 3-inch guns, while the 2d Brigade contained eight Napoleons and twenty-two 3-inch guns. The two brigades numbered 43 officers, 1,174 enlisted men, and 2,064 horses. On 31 May 1864, four of the batteries were ordered to the defense of Washington, and the remaining eight batteries were organized into a single brigade, which operated with the Cavalry Corps. Later in the year, six of the remaining eight batteries were ordered to service with the Army of the Shenandoah, leaving only two horse artillery units with the Army of the Potomac. The five horse artillery batteries remaining in the Army of the Shenandoah in March 1865 then rejoined the Army of the Potomac.[49] No regularly equipped horse artillery batteries, such as those with the

[48] Tidball, "Remarks Upon Field Artillery," pp. 8–9, FA School files; Birkhimer, *Historical Sketch*, pp. 70–71.

[49] Birkhimer, *Historical Sketch*, pp. 70–71; War Department, *War of the Rebellion*, 1/36(pt.1): 115–16, 289.

Army of the Potomac and briefly with the Army of the Shenandoah, served with the western armies, although some mounted batteries, equipped as lightly as possible, did serve with the cavalry.

In 1864, the number of infantry corps in the Army of the Potomac was reduced to three with the number of artillery batteries falling to forty-nine by 5 May (*Table 8*). Of these, twenty-five were in the corps artillery brigades (nine in the II Corps and eight in each of the V and VI Corps). The two horse artillery brigades in the Cavalry Corps each contained twelve batteries, as did the Artillery Reserve. In addition, a battalion of heavy foot artillery was attached to each of the infantry corps, and two heavy artillery regiments formed part of the Artillery Reserve. Armed as infantry, the heavy artillery soldiers guarded the trains and provided escort, protection, and field construction work for the brigades.[50]

In the Wilderness campaign of May 1864, even light artillery proved difficult to maneuver in the swampy and wooded countryside that had few clearings for gun positions. General Grant reduced the artillery from six-gun batteries to four-gun batteries, except for the horse artillery units. Given the abundance of artillery, he maintained that one-fourth of it could not be used to any advantage.[51] Moreover, he opined that the surplus was a hindrance in using up scarce roads, consuming a great deal of limited forage and other stores. In his words: "Artillery is a very burdensome luxury where it cannot be used. Before leaving Spotsylvania, therefore, I sent back to the defense of Washington over one hundred pieces of artillery, with horses and caissons. This relieved the road over which we were to march of more than two hundred six-horse teams, and still left us more artillery than could be advantageously used."[52] Most of the pieces ordered away were returned for the siege of Petersburg.

At the same time, the number of batteries in each infantry corps was increased to twelve (taken from the artillery reserve) with a total of forty-eight guns in each corps. The IX Corps, assigned to the Army of the Potomac on 28 May 1864, had nine batteries, and by early 1865 the II Corps had twelve batteries; the V Corps, eleven; the VI Corps, nine; the IX Corps, six; and the Artillery Reserve, four. The Army of the Potomac's total number of guns was 202, plus 12 Coehorn mortars.[53]

On 29 March, Grant reduced the field batteries in the corps artillery brigades to six batteries each for the II and VI Corps and to five each for the V and IX Corps. The surplus pieces were either left temporarily in position or sent to the Artillery Reserve, which, by the circumstances, was strengthened with nineteen batteries and the supply (artillery) and ammunition trains.[54] The reduction resulted from the need to increase mobility as Grant's campaign entered a pursuit phase. Also, the large

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[50] War Department, *War of the Rebellion*, 1/36(pt.1):106–16, 284–86; Tidball, "Remarks Upon Field Artillery," pp. 86–87, FA School files; Downey, *Sound of the Guns*, p. 148; Birkhimer, *Historical Sketch*, p. 86.

[51] Ulysses S. Grant, *Personal Memoirs of U. S. Grant*, 2 vols. (New York: Charles L. Webster and Co., 1885–86), 2:181.

[52] Ibid., p. 241.

[53] War Department, *War of the Rebellion*, 1/36(pt.1): 289; 1/46(pt.1):660–61.

[54] Ibid., 1/46(pt.1):659–62.

Table 8—Artillery Organization, Army of the Potomac, May 1864

Unit	*Guns per Battery*		*Batteries*	*Total Guns*
	No.	*Type*		
II Corps	6	Napoleons	5	30
	6	3-inch rifles	4	24
V Corps	6	Napoleons	4	24
	6	3-inch rifles	3	18
	6	10-pounder Parrotts	1	6
VI Corps	6	Napoleons	4	24
	6	3-inch rifles	3	18
	6	10-pounder Parrotts	1	6
1st Brigade, Horse Artillery	4	Napoleons	2	8
	6	3-inch rifles	4	24
2d Brigade, Horse Artillery	4	Napoleons	2	8
	4	3-inch guns	1	4
	6	6-inch guns	3	18
2d Brigade, Artillery Reserve	6	20-pounder Parrotts	1	6
	6	10-pounder Parrotts	2	12
	6	Napoleons	1	6
	4	Napoleons	1	4
	4	3-inch rifles	1	4
3d Brigade, Artillery Reserve	6	3-inch rifles	1	6
	4	3-inch rifles	2	8
	6	Napoleons	2	12
	4	Napoleons	1	4
Total			49	274*

*In addition, the 15th New York Foot Artillery Regiment had eight 24-pounder Coehorn mortars.

brigades created when the reserve was broken up had proved unwieldy, and in any case, the corps were used to sending their equipment to the reserve for repair (*Table 9*).[55] By this time, the artillery reserve had become a means of resupply, maintenance, and reinforcement rather than a vital source of battlefield firepower.

From Mobile to Static Warfare

Although there were already enough rifles in the hands of the infantry at the beginning of the Civil War to make a significant impact on the battlefield, neither the North nor the South was as well supplied with field artillery pieces. On 21 January 1861, the U.S. Army listed 4,167 artillery pieces on hand, but only 163 were serviceable field guns and howitzers. During the war, Northern factories produced 7,892 cannon, of which 1,156 were Napoleons. Once production in the North caught up with the demand for guns, the Union was able to put foreign weapons aside to simplify ammunition supply. The Confederacy did not have as broad an industrial base, although some foundries did exist, and the most notable, the Tredegar Iron Works in Richmond, Virginia, continued to produce artillery pieces until near the end of the war. To supplement their manufactured pieces, the Southerners made extensive use of captured Union pieces, especially 3-inch rifles and 10-pounder Parrotts. They also purchased weapons from abroad until the Union blockade virtually eliminated that source. Of the imported cannon, most came from England—the Whitworth, Armstrong, and Blakely models.[56]

The science of coastal defense had been static until the Civil War demonstrated the inability of the older brick and masonry forts to withstand modern firepower and the advantages of using rifled cast-iron gun tubes and wrought-iron carriages. Earthworks, properly constructed, proved more effective than brick and masonry. The augmentation of naval forces in support of land forces and the placement of underwater obstructions and mines gave greater depth to coastal defenses. The use of rifled artillery did not surpass that of smoothbores in the field, but in forts and garrisons rifled guns were much more effective. Great progress had been made in casting heavy, rifled iron gun tubes and favorable reports by American observers of Russian experiments stimulated the introduction of wrought-iron carriages. The iron guns had many advantages over the older, smoothbore pieces mounted on wooden carriages. Fewer men were needed to crew the big iron fortress guns as they could be elevated and depressed easily, and the carriages had interchangeable parts. Iron withstood damage better than wood and bronze and, when positioned within casemated walls or earthworks or protected by turrets or shields, could endure heavy battering. Also, the greater accuracy of rifled guns gave fortress batteries a marked advantage over ships armed with smoothbore artillery.[57]

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[55] Birkhimer, *Historical Sketch*, p. 89.

[56] Harold L. Peterson, *Notes on Ordnance of the American Civil War, 1861–1865* (Washington, D.C.: American Ordnance Association, 1959), pp. 8, 13. It has been estimated that two-thirds of the artillery in the South was captured from Union troops.

[57] Jay Luvaas, *The Military Legacy of the Civil War* (Chicago: University of Chicago Press, 1959), pp. 25, 30, 34, 39, 44, 68. 76–77.

Table 9—Artillery Organization, Army of the Potomac, March 1865

				Guns per Battery			
	No.	*Type*		*No.*	*Type*	*Batteries*	*Total Guns*
Siege Artillery			*Field Artillery*				
	11	Napoleons	II Corps	4	Napoleons	3	12
	8	12-pdr. field howitzers		4	3-in rifles	3	12
	1	24-pdr. howitzer					
	2	32-pdr. howitzers	V Corps	4	Napoleons	3	12
	9	20-pdr. Parrotts		4	3-in. rifles	2	8
	4	10-pdr. Parrotts					
	4	3-in. rifles	VI Corps	4	Napoleons	3	12
	1	6-pdr. Sawyer		4	3-in. guns	3	12
	12	8-in. siege howitzers					
	1	13-in. seacoast mortar	IX Corps	4	Napoleons	3	12
	6	10-in. seacoast mortars		4	3-in. guns	3	12
	10	10-in. siege mortars					
	20	8-in. siege mortars					
	36	Coehorn mortars					
	10	100-pdr. Parrotts					
	38	30-pdr. Parrotts					
	14	4.5-in. siege rifles					
	1	30-pdr. Brooke					
Total	188[a]		Total				92[b]

[a] Manned by the 1st Connecticut Foot Artillery Regiment and 3d Connecticut Heavy Artillery Battery.
[b] The batteries in the Artillery Reserve were listed in the report of March 1865, but no cannon were noted.

The chief advantage of rifled artillery over smoothbores was an increase in range and accuracy, and ranges were extended even further when tubes were mounted on newer carriages that supported a greater degree of elevation.[58] Maximum ranges for rifled pieces were considerably greater than those for smoothbores, but the benefit of such ranges was uncertain. When the gunner could not see the target, he could neither judge the effect of nor adjust the rounds. Thus, long-range artillery offered little practical use in land warfare unless gunners were firing with an unobstructed view or were participating in a siege where the target was both wide and deep. Rifled artillery had some value at shorter ranges in the defense, but the canister effect of the Napoleons was more deadly against infantry. Consequently, the principal role for rifled artillery became counterbattery fire. At Malvern Hill in the summer of 1862, the Union artillery showed its defensive power against attacking infantry and its ability to provide effective counterbattery fire. Most of the Union artillery pieces were rifles with greater ranges than the smoothbores that made up the majority of Confederate artillery weapons. Union rifled artillery, positioned on a cleared hill offering excellent fields of fire, unmercifully battered the massed target presented by the Confederate artillery batteries. The Southern artillery, besides having inferior range and being hindered by poor roads and trails, was badly handled. Over 5,000 Confederate soldiers fell in the battle—over half of them, according to Maj. Gen. D. H. Hill, hit by artillery fire.[59]

Again, at Antietam in September 1862, the Union artillery provided excellent counterbattery fire, but its total effectiveness was reduced by the lack of higher artillery staffs that were not yet thought necessary. General Robert E. Lee had already gone to a battalion organization for his artillery, which gave the Confederates a ready means of centralized control to shift batteries to threatened points and partially offset their inferiority in quantity and quality of materiel. Even though the Army of the Potomac's Artillery Reserve had been significantly reduced to fill understrength artillery units assigned to infantry commands (usually brigades), many Union commanders still felt it was not enough and that all light batteries should have been under their direct control. They blamed the artillery for the lack of overwhelming victory at Antietam and recommended that the Artillery Reserve be abolished. In reality, nearly all the light batteries had been in the hands of infantry commanders, leaving the Artillery Reserve with the heavier, less maneuverable 20-pounder Parrotts. Ignored was the fact that the offensive power of artillery, so prevalent during the Mexican War, was simply no longer paramount.[60]

Although artillery served well in counterbattery fire, General Hunt perceived that the chief value of the arm was to assist the infantry in repulsing attacks. In his opinion,

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[58] See Table 6 for effective ranges of artillery pieces at 5-degree elevation. Maximum ranges were considerably greater. The older Napoleons could not be elevated beyond 5 degrees.

[59] Naisawald, *Grape and Canister*, p. 135; McWhiney and Jamieson, *Attack and Die*, pp. 3, 112–13, 117; Frank E. Comparato, *Age of Great Guns* (Harrisburg, Pa.: Stackpole Co., 1965), pp. 187–89.

[60] Naisawald, *Grape and Canister*, pp. 183–84, 229–30; Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 31–32.

The Coehorns—Cold Harbor [Virginia] *by A. R. Waud*

infantry and cavalry require the aid of artillery for specific purposes: to destroy walls, earthworks, and other means of cover; to set fire to or render untenable farm buildings, villages, woods, and other lodgments, etc. Its presence alone, if known to be powerful, often prevents an enemy from resorting to such defenses. Thus set free for its primary objectives, the artillery is used in the open field to commence battles, to prepare the way and aid in attacks, to protect the movement of our own troops, and to hinder those of the enemy, to pursue and prevent the enemy from rallying, or to cover our own retreat.[61]

In repelling attacks, the artillery opened fire at long range with rifle shell, with the smoothbores joining in with solid shot as the enemy came near. At about 200 yards, the smoothbores changed to canister. Despite concerted efforts toward aggressive tactics, however, the main value of field artillery in the Civil War lay in the defense.

Gettysburg was the last battle of the Civil War in which field artillery fire was paramount. Its defensive power was clearly demonstrated once more in the role played by the Union artillery against the charge of Maj. Gen. George E. Pickett's troops. By the end of 1863, the tide of war had changed in the eastern theater, with both sides making more use of field fortifications to cover themselves from the murderous fire of the infantry rifle. The struggle became a war of attrition. Entrenchments, which had been used constantly in the western theater, became standard in the East. The Army of Northern Virginia had used field fortifications at Fredericksburg and Chancellorsville and had stepped up their use as declining manpower forced the South more and more on the defensive. The infantry rifle had driven soldiers to cover, strengthening the defense, and direct fire artillery had little

[61] Hunt, "Experience in Artillery," p. 161.

effect. With the loss of effective artillery fire support, attacks became increasingly costly. Some relief came for the Union artillery with the introduction of the Coehorn mortar in the Army of the Potomac. Mortar shells, fired at high angles, often reached the trenches that other artillery projectiles did not. Being small and hand portable, the Coehorns proved extremely useful for trench warfare. The Confederate States Army recognized the utility of the Coehorns and also adopted high-angle fire for use in the trenches.[62]

The Civil War had been a transitional period for the artillery. With the introduction of rifled weapons, coastal defense changed, the older harbor forts becoming obsolete. Yet on the battlefield, the effect on an enemy that went under the cover of trenches and fortifications was negligible. In organizational structure, both the North and South initially assigned artillery in small groups as the Army had done in previous wars, but gradually both centralized firepower at the division and corps level to provide massed fire support for their respective armies. Following the end of the war, however, the great Union army was largely disbanded, leaving a small regular force to once again guard the coastline and protect the frontier.

[62] Henry L. Abbott, "Siege Artillery in the Campaigns Against Richmond . . .," in *Professional Papers [of the] Corps of Engineers*, ser. no. 14 (1867; reprint, New York: D. Van Nostrand, 1868), pp. 17–20; War Department, *War of the Rebellion*, 1/26(pt.1):211–512, 517–28; Tidball, "Remarks Upon Field Artillery," p. 25, FA School files.

CHAPTER 4

Diverging Missions

Between the Civil War and the turn of the century, the gap widened between mobile and position artillery. The Army placed most of its emphasis during those years on coastal defense, relegating field artillery to a relatively minor position. Although technological advances in seacoast artillery eventually had a beneficial impact on field artillery, they simultaneously underscored the distinct differences in the respective weaponry, which in turn gave rise to more specialization. Developments in field artillery achieved greater mobility, their use forging more integration with infantry and cavalry; in contrast, seacoast weapons became increasingly large and immobile and concentrated on defense. The performance of field artillery during the War With Spain was disappointing, but the formal separation of coast and field artillery forces in 1901 reflected a desire to increase the efficiency of the former rather than improve the latter. Thereafter, the two new branches evolved separately, with coast artillery concentrating on the defense of harbors and cities and with field artillery operating with maneuver forces in the Army.[1]

Era of Slow Progress

At the end of the Civil War, the artillery retained the five Regular Army regiments that had been organized by 1861. Except for two batteries in each artillery regiment that were retained as mounted field units, the batteries that had served as field artillery during the war were dismounted to serve at posts along the Atlantic and Pacific coastlines. One of the two remaining field batteries in each regiment was to be equipped with four 3-inch Ordnance rifled guns and the other with four 12-pounder Napoleons.[2]

The act of 28 July 1866 set the peacetime military establishment at five artillery, ten cavalry, and forty-five infantry regiments. Out of an authorized Army strength of 54,302, about 10 percent were artillerymen. The act stipulated that all artillery regiments would have the same organization as that of the 5th Regiment of Artillery in 1861, although subsequent organizational changes caused the authorized

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[1] From 1901, the evolution of coast artillery into the Air Defense Artillery branch will be covered in *Air Defense Artillery*, a future volume in the Army Lineage Series.

[2] WD GO 126, 20 Jul 1865; WD GO 139, 28 Sep 1865; WD GO 144, 9 Oct 1865; WD GO 151, 16 Oct 1865.

strength to fluctuate over the years (*see Table 7*).[3] In 1869, the number of infantry regiments was reduced to twenty-five, but the number of cavalry and artillery regiments remained unchanged.[4]

In the years immediately following the Civil War, the Army sought to improve artillery training, and in 1866, the War Department established a permanent board of four artillery officers, the senior member being Brevet Maj. Gen. Henry J. Hunt who had served as the Army of the Potomac's artillery chief. One of the Artillery Board's duties was to prepare a project for artillery instruction at various posts.[5] It recommended that the Artillery School of Practice be reestablished at Fort Monroe, Virginia, as a school of instruction for heavy or seacoast artillery, a recommendation carried out in 1868. The board also submitted a plan for the instruction of artillery at other posts, recommending several standard artillery manuals. A handbook issued to noncommissioned officers and enlisted men was the first to provide theoretical courses for the rank and file in artillery. Where there was at least one artillery unit on a post, the battery commander, supervised by the regimental colonels, was to direct instruction. If practical, instruction was to include maneuvers of the pieces as well as practice firing.[6] The reestablishment of the Artillery School, however, was the board's chief accomplishment. After it adjourned in 1867, the board never reconvened.

The first commandant of the Artillery School after the Civil War was now Col. William F. Barry, who had served as artillery chief for both General McDowell and General McClellan. Five artillery companies (one from each regiment) were stationed at Fort Monroe at one time for a one-year course, which was lengthened to two years in 1876. The course, both theoretical and practical, covered such subjects as mathematics, military history, military engineering and surveying, and law. At the outset, the school had little impact on the artillery, but it eventually became a major focus for professionalism within the branch.[7]

The publication of a new manual of infantry tactics by Emory Upton in 1867 led to a revision of tactics throughout the Army, and in 1868, Barry convened a board to discuss artillery tactics that would be compatible with those of the infantry. The Barry board, however, did little more than confirm experiences gained in the Civil War.[8] In 1869, another group of officers under Maj. Gen. John M. Schofield met at Fort Leavenworth, Kansas, to evaluate tactics for the infantry, cavalry, and artillery, and in 1873, a revision of artillery and cavalry tactics was integrated with Upton's

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[3] Act of 28 Jul 1866, ch. 299, 14 Stat. 322–39; WD GO 56, 1 Aug 1866; U.S. Congress, House, *Annual Report of the Secretary of War*, 39th Cong., 2d sess., 1866, H. Doc. 1, pp. 6–7.

[4] WD GO 16, 11 Mar 1869; WD GO 17, 15 Mar 1869.

[5] WD GO 6, 30 Jan 1866; WD GO 16, 12 Mar 1866.

[6] WD GO 67, 21 Aug 1866.

[7] WD GO 99, 13 Nov 1867; U.S. Congress, House, *Report of the Secretary of War*, 42d Cong., 2d sess., 1871, H. Doc. 1, pt. 2, 1:79–81; Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 76–78; WD GO 14, 25 Feb 1876.

[8] Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 81–83.

Major General Barry

tactics for infantry.[9] In practice, however, there was little change in artillery employment or doctrine.

Because the school at Fort Monroe concentrated on heavy artillery, the Secretary of War in 1869 directed the establishment of a school for light artillery, similar to one recommended by General Scott in 1857. Established at Fort Riley, Kansas, as the School of Instruction for Light Artillery, the new facility was to provide more uniformity in artillery tactics and improvement in materiel. But the effort turned to nothing. The Army reduced the ten authorized light batteries to five and used four to establish the school. The batteries remained in Kansas only two years before being reorganized as cavalry to serve on the frontier, and the school closed.[10]

One of the Army's primary interests in the latter half of the nineteenth century was coastal defense. This posture was taken because officers in the reduced postwar Army strongly believed that large numbers of trained troops were required to conduct an offensive and because the civilian populace viewed defensive measures as a means of strengthening the country against foreign invasion without incurring the expense of a large standing army. There were also foreign influences. Great Britain had led the way in improving seacoast defenses with a vast construction program between 1863 and 1880, and Germany and France followed suit. Furthermore, the development of rifled cannon had rendered the old vertical masonry forts along the American seaboard obsolete. Fortifications needed to be dug into the earth and armed with breechloading heavy rifled ordnance, shielded by armor plate, in order to withstand attacks from modern weapons. As early as 1869, General of the Army William T. Sherman pushed for the replacement of prewar fortifications with defenses that could resist modern artillery. Sherman persisted in his recommendations throughout the 1870s, and his successor, General of the Army Philip H. Sheridan, did the same. Although some construction work began, appropriations halted in the mid-1870s, and all work soon ceased.[11]

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[9] WD GO 60, 6 Aug 1869; HQ Army GO 6, 17 Jul 1873. The manual was not actually published until 1874.

[10] WD GO 6, 18 Feb 1869; WD GO 17, 4 Mar 1871; *Annual Report of the Secretary of War, [FY1869]*, 1:24, 69.

[11] *Annual Report of Secretary of War, [FY1869]*, 1:31–32; ibid., *1879*, 1:xv–xvi.

While little was being done to upgrade coastal fortification structures, improvements in coast artillery weapons were significant. At the end of the Civil War, Chief of Ordnance Brig. Gen. Alexander B. Dyer had proposed that more attention be given to coastal defenses. The main objective of coast artillery—decisive engagement of ships—demanded that weapons be large enough and powerful enough to defeat naval armor and guns. Some inherent difficulties in developing effective coast artillery materiel lay in the existing limitation posed by cast- and wrought-iron metallurgy. Another problem to overcome was that of recoil, for the older gun carriages could not contain the rearward force generated by powerful propelling charges. The Ordnance Department, working with numerous boards and congressional committees, played a pivotal role in overcoming these difficulties. Occasional disputes among the various players, exacerbated sometimes by civilian ordnance inventors, did much to reduce the efficiency of acquiring suitable materiel. Nevertheless, progress was steady, and developments in heavy artillery in the late nineteenth century changed these weapons from relatively unsophisticated pieces of equipment into the modern weapons of today. Steel gave strength to the pieces without the weight of iron or the fragility of bronze; chambering reduced internal pressure on guns making more powerful charges possible; longer ranges allowed guns at different locations to converge their fire on a single target for massed effect; recoil control and breechloading made higher rates of fire possible; and sighting mechanisms provided better accuracy.

The Army directed the ordnance board that met in 1867 to determine calibers of ordnance at forts and the proportions of rifled guns to be procured. Subsequently, the board recommended an equal number of rifles and smoothbores.[12] Until the early 1870s, the smoothbores remained the preferred weapon by default, primarily because efficient rifled barrels were beyond mass-manufacturing capabilities and because its "devotees" were generally reluctant to acknowledge the rifle's superiority. As smoothbores usually had higher muzzle velocities than similarly calibered rifles, some considered smoothbores more efficient at short ranges. The Chief of Ordnance thus recommended the continued purchase of smoothbores as late as 1873.[13]

Breechloading weapons received their first large-scale testing in the Prussian wars between 1864 and 1871. The last of these, the Franco-Prussian War (1870–71), proved to all of Europe that the Krupp steel breechloading rifle was superior by far to all previously built cannon.[14] Mechanical difficulties with the breech apparatus still prevailed, and gunners needed more time with breechloaders to ensure they avoided their recoil. Given the trend for larger and heavier guns, which were more difficult to maneuver, muzzleloaders became increasingly less efficient for heavy ordnance. Congress, dissatisfied with the Ordnance Department's progress in modernizing artillery weapons, established a special board in 1872 to examine the position of American heavy ordnance in light of European developments and to explore the

[12] Birkhimer, *Historical Sketch*, p. 288.

[13] Ibid., p. 289.

[14] The Krupp family owned and operated a steelworks, established in 1811 in Essen. The firm played an important role in the production of armaments in Germany, and after the Franco-Prussian War, it became popularly known as the Arsenal of the Reich.

possibilities of converting old muzzleloaders to a breechloading configuration.[15] Because of disagreements between Congress and the German manufacturer Alfred Krupp, the breechloader was never adopted, but its consideration was the first serious attempt shown by the United States in a steel weapon.[16]

At the time, no manufacturers in the United States were capable of producing the high-quality steel needed for artillery pieces. In 1879, Chief of Ordnance Brig. Gen. Stephen V. Benét, after considering the success of tests on Krupp breechloaders and reassessing the disaster on a British ship involving a muzzleloader, reported to the Secretary of War that it was only a matter of time before the general introduction of breechloaders.[17]

Breechloading allowed for more efficient use of rifling, and modern carriages that compensated for recoil eliminated cannon displacement after each firing. The problem of recoil was especially serious in the confines of fortifications because guns of sufficient size to exchange fire with modern ships needed a great amount of room to accommodate the extensive rearward roll of both the cannon and carriage. Steel carriages allowed the tube to move to the rear in reaction to the forward thrust of the projectile while the carriage remained in place. The buildup of pneumatic and hydraulic pressure slowed and finally stopped the rearward motion of the tube. A variety of 8-, 10-, and 12-inch coast artillery guns, numbering over two hundred fifty, were mounted on disappearing carriages, designed on a counterweight system that allowed the tubes to be lowered into positions for loading. The new carriages, which protected gun crews from danger and increased the rate of fire, resulted in greater speed and accuracy because an artillery piece could, after reloading, be refired immediately once the tube returned to its forward position and a quick check made for proper alignment and elevation. With effective recoil mechanisms, telescopic sights became practical, as the jolt of recoil previously forced the removal of such devices before firing and their readjustment after remounting. Seacoast guns improved to such an extent that by 1900 only one heavy gun was required for roughly every five emplaced in 1865.[18]

In light of changes that had been taking place in guns and equipment, the Army began to consider improvements in field artillery materiel. The only notable change in materiel in the years immediately following the Civil War was the addition of automatic rapid-firing weapons. The Gatling gun, invented by Richard Jordan Gatling in 1861 and patented the following year, had ten parallel barrels that rotated and fired as many as 350 shots per minute. Weighing about 200 pounds, it was turned

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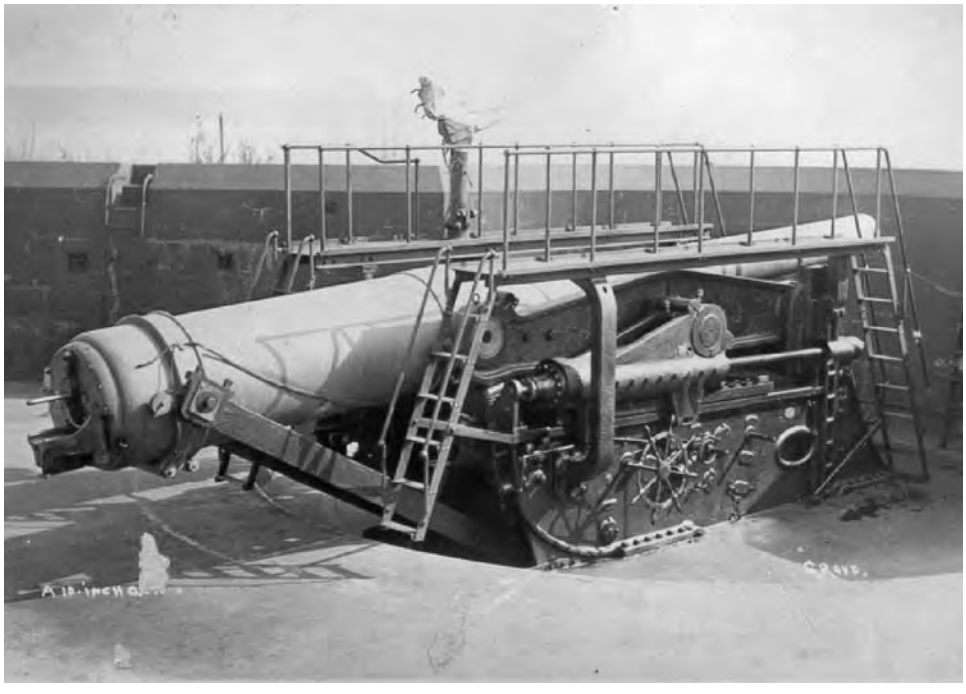
[15] Rowan A. Williams, "The Adoption of Breech-loading Cannon," pp. 3–4, copy in CMH files; Field Artillery School, *Development of Field Artillery Materiel*, pp. 45, 49; Act of 6 Jun 1872, ch. 316, 17 Stat. 258–61; WD GO 57, 28 Jun 1872; "Proceedings of a Board on Heavy Ordnance, July 10, 1872–August 14, 1872," box 24, Special File, RG 156, NARA.

[16] Nesmith, "Quiet Paradigm Change," Ph.D. diss., p. 137. Krupp wanted to manufacture the weapon for the United States, while the United States wanted the plans to manufacture the gun itself.

[17] U.S. Congress, House, *Report of the Secretary of War*, 46th Cong., 2d sess., 1879, H. Doc. 1, 3:8.

[18] *Five Years of the War Department Following the War With Spain, 1899–1903* . . . (Washington, D.C.: U.S. Government Printing Office, 1904), pp. 269–70; Lewis, *Seacoast Fortifications*, pp. 9, 76, 79–81.



10-inch disappearing gun

manually by a crank and mounted on a wheeled horse-drawn carriage. In 1866, the Army adopted the Gatling gun, which was designed to defend buildings, causeways, and bridges.[19] Like the 3-inch Ordnance gun and Napoleon, the Gatling gun was more valuable in the defense than the offense. Another weapon accepted by the Ordnance Department was the Hotchkiss gun, named for its inventor Benjamin B. Hotchkiss. The gun was a built-up, rifled, rapid-firing weapon of oil-tempered steel. It had five firing barrels, and a mechanically turned crank ejected its shells. Although the War Department expressed much interest in the Hotchkiss gun, it remained an auxiliary weapon.[20]

Because of a lack of funding to develop new field artillery weapons and because of the large number of 3-inch Ordnance rifles left from the Civil War, the Ordnance Department decided to convert a number of them into breechloaders. The first of these converted guns, which had to be rebored to 3.18 inches to fit modern ammunition, appeared, along with a new steel carriage, in 1879. At this time, the Ordnance Board recommended that these guns be issued to a battery for competitive field trials against a battery of muzzleloaders. The results were so favorable to the

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[19] Ernest F. Fisher, "Weapons and Equipment Evolution and Its Influence Upon the Organization and Tactics in the American Army From 1775–1963," p. 41, copy in CMH files; George M. Chinn, *The Machine Gun*, 5 vols. (Washington D.C.: U.S. Government Printing Office, 1951–87), 1:48, 54.

[20] Birkhimer, *Historical Sketch*, pp. 294–95; Chinn, *Machine Gun*, 1:71–78.

The Gatling Guns, July 1, 1898*, by Charles Johnson Post*

breechloaders that the following year six converted wrought-iron breechloaders (designated as 3.2-inch) were issued to the troops for tests in actual service.[21]

In 1881, a board of seven artillery officers, headed by Col. John C. Tidball, convened in Washington to consider recent innovations in materiel for field batteries. The board recommended improved field guns and a short steel mortar or howitzer for high-angle fire, noting that the low trajectory of contemporary field guns was of little value against entrenchments, rifle pits, forts, and any temporary cover used by soldiers. It accepted the breechloading mechanism modifications already begun, but also proposed new steel designs in two sizes for future development: a light gun similar in size to the 3-inch Ordnance rifle and a heavier piece similar in size to the 20-pounder Parrott used as a siege gun in the Civil War. The board also sought the addition of telescopic sights and new carriages that would allow sufficient elevation for curved fire. As the Chief of Ordnance, General Benét directed his department to develop the lighter gun and its carriage, with work on the heavier gun to follow. The Ordnance Department was successful, and the new 3.2-inch steel breechloading gun with its carriage containing spring recoil brakes was completed in 1885.

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[21] *Annual Report of the Secretary of War, 1879*, 3:9, 179; ibid., *1881*, 3:503; Konrad F. Schreier, Jr., "The U.S. Army 3.2-Inch Field Gun," *Military Collector & Historian* 24 (Fall 1972): 77.

Within five years, one hundred of these field pieces were in service, but the gun was soon proven obsolete.[22]

A collateral development was the use of explosive shells with percussion fuzes, giving field guns superiority at long distances over infantry rifles. Although shrapnel had been introduced in the early nineteenth century, the fuzes were deficient and did not give shells a range beyond that of solid shot. With perfected fuzes, the effect of a single projectile increased considerably at all distances. More importantly, it allowed the observation of the points of fall at all ranges and the regulation of fire based on observation.[23]

The Franco-Prussian War influenced field artillery employment as well as weapons. The Prussians employed artillery aggressively in the field but not in the forward line in the Napoleonic manner. Instead, they placed artillery pieces as close behind the infantry line as possible. The effectiveness of Prussian artillery was in large part due to the fact that it was armed with rifled breechloaders, while the French still used muzzleloaders. In organization, the Prussians eliminated the reserve, preferring instead to send their guns forward with the infantry. The French, on the other hand, maintained a large artillery reserve for special concentrations. To avoid a stalemate, the Prussians tried to bypass defensive positions, if possible, but if an attack were deemed necessary, then it followed a heavy bombardment. Another tactic used by the Prussians was to seize ground in order to force an enemy attack, thereby giving them the advantages of the defense. Although field fortifications did not dominate the war as they had in the Civil War, trench warfare concepts continued to develop.[24]

In the latter half of the nineteenth century, military conditions in the United States were not conducive to employment of field artillery. Occasionally, field pieces were decisive in campaigns against the Indians, but usually they only hindered the mobility of maneuver forces. When they were employed, the gunners were often not artillerists, but men detailed from the cavalry and infantry. Col. Henry J. Hunt believed the situation intolerable, especially when only five of the ten field batteries authorized in 1882 were mounted and equipped. Hunt also thought Gatling guns would be effective against the Indians if trained artillerists and hardy animals served them.[25]

By the 1880s, coastal fortifications had fallen into such disrepair that the situation could no longer be ignored. The beginnings of modernization in the Navy called attention to the neglected harbors in which the newly authorized ships would be based. Finally, in 1885 Congress established a board under Secretary

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[22] Schreier, "3.2-Inch Field Gun," pp. 77–79; Birkhimer, *Historical Sketch*, pp. 195–96; WD GO 39, 28 Apr 1881; Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 212–22.

[23] Maurice H. Anthoni, trans., "Influence of the Adoption of the New Guns on the Fire of Field Artillery," *Journal of the United States Artillery* 21 (May-June 1904): 285.

[24] Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 123–24.

[25] Robert M. Utley, *Frontier Regulars* (New York: Macmillian, 1973), pp. 72–73; WD GO 96, 15 Aug 1882. For additional information on the use of artillery in the Indian Wars, see Larry Don Roberts, "The Artillery with the Regular Army in the West, 1866–1890" (Ph.D. diss, Oklahoma State University, 1981).

of War William C. Endicott to plan the restoration of the coastal defenses. The board's report in 1886 recommended changes and additions at an estimated cost of $127 million. The expense appeared somewhat excessive since the board was unable to identify the enemy likely to challenge such defenses. Also, the estimate did not take into account the cost of ammunition for the guns or land for the installations. In addition, it was contemplated that about 80,000 men would be needed to man the completed installations.[26] Militia artillery units were few because of the expense in maintaining them. New York, for example, did not have a single unit trained for duty with heavy seacoast guns. Various ideas concerning training of militia artillery were considered, but almost nothing was accomplished.[27] Nevertheless, the Endicott board started a building program that would continue for over twenty years.

No money was available until September 1888, when Congress voted an initial appropriation to carry out the proposals and established a permanent Board of Ordnance and Fortification under General Schofield to supervise the program. Among the Endicott board's recommendations were the procurement and erection of 2,362 guns and emplacements, but by 1 April 1898, only 151 of these had been completed. Shortly before the outbreak of the War With Spain, intensive work was done to emplace guns and prepare additional defenses, but even these measures remained unfinished. The war caused some changes in the coastal defense program, but in general the hastily improvised measures taken in 1898 to protect the Atlantic coast only stressed the necessity for more modern defenses.[28]

Many types of weapons were used to arm the fortifications, the majority being the 8-, 10-, and 12-inch guns and the largest having a range between 7 and 8 miles. Most were mounted on disappearing gun carriages. About 300 heavy guns were eventually installed during the Endicott period, mostly in batteries of two to four guns each. Other weapons used were heavy mortars for high-angle fire, rapid-fire guns for close defense, and underwater mines. At the same time, the Army abandoned its Civil War forts around major harbors and replaced them with earthworks and armor-plated concrete pits armed with heavy guns.[29]

Despite the advances in material and the addition of five light batteries for a total of ten in the Army, field artillery still lagged behind coast artillery. A professor at the Military Academy in 1887 asserted that "the Artillery are in reality Infantry, with red instead of white facings on their uniforms, and are constantly employed

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[26] Act of 3 Mar 1885, ch. 345, 23 Stat. 434; WD GO 26, 13 Mar 1885; *Annual Report of the Secretary of War, 1886*, 1:32–33; Edward Ranson, "The Endicott Board of 1885–86 and the Coast Defenses," *Military Review* 31 (Summer 1967): 82. The Regular Army at this time was authorized fewer than 28,000 men. For the full report, see U.S. Congress, House, *Report of the Board on Fortifications or Other Defenses*, 49th Cong., 1st sess., 1886, H. Doc. 49.

[27] H. C. Aspinwall, "Artillery, State of New York," *Journal of the United States Artillery* 3 (January 1894): 14–21; Elisha S. Benton, "The Artillery of the U.S. National Guard," ibid. 2 (July 1893): 326–47; Edmund C. Brush, "The Artillery of the U.S. National Guard," ibid. 3 (October 1894): 608–14.

[28] U.S. Congress, House, *Report of the Secretary of War*, 50th Cong., 1st sess., 1887, H. Doc. 1, pt. 2, 1:118–21; idem, *Report of the Secretary of War*, 51st Cong., 1st sess., 1889, H. Doc. 1, pt. 2, 1:68–74; idem, *Report of the Secretary of War*, 51st Cong., 2d sess., 1890, H. Doc. 1, pt. 2, 1:5–7; *Annual Report of the Secretary of War, 1892*, 1:17, 46.

[29] Lewis, *Seacoast Fortifications*, pp. 79–88.

on infantry duty. We have no longer any artillery troops."[30] The following year, the Army's Inspector General noted 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 . . . nearly a quarter of a century ago that such guns would not meet modern requirements."[31] Artillerists themselves worried about the state of their arm, noting the lack of a general system of target practice and the employment of artillery troops for duties other than as artillery. The fact that the companies and batteries were widely scattered at posts throughout the country exacerbated the problem.[32] An artillery officer in 1892 reported his observation that "much of the artillery was stationed for years at posts where there was no artillery materiel but a reveille gun. The spectacle was seen of men serving whole enlistments without seeing a cannon other than the above-mentioned field piece."[33]

One effort toward improving field artillery was the recommendation in 1887 to reestablish a light artillery school at Fort Riley, which had closed in 1871. After a long construction period, the School of Instruction for Cavalry and Light Artillery officially opened on 9 January 1893. The curriculum stressed target practice, concentrating more on field exercises and drill than on theory, and experimented with new systems of instruction.[34] Although it lacked the stature of the Artillery School at Fort Monroe, it did make some strides in cooperation between cavalry and its supporting artillery. The school closed during the War With Spain and did not reopen until 1901.

The Ordnance Department also considered siege artillery. Since the Russo-Turkish War of 1877–78, the trend in Europe had been toward heavier weapons for field and siege artillery. In 1885, the Ordnance Department planned for a 5-inch rifled siege gun and the following year designed a 7-inch howitzer. The capacity of pontoon bridges to support the weapons restricted the upper weight limit of siege guns rather than horse-drawing capacity, which limited the weight of the field pieces. Field artillery cannon were restricted by the weight six horses could draw (about 5,000 pounds), given that teams larger than six horses were difficult to maneuver. Teams could be larger for siege artillery where maneuverability was not considered as important, thus allowing a heavier weight limit.

In 1890, the Ordnance Department designed prototypes for a 3.6-inch gun to replace the 3.2-inch field gun in the light batteries and a new 3.6-inch mortar for

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[30] Peter S. Michie, "The Personnel of the Sea-Coast Defense," *Journal of the Military Service Institution of the United States* 8 (March 1887): 8.

[31] U.S. Congress, House, *Report of the Secretary of War*, 50th Cong., 2d sess., 1888, H. Doc. 1, pt. 2, 1:104.

[32] Charles F. Benjamin, "The Artillery and Ordnance," *Journal of the Military Service Institution of the United States* 8 (December 1887): 361–80; James Chester, "The Theoretical Instruction of Gunners," *Journal of the United States Artillery* 1 (July 1892): 171–206; Charles D. Parkhurst, "Field-artillery, Its Organization and Its Role," ibid. 1 (July 1892): 250–77; Henry C. Davis, "Target Practice," ibid. 2 (January 1893): 422–39, 543–88. A board met in 1888 to revise the tactics for infantry, cavalry, and light artillery, but it concerned itself primarily with drill matters and did little to change tactics.

[33] W. A. Simpson, "Our Artillery Organization," *Journal of the United States Artillery* 1 (January 1892): 52.

[34] Act of 29 Jan 1887, ch. 72, 24 Stat. 372; WD GO 9, 9 Feb 1887; WD GO 17, 14 Mar 1892.

high-angle fire in siege artillery. The new mortar was superior in both range and projectile weight than the old Coehorn used in the Civil War and also had a carriage that permitted variable elevation, which the Coehorn lacked. Both the field gun and the mortar reflected the trend toward heavier field weapons and high-angle fire. A 7-inch mortar, similar to the 3.6-inch model, was also adopted. Other improvements considered at the time were smokeless powder, a new sight for the 7-inch howitzer, and a hydraulic recoil buffer for the 5-inch siege gun, all of which were significant advances affecting both siege and field artillery.[35]

The War With Spain

The modernization and creation of many coastal installations, as well as the shortage of field and siege artillery, made it apparent in the late 1880s that artillery was understrength, but it took the threat of war in 1898 before Congress acted and authorized an increase. In 1887, General Schofield had calculated that with the existing organization of twenty-five infantry and ten cavalry regiments, at least thirty-four field batteries were needed for a balanced force. To obtain such an artillery force, he recommended the addition of twelve artillery regiments for a total of seventeen, each with two field batteries in addition to coastal defense units. That October, an artillery council, comprising ten artillery officers, met in New York City to discuss improvements in the arm. Among its recommendations, the council proposed the addition of two artillery regiments, for a total of seven, and a chief for the arm. In his report two years later, Schofield revised his estimate to two rather than twelve additional regiments, and from then until 1898, the plea for more artillery troops appeared annually in the reports of the Secretary of War.[36]

Although some advances in field and siege artillery were realized during the late nineteenth century, the Army devoted most of its time and resources in strengthening coastal defenses. In 1896, Chief of Ordnance Brig. Gen. D. W. Flagler told a congressional committee on appropriations: "Until these 27 forts are made impregnable, it is a fact that foreign nations might, in a few weeks, land armies on our coast. We ought, of all nations, be ready to resist an army on land, and to do this, we must have field and siege artillery."[37] General Flagler took care to explain that during previous years a large proportion of funds had been allotted to building coastal fortifications and that, as a result, field and siege weapons had been neglected. He pointed out that the Army had 150 light 3.2-inch field guns of modern design, but that to equip a field army of 500,000 the artillery would need ten times that number. Siege artillery was in a similar state. The Chief of Ordnance based his estimate on the old standard ratio of three guns per 1,000 men, which was the minimum he thought possible,

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[35] Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 227, 229–32, 240, 242, 246, 248.

[36] *Report of the Secretary of War*, 1887, 1:5, 119–21; ibid., 1889, 1:4, 72–73; U.S. Congress, House, *Report of the Secretary of War*, 54th Cong., 2d sess., 1896, H. Doc. 2, 1:7; ibid., 55th Cong., 2d sess., 1897, H. Doc. 2, 1:7; Benjamin, "Artillery and Ordnance," pp. 361–80; J. P. Sanger, "The Artillery Council of 1887," *Journal of the United States Artillery* 49 (September-December 1918): 233–63.

[37] U.S. Congress, House, Committee on Appropriations, *The Fortification Appropriation Bill Hearings*, 54th Cong., 1st sess., 1896, p. 20.

Battery M, 7th Regiment of Artillery, near Poncé, Puerto Rico

and he saw no possibility of using Civil War vintage materiel as a reserve because of the many new advances in gun design.[38]

Soon after the battleship *Maine* blew up in the Havana harbor in February 1898, Congress authorized the two additional artillery regiments that had been requested by the War Department, making a total of seventy heavy coast and fourteen light field batteries in the Regular Army. As stated in a professional journal at the time, "It took years to induce Congress in time of peace to increase the country's artillery forces from five regiments to seven; and the labors of many influential persons would not then have been successful had not the imminent danger and confident expectation of war existed."[39]

The Army established the 6th Regiment of Artillery at Fort McHenry, Maryland, and the 7th at Fort Slocum, New York. Both were organized along the lines of the five artillery regiments already in service, and the new units gave the arm a maximum authorized strength of 301 officers and 5,635 enlisted men. The equipment for each of the fourteen field batteries was to include six guns and caissons, a forge and battery wagon, and one hundred horses.[40] On 26 April, Congress authorized a further increase in the artillery, bringing the strength of the foot companies up to 200 enlisted men and the field batteries to 173. One lieutenant also augmented each battery (*Table 10*). In time of war, the president could determine the composition of

[38] Ibid., pp. 19–22.
[39] *Army and Navy Register*, 26 Feb 1898, p. 136.
[40] Act of 8 Mar 1898, ch. 53, 30 Stat. 261; WD GO 6, 11 Mar 1898; WD GO 21, 20 Apr 1898.

Table 10—Artillery Organization, 1898–1901

Staff	*8 Mar 1898 Artillery Regiment*	*26 Apr 1898 Artillery Regiment*	*2 Mar 1899 Artillery Regiment*	*2 Feb 1901 Artillery Corps*
Colonel	1	1	1	14[a]
Lt Colonel	1	1	1	13
Major	3	3	3	39
Adjutant	1	1	1	
Quartermaster	1	1	1	
Sergeant Major	1	1	1	48
QM Sergeant	1	1	1	
Principal Musician	2	2		
Band	24	24	28	[b]
Chief Musician	1	1		
1st Lieutenant				39
2d Lieutenant				39
Total	36	36	37	192

Battery or	*8 Mar 1898*		*26 Apr 1898*		*2 Mar 1899*			*2 Feb 1901*	
Company	*Light*	*Heavy*	*Light*	*Heavy*	*Light*	*Heavy*	*Siege*	*Field*	*Coast*
Captain	1	1	1	1	1	1	1	1	1
1st Lieutenant	1	1	1	1	2	1	1	2	1
2d Lieutenant	1	1	2	2	1	1	1	1	1
1st Sergeant	1	1	1	1	1	1	1	1	1
QM Sergeant			1		1	1	1	1	1
Vet Sergeant			1						
Stable Sergeant				1			1		
Sergeant	6	6	6	22	6	8	8	6	8
Corporal	8	4	15	10	12	12	12	12	12
Musician	2	2	2	2	2	2	2	2	2
Artificer	2	2	2	2	4			4	
Mechanic						2	2		2
Wagoner	1	1	1	1					
Farrier	2		2						
Saddler	1		1						
Cook					2	2	2	2	2
Private	52	49	141	162	133	85	117	131	81
Total	78	67	177	205	165	116	149	163	112

[a]Includes Chief of Artillery.

[b]Ten bands, each with twenty-eight enlisted men, were allotted to the Corps of Artillery.

the regimental elements as light or heavy. Two batteries in the seven regiments (K, 5th Regiment, and O, 7th Regiment) were designated as heavy siege batteries.[41]

Of the 223,235 volunteers raised for the war, only 3 percent were artillerymen. Twenty of the forty-four states furnished artillery units, which included one heavy regiment, eleven heavy batteries, and thirty-one light batteries. The volunteer units were raised and officered by the states and came chiefly from existing militia organizations.[42]

While the nation mobilized for war in May, the ten existing field batteries first assembled at Chickamauga Park, Georgia, and then moved to Tampa, Florida. By using existing reserves of 3.2-inch field guns, the Army equipped each battery with four field pieces. A siege train of 5-inch guns, 7-inch howitzers, and 3.6-inch mortars was also organized. Only four light and two siege batteries actually sailed to Cuba with the newly organized V Corps because of insufficient space on the transport ships. At Santiago the V Corps, under the command of Maj. Gen. William R. Shafter, had two infantry divisions of three brigades each, an independent infantry brigade of three regiments, a volunteer brigade of three regiments, a light artillery brigade of four batteries, a mounted cavalry squadron, a siege artillery battalion of two batteries, a signal detachment and balloon detachment, and a four-piece Gatling gun detachment. The artillery was unable to lend much support because of enemy fire and unsuitable terrain. The field guns brought to the front were poorly placed and subjected to both small arms and cannon fire; the siege artillery arrived too late to be of much use.[43] The guns had been employed by battery, much as they had been during the Mexican War. The 3.2-inch field guns were capable of long-range fire, but they were of little value to the infantry without effective fire control or without being massed. A contemporary analysis of the Cuban campaign stated that

> any demonstration of the uses of artillery in mass—as support to an attack or in the other methods taught, at the schools or written about by experts, seem to have been impossible. The guns were brought up, "put in here" in the old familiar fashion of the Civil War. No doubt if conditions had favored it the artillery would have been handled after the most approved methods. But had conditions been more satisfactory than they were, we did not

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[41] Act of 26 Apr 1898, ch. 191, 30 Stat. 364–66; WD GO 21, 20 Apr 1898; WD GO 27, 27 Apr 1898; WD GO 29, 29 Apr 1898; *Annual Reports of the War Department, FY1898*, 1(pt.2):485–86. The two siege batteries are currently designated as the 3d and 2d Battalions, respectively, 5th Field Artillery.

[42] *Annual Reports of the War Department, FY1898*, 1(pt.2):485–91; Act of 22 Apr 1898, ch. 187, 30 Stat. 361–63; [U.S. War Department], Adjutant General's Office, *Statistical Exhibit of Strength of Volunteer Forces Called Into Service During the War With Spain . . .* (Washington, D.C.: U.S. Government Printing Office, 1899). Jim Dan Hill, in *The Minute Man in Peace and War* (Harrisburg, Pa.: Stackpole Co., 1964), pp. 164–65, lists one heavy artillery regiment and forty-one light batteries.

[43] *Annual Reports of the War Department, FY1898*, 1(pt.2):367, 457; *Correspondence Relating to the War With Spain . . .* , 2 vols. (1902; reprint, Washington, D.C.: Center of Military History, United States Army, 1993), 1:7, 399, 539 and 2:638–39, 666, 742; "The Artillery at San Juan," *Army and Navy Journal*, 29 Oct 1898, p. 212; "Professional Results of the Santiago Battles," ibid., 23 Jul 1898, p. 952; Letter to Editor on "The Artillery at San Juan," ibid., 19 Nov 1898, p. 274; *Report of the Commission Appointed by the President To Investigate the Conduct of the War Department in the War With Spain (Dodge Commission Report)*, 8 vols. (Washington, D.C.: U.S. Government Printing Office, 1899), 2:800, 4:956, 6:2857, 2868.

Artillery in action at El Caney, Cuba

have enough guns. If a more powerful fire could have been directed at one specific point, the artillery effect would have been greater.[44]

The Ordnance Department was concerned enough about the performance of its equipment to appoint a board of officers to investigate the efficiency of American weapons in the Cuban and Puerto Rican campaigns. The board reported that artillery employment was too limited to produce any useful evaluation.[45] In the Philippines, the Spanish did not offer much resistance, and the opportunity to maneuver artillery in the swampy terrain around Manila was limited, although a battalion of the 2d Regiment of Artillery was particularly commended for its efforts in repelling an attack on 31 July.[46]

One of the chief complaints about the artillery during the War With Spain was its use of black powder.[47] A major in the Prussian artillery had produced the first smokeless powder in 1865, although French engineer Paul Vieille in 1886

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[44] "Professional Results of the Santiago Battles," p. 952.

[45] "American Ordnance," *Army and Navy Journal*, 8 Oct 1898, p. 140.

[46] "The Military Situation," *Army and Navy Journal*, 13 Aug 1898, p. 1035; U.S. Congress, House, Committee on Appropriations, *The Fortification Appropriations Bill Hearings*, 55th Cong., 3d sess., 1899, p. 19.

[47] Black powder is an unstable, sensitive, and easily ignitable low-explosive charge used as a component of igniters, igniting primers, and blank-fire charges.

developed a smokeless powder that proved more effective. Appearing on the battlefield during the Russo-Turkish War of 1887–88, smokeless powder permitted a more rapid rate of fire and, in the absence of smoke clouds, also helped conceal gun positions. Furthermore, its range and penetrating power were far superior to that of black powder.[48] The Ordnance Department had tried to provide the artillery with the newer smokeless powder, but the shipment arrived at Tampa too late to accompany the expedition to Cuba.

Postwar Reforms

At the end of the War With Spain, the Army had an aggregate authorized strength of 64,586 officers and men, of whom a little less than 16 percent were in the artillery. Around 60 percent of the artillery units were in the United States, 20 percent in the Philippines, and the remainder in Puerto Rico, Hawaii, and Alaska.[49] The United States had developed into a world power, with possessions from Puerto Rico in the Atlantic to the Philippines in the Pacific. To protect these possessions Congress authorized the postwar Regular Army twenty-five infantry, ten cavalry, and seven artillery regiments. Each artillery regiment contained fourteen batteries (an increase of two), twelve for manning coastal fortifications (eleven in the 5th and 7th Regiments, since one battery in each of these organizations was organized as siege artillery) and two for field service, plus a band. The coast artillery batteries in each regiment were organized into three four-battery battalions. The act of 2 March fixed the enlisted strength of the Regular Army at 65,000 men, of whom almost 12,000 were authorized as artillerists.[50]

Prior to the War With Spain, reformers had suggested radical changes in the structure of the artillery. Under consideration were measures to separate the coast and field artillery units, whose functions were vastly different; to abolish the regimental organization of artillery, which had almost always operated on the company or battery level; and to create a chief of artillery in order to establish credible representation for the arm.[51] In general, artillerymen perceived the regimental organization as too inflexible for manning the harbor defenses, some of them requiring few companies and others considerably more. They wanted a corps structure with no established organization above the company level. At the time, little thought was given to field artillery on the very same issues.

New in office, Secretary of War Elihu Root was sympathetic. In November 1899, he recommended an increase in personnel, for he considered the strength of

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[48] *Annual Reports of the War Department, FY1898*, 1(pt.2):153, 232, 236, 596, 598; Dwight E. Aultman, "Personal Recollection of the Artillery at Santiago," in *The Santiago Campaign* (Richmond, Va.: Williams Printing Co., 1927), pp. 182–94.

[49] *Annual Reports of the War Department, [FY1899]*, 1(pt.2):5–6, 383–84.

[50] Act of 2 Mar 1899, ch. 353, 30 Stat. 977–79; WD GO 36, 4 Mar 1899; WD GO 37, 9 Mar 1899; WD GO 50, 17 Mar 1899; WD GO 152, 21 Aug 1899; WD GO 153, 29 Aug 1899.

[51] "Organization of the Seacoast Artillery," *Army and Navy Journal*, 17 Dec 1898, p. 367; Ranson, "Endicott Board," p. 83; Simpson, "Our Artillery," pp. 48–51; Henry Loomis Nelson, "Our Crippled Artillery," *Harper's Weekly*, 21 Oct 1899, pp. 1071–72.

Artillery in action at Coama, Puerto Rico

the heavy artillery to be short by 80 percent. He also urged the creation of a chief for the artillery branch. In his report for that year, Root stated:

> There are two special changes, which, I am clear, the same principles require. One is that the artillery branch of the service should have a chief. The present guns, carriages, projectiles, explosives, and all the complicated and delicate machinery which belong to them are made and delivered over to the artillery branch, and there is no one to represent or speak for the men who are to work with the tools thus furnished. There are seven colonels of the artillery, and it is not the business of any one of them more than another to speak for his branch of service. The valuable results of experience in the use of ordnance machinery are not utilized because it is not the business of anyone in particular to insist upon it. . . . The use of modern ordnance is a highly specialized and scientific business, and there ought to be an expert charged with the duty and responsibility of seeing that the officers and men of the corps understand their business and are properly trained in it. This office should be a member of the war college, and might well be on the staff of the Major-General commanding. He should not be the head of an additional bureau.[52]

In 1900, Root proposed that the branch be increased from its strength of about 11,000 men to over 18,000 men in five yearly increments. This effort to increase the artillery was part of a wider movement to raise the strength of the Army above

[52] *Annual Report of the Secretary of War, 1899*, 1(pt.1):52.

its prewar level. The old regimental system was to be abolished in favor of a corps organization, with the batteries and companies being divided into two subbranches—coast and field. Siege, mountain, and field batteries were to be included in field artillery.[53]

The act of 2 February 1901 divided the existing artillery force of seven regiments into separate batteries of field artillery and companies of coast artillery. After the reorganization, both types of units functioned as the Corps of Artillery, under one Chief of Artillery, who was the administrative and tactical head of the arm. The same act increased the sixteen field and siege batteries to thirty and the eighty-two coast artillery companies to one hundred twenty-six. At the same time, the infantry regiments were increased to thirty and the cavalry to fifteen. Coast artillery included coastal defenses, submarine and land mines, and torpedo devices, whereas field artillery included horse artillery, mountain artillery, siege artillery, and machine-gun units.[54]

Officers were assigned to coast or field artillery units in accordance with their aptitudes for the respective services. The act specified that one of the fourteen colonels authorized the corps be selected as the Chief of Artillery. The position was upgraded in 1903 to a brigadier general. The enlisted strength of the corps was set at 18,920, to be achieved by annual increments of 20 percent over a five-year period. The battery and company organizational structures remained essentially as they had been previously established. The aggregate strength of the Army (not including a regiment of Philippine Scouts and a Puerto Rican infantry regiment) was 3,820 officers and 84,799 enlisted men. The shortage of field artillery officers was to be met through transfers from the cavalry. The fourteen field and two siege batteries from the old seven regiments were redesignated as the 1st through 16th Field Artillery Batteries, and the new units were designated as the 17th through 30th. The 14th and 25th Field Artillery Batteries were organized as mountain artillery units. The remaining heavy artillery units were redesignated as separate numbered coast artillery companies.[55]

The reorganization of the artillery had accomplished its purpose of not only giving coastal defense units flexibility in employment but also providing additional means for promotions within the Corps of Artillery. Despite the fact that field artillery realized little from the change, the appointment of a branch chief who was willing to consider the needs of both coast and field artillery was significant. On balance, the reorganization allowed field artillery to develop over time into a strong branch without foundering in the interests of coastal defense programs.

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[53] "Secretary Root's Reorganization Plan," *Army and Navy Journal*, 24 Feb 1900, p. 595; *Annual Reports of the War Department, [FY1900]*, 1(pt.1):50–56; "Hope for the Artillery," *Army and Navy Journal*, 13 Jan 1900, p. 461.

[54] Act of 2 Feb 1901, ch. 192, 31 Stat. 748–58; WD GO 15, 13 Feb 1901; WD GO 9, 6 Feb 1901. Cavalry and infantry regiments were given machine-gun elements under the reorganization, but no separate units for these weapons were organized in the field artillery.

[55] Act of 2 Feb 1901, ch. 192, 31 Stat. 748–58; WD GO 66, 13 May 1901; WD GO 9, 6 Feb 1901; WD GO 116, 3 Sep 1901; WD GO 24, 7 Mar 1903.

Although neglected during the latter years of the nineteenth century, field artillery had actually made some progress. There was a new professionalism within the artillery branch as a whole, and there had been significant advances in technology, all of which would ultimately affect field artillery weapons and doctrine. Artillerymen also realized that much more needed to be accomplished in order to make their arm equal to those of other leading armies. In the end, recognizing the differences between coast and field artillery would enable the Army in the early years of the twentieth century to concentrate on the development of a combined arms team, whereby artillery could effectively support infantry and cavalry on the battlefield.

CHAPTER 5

A Time of Growth

During the latter half of the nineteenth century, developments in field artillery doctrine and materiel in the United States had lagged behind those in Europe. Disturbed by the lack of effective artillery support during the War With Spain, Army officers and others worked diligently to reorganize and revitalize the arm. They made great strides in the early twentieth century, and by the end of World War I, field artillery in the U.S. Army could equal or surpass that in most modern European armies. Technical and organizational improvements—for example, breechloading guns with effective recoil mechanisms and the capacity for indirect laying, that is, sighting on an aiming point rather than the target; new means of communication and transportation; and unit structures above the battery level—all contributed to the effectiveness of artillery support during World War I. But the road traveled proved rougher and more challenging than anyone would have ever imagined.

Modernizing the Arm

The development of modern breechloading rifles with effective recoil mechanisms changed field artillery gunnery profoundly, with direct fire giving way to indirect fire. The former had been relatively simple. Laying (pointing) the pieces and delivering accurate direct fire were critical, with the actual firing executed at a range and direction judged by the eye. Sighting mechanisms were fairly rudimentary, and gunners used the piece to determine the natural line of sight to a target at pointblank range, usually under 1,000 yards (914.4 meters). Fire was massed at key points by grouping the pieces. Each piece was fired independently, and the results depended mostly on the chief of the piece and the gunner—often the same person. Aiming and laying were the art of the cannoneer; a good one knew how his gun fired and corrected his own fire, similar to an infantryman firing his rifle. The role of the battery commander, who had little to do with the actual firing, was to indicate the target, supervise fire discipline and ammunition resupply, and monitor security and unit mobility.[1]

While the coast artillery had been testing new fire control methods for a number of years, the field artillery was slow in adopting them. Artillerists, who traditionally

[1] Anthoni, trans., "Influence of the Adoption of the New Guns," pp. 283–84.

used firing tables and the quadrant,[2] had developed mechanical range finders to adjust range, but direction remained a problem. During the Russo-Turkish War (1877–78), the Russians had used a method of laying their coast artillery guns indirectly for direction,[3] and in 1882, a Russian officer published a book discussing the implications of indirect laying for field artillery.[4] The concept took hold in the United States in 1894, when the Board on Regulation of Seacoast Artillery Fire was established. Its mission was to devise methods of aiming several guns on a ship without the gunners actually having to see the target, recommending telephonic and telegraphic communications for transmitting the necessary data to the gunners.[5]

The last years of the nineteenth century saw rapid technical developments in artillery materiel, and as a consequence, the degree of accuracy, ranges, and rates of fire all improved. Artillery pieces could be aimed accurately from concealed positions, and batteries could be dispersed over greater areas behind front lines and their fires concentrated on targets at longer ranges**.** The prototype for modern field artillery guns in the United States was the French 75-mm. gun, produced in 1897 by the Schneider firm. An innovative weapon, its features included a built-up construction of alloy steel, a simple but effective breechblock, a hydropneumatic long-recoil mechanism, an advanced method of traversing and elevating, and improved ammunition with a point-detonating fuze. The gun could achieve a maximum range of 6,000 yards (5,486.4 meters). The design of its sights was revolutionary because it incorporated provisions for indirect laying and for setting elevation from either side of the piece. The battery commander could regulate the fire of his battery, which then became the unit of fire. The French 75-mm. gun, at the time of its introduction, made all other cannon obsolete. It was more mobile, and it could be fired faster, farther, and more accurately than any other light field piece of the period.[6]

Indirect fire, where the target cannot be seen from the gun position, at first depended upon an observer who could see both the target and the gun.[7] Using a gun-mounted panoramic sight that measured horizontal clockwise angles in mils,[8] the gun layer could direct his line of sight in any direction. From a map, he

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[2] A quadrant is an instrument for measuring angular elevations. It consists commonly of a graduated arc of 90° and has a movable index and a sight.

[3] "Artillery Practice at Cronstadt," *Army and Navy Journal*, 7 Apr 1877, p. 562.

[4] J[onathan] B. A. Bailey, *Field Artillery and Firepower*, rev. ed. (Annapolis: Naval Institute Press, 2004), pp. 211–12. The Russians had practiced indirect laying for field artillery for some time but not extensively. See Chris[topher] Bellamy, *Red God of War* (London: Brassey's Defence Publishers, 1986), ch. 1.

[5] Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 262–63.

[6] *Handbook of the 75-mm. Gun Materiel* (Washington, D.C.: U.S. Government Printing Office, 1918); H. C. Carbaugh, "Present Status of Field Artillery," *Journal of the Military Service Institution of the United States* 20 (May 1897): 500–17.

[7] The method of using a line of markers from the gun to a position where the target was clearly visible had been in use for some time, but it was not suitable for mobile warfare.

[8] A mil, shortened from the French word *millième* meaning one thousandth, is a unit of angular measurement equal to 1/6400 of the circumference of a circle. Introduced by Switzerland in 1864 and adopted by France in 1879, the *millième* came into use in America on the sight of the 1902 model 3-inch field gun.

This French 75-mm. gun, manned by Battery C, 6th Field Artillery, reportedly fired the first American shot of World War I on 23 October 1917.

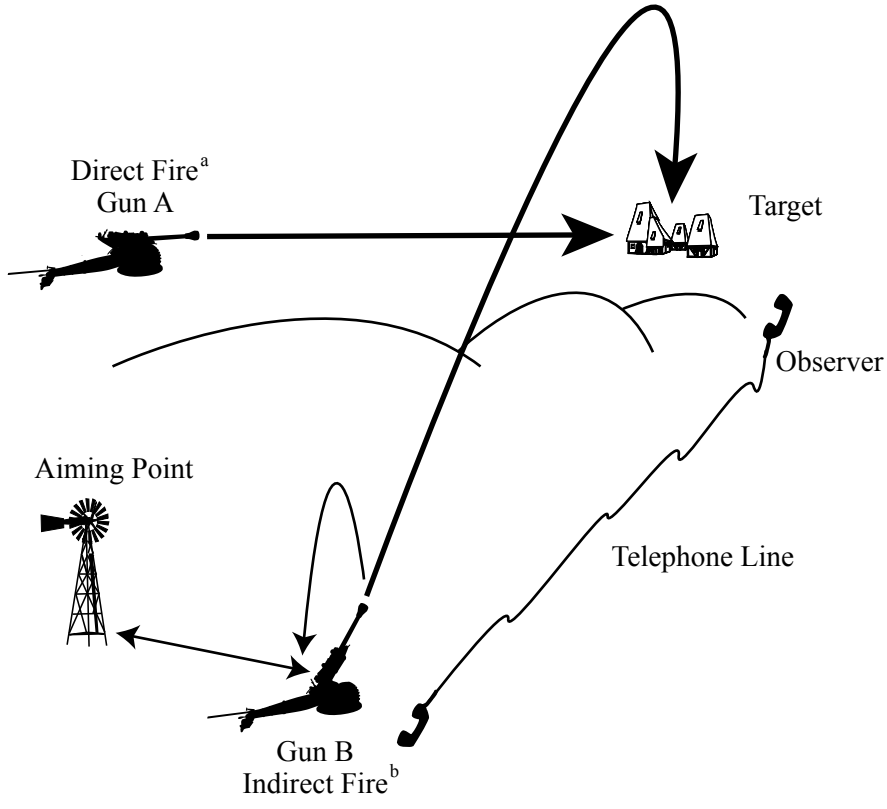
measured the azimuth[9] of the target; selected a suitable aiming point,[10] such as a church steeple, identified on the map; and calculated the azimuth to this object. The angle between the two lines gave the measurement for setting the sight. The gunner then rotated the gun until the line of sight was on the aiming point, thus pointing the muzzle of the gun on the target. Shells would fall within the general range of the target, the location of which an observer could report back to the gun battery (*Diagram*). Employing the same procedures to direct the fire of his guns, the battery commander either used his aiming circle[11] or had his gunners lay their sights on a common aiming point. Later, because of technological advances and improved map-making, an observer was able to call for fire without also having to see the gun position. Thus, guns could fire from greater distances, farther than the gunner's eye could see, and the artillery could operate out of sight of the enemy. The great difficulty was effective communications between observers and gun

[9] Azimuth is the direction expressed as a horizontal clockwise angle measured from north.

[10] An aiming point is a sharply defined object that is used as a reference in laying an artillery piece or for orienting purposes.

[11] An aiming circle is an instrument that measures horizontal and vertical angles, used in surveying and similar work in connection with artillery fire. It is equipped with a magnetic needle so that magnetic azimuths can also be set off or read.

Diagram–Direct and Indirect Fire



[a] The layer of gun A clearly sees the target through the telescopic sight. At ranges up to 1,500 yards, the engagement is accurate and decisive, although the gun is exposed to counterfire.

[b] With cannons emplaced in defilade, the layer of gun B is unable to see the target; requires the gunnery team's coordinated efforts; and, based on an estimated range and observer then adjusts fire by trial and error. Overall, the process of locating and drawing counterfire is slower.

Source: Adapted by author from Shelford Bidwell and Dominick Graham, *Fire-Power* (London: George Allen and Unwin, 1982), p. 8.

batteries. Artillerymen at first used flags and heliographs and later telephones, but truly effective communications did not become a reality until many years later with the development of lightweight field radios.[12]

Soon after the French adopted the *soixante-quinze*, the United States began work on a new design for a 3-inch (76.2-mm.) field gun that provided increased velocity and firepower, a flatter trajectory, and an anti-recoil mechanism allowing for more effective use of gun sights and more rapid fire. The weapon also had a gun shield on the carriage for protection of the crew. Experiments with various models began in 1899, and issue of the 1902 model began in 1904. Manufacture was delayed because of the necessity of obtaining the counter-recoil springs and panoramic sights from abroad, but by 1904, these items were being manufactured in the United States. The sights were similar to those on the French 75-mm. piece, which made the 1902 model the first American weapon suitable for indirect laying. The 3-inch piece fired a 15-pound (6.8-kilogram) shrapnel or explosive shell for an effective range of 6,500 yards (5,943.6 meters) and a maximum range of 8,000 yards (7,315.2 meters). Improvements were later made on the tube and breech, but subsequent models were still commonly referred to as the 1902 model 3-inch gun. It was the principal field piece of the Army from 1905 to 1917.[13]

With the 3-inch field gun, the Army had the ingredients for employing indirect fire, and the Russo-Japanese War of 1904–05 provided the impetus. That war involved the clash of large armies armed with modern weapons, resulting in the extensive use of trenches. The effectiveness of artillery fire drove both sides to cover, that is, in defilade. Laying guns indirectly while in defilade became standard, with centralized control provided through the use of telephone wire. Indirect fire control resulted in an increase in the number of potential firing locations, and the ability to shift the fire of a great number of pieces without physically moving them permitted the use of heavier, less mobile artillery in the field.[14]

Referring to reports of observers sent to both sides in the conflict, the Chief of Artillery, Brig. Gen. John P. Story, campaigned for improvements in the American arm. He criticized the structure of field artillery, which was still organized into

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[12] Ernest Hinds, trans., "Employment of Artillery Fire," pts. 1 and 2, *Journal of the United States Artillery* 22 (July-August 1904): 55–74 and 22 (September-October): 147–66; Ian V. Hogg, *Allied Artillery of World War One* (Ramsbury, Marlborough, England: Crowood Press., 1998), pp. 13–16; Bailey, *Field Artillery and Firepower*, pp. 283–84**;** David Adams Shugart, "On the Way" (Ph.D. diss., Texas A&M University, 2002), pp. 54–55.

[13] Konrad F. Schreier, Jr., "The U.S. Army 3 Inch Field Gun Model 1902," *Military Collector & Historian* 25 (Winter 1973): 185–92; *Annual Reports of the War Department, 1904,* 10:25–27; Nesmith, "Quiet Paradigm Change," Ph.D. diss., pp. 295–301. These guns served along the Mexican border and in the Punitive Expedition, but they were never actually engaged. The Germans had redesigned their 77-mm. gun with a spring recoil, and the 3-inch field gun was modeled after it rather than the hydropneumatic recoil system of the French "75."

[14] U.S. War Department, General Staff, *Reports of Military Observers Attached to Armies in Manchuria During the Russo-Japanese War* (Washington, D.C.: U.S. Government Printing Office, 1906). See also John Thomas Greenwood, "The American Military Observers of the Russo-Japanese War, 1904–1905" (Ph.D. diss., Kansas State University, 1971), pp. 426–32.

3-inch field gun, model 1902

separate batteries, recommending the organization of divisional battalions and regiments, and pointed out that there were no senior field-grade branch officers serving in the field.[15] Also, the 1901 reorganization had specified that artillery officers be promoted from the same list and that their assignments alternate between coast and field artillery, all of which undermined the growing specialization of the two branches.[16]

The Army had already organized provisional field artillery battalions for maneuvers and instruction. In 1902, it authorized provisional battalions at posts having two or more batteries and, in the fall of 1903, combined the 14th and 21st Field Artillery Batteries and an Indiana National Guard battery into a battalion at West Point, Kentucky, for maneuvers. The battalions were organized as light artillery but for the 5th Battalion (horse artillery) at Fort Riley, Kansas; the 11th Battalion (mountain artillery) in the Philippines; the 13th Battalion (mountain artillery) at Vancouver Barracks, Washington; and the 8th Battalion (siege artillery) at Buffalo, New York. The War Department in 1904 directed that a regiment be formed from the 4th and 5th Battalions at Fort Riley and the 9th Battalion at Fort Leavenworth, also in Kansas, and the following year, a second provisional regiment was organized at Fort Sill, Oklahoma Territory (later Oklahoma).[17]

In 1905, the War Department directed the Chief of Artillery to prepare a report on the organization of artillery, which later served as the basis for a bill in Congress separating coast and field artillery and providing field artillery with a regimental

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[15] *Annual Reports of the War Department, 1904*, 2:418–20.

[16] "Report on Reorganization and Increase of the Artillery Corps of the U.S. Army," 26 Oct 1905, p. 17, file 3710, box 20, Entry 296, RG 165, NARA.

[17] WD Cir 7, 27 Feb 1902; WD GO 11, 8 Sep 1903; WD GO 152, 14 Sep 1904. In 1906, the 12th Battalion was also authorized as a mountain artillery unit (WD GO 164, 27 Sep 1906).

structure.[18] The *Field Service Regulations* of 1905 promulgated the regiment as the largest permanent unit in a peacetime Army but the use of provisional corps, divisions, and brigades in times of war. Two to three divisions were to constitute a corps. Since field artillery was still organized into separate batteries, provisional regiments were to be organized to support divisions and corps. Each divisional regiment was to have nine batteries, six to support the division and three to support the corps. Six horse artillery batteries were planned for the cavalry division. The regulations were revised two years later to provide a two-regiment artillery brigade supporting an infantry division, which was also to include three infantry brigades, a cavalry regiment, and supporting units.[19] These changes were incorporated into the *Field Service Regulations* of 1910. Additional heavy artillery was to support the corps.

Congress passed the act separating coast and field artillery into two branches in 1907. The same act authorized six additional field batteries and gave the heretofore provisional regiments legal standing. The regiments, numbered 1 through 6, each had two battalions of three four-gun batteries. The 1st, 3d, and 5th Field Artillery were authorized as light artillery to serve with infantry troops, the 2d and 4th as mountain or pack artillery, and the 6th as horse artillery to serve with the cavalry. The Chief of Artillery, Brig. Gen. Arthur Murray, noted that although a large number of artillery officers favored a regimental organization of three two-battery battalions, it was believed that the authorized organization more closely followed the lessons of the Russo-Japanese War.[20] The new organization contained no siege artillery. After the War With Spain, the Army had retained two siege batteries, but by 1907, the siege weapons were obsolete. General Murray allowed that siege materiel would be reissued when the Ordnance Department furnished new equipment.[21]

The early twentieth century was also a period of reorganization for the upper echelons of the Army, reflecting an increased interest in practical instruction and higher education. Under the leadership of Secretary of War Root, the genesis of the Army general staff appeared, the Army school system grew, and the Army War College opened. In 1903, when the War Department General Staff was formally established, the Chief of Artillery became an additional member with the rank of brigadier general.[22] To further instruction, the War Department stipulated in 1901 that certain posts were to have schools of instruction for officers in a prescribed

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[18] Edgar F. Raines, "Major General Franklin Bell and Military Reform: The Chief of Staff Years, 1906–1910" (Ph.D. diss., University of Wisconsin, 1976), pp. 455–56; "Report on Reorganization and Increase of the Artillery Corps," 26 Oct 1905, pp. 1–43, file 3710, box 20, Entry 296, RG 165, NARA.

[19] WD GO 146, 5 Jul 1907.

[20] Act of 25 Jan 1907, ch. 397, 34 Stat. 861–64; WD GO 24, 2 Feb 1907; WD GO 118, 31 May 1907; WD SO 132, 6 Jun 1907; *Annual Reports of the War Department, 1907*, 1:179, 2:217; ibid., 1908, 1:29–30.

[21] *Annual Reports of the War Department, 1907*, 1:179. See also Oliver L. Spaulding, Jr., *Notes on Field Artillery for Officers of All Arms*, 4th ed. (Leavenworth, Kans.: Press of Ketcheson Printing Co., 1917), p. 33; U.S. War Department, General Staff, *Reports of Military Observers*, pp. 5–6. As a result of observations made during the wars in South Africa and Manchuria, the War Department saw a need for weapons more powerful than light guns, and the Ordnance Department was working on materiel in the 3.8-, 4.7-, and 6-inch categories.

[22] Act of 14 Feb 1903, ch. 553, 32 Stat. 830–31; HQ Army GO 15, 18 Feb 1903; HQ Army GO 120, 14 Aug 1903; WD GO 2, 15 Aug 1903.

course of theory and practice. Students who showed promise were designated for advanced training. The advanced centers of learning were organized under a unified system in 1904.[23]

The School of Instruction for Cavalry and Light Artillery at Fort Riley had reopened in September 1901 as the School of Application for Cavalry and Light Artillery, which was misleading for artillery tactics were not taught. Even though the faculty expanded the course of instruction to include field engineering, topography, and tactics, the real purpose of the school was to teach equitation. Thus, to more accurately reflect the mission, the name was changed in 1907 to the Mounted Service School.[24] Field artillery units continued to assemble at various posts for maneuvers, but no centralized school existed for instruction in modern tactical methods except the institution at Fort Monroe, which became the Coast Artillery School during the 1907 reorganization.[25]

In 1909, Capt. Dan T. Moore, an honors graduate from the School of Application for Cavalry and Light Artillery in 1904, went to Europe to visit foreign field artillery schools for a study of methods of gunnery and instruction. His impressions of the German artillery school at Jüterbog greatly influenced the founding of the School of Fire for Field Artillery at Fort Sill in 1911, with Captain Moore serving as the first school commandant. In 1910, Moore had made a preparatory inspection visit to the post, where much of the artillery force had been concentrated since 1905. The reservation was remote from the centers of population and industry; its more than 50,000 acres provided the critical space for target practice; and its terrain features offered excellent observation and tactical variations for training. The purpose of the school was to give a practical and theoretical course in the principles and methods of field artillery.[26]

In 1913, the Field Artillery Board, which had been established at Fort Riley in 1902 to study and report on all subjects pertaining to field artillery, moved to Fort Sill.[27] The establishment of the Field Artillery Association in June 1910 at Fort Riley was another milestone for the new branch. In 1892, the Artillery School at Fort Monroe had founded the *Journal of the United States Artillery*, but after the reorganization of 1907 it had become devoted to items about coast artillery. As one of its first accomplishments, the new association began its official publication *Field Artillery Journal* in 1911. Campaigning for approval of the magazine had begun three years before by officers who thought that radical changes in the use of the arm had occurred and that such changes were not readily appreciated due to the lack

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[23] WD GO 155, 27 Nov 1901; WD GO 115, 27 Jun 1904.

[24] WD GO 60, 30 Apr 1901; WD GO 191, 13 Sep 1907; Nesmith, "Quiet Paradigm Change," Ph.D. diss., p. 307; *Annual Reports of the War Department, 1907*, 2:212; 4:124.

[25] WD GO 178, 28 Aug 1907.

[26] WD GO 72, 3 Jun 1911; WD GO 82, 17 Jun 1911; WD GO 60, 25 Jan 1902; WD GO 156, 26 Sep 1905; Morris Swett, "Forerunners of Sill," *Field Artillery Journal*, November-December 1938, pp. 453–63; Riley Sunderland, *History of the Field Artillery School, 1911–1942* (Fort Sill, Okla.: Field Artillery School, 1942), pp. 28–30. The school was closed during the period troops were concentrated on the Mexican border, but reopened in July 1917 to assist in training field artillerymen for World War I.

[27] WD GO 58, 30 Sep 1913; G. B. McReynolds, "Notes on Some Random Activities of the Field Artillery Board," *Field Artillery Journal*, July 1942, pp. 505–10.

of accessible literature.[28] Although the new journal was only semiofficial, the articles were considered authoritative and reliable. As a consequence, the magazine became the "spokesman" for the branch.

Prior to World War I, disturbances along the Mexican border provided some practical testing of doctrinal and organizational changes. From 1911 through 1916, Mexico held the attention of the Army. Groups of rebels operating along the border further aggravated political unrest there. To deal with the rebels, the Army in March 1911 concentrated a so-called maneuver division at San Antonio, Texas, consisting of three infantry brigades (each with three regiments), one field artillery brigade of two regiments, one cavalry regiment, an engineer battalion, four ambulance companies, four field hospitals, and two signal companies.[29]

Captain Moore

Cognizant of the problems with the ad hoc unit and of the need for creating permanent tactical divisional organizations, the Army War College undertook a study and published its results in 1912 as *The Organization of the Land Forces of the United States*. Also known as the Stimson Plan after Secretary of War Stimson, with whom the General Staff had consulted, it called for a divisional structure similar to that published in the 1910 *Field Service Regulations*. Each division was to have two regiments, with a combined total of forty-eight guns and sixteen howitzers. In one regiment, two battalions were each to have three batteries of four 3-inch guns and one battalion with two batteries of 3.8-inch howitzers. The other regiment was to have two battalions, each with three batteries of 3-inch guns, and one battalion of 4.7-inch howitzers. With the allocation of such weapons as the 4.7-inch howitzer down to the division level, it became apparent that the old concept of siege artillery as specialized weapons had given way to one in which they became part of the usual field artillery armament. The siege train of former days had disappeared with the amalgamation of siege and field pieces. These organizations, along with those programmed for the cavalry division and field army, would have provided an

[28] U.S. Field Artillery Association, *History and Constitution* (Washington, D.C.: n.p., 1942), p. 13; William J. Snow, "Sketch of the Origin of the Field Artillery Association," pts. 1 and 2, *Field Artillery Journal*, July-August 1932, pp. 411–20, and September-October 1932, pp. 528–38.

[29] WD GO 35, 13 Mar 1911. See also John B. Wilson, *Maneuver and Firepower* (Washington, D.C.: Center of Military History, United States Army, 1998), ch. 2, which covers the genesis of divisions.

School of Fire for Field Artillery, Fort Sill, Oklahoma

average of 3.16 guns per 1,000 rifles—a figure recommended by the Greble Board, which was appointed in 1911 to survey the needs of the artillery. The Stimson Plan, which constituted a whole program for mobilization, along with an expanded revision prepared in 1915 entitled *Statement of a Proper Military Policy for the United States*, later influenced Congress in framing the National Defense Act of 1916.[30]

The plans anticipated a wartime force consisting largely of state troops rather than regulars, and the Army took steps to reorganize the militia system that had been in effect since 1792. Secretary of War Root in 1900 envisioned a wartime army composed chiefly of volunteers, although he believed that the Regular Army should be strengthened in the specialized arms, including artillery, because of their need for a greater amount of time and money for training and equipment. He recognized the existence of many admirable artillery units in the National Guard, but thought their numbers too small to affect his conclusion that the "expenditure of time and money necessary to acquire and maintain proficiency in artillery . . . [was] so great that the numbers in whose [specialized] branches of the National Guard must necessarily continue small."[31]

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[30] *Annual Reports of the War Department, 1912*, 1:106–07, 259–61; Wilson, *Maneuver and Firepower*, pp. 31–34.

[31] *Annual Reports of the War Department, FY1900*, 1:54–55 (quoted words); ibid., *FY1902*, 1:28.

The Militia Act of 1903, also known as the Dick Act after its author in the House of Representatives, Ohio National Guard Maj. Gen. Charles F. Dick, was an attempt to provide a more balanced militia force and to draw the organized state troops under closer supervision of the federal government. The Dick Act signified the end of the old militia system. It provided for federal recognition and aid to the National Guard as the organized militia, having the dual role of serving as state troops and as first-line national reserves in time of war or other emergency. In 1903, the National Guard had an aggregate strength of 116,542, of whom 4,725 field artillery personnel were organized into seventy-six batteries with a total of two hundred forty-four artillery pieces. Less than one-third of the weapons were of recent vintage (seventy-three 3.2-inch and three 6-inch breechloading rifles), about one-third were muzzleloaders, and over 10 percent were from the Civil War era (forty-one 12-pounder Napoleons and two brass 6-pounders). To bring fourteen of the National Guard batteries in conformance with those in the Regular Army, funds were allocated to replace their 3.2-inch field guns, the standard militia field gun, with the new 3-inch model.[32]

The preponderance of infantry still made the National Guard an unbalanced force. In 1908, the National Guard Association at a meeting in Boston proposed a plan for a seventeen-division force with the Guard furnishing two-thirds of the regiments in each brigade, two-thirds of the batteries in each artillery battalion, and two-thirds of the squadrons in each cavalry regiment. The Regular Army was to make up the remainder of the force. The scheme was dropped as being impracticable and, with the publication of the Stimson Plan in 1912, formally abolished. In 1912, the National Guard had only forty-eight field artillery batteries but one hundred thirty-nine infantry regiments, eight separate battalions, and eight separate companies—that is, enough infantry for sixteen divisions but only enough field artillery for three.[33] Moreover, the existing field batteries were poorly equipped. Maj. Gen. John Chase, the Adjutant General of Colorado, reported that

> a little while ago the War Department produced a very thoughtful article calling attention to the fact that for defense of the Government in time of war there should be 48 regiments of field artillery, and we had 48 batteries instead of 48 regiments; and to my consternation and embarrassment, a miserable old smoothbore gun battery that we had in Denver in the State of Colorado was counted as one of those 48 batteries. That is the condition that is confronting us.[34]

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[32] Act of 21 Jan 1903, ch. 196, 32 Stat. 775–80; Act of 27 May 1908, ch. 204, 35 Stat. 399–403; Act of 25 Apr 1914, ch. 71**,** 38 Stat. 347–51; *[Annual] Report of the Secretary of War, FY 1903*, 1:16–17, 22–23, 165 and 2:285.

[33] Hill, *Minute Man*, pp. 201–02; *Annual Report of the Secretary of War, 1908*, pp. 168–69; *Annual Reports of the War Department, 1909*, 1:62; ibid*., 1912*, 1:123. For conditions of the artillery in the National Guard prior to the Dick Act, see Brush, "Artillery of the National Guard," pp. 608–14; Benton, "Artillery of the National Guard," pp. 326–47; U.S. Congress, House, *Reports of the Committee on the Militia . . . From . . . 1835 . . . to 1887, Inclusive*, 49th Cong., 1st sess., 1887, H. Rep. 1267.

[34] U.S. Congress, Senate, *Militia Pay Bill Hearings Before the Committee on Military Affairs on S. 1996*, 62d Cong., 1st sess., 7 Jun 1911, p. 22.

One reason for the Guard's failure to maintain a balanced force was the apparent conflict between the states and the federal government regarding the function and purpose of its troops. The National Guard Association in 1881 clearly saw one of the Guard's major roles as state police forces to be used for such purposes as strike duty. Given that function, many of the officers felt that artillery was superfluous. Being expensive and unnecessary for state police duties, it was thus almost entirely neglected, even after passage of the Dick Act.[35] In his report to the War Department in 1913, Chief of Staff Maj. Gen. Leonard Wood wrote:

> How to provide an adequate and efficient Field Artillery continues to be a most vexed problem. It is so, due to the great cost of maintenance compared to other arms and to the constant opposition on the part of individual States to spending so much money for what they regard as purely Federal purposes, and hence the State authorities look upon their creation and maintenance with greater favor than in the case of Field Artillery. While this view is not without some justification, yet it is far from being correct. It fails to take into account the dual relationship of the Organized Militia to the State and to the Nation. . . . It is regarded as necessary to ultimately modify existing Federal laws relating to the Federal allotments to the militia, so as to expand special aid to the Field Artillery. In no other way, in my opinion, can this arm be developed to the extent that it is necessary to make an efficient fighting force of the entire Organized Militia.[36]

Subsequently, the war in Europe further accentuated the vital role of field artillery, and the War Department soon realized that it would have to furnish greater support to the National Guard to create a more balanced force structure.

While the situation in Europe grew worse, friction on the Mexican border reached a climax on the night of 8–9 March 1916, when Francisco "Pancho" Villa raided the town of Columbus, New Mexico. A hastily gathered force, including two field batteries, was sent in pursuit. Border patrols were established, and nearly all of the National Guard was called into federal service. Among the federalized units were six regiments, twelve battalions, and seventeen batteries of field artillery.[37]

In the same year, Congress enacted the National Defense Act. The act, a milestone in the Army's history, reorganized the land forces of the United States into four components—the Regular Army, the National Guard, the Organized Reserves, and the Volunteer Army. When the United States entered World War I, however, most volunteers went directly into the Regular Army or National Guard. The Volunteer Army thus became the National Army, which was filled through conscription. The Regular Army was authorized an increase of thirty-four infantry regiments for a total of sixty-five, an increase of fifteen field artillery regiments for a total of twenty-one, an increase of ten cavalry regiments for a total of twenty-five, and an increase of

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[35] William H. Riker, *Soldiers of the States* (Washington, D.C.: Public Affairs Press, 1957), pp. 52–53, 74; *Annual Reports of the War Department, 1913*, 1:159.

[36] *Annual Reports of the War Department, 1913*, 1:168–69. For additional statements, see Senate, *Militia Pay Bill Hearings*, 7 Jun 11, pp. 46, 49–50, and U.S. Congress, House, *Militia Pay Bill Hearings Before the Committee on Military Affairs on H.R. 8141,* 62d Cong., 1st sess., 6 Jun 1911, pp. 35, 77.

[37] Hill, *Minute Man*, p. 242; *Annual Reports of the War Department, Department, 1916*, 1:7–17, 186–91.

ninety-three coast artillery companies for a total of two hundred sixty-three. The field artillery regiments remained with six batteries each, grouped into two or three battalions. The Regular Army, through five annual increments, was to grow, to a maximum authorized strength of 235,000. As a result, the maximum aggregate strength of its field artillery was to increase from 7,362 to 27,237—or about 11 percent of the Army. After garrisoning overseas stations, the Army planned to have enough troops in the United States to organize six divisions—two cavalry and four infantry. The act also provided for five annual increments to enlarge the National Guard to bring its strength up to approximately 17,000 officers and 440,000 enlisted men. The ultimate effect of the act would have been to almost double the peacetime Regular Army and to quadruple the National Guard.[38]

The act also established the Reserve Officers Training Corps (ROTC), which continued, in improved form, military training originally provided by the Morrill Act of 1862. The War Department prescribed courses of instruction at schools, colleges, and universities to give training in the various arms. The first field artillery unit in the ROTC was established at Culver Military Academy, Culver, Indiana. Reserve commissions could also be given to civilians proven qualified by examination. Enlisted reserves were to be built up by furloughing soldiers from active to reserve status.[39]

The National Defense Act contained provisions to strengthen the divisional field artillery units, both in numbers and equipment. The tables prepared by the General Staff in 1914 allotted infantry divisions 2.82 guns for every 1,000 rifles, the personnel and equipment being placed in the respective field artillery brigade with two regiments of two battalions each. Each regiment was authorized an aggregate strength of 1,170, with each battery numbering 176, as well as a medical detachment of 22 officers and men from the Hospital Corps.[40]

The 1916 tables (published in 1917), rather than having a two-regiment divisional field artillery brigade, authorized three regiments with a total of forty-eight 3-inch guns and twenty-four 3.8-inch howitzers. In addition, each regiment was to have a maximum strength of 1,337 and each battery 195. Some of the functions that had been divided among the batteries were centralized in the newly organized regimental headquarters companies of 92 enlisted men (including a 28-man band). These modifications reflected a formal acceptance of some of the ideas embodied in the Stimson Plan. The headquarters company was designed to supply the necessary personnel for the tactical and technical work of the regimental and battalions headquarters and included officers and men for reconnaissance, communications (including radio and telephone operators, linesmen, signalers, and scouts), intelligence, orientation, and

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[38] *Annual Reports of the War Department, 1916*, 1:163–66; ibid., *1919*, 1:54–56; Act of 3 Jun 1916, ch. 134, 39 Stat. 166–217; WD Bull 16, 22 Jun 1916. In the National Guard, the number of enlisted men to be organized was to be for each state in the proportion of 200 for each senator and representative and a number to be determined for each territory and the District of Columbia. The number was to be increased yearly thereafter in proportion of not less than 50 percent until a total peace strength of not fewer than 800 enlisted men for each senator and representative was reached.

[39] WD GO 49, 30 Sep 1916; WD Bull 38, 8 Nov 16; Act of 3 Jun 1916, ch. 134, 39 Stat. 166–217.

[40] TO, *1914*, pp. 3, 15–18, 23, 25–28, 32–38. Note that war strength tables have been used consistently throughout this chapter.

aerial observation. Regimental supply companies were also authorized to centralize the coordination of battery supply elements. If necessary, sections from both headquarters and supply companies could act independently at the battalion level. The entire field artillery brigade numbered 4,030 officers and men, while the maximum authorized strength of the division (not including trains) was set at 25,871.[41]

The 1916 tables strengthened other artillery units as well as those in the infantry division. The 1914 tables had allotted a cavalry division 3.11 guns per 1,000 rifles, the men and equipment being organized into a two-battalion horse artillery regiment. The cavalry division in 1916 was still authorized only one regiment, but it was organized into three battalions rather than two. The additional battalion headquarters and the regimental headquarters and supply companies increased the maximum authorized strength of the regiment from 1,265 to 1,374. The regimental commander in the cavalry division and the artillery brigade commander in the infantry division functioned as the chief of artillery on the division headquarters staff. Corps artillery brigades became fixed organizations under the 1916 tables and reflected changes that were taking place in transportation. Although horse-drawn brigades were still authorized, motorized ones were planned. The horse-drawn brigade, having an aggregate authorized strength of 4,135, comprised three regiments of three battalions each—one more than specified in the 1914 tables. The motorized brigade also contained three regiments of heavy guns and howitzers, but was authorized an aggregate strength of 3,685, the reductions mainly due to motorization.[42]

The effective coordination of fire from a single commander demanded further advances in communications and equipment. For visual communications, artillerymen used signal lanterns and searchlights, flares, flags, and rockets. For telephone communications, the batteries used buzzer wire and hand reels. Units larger than the battery used heavier wire and four-horse carts (mule carts in mountain units) to carry the wire, reel, and signal and fire control supplies. The signal detail in a battery included a corporal and two privates manning three telephone stations. Each battalion and regiment was authorized two telephone stations. By 1918, over half the authorized divisional signal equipment was in the field artillery brigade.[43]

Aerial reconnaissance played an increasing role in field artillery. Although aerial observation had been tried as early as the Civil War with balloons, artillery observation by airplane was not attempted in the United States until November 1912. Locating targets and giving range corrections by experimentation, aerial observers found the most successful method of transmitting their information to a battery was through radiotelegraphy.[44] From 1915, aerial photography supple-

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[41] Ibid., *1917*, pp. 12–13, 38–39; Act of 3 Jun 1916, ch. 134, 39 Stat. 166–217**;** WD Bull 16, 22 Jun 1916. The Treat board, appointed under WD SO 89, 17 Apr 1915, used the 1914 tables to recommend the proportion of 5 guns per 1,000 rifles. See Rpts, Treat Board, box 13, Charles P. Summerall Papers, Ms Div, LC.

[42] TO, *1917*, pp. 16, 20, 38, 57.

[43] Spaulding, *Notes on Field Artillery*, pp. 121–23; U.S. War Department, Office of the Chief of Staff, *Provisional Drill and Service Regulations for the Field Artillery (Horse and Light), 1916*, 4 vols. (Washington, D.C.: U.S. Government Printing Office, 1916), 4:31–35; TO 1, ser. A, 14 Jan 1918.

mented the observers in detecting sites for counterbattery fire and in preparing maps.

Camp telephone set, model A

Organizing for War

As part of the 1916 force structure expansion, the Regular Army immediately organized three of the authorized twenty-one field artillery regiments by splitting up four of the six existing ones and filling the vacancies with recruits.[45] The 7th Field Artillery was armed with 3-inch guns and the 8th Field Artillery with 3.8-inch howitzers. The 9th Field Artillery was formed in Hawaii as a heavy motorized regiment with four batteries of 4.7-inch guns and two batteries of 6-inch howitzers. This unit was the first to be fully motorized; before its organization, only one motorized battery had been authorized for experimental purposes.[46]

When the United States declared war in April 1917, the field artillery included nine Regular Army regiments with 408 officers and 8,252 enlisted men (6.7 percent of the Army), the equivalent of sixteen National Guard regiments with 541 officers and 12,975 enlisted men, and an Organized Reserve Corps of 221 officers and 33 enlisted men. By the end of the war, the field artillery had 22,393 officers and 439,760 enlisted men, which represented 13.7 percent of the Army.[47]

As soon as war was declared, the Regular Army formed the remainder of the twenty-one field artillery regiments covering widely scattered areas, mostly in the western states where horses were readily available. The nucleus of trained artillerists was small (only 275 officers and 5,253 enlisted men in the Regular Army had more than one year of service), and untrained recruits brought the units up to strength.[48] As was the case in 1916 for the first three units, twelve were organized

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[44] *Annual Reports of the War Department, 1913*, 1:782–82. For aerial observation prior to World War II, see Edgar F. Raines, Jr., *Eyes of Artillery* (Washington, D.C.: Center of Military History, United States Army, 2000), pp. 5–9; Shugart, "On the Way," Ph.D. diss., pp. 175–208.

[45] *Annual Reports of the War Department, 1919*, 1:5051.

[46] WD GO 22, 30 Jun 1916; Hawaiian Dept GO 14, 4 Aug 1916, in 9th FA fldr, CMH files.

[47] *Annual Reports of the War Department, 1919*, 1:5051–52, 5060–63; William J. Snow, "The First Chief of Field Artillery," pt. 1, *Field Artillery Journal* (January-February 1940), p. 3. The 1918 artillery personnel figures include coast artillery acting as field artillery.

from cadres of the existing regiments. In late 1917, because cavalry was not being used in France, eight cavalry regiments were converted to field artillery. As a result, the total number of Regular Army field artillery regiments increased from twenty-one to twenty-nine.[49]

The vast majority of field artillery during the war came from outside the Regular Army. The National Guard had six regiments, nineteen battalions, and seventy-nine batteries of field artillery at the beginning of the war, all of which had served on the Mexican border. By the end of the war, the number of National Guard field artillery regiments totaled fifty-one. Transfers of personnel from the National Army and some from the Regular Army were made to fill the units.[50]

The organization of units for the National Army was a major project. Unlike the Regular Army and National Guard, the National Army had no cadre upon which to expand, for the reserve system that had been established under the National Defense Act was too new and too small to provide much assistance for the one hundred four field artillery regiments created in this component. Eventually, cadres were organized using personnel of the Regular Army and Organized Reserve Corps, plus National Army officers trained at officer training camps. Of the 80,568 officers commissioned from these centers, about 25 percent (20,291) were for field artillery.[51]

To solve problems deriving from duplication in regimental numbers (such as the 1st Field Artillery, Regular Army, and the 1st Field Artillery from one of the states), the War Department established a standard numbering system in the summer of 1917. The numbers from 1 through 100 were reserved for the Regular Army, from 101 through 300 for the National Guard, and 301 and above for the National Army. Under this system the 1st through 21st and 76th through 83d were organized in the Regular Army; the 101st through 151st, in the National Guard; and the 301st through 351st, plus the 25th through 75th and the 84th and 85th, in the National Army. By August 1918, the system became obsolete with the War Department's decision to eliminate references to the respective component. This notwithstanding,

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[48] *Annual Reports of the War Department, 1919*, 1:5051; Snow, "First Chief of Field Artillery," pt. 1, p. 3.

[49] *Annual Reports of the War Department, 1919*, pp. 5061–65, 5074–75; WD GO 139, 1 Nov 1917. Orders were issued in July 1917 to convert the cavalry regiments into field artillery, but actual organization was delayed until Congress could legalize the conversion of units from one branch to another. The National Defense Act of 1916 only allowed the field artillery twenty-one regiments.

[50] *Annual Reports of the War Department, 1919*, 1:5051–64; Marvin A. Kreidberg and Merton G. Henry, *History of Military Mobilization in the United States Army, 1775–1945* (Washington, D.C.: U.S. Government Printing Office, 1955), pp. 221, 224–25; *Order of Battle of the United States Land Forces in the World War*, 3 vols. (Washington, D.C.: Center of Military History, United States Army, 1988), 3/3:1238–56.

[51] Kriedberg and Henry, *History of Military Mobilization,* p. 283; *Annual Reports of the War Department, 1919*, 1:5051–64; *Order of Battle*, 3/3:1238–56. The Chief of Field Artillery in his 1919 report states that 138 field artillery regiments were formed in the National Army, but the appendix of the same report lists 104 regiments. Other records also show that only 104 regiments were ever organized in that component. See also Final Rpt, CofArty, AEF, 1919, fldr 381, box 41, Entry 22, RG 120, NARA, and Annual Rpt, CofFA, WD, FY1925, p. 70, file 319.12, box 1726, Entry 37c, RG 407, NARA.

the general pattern still remained. Of the regimental numbers, with 351st being the highest in World War I, one hundred sixty-seven were never used.[52]

At some time during the war, all but five of the one hundred eighty-four field artillery regiments were assigned to brigades as either divisional or corps artillery. Of the five, the 9th Field Artillery and the 1st and 14th Field Artillery stayed on duty throughout the war as school troops at the School of Fire at Fort Sill. Organized as a mountain unit with 2.95-inch mountain howitzers, the 4th Field Artillery (less Batteries E and F) served along the Mexican border; prior to the war, Batteries E and F were deployed to the Canal Zone. The 82d Field Artillery, a converted cavalry regiment armed with 3-inch guns, patrolled the Mexican border as an element of the 15th Cavalry Division.[53]

The General Staff began making plans for sending troops to France soon after the United States entered the war. After studying various problems, the War College Division of the General Staff prepared tables of organization, based on the National Defense Act and approved by the Chief of Staff on 14 May 1917, authorizing each infantry division one field artillery brigade of two 3-inch gun regiments and one 6-inch howitzer regiment. The number of field pieces in the three regiments totaled seventy-two. The division also included a trench mortar battery.[54]

Four days after approval of the infantry division tables, Secretary of War Newton D. Baker directed Col. Chauncey Baker to head a mission to Europe to visit training camps and other military establishments to observe the organization, equipment, training, transportation, operation, supply, and administration of the allied forces. At the end of six weeks, the so-called Baker board was to return to Washington and make its report. Simultaneously, Maj. Gen. John J. Pershing, who had assumed his duties as the American Expeditionary Forces (AEF) Commander in Chief on 26 May, and his staff were on their way to Europe. While Pershing's staff and the Baker board were in England conducting similar investigations, they decided to meet in Paris and arrive at some agreement regarding the types of organizations needed for war.[55]

The Baker board arrived in Paris in early July, and immediately thereafter, General Pershing directed his Operations Section and Baker's staff to form committees for studying the infantry, cavalry, artillery, and engineers and to exchange ideas as to organization, equipment, and training of their respective arms. One of the salient disagreements between Pershing's staff and the board was over the organization of the divisional artillery brigade. Investigations by the Baker board indicated that the allies, because of the lack of artillery, had been unable to conduct an offensive on a broad front sufficient to break down enemy defenses and make the opposing forces withdraw. The allies were taking artillery from the quiet sectors of the line to

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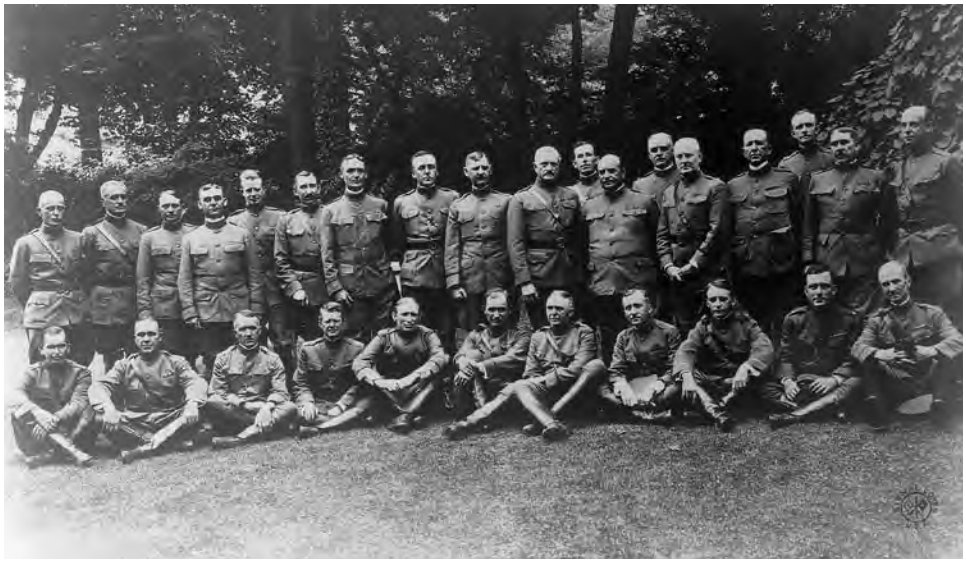
[52] WD GO 88, 11 Jul 1917; WD GO 115, 29 Aug 1917; WD GO 73, 7 Aug 1918.

[53] See unit folders on 1st, 4th, 9th, 14th, and 82d Field Arty, CMH files. Although the 82d served as divisional artillery, cavalry divisions were not authorized field artillery brigades.

[54] AEF GO 14, 15 Jul 1917; Memo, Chief, War College Div., to CofS, 24 May 1917, sub: Plans for Possible Expeditionary Force to France, and Memo, ACofS to CofS, 26 May 1917, sub: War College Div, file 10050–21, box 488, Entry 296, RG 165, NARA.

[55] *United States Army in the World War, 1917–1919*, 17 vols. (1948; reprint, Washington, D.C.: Center of Military History, United States Army, 1988–92), 1:3–4, 53, 55–56, 91.



Colonel Baker (standing, sixth from right) *and his mission with General Pershing and the AEF staff in Paris*

reinforce the attack in an offensive, which gave the enemy the opportunity of taking over the offensive in sectors experiencing inadequate artillery support. The Baker board believed that artillery had to be furnished in quantities unheard of prior to the war in order to solve this problem. Both groups agreed that the division needed two 3-inch (75-mm.) gun regiments, but they disagreed on the caliber of howitzers for the general support regiment. The Baker board recommended 3.8- or 4.7-inch howitzers, weapons known for their mobility; the Operations Section advocated 6-inch (155-mm.) howitzers. The Operations Section based its recommendation on the belief that the war would not be one of great movement and that the French 155-mm. Schneider howitzer was superior to the current or prospective 3.8- or 4.7-inch howitzer. The men from Pershing's staff also pointed out that the British were reducing, by one-third, the number of 4.5-inch howitzers. Another important consideration was the possibility of obtaining 155-mm. howitzers from France for the American divisions. The group finally settled on the Operation Section's recommendations.[56]

The divisional trench mortar battery was to be armed with twelve French 58-mm. mortars (weapons the U.S. Army found less than satisfactory), later changed to twelve British 6-inch Newton mortars. Other trench mortars included the 3-inch Stokes mortars, which were used by the infantry, and larger weapons (the 240-mm. mortar being the most common), which were assigned to corps artillery. Personnel

[56] Ibid., 1:67–73, 108–15. The French and Germans measured their weapons in millimeters, while the Americans and British measured theirs in inches. Thus, 155 millimeters equals 6.1 inches and 75 millimeters equals 2.95 inches. The weapons were not exactly the same size, but were used for the same missions.

French 155-mm. Schneider howitzer during a gas attack

from the Coast Artillery Corps manned the corps trench mortar battalions as they did many of the divisional trench mortar batteries.[57]

In late July, the General Staff received the findings of the Baker board and the Operations Section. The report, entitled the "General Organization Project" and approved by Pershing on the eleventh, outlined more specific plans for the organization of the American forces. The tables of organization that the War Department subsequently issued on 8 August generally followed the recommendations contained in the report. The square infantry division of World War I operated with two 75-mm. gun regiments, each supporting one infantry brigade of two regiments; one 155-mm. howitzer regiment supporting the division as a whole; and a trench mortar battery, all under an artillery brigade headquarters.[58]

Meanwhile, plans had been developed to dispatch one artillery and four infantry regiments to France immediately as the 1st Expeditionary Division. Pershing chose the 6th Field Artillery as the artillery regiment that was to become part of the division.[59] The 1st Expeditionary Division was to be organized under

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[57] *United States Army in the World War*, 1:97, 114; TO 1, ser. A, 14 Jan 1918; P[eter] H. Ottosen, ed.,*Trench Artillery, A.E.F.* (Boston: Lothrop, Lee and Shepard Co., 1931), pp. 20–22, 333. The tables originally called for the French 58-mm. trench mortar; later tables authorized the 6-inch mortar. By the end of the war, 85 percent of the divisional batteries were armed with 6-inch mortars and 15 percent with 58-mm. mortars.

[58] *United States Army in the World War*, 1:115; WD GO 101, 3 Aug 1917.

Battery C, 6th Field Artillery, on the Lorraine front

the provisional tables approved in May 1917. The organization of the 1st Field Artillery Brigade, comprising the 5th, 6th, and 7th Field Artillery, was completed in August 1917 at Valdahon, France.[60] The 6th and 7th were armed with 75-mm. guns and the 5th with 155-mm. howitzers.

In general, the field artillery brigades making up the divisional artillery were organized in accordance with previous planning. By the end of the war, sixty-one field artillery brigades were organized, of which fifty-eight were at some point designated as divisional brigades. Each brigade, in addition to its assigned regiments and trench mortar battery, had an attached ammunition train, as well as attached range-finding teams and communications, ordnance, and liaison personnel. Many of the divisions fought without their organic artillery brigades because of the length of time it took to train the artillery and because the artillery trained in areas separate from the divisions. Thirteen of the twenty-nine combat divisions in France operated without their own artillery.[61]

The last basic changes in the organization of the infantry division during the war came out in revised tables on 14 January 1918. Among other modifications, the tables increased the armament of the artillery with the addition of twelve antiaircraft artillery guns to each field artillery regiment. The artillery armament of the division as of that

[59] John J. Pershing, *My Experiences in the World War*, 2 vols. (New York: Frederick A. Stokes Co., 1931), 1:2–3; *Order of Battle*, 2:5.

[60] See annotated draft for Lineage and Honors Certificate, HHB, 1st Inf Div Arty, CMH files.

[61] *Order of Battle*, 2:5 and 3/3:1231–37.

date included fifty 75-mm. guns (forty-eight in the two regiments and two in the ammunition train), twenty-four 155-mm. howitzers, thirty-six antiaircraft machine guns, and twelve 6-inch Newton mortars.[62] A shortage of animals in Europe, the problems of shipping them from the United States, insufficient forage, and hard usage resulted in another change in the brigades. During the last days of combat, the dearth of horses was so great that some American artillery was hauled forward by hand.[63] Corps artillery brigades had already been authorized to motorize, and plans were made in 1918 to motorize the 155-mm. howitzer regiment and one of the 75-mm. gun regiments in each divisional artillery brigade. Tractors for the purpose were developed, and by Armistice Day, eleven 155-mm. howitzer regiments were each equipped with twenty-five caterpillar tractors and twenty-five ammunition trucks. None of the 75-mm. gun regiments, however, was motorized by that date.[64]

A corps usually contained from two to six combat divisions. In addition to the artillery that was available at the division level, each corps had its own artillery force consisting of a two-regiment brigade—one regiment of 4.7-inch guns and one of 6-inch (155-mm.) howitzers. The brigade also had a trench mortar battalion of 240-mm. mortars, organized into four batteries; an observation and sound-ranging section; and some antiaircraft units. At the outset of the European operations, the headquarters of a corps artillery brigade was contemplated for use as the corps artillery headquarters, with the brigade commander being the corps chief of artillery. After brief experience with this arrangement, however, the corps artillery staff (eight officers) was made separate and distinct from the corps artillery brigade. The higher-echelon army artillery (between three and five corps constituted a field army; the First Army had three corps) included four brigades of three howitzer regiments each, thirty batteries of railway reserve artillery with 10- and 12-inch seacoast mortars, and an army artillery park of three park batteries (each battery consisted of laborers to make repairs and issue materiel and spare parts), and twenty antiaircraft artillery batteries.[65] The Coast Artillery Corps furnished the personnel and equipment for the antiaircraft artillery units and the heavy units, except for five batteries of railway guns manned by Navy personnel under Rear Adm. Charles P. Plunkett.[66]

The planners of the General Organization Project for the AEF in 1917 had realized that there had to be some provision for artillery in large calibers similar to that employed by European armies. As the U.S. Army had no experience with materiel of that size except in coast defense, the War Department decided that units above the corps level would be organized from the considerable harbor defense artillery

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[62] TO 1, ser. A, 14 Jan 1918.

[63] Pershing, *My Experiences in the World War*, 2:380.

[64] *United States Army in the World War*, 15:189–90, 203–06; James A. Huston, *The Sinews of War* (Washington, D.C.: Office of the Chief of Military History, United States Army, 1966), p. 378; Ltr, CofArty, AEF, to TAG, AEF, 10 May 1919, pp. 5, 13, in Final Rpt, CofArty, AEF, 1919, fldr 381, box 41, Entry 22, RG 120, NARA.

[65] John J. Pershing, *Final Report of General John J. Pershing, Commander-in-Chief, American Expeditionary Forces* (Washington, D.C.: U.S. Government Printing Office, 1920), plate 9; Ltr, CIC, AEF, to Gen Peyton C. March, 2 Oct 17, box 2, fol. 3, Summerall Papers, Ms Div, LC.

[66] Pershing, *Final Report*, p. 75; idem, *My Experiences in the World War*, 2:373–74; Josephus Daniels, *Our Navy at War* (New York: G. H. Doran Co., 1922), pp. 218–27.

then available, both in the Regular Army and National Guard. Therefore, during World War I, the Coast Artillery Corps manned artillery materiel above the 6-inch (155-mm.) howitzer level, most of the trench mortar artillery, and the antiaircraft artillery units.[67]

At the beginning of the war, there was only enough artillery to equip about three and a half reduced-strength army corps, and much of that equipment was obsolete. Ammunition was also in short supply, and production facilities for both artillery and ammunition were limited. Even if the ammunition had been forthcoming, the existing pieces were too few in number to fully use it. Upon entering the war, the Army had only five hundred forty-four 3-inch (1902 model) guns; sixty 4.7-inch guns; and about three hundred other pieces of various calibers. This materiel had to be distributed immediately among the field artillery regiments being organized for the war. One result was that some of the divisional artillery brigades had only one to four guns for their regiments. Because the 75-mm. gun was already in production and in action on the front, steps were taken to purchase arms from France. The abandonment of the 3-inch gun, which was an excellent weapon (especially its carriage), caused much criticism; but, in addition to easing the supply problem, the adoption of uniform weapons in the American and French armies simplified training. France, in exchange for metal and other materials, supplied the AEF with 3,128 field pieces (eighteen hundred sixty-two 75-mm. guns, two hundred thirty-three 155-mm. guns, seven hundred ninety-six 155-mm. howitzers, and two hundred thirty-seven trench mortars), other artillery materiel, ammunition, and balloon and airplane units. After the war, the 75-mm. French gun became the standard American divisional field piece, although the National Guard continued to use the 3-inch gun as late as 1920.[68] Production in quantity of the 75-mm. gun in the United States followed the end of the war. The U.S. Army later improved the weapon by adding its own panoramic sight and by equipping the carriage with rubber tires.

Prior to 1914, the French had failed to develop adequate medium or heavy artillery. As a result, they initially had only about 300 pieces of higher-caliber artillery opposing about 3,500 heavier German weapons. The French promptly took measures to correct this deficiency, and by early 1918, the GPF (*Grande puissance Filloux* "Great power Filloux") 155-mm. gun was in production. In addition

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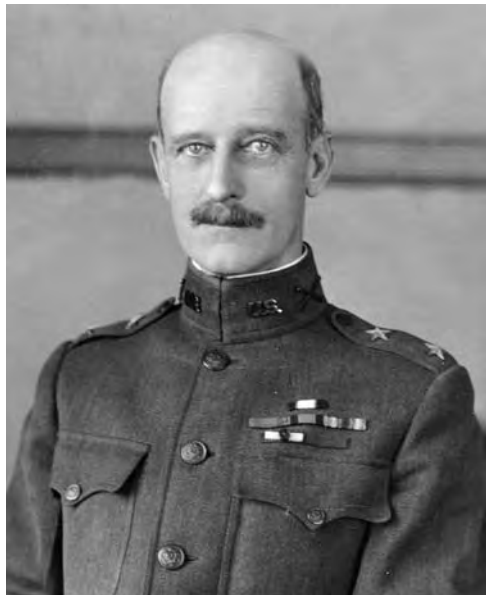
[67] *Annual Reports of the War Department, 1917*, 1:929. Information on these units will be included in a forthcoming Air Defense Artillery volume.

[68] *United States Army in the World War*, 14:82–84; William J. Snow, "Wartime Procurement of Field Artillery Materiel," *Field Artillery Journal*, March 1941, pp. 167–70; idem, "Gun Procurement," *Field Artillery Journal*, May 1941, pp. 299–304; Ltr, Munitions Board to SecWar Newton D. Baker, 28 Dec 16, sub: Data on Manufacture of Munitions, 1916, box 13, Summerall Papers, Ms Div, LC; H. A. DeWeerd, "American Adoption of French Artillery, 1917–1918," *Journal of the American Military Institute* 3 (Summer 1939): 104–16; U.S. Congress, House, *Army Appropriation Bill for 1917: Hearings Before the Committee on Military Affairs*, 64th Cong. 1st sess., 4 Apr 1916, pp. 721–94; Conrad H. Lanza, "Army Artillery, American First Army," pt. 1, p. ii, copy in CMH files; *Annual Reports of the War Department, 1919*, 1:3911–14; Benedict Crowell, *America's Munitions, 1917–1918* (Washington, D.C.: U.S. Government Printing Office, 1920), pp. 69–71. See also Edward M. Coffman, *The War To End All Wars* (1968; reprint, Madison: University of Wisconsin Press, 1986), pp. 40–42, concerning the adoption of the French gun rather than the 1902 3-inch field gun.

to the 75- and 155-mm. guns and the 155-mm. howitzer, the United States also adopted the 240-mm. howitzer from France for heavy artillery.[69]

American forces also depended upon the allies for artillery support due to delays in organizing, training, and shipping American units. For example, in the first major offensive by the American First Army in the St. Mihiel campaign, 12–16 September 1918, the French and British provided the bulk of artillery support. Of the 3,010 artillery pieces in the AEF, none was manufactured in the United States, and the French manned 1,329 of them, with American troops serving the remainder. By 3 November, however, American units had replaced much of this foreign support.[70]



General Snow

When the Chief of Artillery relinquished control over field artillery in 1908, the War Department thus lacked someone in a position of authority for formulating military policy or for acting on behalf of the arm. At the outbreak of the war, that situation had not been corrected. Brig. Gen. William J. Snow, commandant of the School of Fire, was an expert in the technical aspects of artillery training, and he put into operation programs that were to have immediate and long-range effects on the branch. It was not until 10 February 1918, however, that the War Department detailed General Snow as Chief of Field Artillery. Acting in this capacity, he oversaw a series of accomplishments, establishing field artillery replacement depots and schools for specialists; reorganizing and enlarging the School of Fire; organizing the Central Officers Training School at Camp Zachary Taylor, Kentucky; implementing a system of training and coordination through inspector-instructors, who both inspired and aided in the training of brigades; redistributed materiel; and coordinated materiel production through the War Industries Board.[71] Snow, who accepted promotion to major general as of 9 July, also set up a personnel section that exercised close supervision over the training and assignment of artillery

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[69] Snow, "Gun Procurement," pp. 299–304. The French 155-mm. GPF gun, named after its designer Col. L. J. F. Filloux, was nicknamed "Long Tom" during World War I in contemporary magazines. It was the forerunner of the American "Long Tom" of World War II fame.

[70] Pershing, *My Experiences in the World War*, 2:260–66, 371; Lanza, "Army Artillery," pt. 1, pp. 14–79, CMH files; *United States Army in the World War*, 14:32–33, 37, 82–84.

[71] *Annual Reports of the War Department, 1919*, 1:5053–59; AEF GO 64, 29 Apr 1918; "Duties of the Chief, Artillery, A.E.F.," fldr 381, box 41, Entry 22, RG 120, NARA; *Order of Battle*, 1:197–99, 202–05. Centers of instruction were set up to train artillery organizations by brigades, including the trench mortar battery and ammunition train.

officers and made arrangements for French officers to visit the United States and for the exchange of artillery officers between the AEF and training centers in the United States. This last step allowed training in the United States to keep abreast of doctrine employed in France. In addition to training camps for divisions, the War Department established sixteen special training camps, two of which were for field artillery (Camp Bragg, North Carolina, and Camp Knox, Kentucky), and four firing centers for field artillery brigades (Fort Sill, Oklahoma; Camp McClellan, Alabama; Camp Knox, Kentucky; and Camp Jackson, South Carolina).[72]

Replacement training began in 1917 in three battalions organized for that purpose at Camp Jackson, but by the spring of 1918, more men were needed overseas, and the units were sent to France before the program was completed. In France, the soldiers in the battalions were distributed to regiments in the 1st Field Artillery Brigade. Later, drafts on regiments in the United States provided replacements, a practice that did much to disrupt training. Replacement depots, organized at Camp Jackson on 8 May 1918 and later at Camp Zachary Taylor, were designed to eliminate this interference. Their programs were to provide six twelve-day progressive instruction periods, but the demands for replacements were so great that no recruit ever finished the full course. Even so, 8,125 officers and 73,235 enlisted men eventually received training at the two depots.[73]

General Pershing had assumed that units would arrive in France with at least their basic training having already been completed. The collapse of Russia, the Italian defeat at Caporetto, and the exhaustion of the allied armies by three years of warfare, however, sped up the dispatch of American troops to Europe. This acceleration caused many units to arrive without having received any systematic training, which then had to be completed in France. Suitable firing ranges were unavailable in divisional areas, so the French established special artillery training centers at Valdahon, Coëtquidan, Meucon, Sougé, Le Courneau, and La Courtine. Training received at these centers was to be followed up, as far as possible, with field practice in cooperation with the infantry. Assigning units to quiet sectors on the front was the last segment of the training.[74] In addition to the centers, there was an artillery school for officers at Saumur and a heavy artillery school at Mailly. Although all brigades finished their technical artillery instruction, less than half of them had the opportunity to operate in quiet sectors of the front, only two or three brigades completed a period of tactical training with their assigned division, and the artillery school was put in operation less than a month before the Armistice.[75]

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[72] "Duties of the Chief, Artillery, A.E.F.," fldr 381, box 41, Entry 22, RG 120, NARA; Kreidberg and Henry, *History of Military Mobilization*, p. 318.

[73] *Annual Reports of the War Department, 1919*, 1:5049–238; Sunderland, *Field Artillery School*, pp. 70–71.

[74] Pershing, *Final Report*, pp. 14–15; *United States Army in the World War*, 14:312–13; ibid., 15:177–80; Historical Section, Army War College, *The Genesis of the American First Army* (1928; reprint, Washington, D.C.: U.S. Government Printing Office, 1938), p. 5; Ltr, CofArty, AEF, to TAG, AEF, 10 May 1919, p. 4, in Final Rpt, CofArty, AEF, 1919, fldr 381, box 41, Entry 22, RG 120, NARA.

[75] *United States Army in the World War*, 15:178.

The creation of the Chief of Artillery, AEF, facilitated training in Europe. Maj. Gen. Ernest Hinds, who had previously commanded I Corps artillery and First Army Artillery, served in this capacity from 27 May 1918 through the end of the war. His major duties were to supervise and inspect the training of artillery organizations until they joined their units, to supervise and inspect most of the artillery schools, and to provide advice and guidance on artillery matters for the AEF.[76]

On the Battlefield

In the history of warfare, the balance between the power of the offense and defense is constantly shifting, usually because of changes in weapons and equipment with resulting changes in tactics. Such shifts are often unnoticed until they are demonstrated in combat. Although noted in previous wars, the changing balance from the offense to the defense was not fully recognized until World War I. As in the Civil War, artillery in World War I could not succeed against strongly prepared defensive positions unless the offense had a definite superiority in numbers over a largely exhausted enemy. The tactical effect of the vastly increased firepower, brought about by new automatic weapons, rapid-firing artillery, and modern transportation means, gave a new superiority to the defense. Tactical mobility became dependent on firepower, but neither side had sufficient artillery and ammunition to achieve the advantage.

Early engagements demonstrated the necessity for distributing guns in great depth along the defense and the need for greater quantities of medium and heavy artillery. By 1917, it had become apparent that, given enough artillery and ammunition, limited advances (under a mile) could be achieved. But the element of surprise was sacrificed, with attacks being accompanied by heavy preparatory bombardments that often lasted several days. Although these barrages were somewhat effective as a demoralizing factor, they were not entirely satisfactory. When a barrage was lifted, the defending infantrymen had time to man the trenches and machine-gun emplacements and to engage the opposing infantry advancing without cover. Most offensive actions failed even though massive barrages preceded them. Also, ammunition expenditures proved a heavy strain. The opposing forces took countermeasures in the form of counterpreparation (the use of artillery to weaken imminent attacks by neutralizing enemy artillery) and stationary barrages close to the front to repel the attackers. New tactics, weapons, or strategies were needed to break the stalemate.

Except for the first few months of the war, neither side was able to gain much ground until the spring of 1918 when the Germans achieved some success on the Western Front. Characteristics of the German tactics included an intense barrage of artillery, lasting several hours, followed by a rolling barrage in front of the infantry at a preset rate; the bypassing of enemy strongholds; infiltration by small groups; and continuous forward movement of both infantry and artillery. These tactics called for the greatest cooperation between artillery and infantry,

[76] "Duties of the Chief, Artillery, A.E.F," fldr 381, box 41, Entry 22, RG 120, NARA.

attempted to increase the infantry's effectiveness with machine guns, emphasized individual initiative and leadership with small units, and stressed the importance of terrain and local flanking movements to speed the advance. The French developed countermeasures—counterpreparation, thinning the troops in the forward zone while organizing the main line of defense in the rear, and readjustment of artillery fire.[77]

When the United States entered the war, many of its leaders, including General Pershing, believed that the war could be one of movement, relying mainly on infantry rather than artillery. Yet they still had to learn that effective, coordinated artillery support was a major factor in the success of an operation. Heavy casualties were the price of open warfare.[78]

When well-trained and experienced commanders applied artillery fire correctly, the results were devastating. One example was the American attack in April 1918 at Cantigny, which entailed elaborate planning. Brig. Gen. Charles P. Summerall, who commanded the 1st Division's artillery and who had been the senior artillery officer on the Baker board, utilized the flexibility of his weapons to a degree heretofore unrealized in the U.S. Army. The preparatory barrages were designed to isolate and destroy German positions around Cantigny. A rolling barrage, with shells hitting 100 meters (109.4 yards) in front of the infantry, moving forward every two minutes, was to precede the assault. The heavy guns and mortars converted Cantigny and the enemy dugouts into a volcano of bursting shells, flame, and smoke.[79] The communications network between the advancing troops and their supporting artillery was such that the infantry could depend upon the artillery, when requested, to hit accurately and eliminate resistance. In his report, General Pershing acknowledged that the "artillery acquitted itself magnificently, the barrages being so well coordinated and so dense that the enemy was overwhelmed and quickly submerged by the rapid onslaught on the infantry."[80]

In contrast, inadequate artillery support to the 2d Division at Belleau Wood, caused in part by the mistaken belief that infantry alone could break through against a well-entrenched enemy, led to heavy casualties. Success came only when overwhelming artillery support was provided to the attacking infantry.[81] Even when artillery support was more than adequate at the beginning of an attack, the AEF found it difficult to sustain. It was hard to move artillery and supplies forward, especially when they were dependent upon horses for transportation. The time needed to prepare thoroughly coordinated fire support plans seemed elusive, and communications between the infantry and artillery were frequently impossible.

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[77] Bailey, *Field Artillery and Firepower*, pp. 258-61.

[78] See Mark E. Grotelueschen, *Doctrine Under Trial* (Westport, Conn.: Greenwood Press, 2001).

[79] *United States Army in the World War,* 14:20; Society of the First Division, A.E.F., *History of the First Division During the World War, 1917–1919* (Philadelphia, Pa.: John C. Winston Co., 1922), pp. 77–84. In Summerall Papers, Ms Div, LC, see also Cantigny Opns Jnl, 1st FA Bde, AEF, 28–30 May 1918, and Opns no. 99, 1st FA Bde, Plan of Defense Doc. no. 3, 21 Jun 1918, box 2, folio 3; Resumé of Opns, 1st Div, Cantigny, box 14; and Arty Employment Plan, 1st FA Bde, in 1st Div, AEF, GO 18, 20 May 1918, box 15.

[80] Pershing, *Final Report*, p. 51.

[81] Grotelueschen, *Doctrine Under Trial*, pp. 31–53, 72–73.

For the field artillery in the U.S. Army, World War I was a watershed. The many developments in materiel, along with innovations in tactics and doctrine, all contributed in making field artillery a dominant force on the battlefield. By the end of the war, the old method of direct fire had been relegated to the defense of position areas, while indirect fire became the foremost means of offensive fire. The role of field artillery was to provide close support to the maneuver forces, which it tried to accomplish through massive doses of indirect fire, planned ahead in great detail and delivered with as much flexibility as communications and command and control at that time permitted. Mass was the key to success. For great barrages, the artillery pieces were lined hub to hub, accentuating the delivery of mass fire. This technique, however, also made the artillery more vulnerable to counterbattery fire.[82]

What both sides lacked during the war was a means of directing artillery fire efficiently. Telephone wires were cut, runners took time, and messages were sometimes insufficient. In previous wars, gunners could see their targets; in later wars observers, advancing with the infantry or tanks, could direct fire using radios and map references. But in World War I, even though areas were thoroughly mapped and constantly updated, modern communications were not available, and close coordination between infantry and artillery proved extremely difficult. In addition, inexperience in the two arms working together exacerbated the problem. The infantry and artillery in a division did not always arrive in France together, nor did they train together. Division artillery brigades were sometimes assigned indiscriminately so that infantry soldiers and their supporting artillery did not get a chance to work together effectively.

Indirect fire without adjustment was a tactical and technical achievement brought to fruition during the war.[83] The technical prerequisites were accurate fire control instruments, a precise means of computing fire data, the location of guns and target on a common grid system, and a means of measuring and compensating for the many variables that affected a projectile's flight. By 1917, the French had worked out the details of indirect fire without adjustment, often called *map firing*. They had perfected a system of ground survey that could be used to tie the firing batteries and targets together on a common grid system, which the Americans soon adopted. A reconnaissance officer assigned to each battalion, aided by excellent French maps, was responsible for bringing horizontal, vertical, and directional control into each battery position area. A premium was placed on the precise directional orientation of each individual gun. Because of variable factors, including nonstandard guns and powder, atmospheric conditions, and difference in projectiles, artillerymen adopted an empirical method of measuring the sum and direction of nonstandard effects. By firing a weapon of known location and comparing the firing table values achieved in firing, the sum of nonstandard effects could be inferred and expressed as a correction. These corrections, determined and applied in proper ratio, permitted fire

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[82] Donald E. Ingalls, "Artillery Innovations in WWI," *Field Artillery Journal*, September-October 1974, pp. 54–57.

[83] An adjustment is the necessary correction to one or more elements previously transmitted, such as target direction, method of fire, deviation, range, and height of burst, by the observer until the target is hit or the mission was complete.

without adjustment on other targets. The technique was called *registration*. To aid in registration, the American field artillery used weather data collected by the French and transmitted it to the field through the Artillery Information Service.[84]

The AEF's Artillery Information Service had the responsibility of communicating all target information by daily bulletin to all levels down to battery commanders. The key personnel were the artillery intelligence officers, who were stationed at levels from army artillery through battalion and sometimes the battery. At each level, the artillery intelligence officer unified target information, exchanged this information with other artillery intelligence officers, advised the artillery commander, maintained a plot of enemy locations, disseminated meteorological data, coordinated the observation and adjustment of fire, and supervised sound ranging (the technique of locating targets by sound waves) and flash ranging (the technique of locating targets or adjusting friendly batteries by sighting their fire). He also worked closely with conventional intelligence officers throughout the AEF.[85]

In addition to sound ranging and flash spotting, aerial observation by airplane and balloon became effective means of acquiring targets. Aerial observers were listed as artillerymen in the regimental tables of organization, but upon completing their training at Fort Sill, they were usually taken over by the newly forming Air Service. This trend, of course, made regimental commanders reluctant to send men for training as aerial observers. Retaining the men in the Field Artillery branch but detailing them to the Signal Corps, which then controlled the Air Service, partially solved the problem. Nevertheless, difficulties in obtaining enough aerial observers with sufficient training continued throughout the war.[86]

In daylight and good atmospheric conditions, the use of airplanes permitted rapid and accurate observation. As a result, salvos could be sensed and often their error in reference to the target could be valuated exactly. The aerial observers communicated to the ground by wireless, searchlight, weighted messages, and rockets. The ground receiving station communicated with the plane by identification panels and sometimes searchlights. The identification panels, which aerial observers found more convenient, were visible to the enemy; the reverse was true with searchlights. Another observation venue was balloons, which could not ascend above 1,500 meters (1,640.4 yards) and were obliged to keep at least 7 kilometers (4.3 miles) from enemy lines. Portions of the terrain were thus hidden from the observer at any given observation point. Compared to airplanes, balloons were used only as an auxiliary in adjusting artillery fire and generally performed only surveillance missions. Communication with the balloon observer was by telephone.[87]

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[84] Alexander T. Jennette, "Mass Fire in World War," pt. 1, *Field Artillery Journal*, May-June 1975, pp. 40–41.

[85] Ibid., pp. 42–43; *Manual for the Artillery Orientation Officer* . . . (Washington, D.C.: U.S. Government Printing Office, 1917), p. 37. Sound-ranging and flash-ranging organizations were authorized as engineer units.

[86] Sunderland, *Field Artillery School*, p. 68.

[87] *Manual for the Battery Commander, Field Artillery, 75-mm. Gun* (Washington, D.C.: U.S. Government Printing Office, 1917), pp. 138, 140. For information concerning aerial observation in World War I, see Raines, *Eyes of Artillery*, pp. 10–14.

A significant factor that enabled field artillery to provide mass fire was ammunition supply, almost all furnished by the French. Increases in the supply and expenditure were remarkable and, in large part, made possible by modern means of transportation, such as motor trucks and tractors and the railroad. The newer rapid-firing weapons increased the demand. Because of the seemingly unlimited ammunition at hand, extensive fire could be registered in concentrated areas. With sufficient planning, artillery could then be employed effectively as an offensive weapon to put enemy gun positions out of action for a period of time. A "creeping" barrage allowed the infantry to advance behind a curtain of fire; a "box" barrage isolated a section of enemy trenches; and a "saturation" barrage concentrated the fire of all available arms on a small area to destroy it completely. During an infantry assault, a barrage began on a signal from the infantry, the liaison officer, or a ground or aerial observer. Having the guns laid on precomputed (periodically updated) firing data made rapid delivery of such barrages easier. The most successful bombardments were those accomplished after much prior planning.[88] But when more mobile, ad hoc arrangements were called for, artillery was generally much less successful.

Ammunition expenditures during the war were on a scale never before anticipated. For example, at Gettysburg the Union Army had averaged thirty-four rounds of ammunition per gun per day. During the Meuse-Argonne campaign (26 September–11 November 1918), the 40,000 tons of artillery ammunition on hand when the battle began had to be replaced daily by twelve to fourteen trainloads. Twenty thousand guns firing a three-hour preparation supported the initial nine-division assault. A single battery of 75-mm. guns fired 11,806 rounds on the first day, and during the entire campaign, the American artillery there fired 4,214,000 rounds.[89]

The participation of U.S. Army field artillery in World War I was brief. When the American forces, supported by vast materiel and personnel resources, entered the struggle, both sides were war weary, and the Germans did not have the strength to continue the fight.Despite limitations caused by shortages in equipment, materiel, and trained personnel, the field artillery made considerable progress in the development of firepower, gained mostly through the use of massed guns. A Frenchman, writing of the American artillery effort during the war, stated:

> The American artillery . . . always comported itself in a manner deserving all praise and earning the admiration of those French artillerymen who were privileged to find themselves by its side in combat.
>
> The quickness of its evolutions, taking up battery positions, and changes of firing objectives, the care and vigor shown in the preparation and execution of fire, gave it at once a marked superiority over the German artillery, and this the enemy himself was compelled

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[88] Jennette, "Mass Fire," pt. 1, p. 43; Spaulding, *Notes on Field Artillery*, pp. 9–10, 76–78.

[89] *United States Army in the World War*, 14:54; Huston, *Sinews of War*, p. 382; Pershing, *My Experiences in the World War*, 2:185; Alexander T. Jennette, "Mass Fire in World War I," pt. 2, *Field Artillery Journal*, July-August 1975, p. 17.

to acknowledge on several occasions. A German document . . . states that their troops feared American artillery on account of the "power and accuracy" of its fire.[90]

[90] [Jacques] de Chambrun and [Charles] de Marenches, *The American Army in the European Conflict* (New York: Macmillan, 1919), p. 192.

CHAPTER 6

Between the Wars

Following the Armistice, the United States returned to its traditional peacetime policies, and the Army found it difficult to obtain sufficient funds from a reluctant Congress to modernize as rapidly as needed based on postwar evaluations. But Regular Army officers had a much higher regard for research and military theory and were much better versed in tactical theory and techniques than most officers had been before the war. The lessons of war and persistence combined to encourage two decades of remarkable change and progress in the development of field artillery despite adverse conditions.

The Postwar Years

Steadily declining personnel authorizations during the interwar years greatly affected the structure, as well as the number, of field artillery organizations. At the close of World War I, the branch had 22,393 officers and 429,760 enlisted men, but by 1 January 1920, the entire Army had only some 130,000 troops performing the usual peacetime missions at home and abroad in addition to a token occupation force in Germany. The General Staff had proposed to Congress in early 1919 a permanent Regular Army of 500,000 men organized in an expandable force that would serve as the half-strength skeleton of a field army of five corps. Col. John McCauley Palmer, a friend of General Pershing serving as a special emissary to the General Staff, suggested a much smaller army—an essentially complete one that would be ready to serve immediately in any emergency short of one requiring massive mobilization. Colonel Palmer proposed that during peacetime a citizen army be trained, thereby ensuring the resources were at hand for expanding the armed forces upon mobilization as complete units and not as fillers to be placed in units under Regular Army cadres. He did much to shape the National Defense Act of 1920 but failed to secure one of his main objectives, universal military training for a citizen army.[1]

The National Defense Act of 1920 authorized the largest peacetime army in the history of the United States, the objective being to form strike forces for immediate

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[1] Sunderland, *Field Artillery School*, p. 73; Weigley, *History*, p. 396; idem, *Towards an American Army* (New York: Columbia University Press, 1962), pp. 226–39; John McAuley Palmer, *America in Arms* (New Haven, Conn.: Yale University Press, 1941), pp. 163–79; Act of 4 Jun 1920, ch. 227, 41 Stat. 759–812.

duty, to garrison overseas posts, and to provide cadres for wartime expansion. It approved a ceiling of 280,000 enlisted men, including 37,000 field artillerymen, and provided for 1,900 artillery officers led by a field artillery chief (with the rank of major general) as well as setting up both tactical and administrative organizations in the National Guard and Organized Reserves. The act divided the continental United States into nine corps areas, each planned to have one Regular Army division, two National Guard divisions, and three in the Organized Reserves, for a total of fifty-four divisions. The Regular Army divisions, augmented by a training staff, were to train the citizen troops in each area. Congress, however, never appropriated enough money to bring the land forces even close to the specified ceiling. As early as 1921, congressional appropriations forced a reduction in Regular Army strength to 150,000; in 1922, to 137,000; and in 1927, to 118,750.[2]

Even though the National Defense Act of 1920 was a milestone in legislation for the United States Army, within a few years of its passage the military structure had become almost useless, even as a mobilization base. Actual enlisted strength between 1924 and 1928 varied from 71 to 92.5 percent of that authorized. Although the act had authorized 1,901 field artillery officers in the Regular Army, actual strength between 1921 and 1928 averaged 1,335, with an average of only 816 serving with the units. Colonel Palmer wanted to inactivate some of the divisions in order to keep a few up to full strength, but the General Staff modified the old Uptonian tradition and skeletonized the nine Regular Army divisions. Financial pressure was also a reason the nine corps area training detachments were eliminated and their functions placed into the skeletonized divisions. The National Guard divisions, dependent on federal pay, were seldom to achieve even 50 percent of their authorized strength. In 1927, only 60 percent of the authorized National Guard field artillery units were organized and federally recognized. The number of Organized Reserves field artillery officers considered necessary in an emergency had been calculated at 20,000, but the number of officers in that component between 1921 and 1928 never went above 12,000 (of whom many held dual commissions in the National Guard).[3]

Despite reductions in personnel, the Army made great strides during the interwar period in motorization, materiel, organizational structure, and doctrine. In December 1918, a board of officers, headed by Brig. Gen. Andrew Hero, Jr., was appointed to study experiences gained by the artillery in the AEF. In the same month, Chief of Staff General Peyton C. March, a former field artillery officer, appointed a board of artillery and ordnance officers, headed by Brig. Gen. William I. Westervelt, to study the armament, caliber of weapons, types of materiel, kinds and proportions of ammunition, and methods of transportation to be authorized a field army. These

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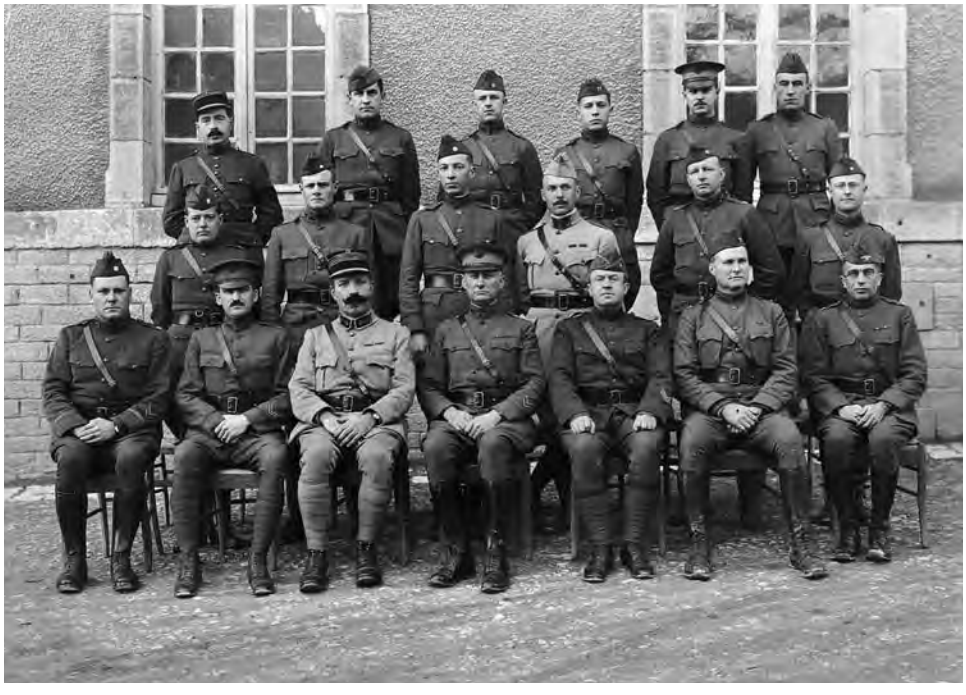
[2] Act of 4 Jun 1920, ch. 227, 41 Stat. 759–812; Act of 30 Jun 1922, ch. 253, 42 Stat. 732; Weigley, *History*, pp. 396, 399, 400–401; Millis, *Arms and Men*, pp. 217–18; WD Bull 25, 9 Jun 20; Memo for Dir, War Plans Div, 10 Jul 20, sub: Report of Committee Number 2 on Army Reorganization, copy in MHI files; *Annual Report of the Secretary of War, 1921*, pp. 24, 231–34; National Defense Act, 1924 and 1942.

[3] In NARA, RG 407, file 319.12, see Annual Rpts, CofFA: FY1921, box 1733, Entry 37c; FY1922, box 637, Entry 37a; FY1923, box 1727, Entry 37c; FY1924, box 1727, Entry 37c; FY1925, box 1726, Entry 37c; FY1926, box 1342, Entry 37g; FY1927, box 370, Entry 37i; and FY1928, box 370, Entry 37c.



General Westervelt (seated, third from right) *with fellow staffers of AEF and Chief of Artillery General Hinds* (seated, fourth from right)

reports, submitted in early 1919, became the basis of field artillery development, both in weapons and in organization, for the next twenty years.[4]

The Hero board deemed the organizational structure of units employed during World War I generally satisfactory. It did, however, find the AEF organization for ammunition supply inadequate and advocated the grouping of battery combat trains into ammunition batteries and battalions to improve ammunition supply. Another of its recommendations was for a larger battalion staff to coordinate communications, ammunition supply, motorization, and observer and liaison functions more effectively. The board also found the regimental headquarters company too large and unwieldy, recommending that it be subdivided, detailing sections to the battalions as separate and distinct units.[5]

For the division artillery, the Hero board recommended eliminating the trench mortar battery and replacing it with a four-battery battalion of sixteen mountain

[4] Final Rpt, CofArty, AEF, 1919, fldrs 381–86, box 41, Entry 22, RG 120, NARA; *Report of the Chief of Field Artillery to the Secretary of War, 1919*, pp. 184–87, 189–94; "Proceedings of the Board of Officers Commanded by the following order: Headquarters, American Expeditionary Forces, Office of the Chief of Field Artillery, 9 December 1918 (Hero Board Report)," FA School files (hereinafter Rpt, Hero Board, 9 Dec 1918).

[5] Final Rpt, CofArty, AEF, 1919, fldrs 381–86, box 41, Entry 22, RG 120, NARA; Rpt, Hero Board, pp. 3–5, FA School files; *Report of the Chief of Field Artillery, 1919*, p. 190.

guns. The trench mortar battery would then be transferred to the artillery reserve. The board also proposed that an ammunition train, for the supply of artillery ammunition alone, and a mobile ordnance repair shop be added to the divisional field artillery brigade. The 155-mm. howitzer was thought to be an excellent weapon, but too heavy for divisional artillery. Thus, the board suggested that a lighter weapon be adopted instead and, additionally, that the French 75-mm. gun carriage be improved to permit high-angle fire and more rapid transport over roads. As a result, the divisional field artillery brigade would include two 75-mm. gun or 3-inch gun regiments, one 120-mm. howitzer regiment, one battalion of 3-inch mountain guns, one artillery ammunition train, and one mobile ordnance repair shop.[6]

Regarding corps artillery, whose function was seen chiefly as the neutralization of enemy guns (counterbattery fire), the board recommended that the chief of corps artillery be on the corps headquarters staff and be entirely separate from the commander of the corps artillery. It suggested that the corps field artillery brigade consist of three regiments (one 4.7-inch gun, one 6-inch [155-mm.] gun, and one 155-mm. howitzer). The brigade staff was to be organized in a manner similar to the divisional field artillery brigade staff. The board felt that artillery not in a division or corps should be organized into a general artillery reserve and that no organic army artillery was necessary. The army artillery staff would then be a small, tactical one.[7]

The Hero board made many other far-reaching recommendations and suggestions for postwar field artillery. Modifications for ordnance, quartermaster, signal, and motor transport equipment were suggested, and the report included a recommendation that communications personnel and equipment be increased. The board felt that aerial observation would be more effective if the observers were in the field artillery branch rather than in the Air Service and if an observation squadron were assigned to each division. It also advocated energetic study and experimentation toward motorization and training courses in artillery operations for general, field, and staff officers of the infantry and artillery.[8]

In the meantime, the Westervelt board considered the stocks of war materiel on hand and probable postwar reductions in appropriations and, relying on the Hero board's suggestions, based its recommendations on recent war experiences. It classified the recommended artillery pieces into two categories: practical types for immediate development and ideal types for further development. The Army conducted many experiments with pilot models after the war, but no new weapons (except antiaircraft artillery) were produced in quantity for about fifteen years because of the large stocks of war materiel on hand. Instead, more effort was placed on modernizing existing

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[6] Rpt, Hero Board, 9 Dec 1918, pp. 6, 9, 12, FA School files; Final Rpt, CofArty, AEF, 1919, fldrs 381–86, box 41, Entry 22, RG 120, NARA; *Report of the Chief of Field Artillery, 1919*, p. 190.

[7] Rpt, Hero Board, 9 Dec 1918, pp. 9, 12–13, FA School files; Final Rpt, CofArty, AEF, 1919, fldrs 381–86, box 41, Entry 22, RG 120, NARA; *Report of the Chief of Field Artillery, 1919*, p. 190.

[8] Rpt, Hero Board, 9 Dec 1918, p. 25, FA School files; Final Rpt, CofArty, AEF, 1919, fldrs 381–86, box 41, Entry 22, RG 120, NARA; *War Department Annual Reports, 1919*, 1:5228–338.

weapons, especially their mobility. The recommendations of the Westervelt board on field artillery pieces and their transport are outlined in Tables 11 and 12.[9]

Motorization and Mechanization

Partially accomplished in the field artillery during World War I, motorization had actually begun earlier in the century. In 1902, the Ordnance Department had let a contract to the Long Distance Automobile Company for an automobile forge and battery wagon, which was delivered the following year and tested with an artillery battery in 1904 near Gettysburg, Pennsylvania. Although it served well, it was not considered totally suitable for military purposes because of its high gasoline and oil consumption, its weight, and its inability to follow the battery over rough terrain. Nevertheless, from a design standpoint, the Ordnance Department considered the vehicle an experimental success and planned to build a better one, but as late as 1914 no such vehicle had appeared.[10]

By 1913, the Ordnance Department had turned its major interest toward the development of an artillery tractor, and testing facilities were established at Rock Island, Illinois. Prior to this time, some private individuals and companies had tried to interest the Army in the use of tractor and traction engines, but these efforts had failed. The Army wanted a four-wheel drive truck capable of towing about eight tons. In May 1915, tests of tractors and two- and four-wheel drive trucks began at Fort Sill and the Rock Island Arsenal and in Hawaii. By 1917, the tractors were under manufacture.[11]

A board, directed in 1917 to consider motorization of field artillery, had recommended the motorization of the 4.7-inch gun and 8-inch howitzer, the use of rubber tires on all gun carriages and vehicles, a pool of thirty tractors per division, and the organization of a board to be sent to France to investigate motorization of field artillery to the greatest extent possible. Restrictions on shipping space, however, prohibited full motorization before World War I ended.[12]

The Westervelt board, assuming that mobile warfare was more probable for an American army than positional warfare, recommended in May 1919 the immediate motorization of all weapons larger than the 75-mm. gun and 4-inch howitzer and, when conditions warranted, the motorization of all divisional guns and howitzers as well as those in the horsed sections of ammunition trains. Motorization would have decreased personnel and animals, increased the mobility of field artillery brigades and divisions, permitted storage of complete reserve batteries (which would have

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[9] WD SO 289, 11 Dec 1918; "Report of a Board of Officers Appointed by Par. 143, SO 289–9, WD, 1918: A Study of the Armament, Calibers, and Types of Materiel, Kinds and Proportion of Ammunition, and Methods of Transport of the Artillery To Be Assigned to a Field Army, Washington, D.C., 5 May 1919," copy in FA School files (hereinafter Rpt, Westervelt Board, 5 May 1919). The report was also published in *Field Artillery Journal*, July-August 1919, pp. 289–347.

[10] Norman Miller Cary, Jr., "The Use of Motor Vehicles in the United States Army, 1899–1939" (Ph.D. diss., University of Georgia, 1980), pp. 19–23.

[11] Ibid., pp. 70–77; Rpt, Westervelt Board, 5 May 1919, p. 44, FA School files.

[12] Rpt, Westervelt Board, 5 May 1919, pp. 45–46, FA School files.

Table 11—Field Artillery Pieces Recommended by the Westervelt Board, 1919

Type	Practical	Improvements Desired	Ideal Characteristics
Light Field Artillery (Division)			
Gun	50% French 75-mm. (1897) 50% U.S. 75-mm. (1916)	Perfect split-trail carriage and study carriage for all-around traverse	Approximately 3-inch caliber; ranges 11,000–15,000 yards; 20 rounds per minute rate of fire; carriage interchangeable with light howitzer
Howitzer	155-mm. French Schneider (1918) (considered medium artillery)	Development of howitzer, with specifications listed under Ideal Characteristics column	Approximately 105-mm. caliber; maximum range 12,000 yards; 65° elevation; all-around traverse; carriage interchangeable with light gun
Medium Field Artillery (Corps)			
Gun	4.7-inch U.S. gun (1906) 5-inch British gun recommended for purchase	Develop split-trail carriage for 4.7-inch gun and study carriage for all-around traverse	4.7-inch to 5-inch caliber; ranges 12,000–18,000 yards; 80° elevation, all-around traverse; 6 rounds per minute rate of fire; carriage interchangeable with medium howitzer
Howitzer	155-mm. French Schneider (1918)	Develop carriage for high elevation and all-around traverse; interchangeable with that of medium gun	155-mm. caliber; maximum range of 16,000 yards; 65° elevation; all-around traverse; 5 rounds a minute rate of fire; carriage interchangeable with medium gun

Table 11—*Continued*

Type	Practical	Improvements Desired	Ideal Characteristics
Heavy Field Artillery			
Gun	155.-mm. French GPF	Study carriage for high elevation and all-around traverse	155-mm. caliber; ranges 18,000–25,000 yards; 65° elevation; all-around traverse; carriage interchangeable with heavy howitzer
Howitzer	8-inch British	None	8-inch caliber; maximum range 18,000 yards; 65° elevation; all-around traverse; carriage interchangeable with heavy gun
Weapons of Greater Power			
Guns	None on hand		Approximately 8-inch caliber; maximum range 35,000 yards; 65° elevation; all-around traverse; caterpillar carriage
Howitzer	240-mm. (1918)	Develop carriage requiring less time to emplace	Approximately 9.5-inch caliber; maximum range 25,000 yards; 65° elevation; all-around traverse; caterpillar carriage
Other			
Infantry Accompanying Gun	37-mm. gun	Heavier projectile needed	2.5-inch caliber; range 25,000 yards; 50° elevation; 6° traverse; not over 300 pounds
Trench	None suitable on hand	Suitable infantry accompanying gun would replace light trench mortar	6-inch caliber; 4,000-yard range; 40°–60° elevation
Pack	75-mm. Vickers	Continue developments leading to ideal gun	Approximately 3-inch caliber; range 5,000 yards; 45° elevation; load not to exceed 225 pounds

Table 12—Field Artillery Transport Recommended by the Westervelt Board, 1919

Type	Practical	Ideal
Light Field Artillery (Division)		
Guns and Howitzers	Six regiments with 75-mm. guns should be motorized immediately (tractor); remainder horsed. The 155-mm. howitzers should be tractor-drawn. Horses should be displaced gradually by tractors only after tractor demonstrates its superiority.	Mechanical transport is prime mover of the future. Experiments should be made with tractors, self-propelled mounts, and wheeled trailers. 12 mph speed sufficient. Mechanical transport will remove weight limit imposed by capacity of six-horse team.
Medium Field Artillery (Corps)		
Guns and Howitzers	All corps guns and howitzers should be tractor-drawn.	See above. Maximum speed 8 mph
Heavy Field Artillery		
Guns and Howitzers	All artillery of this type should be tractor-drawn.	See above. Maximum speed 4 mph.
Weapons of Greater Power		
Guns and Howitzers	All artillery of this type should be tractor-drawn.	See above. Continue experiments with caterpillar mounts.
Other Artillery		
Infantry Accompanying Gun	Manpower	In trucks on march Manpower in battle
Pack	Pack	Pack

sped up mobilization), and simplified transport overseas. The Hero board, however, had supported the retention of the horse for light artillery, at least for the time being. The Chief of Field Artillery, General Snow, concurred, stating "it cannot be claimed at the moment that we have reached the point where horse-drawn light guns can be discarded, but it is believed at the present rate of progress that point will soon be reached."[13]

The Westervelt board also recommended a comprehensive program for mechanizing field artillery and for developing self-propelled weapons and ammunition and cargo carriers for them. It rated the caterpillar tractor to be superior to the horse in mobility and endurance, which proved exponentially significant as the weight and size of the weapons increased. Much less time was needed to set up self-propelled weapons for firing. This advantage was important for large-caliber guns and howitzers because, previously, preparations for firing had often taken several hours.[14]

During the 1920s, progress toward motorization and mechanization was slow, although the development of wheeled cross-country motor vehicles was somewhat more successful than that of tractors and self-propelled weapons. Satisfactory tractors for divisional, corps, and army artillery were designed, but only samples were constructed. Work on developing special tractors for field artillery ceased in 1924 because of the lack of money and because the newer commercial tractors were able to fill military needs. By 1928, the Army was depending solely upon commercial tractors.[15]

The Army carried out the development of wheeled cross-country vehicles primarily at the initiation of the field artillery and infantry. The field artillery wanted an ammunition and cargo truck to replace those used in World War I. The greatest problems with regard to the development of such equipment were the lack of money for design and purchase or construction of test vehicles and an initial lack of commercial interest. By 1924, however, commercial manufacturers had begun to see an ever-expanding demand for cross-country vehicles, an idea the Army encouraged. In 1927, the 11th Field Artillery Brigade in Hawaii had been reorganized as a completely motorized unit with one 155-mm. howitzer regiment and two 75-mm. gun regiments, but the general policy for divisional artillery was still that it be horse-drawn. In addition to the brigade, some school troops at Fort Sill were motorized. The following year, 34 percent of the Regular Army field artillery units were motorized, 57 percent were horse-drawn, and 7 percent used pack animals.[16]

In the area of self-propelled artillery, the Ordnance Department developed thirty field artillery and antiaircraft artillery mounts, mostly tracked, between 1918 and 1922, with the guns and howitzers mounted on a variety of chassis. Further

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[13] Ibid., pp. 51–52**,** FA School files; *War Department Annual Reports, 1919*, 1:5228–338 (quoted words).

[14] Rpt, Westervelt Board, 5 May 1919, pp. 24–59, FA School files; Cary, "Motor Vehicles," Ph.D. diss., pp. 128–29.

[15] Cary, "Motor Vehicles," Ph.D. diss., pp. 128–29.

[16] Ibid., pp. 182–84; Field Artillery School, *Development of Field Artillery Materiel*, p. 67; "Schofield Barracks and the Hawaiian Division," *Infantry Journal*, November 1927, pp. 447–55; Annual Rpts, CofFA, FY1926, p. 86, and FY1929, pp. 31, 35, file 319.12, boxes 1342 and 1337, Entry 37g, RG 407, NARA.

Tractor hauling a 4.7-inch gun to a firing position at Fort Sill, Oklahoma, in 1918

progress waned, however, because of a lack of funds and because the designs developed were not mechanically reliable and the weight of the larger models exceeded bridging capacities. Army leaders also did not clearly see the value of self-propelled artillery.[17]

Some relief appeared for the Army's motorization program in 1933, when Congress authorized the purchase of $10 million worth of automotive equipment through the Public Works Administration (PWA). With the passage of the National Recovery Act of 1933, which was designed to help the nation recover from the Depression, the PWA was established to coordinate the work relief system. Its motorization program aided the depressed automobile industry considerably while improving the Army's artillery.[18]

In 1931, the War Department had approved the organization of a truck-drawn 75-mm. gun battery for testing by the Field Artillery Board, which had relocated from Fort Sill to Fort Bragg, North Carolina, in 1922. The battery used Ford trucks as prime movers. Because of a shortage in high-speed tractors and because trucks were less expensive, the use of the latter for towing all but the heaviest of guns

[17] Annual Rpt, CofFA, FY1922, pp. 3, 22, file 319.12, box 637, Entry 37a, RG 407, NARA; Cary, "Motor Vehicles," Ph.D. diss., pp. 185–86.

[18] Annual Rpt, CofFA, FY1934, p. 4, file 319.12, box 1329, Entry 37g, RG 407, NARA; Sunderland, *Field Artillery School*, pp. 122–24.

Experimental self-propelled gun at Fort Eustis, Virginia, in 1931

and howitzers was most common. The Army also began to experiment with half-track vehicles for use as prime movers and transportation in the 1930s. Because of the success of tests for motorizing the 75-mm. guns, PWA funds were obtained for motorizing all light artillery units in the National Guard, and in August 1933, Chief of Field Artillery Maj. Gen. Harry G. Bishop requested that the Field Artillery School modify its courses so that officers could receive instruction in truck-drawn artillery.[19]

In December 1933, the War Department announced its motorization policy for the Regular Army: All field artillery in the Hawaiian and Philippine Departments, one-half of the divisional 75-mm. gun batteries serving in the United States, one battalion of 75-mm. guns serving with the experimental mechanized cavalry force, all medium and heavy artillery units, and the field trains of horse-drawn, horse, and pack artillery units were to be motorized. In a memorandum for Chief of Staff General Douglas MacArthur, the G–3, commenting upon the continuation of the motorization

[19] In NARA, RG 407, file 319.12, see Annual Rpts, CofFA: FY1933, pp. 8, 10, box 1331, Entry 37g; FY1934, pp. 2–4, box 1329, Entry 37g; and FY1935, pp. 3, 6, 8, box 370, Entry 37i. See also Sunderland, *Field Artillery School*, pp. 122–23. The Field Artillery School was officially redesignated as such in January 1920, although general usage of the term had begun in the spring of 1919 while it was still the School of Fire.

program, stated that there had been definite progress in the modernization of field artillery with the adoption of readily available commercial equipment.[20]

The availability of PWA funds offset reduced congressional appropriations so that the motorization effort proceeded as planned. Under the planned reorganization, all Regular Army units would have had motorized transport within the service elements and 60 percent would have had total motor traction. Prior to the reorganization program, only 43 percent of the firing batteries had been motorized, leaving 57 percent as animal-drawn units. The War Department issued directives late in 1934 to accomplish the reorganization during the following year.[21] By 13 September 1935, sixty-one of the one hundred firing batteries in the Regular Army were motorized. Of the motorized batteries, forty-one were truck-drawn 75-mm. gun units, eighteen were truck-drawn 155-mm. howitzer units, and two were motorized heavy units. With all elements of the brigade, ammunition trains and service batteries motorized, overall motorization was about 70 percent.[22]

By the end of fiscal year 1935, all the motor vehicles purchased with PWA funds had been issued to all Regular Army and National Guard field artillery units except for units in Hawaii, which did not receive all their trucks; to the 1st Observation Battalion, which required special vehicles; and to the battalion with the experimental mechanized cavalry force, which had been issued only a portion of its vehicles. The bulk of the vehicles issued were readily available commercial types—light passenger cars and station wagons for officers and headquarters personnel; pickup trucks for light cargo, light repair, and messenger purposes; and cargo trucks for cargo and prime mover use. Tests on light motorized field artillery battalions showed that further motorization should continue gradually as engineering defects were eliminated and as an adequate supply of vehicles was assured. Motorized artillery proved almost as maneuverable as horse-drawn artillery in forward areas and more maneuverable in rear areas. The Field Artillery School recommended that combat trains, regimental headquarters batteries, service batteries, and ammunition trains all be motorized. Because motorization entailed elaborate maintenance, the school also proposed maintenance sections at the battalion level as well as at the regimental level.[23] Of the one hundred twenty-two firing batteries active in 1939, only eighty-three (68 percent) were motorized, using all-wheel drive trucks assisted, when necessary, by tractors. Nevertheless, the National Guard batteries, except those authorized as horse

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[20] Ltr, AG 320.2 FA (1-26-33) Misc (Ret)–C, 12 Nov 34, sub: Reorganization of Field Artillery, CMH files; Ltr, AG 320.2 FA (12-26-33) Pub, sub: Reorganization of the Field Artillery, 26 Oct 34, CMH files

[21] For the directives and related memoranda on the reorganization, see copies of pertinent documents in CMH files. See also in NARA, RG 407, file 319.12, Annual Rpts, CofFA: FY1933, p. 10, box 1331, Entry 37g; FY1934, p. 2, box 1329, Entry 37g; and FY1935, p. 8, box 370, Entry 37i.

[22] Sunderland, *Field Artillery School*, pp. 123–24; Robert M. Danford, "Development in Armament, Organization, and Employment of Field Artillery" (Paper given at U.S. Army War College, Washington, D.C., 28 September 1938), copy in FA School files; Annual Rpt, CofFA, FY1934, p. 2, file 319.12, box 1329, Entry 37g, RG 407, NARA.

[23] Annual Rpt, CofFA, FY1935, p. 6, file 319.12, box 370, Entry 37i, RG 407, NARA; Sunderland, *Field Artillery School*, p. 125.

Confederate veterans of the Richmond Howitzers manning a self-propelled gun on the exact position on which they fought at Big Bethel, Virginia, in June 1861

units in the cavalry divisions and one regiment in New Jersey, were motorized by the time they were inducted into federal service in 1940–41.[24]

Work on self-propelled vehicles had almost ceased entirely in the early 1920s, but in 1928 the War Department directed the establishment of an experimental mechanized force at Camp Meade, Maryland. The field artillery element of the force used some self-propelled guns and trucks to carry pieces piggyback, *portée*. This effort ended because of insufficient funds and obsolete weapons, but the War Department at least appointed a board to study the results of the experiment. Subsequently, the board recommended the permanent establishment of a mechanized force.[25]

A second experiment, which was also short-lived, did not begin until November 1930 when it was established at Fort Eustis, Virginia.[26] Between March and April of that year, the Field Artillery School tested a self-propelled M1916 75-mm. gun on

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[24] Robert M. Danford, "The Field Artillery" (Paper given at U.S. Army War College, Washington, D.C., 23 September 1939), copy in FA School files. For National Guard field artillery units, see *National Guard Register, 1939*, and World War II induction cards in CMH files.

[25] Robert W. Grow, "The Ten Lean Years: From the Mechanized Force (1930) to the Armored Force (1940)," February 1969, p. 29, copy in CMH files.

[26] Ibid.; Annual Rpt, CofFA, FY1930, pp. 12, 15, file 319.12, box 1336, Entry 37g, RG 407, NARA; H. H. D. Heiberg, "Organize a Mechanized Force," *Armor*, September-October 1976, pp. 8–11, 48–51.

a Mark VII mount, comparing its performance with that of a horse-drawn M1897 75-mm. gun and with the horse-drawn M1902 3-inch gun. The school found the mobility of the self-propelled gun equal to that of the horse-drawn pieces, but its mechanical reliability low. The report concluded by stating that ". . . the self-propelled mount tested is unserviceable and unsuitable as an accompanying gun or for any other purpose. Nevertheless, the basic ideas embodied have much merit and are entitled to further consideration."[27]

When the second test was over, General MacArthur declared that each of the arms and services should adopt mechanization and motorization and conduct research and experiments as were necessary to that end. By 1933, when a third effort to organize a combined arms mechanized force was made at Fort Knox, Kentucky, the artillery still had no self-propelled weapons. In 1934, the 1st Battalion, 68th Field Artillery, was activated with two firing batteries at Fort Knox to support the 1st Cavalry, Mechanized. Initially truck-drawn and armed with 75-mm. guns, the battalion was later issued 75-mm. howitzers and half-track prime movers, thus improving its mobility considerably. In 1937, the battalion was increased with the addition of two more firing batteries. But this battalion was the only mechanized field artillery unit in the Army when war broke out again in Europe in 1939.[28]

Advances in Materiel

The goal of mobility heavily influenced the development of weapons. The Westervelt board had recommended six basic types of field pieces: one gun and one howitzer for each of the categories of light, medium, and heavy artillery. As a basic principle, the board had suggested that the weapons be mobile enough to accompany the infantry and stated a preference for one type that could accomplish all the requirements of divisional artillery. Because such a solution was impractical at the time, consideration was given to substituting a light field howitzer, such as a 105-mm., for the 155-mm. howitzer in the division. Artillery was supposed to be sufficiently mobile to support the infantry with continuous fire, its primary objective being to neutralize the infantry of the opposing forces. The immediate targets were those obstacles preventing the advance of the friendly infantry. Close contact with the supported infantry, forward displacement with reasonable facility, and sufficient ammunition supply were necessary to accomplish the task. For these objectives, the 155-mm. howitzer was too heavy. The board felt that a lighter howitzer would be especially suited for wooded areas and ravines, that it would be the best weapon for

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[27] Annual Rpt, CofFA, FY1930, pp. 12, 15, file 319.12, box 1336, Entry 37g, RG 407, NARA; Sunderland, *Field Artillery School*, p. 130 (quoted words).

[28] Ltr, AG 320.2 (8-16-33) (Misc) M–E (WPD) 3561–27, 18 Aug 33, sub: Development of Four Army Organization, CMH files; Ltr, AG 320.2 FA (12-26-33), 26 Oct 34, sub: Reorganization of the Field Artillery, CMH files; Ltr, AG 320.2 (4-26-37), 10 Sep 37, referenced in 68th Armored FA Bn fldr, CMH files.

harassing fire and giving depth to barrages, and that it would have the same mobility with almost double the destructive power of the 75-mm. gun.[29]

Development of new models was slow. Using captured German field pieces, the Rock Island Arsenal developed a new version of the 105-mm. howitzer and carriage for testing in 1922. The tests were successful enough to warrant continued development, and in 1927, standardization of a model designed primarily for draft by horses or slow tractors was accomplished. The Field Artillery Board found the weapon generally satisfactory with some improvements to the carriage needed, but the economic situation made sufficient production of new materiel and procurement of equipment almost impossible. Because of the lack of a 105-mm. howitzer for use in the division, the 155-mm. howitzer regiment, which had been deleted from the division tables in 1920, was reinstated in 1929. Nevertheless, interest in developing an all-purpose divisional weapon did not diminish. The 155-mm. howitzer was still considered too heavy a weapon for a small mobile division, and dissatisfaction with the 75-mm. gun as a light divisional piece had been expressed during World War I when the weapon was at the height of its fame. The light field gun, due to its limited maximum elevation, could not shoot over a good-sized hill. Also, the projectile was too small to contain the explosive power desired.[30]

In 1930, General Bishop investigated the possibilities of developing a single caliber weapon to replace both the 75-mm. gun and 155-mm. howitzer in the division. Bishop envisioned a weapon that would also be capable of performing as antiaircraft artillery. He also reported that ten M2 105-mm. howitzers (only slightly different from the M1 model adopted in 1927) were under manufacture, but not yet ready for issue. In October 1931, four 105-mm. howitzers were delivered to Battery F, 1st Field Artillery, at Fort Sill for field testing. Although the Field Artillery School expressed faith in the basic weapon, it found the howitzer unsatisfactory for a number of reasons, chiefly the design of the carriage. Yet the M2 105-mm. howitzer was approved as a standard on 23 May 1934 after an extended test of fourteen models. Because of reductions in funds, however, its manufacture had to be deleted from the program for fiscal year 1934. In 1935, a redesign of the 105-mm. howitzer's carriage was again postponed to enable modernization of the 75-mm. gun, which was being modified for high-speed towing with pneumatic tires and new axles, along with

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[29] Rpt, Westervelt Board, 5 May 1919, pp. 7, 10–11, 16–20, FA School files; Final Rpt, CofArty, AEF, 1919, fldrs 381–86, box 41, Entry 22, RG 120, NARA; Rpt, Hero Board, 9 Dec 1918, p. 9, FA School files; Wrapper End, GHQ, AEF, to SecWar, 16 Jun 20, AGO 322 (4-19-20), and Rpt of the Superior Board, AEF, on Organization and Tactics, p. 46, AGO 320 (6-21-20), box 1737, Entry 37c, RG 407, NARA.

[30] Harry G. Bishop, "The Trend of Development of Field Artillery" (Paper given at the U.S. Army War College, Washington, D.C., 19 December 1930), copy in FA School files; John P. Lucas, "The 105-mm. Howitzer," *Field Artillery Journal*, February 1941, pp. 66–69; WD Circ 29, 16 May 1929; WD Circ 39, 29 Jun 1929; Mins 15639, Ordnance Cmte, 20 Feb 40, Meeting no. 8, box 77, Entry 885, RG 156, NARA; Annual Rpt, CofOrd, FY1926, p. 21, AG 319.12, box 1342, Entry 37g, RG 407, NARA. See also in NARA, RG 407, file 319.12, Annual Rpts, CofFA: FY1925, p. 55, box 1726, Entry 37a; FY1926, pp. 73, 81–82, box 1342, Entry 37g; FY1927, p. 40, box 370, Entry 37i; FY1929, pp. 20, 23, 30, box 1337, Entry 37g; and FY1930, pp. 13–14, box 1336, Entry 37g. For details concerning the development of a 105-mm. howitzer using captured German models in the late 1920s, see file 472.23B, box 121, Entry 34, RG 177, NARA.

being altered for both aerial and ground fire. The modernization was considered so successful that plans were made to equip all active divisional 75-mm. gun batteries with new carriages by the end of fiscal year 1937. The 155-mm. howitzer was also being modernized with a new carriage for high-speed towing.[31]

For pack artillery, a 75-mm. howitzer was being developed, and in 1931 the 1st Battalion, 2d Field Artillery, in the Canal Zone was equipped with the new weapon. The piece received high praise, and other roles were contemplated for it: as a supporting weapon in the experimental mechanized cavalry force; as the accompanying weapon in the infantry division; and as the principal weapon in the cavalry division.[32]

Organizational Developments

During World War I the roles and missions of coast and field artillery became blurred, leading to controversy immediately after the war. Throughout the interwar period, the issue of branch consolidation was argued, chiefly because of reduced appropriations. Those who favored consolidation believed that the coast artillery and fixed defenses were obsolete and could easily be sacrificed; those against felt that the coast artillery's defensive mission and field artillery's offensive mission were diametrically opposed to each other and that the need for harbor defenses was genuine and important, given the ineffectiveness as well as high cost of protection provided by aircraft and naval vessels.[33]

Early postwar reports did not indicate the necessity for drastically changing the organizational structure of the divisional field artillery. The major recommendations included reorganizing the three-battalion 155-mm. howitzer regiment into two battalions for tactical reasons (so that each infantry brigade could be supported by one regiment of light artillery and one battalion of 155-mm. howitzers), for economy (through the elimination of one battalion staff), and for simplification of liaison. Other changes included substituting a lighter weapon for the 155-mm. howitzer, eliminating the trench mortar battery from the brigade and centralizing all divisional trench mortar batteries in the general headquarters (GHQ) reserve, reorganizing the battery combat trains into ammunition batteries and battalions, and assigning the artillery ammunition train and mobile ordnance repair shop to the division brigade. Organic army artillery was considered unnecessary, and suggestions were made that artillery not in divisions or corps be organized into a general artillery reserve. The army artillery staff would then be reduced to a small tactical one. It was also

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[31] Mins 15639, Ordnance Cmte, 20 Feb 40, Meeting no. 8, box 77, Entry 885, RG 156, NARA; Sunderland, *Field Artillery School*, p. 130. See also in NARA, RG 407, file 319.12, Annual Rpts, CofFA: FY1930, pp. 13–14, box 1336, Entry 37g; FY1931, pp. 13–14, box 370, Entry 37i; FY1932, p. 13, box 1332, Entry 37g; FY1933, p. 10, box 1331, Entry 37g; FY1934, pp. 61, 73, box 1329, Entry 37g; and suppl. to FY1935, pp. 1–2, box 370, Entry 37i.

[32] Annual Rpt, CofFA, FY1931, p. 13, file 319.12, box 370, Entry 37i, RG 407, NARA.

[33] Larry H. Addington, "The U.S. Coast Artillery and the Problem of Artillery Organization, 1907–1954," *Military Affairs* 40 (February 1976): 1–6.

Superior Board members: left to right*, Maj. Gens. Joseph T. Dickman, John L. Hines, and William Lassiter; Col. George R. Spalding; Brig. Gen. William Burtt; and Col. Parker Hitt*

strongly recommended that the missions of aerial observation and flash and sound ranging be located within the field artillery branch.[34]

The AEF's views on the new Army establishment were key. Following War Department orders, military boards in France had examined the AEF experiences with the arms and services, and the Superior Board had convened in December 1918 to reassess their findings and to incorporate their recommendations on organization and tactics. The latter board completed its task in July 1919 and submitted it to General Pershing, who subsequently relocated to Washington, D.C. Copies of the report were unofficially in the possession of the War Department by the fall of 1919, when Pershing was given the rank of General of the Army of the United States; however, he did not forward the report officially until 16 June 1920. In the meantime, the General Staff's Organizational Section was preparing outlines for tables

[34] Memo, Wm E. Sheperd, Jr., Actg CofFA, for Charles P. Summerall, 20 Dec 1918, box 17, Summerall Papers, Ms Div, LC; *War Department Annual Reports*, 1:5228–338; Final Rpt, Cof Arty, AEF, 1919, fldrs 381–86, box 41, Entry 22, RG 120, NARA; Rpt, Hero Board, 9 Dec 1918, pp. 3, 5, 12, 13, 25, FA School files; Statement of Brig Gen Lesley J. McNair, 25 Jan 1929, sub: Armament of Artillery. . . , copy in FA School files.

of typical divisions, corps, and armies, based in part upon those recommended by the Superior Board but differing somewhat because of the growing belief that the AEF division (approximately 28,000 men) was much too large and unwieldy.[35]

General Pershing, one of the critics of the cumbersome AEF division, felt that much of the Superior Board's report was based too heavily upon the needs of positional warfare in western Europe and not enough on a war of movement. Pershing thought the only way a mobile division (whether in combat, training, or at rest) could have its organic artillery with it at all times was to reduce that artillery. He suggested a division of 16,875 men with a single field artillery regiment (2,300 men) of 75-mm. guns rather than three regiments of 75-mm. guns and 155-mm. howitzers. That regiment was to consist of three battalions, with each battalion having three batteries of four guns each and one ammunition battery. This would have reduced the number of divisional guns from seventy-two of the AEF division to thirty-six. The division contemplated by the General Staff's Organizational Section, on the other hand, had an approximate strength of 24,000 and included one field artillery brigade of two 75-mm. gun regiments (forty-eight guns). This plan conformed to Pershing's idea that the 155-mm. howitzer regiment be eliminated, but differed in that it retained the field artillery brigade structure.[36]

These and other points of disagreement seemed so important that the General Staff's War Plans Division appointed a special committee under Col. William Lassiter to resolve the differences and to plan the organization of the Army in relation to the National Defense Act of 1920. The Lassiter committee discussed the merits of the large AEF division and the smaller one recommended by General Pershing, taking into consideration the increased range and mobility of artillery and the probability that conventional opponents in future wars would be organized in great depth. Although the committee wanted a division that would ensure mobility, sufficient firepower and power of penetration were also important. A division of two infantry brigades and one artillery brigade was not as mobile as a division of one infantry brigade and one artillery regiment, but its mobility could be improved if auxiliary and smaller units were reduced, and it would have greater striking and penetrating power.[37]

Copies of the report were forwarded to the chiefs of arms and services with instructions to prepare tables of organization. In the report, the recommended division had an approximate strength of 19,000 and the field artillery brigade two 75-mm. gun

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[35] Wilson, *Maneuver and Firepower*, p. 86; Rpt of the Superior Board, AEF, on Organization and Tactics, AGO 320 (6-21-20), box 1737, Entry 37c, RG 407, NARA. After receiving the rank of General of the Army of the United States in September 1919, Pershing elected to continue wearing four stars.

[36] Wrapper End, GHQ, AEF, to SecWar, 16 Jun 20, AGO 322 (4-19-20), and Rpt of the Superior Board, AEF, on Organization and Tactics, pp. 32–62, AGO 320 (6-21-20), box 1737, Entry 37c, RG 407, NARA; A[rthur] W. Lane, "Tables of Organization," *Infantry Journal*, May 1921, pp. 486–503.

[37] Lane, "Tables of Organization," pp. 486–503; "Report of Special Committee Appointed by the Director, War Plans Division to Define the General Plan of Organization to be Adopted for the Army of the United States Provided for by the Act of June 4, 1920, Washington, D.C., July 8, 1920 (Lassiter Committee Report)," reprinted in Army War College Course Materials 52–29, pp. 2–7, copy in MHI files (hereinafter Rpt, Lassiter Cmte, 8 Jul 1920). For further information on the interwar period, see Wilson, *Maneuver and Firepower*, chs. 4 and 5.

regiments, temporarily losing its 155-mm. howitzer regiment. With the development of a light howitzer, as had been recommended by both the Hero and Westervelt boards, the howitzer regiment would be retained in the divisional artillery brigade. The artillery ammunition train was to become part of the brigade, but other ammunition was to be carried in the divisional supply train. Trench mortars were eliminated from the division artillery.[38]

For the corps artillery brigade, the committee recommended three 155-mm. howitzer regiments (twenty-four howitzers each), one 155-mm. gun regiment (twenty-four guns), one two-company observation battalion (the flash-ranging component of the former sound- and flash-ranging battalions, with the sound-ranging function being transferred to GHQ artillery), and an ammunition train. The corps artillery's function, as defined, was to neutralize or destroy enemy artillery, to interfere with or prevent the enemy's withdrawal, and to impede services in the enemy's rear areas.[39]

The mission of army artillery, according to the committee, was to fire on areas well beyond the line of friendly infantry, to strike strategic areas, and to paralyze the service of the enemy's rear lines. The only organic artillery recommended was a headquarters and an ammunition train, similar to the corps ammunition train. For the GHQ reserve, one hundred forty-four 75-mm. guns (in three motorized and three *portée* regiments), forty-eight 155-mm. GPF guns (in two regiments), and twenty-four 6-inch guns (one regiment) were allotted for each army. For training and control while in the GHQ reserve, these would be organized into two brigades, one light and one medium-heavy. When the regiments were detached to an army, they would pass to the direct control of the army artillery headquarters. The GHQ artillery for six armies would be six times that allowed for one, plus one regiment of twenty-four trench mortars (the number to be increased when an improved model was developed), one regiment of 12-inch railway guns, one regiment of 16-inch railway mortars, a sound-ranging service (headquarters and ten companies), and antiaircraft artillery and machine guns. Except for the 75-mm. gun regiments, the Coast Artillery Corps was to man all GHQ artillery.[40]

For the cavalry division, the Superior Board had recommended two cavalry brigades (two regiments each), an artillery regiment, an armored car squadron, an engineer unit, and supply and service units, for an approximate strength of 16,500 men. The Lassiter committee, however, favored a smaller division in line with the newer thinking of having lighter, more mobile striking forces. The committee outlined a divisional structure of two cavalry brigades (with two regiments and a two-troop machine gun squadron), a battalion of mountain artillery (pack), and supply and service units. Chief of Staff March approved the latter organization, but changed the mountain artillery battalion to one of horse artillery, the modified

[38] Rpt, Lassiter Cmte, 8 Jul 1920, pp. 2–7, MHI files.

[39] Ibid.; Lane, "Tables of Organization," pp. 486–503.

[40] Lane, "Tables of Organization," pp. 486–503; Rpt, Lassiter Cmte, 8 Jul 1920, pp. 2–7, MHI files.

division having an aggregate war strength of 7,463. In 1928, the horse artillery battalion was increased to a regiment.[41]

In 1929, the structure of the infantry division artillery changed. The possibility of manufacturing enough 105-mm. howitzers for use as divisional artillery seemed extremely remote, and the new models of the 155-mm. howitzer were more mobile than the old because of improvements in their carriages. Since there was a small budget increase that year, the War Department decided to reinstate the 155-mm. howitzer regiment in the division artillery brigade and to reduce the corps artillery brigade by one 155-mm. howitzer regiment. These regiments were motorized, and each was to be organized at reduced strength and have only two battalions. Another measure designed to provide a mobile field army with heavy artillery was the transfer of trench mortars from the Coast Artillery Corps to the field artillery branch.[42]

Reinstatement of the 155-mm. howitzer in the division, an increase in increments from ground troops to the Air Corps, and reductions in enlisted men and animals were all factors contributing to a reorganization of field artillery in 1930. A number of disbanded units were reconstituted and activated, some were inactivated, some headquarters and service units were reduced, and a number underwent changes in armament. Nevertheless, the reorganization did not halt the decrease in artillery because of increased levies on ground troops by the expanding Air Corps. In 1931, the field artillery in the Regular Army had five skeleton brigades (1st, 2d, 3d, 11th, and 13th), one observation battery, and twenty-one regiments (none with more than two battalions). Some regiments were down to two firing batteries, and even the batteries were below strength.[43]

By 1934, with the motorization program implemented, the Army grew in personnel and underwent a reorganization on 1 December. One of its objectives was to have one active element in each field artillery brigade of the nine Regular Army infantry divisions and three cavalry divisions as a mobilization base. The authorized increase of 7,487 enlisted men in the field artillery provided much needed personnel. The field artillery personnel situation was also improved because the extension of motorization released many enlisted men from stable duties for other tasks. By 13 September 1935, there were forty-four gun or howitzer battalions

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[41] Rpt, Lassiter Cmte, 8 Jul 1920, pp. 2–7, MHI files; Memo, Maj. Gen. Peyton C. March, CofS, for Special Cmte, 31 Aug 20, copy in CMH files; Extracts from "Report of the Cavalry Board, A.E.F., on Organization and Tactics," reprinted in *General Staff College, 1919–1920*, vol. 5, *Training*, p. 126, copy at MHI; TOs 401W, Cav Div, 4 Apr 21 and 1 Jul 29, CMH files; Rpt of the Superior Board, AEF, on Organization and Tactics, pp. 32–62, AGO 320 (6-21-20), box 1737, Entry 37c, RG 407, NARA.

[42] WD Cir 21, 13 Apr 29; WD Cir 29, 16 May 29; WD Cir 27, 26 May 30; WD GO 2, 1 Mar 28; Annual Rpts, CofFA, FY1926, p. 86, box 1342, and FY1929, pp. 31, 35, box 1337, file 319.12, Entry 37g, RG 407, NARA.

[43] Annual Rpt, CofFA, FY1930, p. 18, file 319.12, box 1336, Entry 37g, RG 407, NARA; H[arry] G. Bishop, "The Trend of Field Artillery," *Field Artillery Journal*, March-April 1931, p. 128, chart H; FA TO & Ref Data, 1934 ed., pp. 5, 7, 8, 10, 11, 12, copy in CMH files. See also Wilson, *Maneuver and Firepower*, ch. 5.

with one hundred firing batteries, an observation battalion (with one organized battery), and an ammunition train. Eighty-six of the firing batteries were divisional artillery, one was corps artillery, and thirteen were in the GHQ reserve.[44]

After World War I, many officers thought that the Army should be organized into small, highly mobile, hard-hitting units, but as late as the mid-thirties the infantry division remained large, slow, and not well adapted for maneuver. Modern equipment and improved methods of transportation were needed before making smaller units as effective as large organizations, but during the interwar period, the Regular Army was small and the necessary funds were not available. In the mid-thirties, the situation began to change. The grant from the PWA program had increased motorization, Congress began authorizing increases in men and equipment, and the Army noted that the major western European nations and Japan were reorganizing their armies into smaller triangularized divisions based around three infantry regiments (rather than two brigades of two regiments each).

In late 1935, Chief of Staff General Malin Craig observed that for a number of years the proper organization of the division had been in question, citing recent developments in motorization, mechanization, airpower, and firepower. On 31 December, he approved a plan developed by the General Staff G–3 and appointed a committee in January 1936 to study the modernization of the Army, taking into account recommendations of the chiefs of arms and services, the service schools, and other individuals; the organization of foreign divisions; and modern improvements in weapons and transportation. The tentative organization of the proposed division included a completely motorized field artillery regiment, consisting of one general-support 105-mm. howitzer battalion and three direct-support battalions, each with two 75-mm. howitzer batteries and one 81-mm. mortar battery. Because the armament to equip the new organizations was not available, the committee suggested the temporary use of the older weapons (75-mm. gun, 155-mm. howitzer, and Stokes mortar) on hand. Tables of organization were prepared and theoretically tested at the service schools and by small units. By September 1937, the 2d Division had been directed to test the new divisional structure at Fort Sam Houston, Texas. A basic criticism of the proposed division was its lack of sufficient artillery support.[45]

Brig. Gen. Lesley J. McNair, commander of the 2d Division's 2d Field Artillery Brigade, pointed out that the War Department reorganization committee had placed too great an emphasis on artillery in close support of the infantry, reflected in the number and organization of 81-mm. mortars and the substitution of the 75-mm. howitzer for the 75-mm. gun. He believed that modern artillery had great power

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[44] Sunderland, *Field Artillery School*, pp. 123–24; Danford, "Development in Armament, Organization, and Employment of Field Artillery," FA School files; Annual Rpt, CofFA, FY1934, p. 2, file 319.12, box 1329, Entry 37g, RG 407, NARA.

[45] Memo, Col (FA) Wm H. Dodds, Jr., for Actg Comdt, FA School, 17 Dec 1935, sub: Reorganization of the Division and Higher Units; Ltr, CI 400.12/7988–BII C4–1, CofInf to TAG, 31 Dec 1935, sub: Reorganization of Divisions and Higher Units; and Memo, 35651, G–3 for CofS, 30 Jul 1936, sub: Initial Report on Organization of the Army, With Special Reference to the Infantry Division, p. 21. Copies of all in MHI files. See also Harry C. Ingles, "The New Division," *Infantry Journal*, November-December 1939, pp. 521–29; "Infantry Division Test," *Army and Navy Register*, 18 September 1938, p. 4.

General McNair

in the individual projectile and that the key to success lay in the massing of fires on decisive points. Rarely in war, he reasoned, would there be sufficient artillery to cover all points thoroughly and continuously; therefore, fire should be massed in succession on the most important targets. The procedure required centralized control, great flexibility in delivery, considerable range, and good communications. Given improved methods of fire direction (using firing charts on which base points[46] were plotted with fair accuracy), McNair thought that the gain in close support in the proposed division was more than offset by the loss in effective artillery support as a whole. If artillery lost its power to mass fires over a wide front and was dissipated in local combat, then it would no longer exert the influence that had given it such importance in the past. McNair urged that close-support weapons (the light guns, howitzers, and mortars) be kept at a minimum and general-support weapons at a maximum. The division needed more of the heavier weapons and fewer of the lighter ones.[47]

Others, too, had mixed reactions concerning the proper armament of the proposed division's artillery. For general support, the 155-mm. howitzer was preferred to the 105-mm. howitzer because it had adequate mobility, it was more powerful, and, most of all, it was available. The prime mover was thought to be too heavy, but it could be lightened. There was a general trend to have weapons of heavier calibers than the 75-mm. gun for direct support. Because many artillery officers considered the 75-mm. gun unsatisfactory given its comparatively flat trajectory and small projectile, some hoped that the 105-mm. howitzer, when introduced, would replace the 75-mm. gun instead of the 155-mm. howitzer. The 105-mm. howitzer was a better weapon against personnel in the open. The German army was rearming with a new 105-mm. howitzer, and other major powers were taking an interest in the weapon. Even though the United States increased its interest in the 105-mm. howitzer, there were still too many

[46] The term *registration point* rather than *base point* is now used for specifying a precise target location and for plotting precise firing data, after which fires are shifted to other targets in the general area. A firing chart is a map, photo map, or grid sheet showing the relative horizontal and vertical positions of batteries, base points, base point lines, check points, targets, and other data needed in preparing firing data.

[47] Memo, McNair for CG, 2d Div, 8 Apr 37, copy in MHI files.

General Danford

75-mm. guns (with ammunition) left from World War I that, as an economy measure, were being modernized with new carriages. The project for developing a satisfactory carriage for the 105-mm. howitzer to match its already satisfactory tube was too low in priority to receive much attention while the 75-mm. guns and 155-mm. howitzers were being updated.[48]

By June 1938, new tables of organization were prepared, and the 2d Division was again selected for extended testing. The 81-mm. mortars used for close support had been transferred to the infantry. Previous tests had shown that a four-battalion regiment presented no major tactical problems, but the shortage of experienced commanding officers and the trend of foreign armies to increase artillery resulted in the division of light and medium artillery into two separate regiments. The light artillery regiment was to consist of three battalions, each with three firing batteries of 75-mm. guns. The medium regiment was to include one battalion of eight 105-mm. howitzers and one battalion of eight 155-mm. howitzers. Each firing battery was also to have a .50-caliber machine gun for antiaircraft defense. The armament of the proposed division thus consisted of thirty-six 75-mm. guns, eight 155-mm. howitzers, and eight 105-mm. howitzers, for a total of fifty-two weapons.[49]

A study made in 1938 by the Field Artillery School suggested a combination of 105-mm. and 155-mm. howitzers for divisional artillery. In December of that year, however, Chief of Field Artillery Maj. Gen. Robert M. Danford warned the school that if a war erupted, the field artillery should expect to use the modified M1897 75-mm. gun because the project to equip Regular Army units with the modernized weapon was near completion. The attempt to realize the ideals of the Westervelt board had resulted in the production of the 75-mm. weapon as an all-purpose gun. Although a remarkable

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[48] Ingles, "New Division," pp. 521–29; C. D. Roberts, "The Infantry Division," *Infantry Journal*, March-April 1936, pp. 140–44; Ltr, CI 400.12/7988–BII C4–1, CofInf to TAG, 31 Dec 1935, sub: Reorganization of Divisions and Higher Units, copy in MHI files.

[49] Wilson, *Maneuver and Firepower,* pp. 130–31; Roberts, "Infantry Division," p. 144; Notes, Brig Gen. Lesley J. McNair, 31 Mar 1938, sub: Highlights of Report by CG, 2d Division, of the Field Service Test of the PID including the Division Recommended, in Papers of Lesley J. McNair, box 13, Entry 58c, RG 337, NARA; Ingles, "New Division," pp. 521–27; Ltr, AG 320.2 (9-3-38) Misc (Ret) M, TAG to CG, Eighth Corps Area, 15 Oct 38, sub: Reorganization of the 2d Infantry Division, CMH files; *Annual Report of the Secretary of War, 1937*, p. 35.

achievement in design, the weapon was in reality inadequate for either of its primary purposes. It did not have the necessary characteristics of a first-class antiaircraft gun, and it was too heavy and complicated for divisional supporting missions.[50]

The 2d Division completed testing the new division structure on 31 August 1939, and the preliminary report showed the division artillery to be sound. General Craig's replacement, Chief of Staff General George C. Marshall, recommended the reorganization of five Regular Army divisions at peacetime strength under the new structure. The recommendation was approved on 16 September 1939, but the new tables were slow in being published and some of the equipment was not available, resulting in having the medium artillery armed with the 155-mm. howitzer rather than the 105/155 combination. The 1939 reorganization finally eliminated the field artillery brigade in the infantry division. An artillery section within the division headquarters became the means by which the division artillery commander exercised control. The brigade ammunition train was also eliminated. The remainder of the division artillery consisted of one light regiment containing three battalions of 75-mm. guns, for a total of thirty-six weapons, and a medium regiment containing two battalions of 155-mm. howitzers, for a total of sixteen weapons. The total number of field artillery pieces in the division was fifty-two. By October 1939, the five authorized Regular Army divisions and one complete corps artillery brigade were reorganized under the new structure. The organization of the divisions was termed *triangular*, because each division was organized around three infantry regiments rather than four as in the former so-called *square* division.[51]

In addition to reevaluating the organization of the infantry division, the War Department was also considering the reorganization of the cavalry division and the development of a mechanized cavalry force. In 1936, the 75-mm. howitzer was in the process of replacing the M1897 75-mm. gun in both the 1st Cavalry Division and the experimental mechanized cavalry brigade. By 1938, a review board at Fort Bliss, Texas, recommended that the cavalry division field artillery regiment be expanded and strengthened. The board suggested a field artillery regiment of three battalions—two three-battery battalions of four 75-mm. howitzers each and one three-battery battalion of four 105-mm. howitzers each. It also recommended further testing of the suitability of motor vehicles for drawing the cavalry division weapons, but the new tables of organization, giving the cavalry division twenty-four 75-mm. and twelve 105-mm. howitzers, were not adopted until 1940.[52]

[50] Sunderland, *Field Artillery School*, pp. 154–55; *Annual Report of the Secretary of War, 1938*, p. 34; Field Artillery School, *Development of Field Artillery Materiel*, p. 67.

[51] Ltr, AG 320.2 (9-7-39), HQ, 2d Div (Provisional) to CG, Eighth Corps Area, 7 Sep 1939, sub: The Test of New Division Organization, and Memo, 6541–Gen 597, G–3 for CofS, 16 Sep 1939, sub: Organization of Regular Army, First Priority (17,000 Increase), copies in MHI files; Ltr, AG 320.2 (12-5-39) M–C–M, 18 Dec 39, sub: Reports from Triangular Divisions, CMH files; Memo, 35651–55, G–3 for CofS, 14 Sep 1939, sub: Reorganization of the Infantry Division, CMH files. See also Sunderland, *Field Artillery School,* p. 186.

[52] *Annual Report of the Secretary of War, 1936*, p. 37; ibid., *1937*, p. 35; "Report of Board of Review [on Field Service Tests of the Proposed Cavalry Division]," 2 Jul 38, copy in CMH files. See also suppl. to Annual Rpt, CofFA, FY1935, p. 6, file 319.12, box 370, Entry 37i; and Ltr, AG 320.2 (9-11-40) P, TAG to CofArms&Svcs, 13 Sep 1940, sub: Cavalry Division, Horse, file 320.2, box 1974, Entry 363. All in RG 407, NARA.

Training and Doctrine

Reductions in personnel and appropriations in the 1920s adversely affected training as well as weapon development and effective organizations. Only three field artillery schools survived World War I—those at Camp ZacharyTaylor, Camp Bragg, and Fort Sill. In 1920, the School of Fire at Fort Sill was officially redesignated as the Field Artillery School, although general usage of the term had begun in the spring of 1919, and the school at Camp Zachary Taylor was transferred to Fort Knox. In 1922, the three schools were consolidated at Fort Sill, and the number of courses reduced to two.[53]

Techniques developed at the Field Artillery School emphasized reconnaissance and the selection and occupation of position in an attempt to retreat from the static concepts of World War I, even though it was often difficult to assemble even a battery together for maneuvers. In 1919, the school troops (1st, 9th, and 14th Field Artillery) were far understrength. The 1st Field Artillery had only twenty-five officers and three hundred ninety-seven enlisted men, and the 14th had twenty-two officers and two hundred twenty-five enlisted men. In the winter of 1919–1920, the 1st Field Artillery was reorganized as a motorized regiment, armed with French and American 75-mm. guns and the 4.7-inch gun. The 14th was organized with French and American 75-mm. guns and the British 60-pounder, and the 9th Field Artillery with 155-mm. and 9.2-inch howitzers. This arrangement lasted until August 1921; the 9th and 14th Field Artillery were inactivated, leaving the 1st Field Artillery as a horse-drawn regiment with one motorized battalion. The 1st Field Artillery, augmented with one battalion from the 18th Field Artillery after its activation in December 1922, served as the only school troops until the 1930s.[54]

The school policy was for all units at Fort Sill to be authorized at war strength and to be kept as close to that goal as possible, because nowhere else in the continental United States could an artillery officer learn to work with units manned and equipped as would be available during war. But, in reality, the school troops were usually well below war strength. For example, in October 1923, the units were four hundred men understrength, and the batteries had to use cooks and drivers as cannoneers. As reported in 1926, more emphasis was needed in the areas of fire adjustment, communications, horsemanship, marching, and liaison with aircraft; however, the following year Chief of Field Artillery Snow, in addition to commenting on the tremendous shortage of horses, related that it was impossible to carry out the War Department's instructions for practical testing in aerial observation because of the lack of gasoline.[55]

Locating enemy targets and massing fires quickly and accurately were key to the success of artillery. However, prior to World War I specialized methods

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[53] WD GO 7, 30 Jan 1920; WD GO 42, 14 Jul 1920; Sunderland, *Field Artillery School*, pp. 73, 76–78, 85–87.

[54] Sunderland, *Field Artillery School*, pp. 76–78.

[55] Ibid., p. 91; Annual Rpts, CofFA, FY1926, p. 20, and FY1927, p. 26, file 319.12, boxes 1342 and 370, Entries 37g and 37i, RG 407, NARA. See also Harry G. Bishop, *Field Artillery* (Boston: Houghton Mifflin Co., 1935), ch. 9.

were not needed because direct-laying procedures were used to fire cannon. With longer-ranged weapons and the introduction of indirect laying, the main problem was in finding a way to silence enemy guns, the first step being to locate them. Aerial observation was in its infancy, and the AEF adopted the techniques of sound and flash ranging developed by France and Great Britain.[56]

After the war, field artillerymen continued to stress the importance of sound- and flash-ranging techniques, and on 7 August 1922, the 1st Observation Battery (Flash) was organized at Fort Bragg as part of the 13th Field Artillery Brigade. When the field artillery branch took over part of the sound-ranging mission from the coast artillery in 1925, the battery was reorganized with a dual mission. It was expanded into the 1st Observation Battalion in 1934, with the activation of a headquarters battery; the activation of a second sound and flash battery in 1939 completed the organization. Another battalion was authorized that year, and in 1940, the personnel of the existing unit split up to form the 1st and 2d Field Artillery Observation Battalions, each organized with a headquarters and headquarters battery and two observation batteries. Each of the four observation batteries contained one sound-ranging platoon and one flash-ranging platoon.[57]

The technique of massing fires quickly and accurately was one of the great American contributions to field artillery. The Field Artillery School, during the interwar years, developed the concept by which concentrated firepower was achieved with widely dispersed cannon through the use of map data and a communications network. After World War I, the school staff believed that the fire direction methods used during the war were insufficient. If the infantry could transmit a list of map coordinates to the field artillerymen and give them the necessary time to compute firing data, then the latter could deliver fire thoroughly and accurately. There was no way, however, to mass fires quickly when infantrymen suddenly and unexpectedly found they needed it.[58]

Some staff officers of the school's Gunnery Department were aware that coordination within the infantry-artillery team had been weak during World War I. Under the leadership of Maj. Carlos Brewer and others, the fire direction center concept began in 1929. Brewer believed that part of the reason artillery had given unsatisfactory support to attacking infantry during the war lay in the existing method of delivering battalion fires by a descriptive reference to a terrain feature or by giving estimated coordinates of the target to the batteries for them to plot. The methods of 1929 were the same as those of 1918. When all observation posts could see and

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[56] Arthur R. Hercz, *Development of the Field Artillery Observation (Target Acquisition) Battalions* (Fort Sill, Okla.: U.S. Army Field Artillery School, 1972), p. 1; Daniel J. Kevles, "Flash and Sound in the AEF: The History of a Technical Service," *Military Affairs* 33 (December 1969): 374–84.

[57] Glen Coffman, "Sound Ranging: Dead or Alive?," *Field Artillery Journal*, March-April 1974, pp. 19–24; TOs 153W, 7 Mar 21 and 18 Nov 29; Annual Rpts, CofFA, FY1929, p. 36, and FY1930, p. 17, file 319.12, boxes 1337 and 1336, Entry 37g, RG 407, NARA; Sunderland, *Field Artillery School*, p. 132. See also unit information on 1st and 523d Field Artillery Observation Battalions, CMH files.

[58] Frank G. Ratliff, "The Field Artillery Battalion Fire Direction Center—Its Past, Present, and Future," *Field Artillery* Journal (May-June 1950), p. 117; Riley Sunderland, "Massed Fire and the FDC," *Army*, May 1958, p. 56. Also see Shugart, "On the Way," Ch. 3, for a detailed analysis of the development of the fire direction center.

identify the target, then the batteries could all open directly onto it. When the target was obscure, other batteries would watch for the bursts of the adjusting battery to spot it. If the target could be located on a map, coordinates could be passed to the reinforcing batteries for them to plot and compute the data. If there were no map or if only one observer could see the target, the problem seemed almost insurmountable. What was needed was a system whereby anyone who found a target could give firing commands to several batteries.[59]

Before a successful fire direction center could be developed, two fundamental advances were necessary: an effective means of forward observation and a firing chart that would permit rapid preparation of battalion data from the adjustment of a single battery. Brewer and his colleagues were greatly influenced by a book entitled *Field Guns in France*, published in 1922 by Neil Fraser-Tytler, a British officer in World War I. Fraser-Tytler stressed the importance of the observer in adjusting the fire for all batteries. 1st Lt. E. L. Sibert, on the staff of the Gunnery Department, suggested using an air observation method by which fire was shifted from a location known to both observer and fire direction personnel to a target vicinity. The observer would then report the bursts, adjusting them on the target. In the meantime, Brewer developed a firing chart using triangulation, then referred to as *long-base intersection*. Two known points were established and occupied by observers (these two points constituted the base of a triangle). The locations of the observers, who were both able to see the target, were plotted on a chart. Both then measured the direction to the target with compass-type instruments. When lines were extended on a chart from each observer position in the measured directions, the intersection of those lines determined the location of the target. To achieve a more accurate target location, the battalion fire direction center could either extend the length of the base line between two observers or increase the number of observers within the base line. These measures thus made it possible to compensate or identify errors in survey and measuring directions.

The chart and the new forward observer technique were in place when Brewer decided in 1930 that better and faster methods of fire direction should be developed. He decided to plot the base point (now referred to as the *registration point* or *known target*) and, using adjusted range and deflection determined from registration, to compute the initial data for the other batteries.[60] Thus a simpler solution to the problem of concentrating a battalion on an unmapped target on which only one battery had adjusted or had registered was found. This technique gave approximate corrections for other batteries based on the firing experience of one battery, making it unnecessary to strip out weather corrections and permitting the use of any plain or gridded sheet.[61]

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[59] Ltr, MG Carlos Brewer to Comdt, FA School, 5 Feb 44, and "The Fire Direction Center," p. 1, FA School files; Ratliff, "Field Artillery Battalion Fire Direction Center," p. 117; Sunderland, "Massed Fire and the FDC," p. 56.

[60] Deflection is the deviation from the zero mark of the pointer on a measuring instrument.

[61] Ltr, Brewer to FA School, 5 Feb 44, and "The Fire Direction Center," p. 3, FA School files; Sunderland, "Massed Fire and the FDC," p. 58.

The first demonstration of massed fires based on the new concepts of adjustment by any observer and the use of the new chart occurred at Fort Sill in the spring of 1931. There were two computer personnel and one forward observer, communicating by voice radio. No map was used. Early experiments with battalion-massed fires showed that the three firing batteries rarely placed their impact centers on exactly the same spot. Instead they delivered fire accurately within a triangle of error, a phenomenon caused by differences in site.[62] To solve the problem, Maj. Orlando Ward, who followed Brewer as head of the Gunnery Department, suggested they work back from the target by first adjusting on it, assuming zero site, and then plotting battery positions by back azimuth[63] according to adjusted range. This method of constructing firing charts was known first as *back azimuth* and later as *observed fire*.[64]

By the spring of 1933, some definite practical procedures for fire direction had been established, and although the actual fire direction center was still in the future, the term came into use. By using the observed fire chart,[65] it was possible to send actual firing data by telephone or radio from the battalion to the batteries. The procedure of having the observation post conduct fire by locating the target and reporting the corrected data permitted the battalion operations (S–3) section, employing the observed fire chart, to concentrate the battalion on the target. By this time, a very definite fire direction group with specific duties had been established in the battalion under the S–3. This fire direction group, however, handled only observed fire; unobserved fires were directed by distributing overlays drawn from the firing chart, and the batteries computed their own data by applying corrections to compensate for weather or corrections previously derived by registration. In 1934, fire direction personnel included the S–3, two staff officers, a draftsman, and a clerk. The officers computed the firing data, and the clerk assisted the draftsman who prepared the charts. Personnel changes in 1934 resulted in the pioneers of the fire direction center concept leaving Fort Sill for new assignments, and a three-year hiatus in its development followed.[66]

In 1937, Lt. Col. H. L. C. Jones took over a battalion of the 77th Field Artillery at Marfa, Texas, and began to experiment with fire direction techniques. During the previous experimental phase, Colonel Jones, while assigned to the Command and General Staff School at Fort Leavenworth, had followed the developments at Fort Sill closely. The first step Jones took was to make the battalion primarily responsible for the preparation of unobserved fires, leaving the conduct of observed fires to the batteries. To handle the new load, he added three officers (one computer for each battery in the battalion) to the five persons established in the battalion fire

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[62] Site is the difference in altitude between the firing piece(s) and the target.

[63] Back azimuth is the azimuth plus or minus 180 degrees or 3,200 mils.

[64] 1st End, Col E. B. Gjelsteen to Comdt, FA School, 15 Mar 44, and Memo, Dunn to Comdt, FA School, 21 Feb 44, FA School files; Ratliff, "Field Artillery Battalion Fire Direction Center," pp. 117–18; Sunderland, "Massed Fire and the FDC," p. 58.

[65] At the time an observed fire chart, usually a gridded sheet, was one on which the relative locations or batteries of a battalion and its targets were plotted data obtained as a result of firing.

[66] "The Fire Direction Center," pp. 4–5, FA School files; Sunderland, "Massed Fire and the FDC," p. 58; Annual Rpt, CofFA, FY 1933, p. 6, file 319.12, box 1331, Entry 37g, RG 407, NARA.

Graphical firing table and case designed for the M1 8-inch howitzer

direction center of 1934 and another officer to compute angles of site. In 1939, Jones went to Fort Sill to direct the Gunnery Department, where he found the school using methods unchanged since 1935. His goal was to use the techniques developed in Texas to open surprise massed fires within three minutes after any observer reported a target. Jones then proceeded to organize an experimental fire

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[67] The terms *vertical control* (a system of geographic points of known altitudes used in constructing maps and charts) and *horizontal control* (a system of geographic points of known positions on a horizontal plane used in constructing maps or charts) were not coined until 1940.

[68] 1st End, Maj Gen H. L. C. Jones, to Comdt, FA School, 23 Feb 44; 1st End, Gjelsteen to Comdt, FA School, 15 Mar 44; Ltr, Brig Gen W. D. Brown to Comdt, FA School, 24 Feb 44; and "The Fire Direction Center," p. 6. All in FA School files. See also Ratliff, "Field Artillery Battalion Fire Direction Center," pp. 118–19; Sunderland, "Massed Fire and the FDC," p. 59; idem, *History of the Field Artillery School,* pp. 210–11; G. D. Wahl, "Fire Direction Indoors," *Field Artillery Journal* (May-June 1938), pp. 210–15. Along with the graphical firing table, the development of the range deflection fan (now called range deflection protractor) was key in reducing the time required for computing unobserved fires.

direction team to prepare techniques that could be used throughout the entire Army. Using five personnel (vertical control operator, horizontal control operator,[67] and three computers to calculate data for laying and firing pieces), he tried to find a way to apply graphically the adjusted elevation to the measured range in order to reduce the amount of time required to perform computation. After several demonstrations in late November 1940, one of the computers, Capt. Abbot Burns, suggested the logarithmic plotting of scales, thereby inventing the graphical firing table. At this point, the basic concept of the battalion fire direction center, which would handle both observed and unobserved fires, was established.[68]

The development of a division artillery fire direction technique closely followed that of the battalion. In April 1941, General Marshall visited Fort Sill and was given a four-battalion "shoot" demonstration, fired from map data but not including the massing of fires based on observer adjustment. Marshall doubted the ability of the school to mass divisional artillery fires without a map, and the school devised a system to meet the challenge. The vertical control operator of the experimental fire direction team, Maj. Einar Gjelsteen, developed a method of concentrating battalion observed fire charts by having one gun in each battalion register on a division artillery checkpoint. This permitted the massing of division artillery fire by any observer, regardless of the chart's being based on survey adjustment. [69]

General Danford approved the new concept in 1941 after witnessing a demonstration in October of that year, and the new field artillery manuals describing the technique appeared the following year. The 1942 manuals showed the fire direction center comprising gunnery and communications personnel, along with their equipment, located at the battalion command post. Five soldiers served under the battalion S–3, with telephone and radio as the primary means of communication among the officer adjusting the fire, the battalion fire direction center, and the firing batteries. Visual signs, voice, or voice relay were alternate communication means.[70]

The main principles of the fire direction center had been established, although improvements and refinements were made later. In time, this new technique gave a superiority to American artillery by enabling commanders to control the fires of many battalions accurately and rapidly. Assisted by efficient networks of field telephones and radios, both of which were essential to the center's operations, field artillery had the "capability of applying overwhelming masses of firepower on targets, either instantaneously or in accordance with split-second time schedules. . . ."[71] Having the officers in the fire direction center control artillery fire rather than forward observers,

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[69] 1st End, Gjelsteen to Comdt, FA School, 15 Mar 44, FA School files; E. B. Gjelsteen, "Fire Direction Technique for Groupment and Division Artillery," *Field Artillery Journal*, March 1942, pp. 184–94; Ratliff, "Field Artillery Battalion Fire Direction Center," p. 119; Sunderland, "Massed Fire and the FDC," p. 59; Thomas H. Miles, "Notes on the Development of the Fire Direction Center," Fort Sill, 6 Nov 1972, copy in CMH files;

[70] 1st End, Gjelsteen to Comdt, FA School, 15 Mar 44, FA School files; FM 6–40, 1942, pp. 68–69, 288–91; "Fire Direction," *Field Artillery Journal*, May-June 1941, pp. 278–87.

[71] R. Ernest Dupuy and Trevor N. Dupuy, *Military Heritage of America* (New York: McGraw-Hill, 1956), p. 642.

as in the British army, resulted in a slower response but in decisions based on wider intelligence.[72]

Field artillery, despite problems in resources, had undergone dramatic changes during the interwar years—changes in armament, methods of transportation, employment, organization, and fire direction techniques—changes that became decisive factors in winning the next war.

[72] J[onathan] B. A. Bailey, *Field Artillery and Firepower* (Oxford, England: Military Press, 1989), p. 186*n*46.

CHAPTER 7

World War II

Developments during the interwar years had resulted in significant advances in field artillery weapons, communications, fire direction techniques, mobility, and organization. These advances complemented the reorganization of the large unwieldy square division of World War I into smaller harder-hitting units that proved so successful during World War II. For the U.S. Army, World War II marked the high point in the history of American field artillery, best characterized by rapid movement, timely and accurate target location, massing of fires, and flexibility of control.

Infantry Division Artillery

Although many of the crucial developments affecting field artillery had occurred during the interwar period, they had yet to be proven in a mobile war environment. Even before the United States had entered World War II, refinements in organizational structure and equipment continued in response to reports from the European front. In 1939, field artillery was still organized into regiments, despite extensive criticism that the regimental headquarters constituted "excessive overhead" and played "no real part in the control of artillery fire."[1] When the triangular division was reorganized in 1940, the field artillery regimental structure was at last abolished. At this time, the divisional field artillery brigade was reorganized to comprise a headquarters and headquarters battery, division artillery, and four battalions (three for direct support and one for general support), which replaced the three former regiments. With the demise of the regimental headquarters, the division artillery headquarters became solely a tactical command, making it necessary for the battalions to perform administrative as well as tactical functions. The new organization was more responsive in providing support to the maneuver units and complemented the triangular division concept of each regimental combat team having its own direct-support battalion.[2]

Another significant change that resulted from the reorganization of 1940 was the replacement the 75-mm. gun with the new 105-mm. howitzer in the division.

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[1] J. Lawton Collins, "Proposed Organization of the Infantry Division," p. 5, copy in CMH files.

[2] TO 6–10, 1 Aug 1939; TO 6–10, 1 Nov 1940; TO 6–80, 1 Oct 1940; Ltr, AG 320.2 (8–31–40) M (Ret) M–C, TAG to CG, All Corps/Corps Areas, 10 Sep 1940, sub: Reorganization of Triangular Divisions, copy in CMH files.

In January, the committee that had been planning the divisional reorganization prompted the Chief of Field Artillery, General Danford, to send questionnaires to each of the five triangular divisions, in part to determine the wartime production of the 75-mm. gun and the proper armament for the division artillery. About 75 percent of the officers answering the questionnaire wanted to eliminate the 75-mm. gun from the division, their most frequent suggestion being a mixture of 105- and 155-mm. howitzers. Their reasons for desiring the 105/155 combination were much the same as those advanced by the Field Artillery School in 1938. Both the staff and officers opined that the 105's small gain in mobility did not offset the sacrifice in firepower and that the 155 needed to be retained as a general-support weapon for increased firepower and for counterbattery fire.[3]

By May 1940, the Germans had taken over Norway, Belgium, and Holland. The Allies, both in Europe and elsewhere in the world, begged the United States to furnish weapons and supplies. When the president and Congress included the 75-mm. guns as surplus items that were available for distribution, the Army protested, declaring that if war were to come soon the 75-mm. gun was the only plentiful weapon available. But manufacturing more 75-mm. guns, weapons that had been in use over forty years, was not the answer. After maneuvers had been held in April and May, field artillery officers almost unanimously recommended removing the 75-mm. gun from the division artillery and substituting the 105-mm. howitzer. On 27 June, two days after Germany concluded an armistice with France, the General Staff G–3 made the decision to reorganize the division artillery with a headquarters and headquarters battery and four battalions—three for direct support with 105-mm. howitzers and one for general support with 155-mm. howitzers. The War Department issued the reorganization orders for nine triangular divisions on 10 September, and tables of organization were published in October. Although the divisions continued to use the 75-mm. gun until the 105-mm. howitzers became available (which did not occur on any large scale until 1943), the era of the 75-mm. gun in the division ended. As the principal light field artillery piece in the infantry division during the war, the 105-mm. howitzer provided a high rate of fire, a projectile more powerful than that of the 75-mm. gun, good mobility, and a trajectory sufficient to fire over personnel and tanks while in close support.[4]

The reorganization of 1940 greatly reduced the size of the division artillery. In comparison to the old square division (17,609 officers and men) and its field artillery brigade (aggregate strength of 4,363 with seventy-two weapons), the new triangular division had 14,811 officers and men and its artillery an aggregate strength of 2,685 with forty-eight howitzers. Its artillery battalions, with their more powerful weapons, were more maneuverable than the old regiments had been and were easier to control. The division commander could now organize three individual combat teams, each with an infantry regiment, a field artillery battalion, and other supporting elements. One regiment and its supporting units could assault and fix the enemy in position, one could maneuver around the fixed enemy in order to strike a decisive

[3] Janice E. McKenney, "More Bang for the Buck in the Interwar Army," *Military Affairs* 42 (April 1978): 80–86.

[4] Ibid.

blow, and the third could remain in reserve. Each infantry regiment still could rely on its direct-support artillery battalion.[5]

During the late 1930s, the power of the chiefs of the combat arms declined as the Chief of Staff became more convinced that the branch chiefs were the cause of much of the factionalism within the Army. In March 1942, during a massive reorganization of the War Department, these positions, including that of the Chief of Field Artillery, were eliminated. General Danford was the only one of the branch chiefs to place his objections in writing. He recounted the marked advances in the organization, weapons, tactics, and techniques of field artillery, all of which he attributed to the centralized direction and leadership of the branch chief. The Chief of Field Artillery had been responsible for all doctrinal matters pertaining to the branch, but these responsibilities now passed on to special branches within the newly created Army Ground Forces (AGF). Included in the transferred functions were the preparation of tables of organization and equipment. Lt. Gen. Lesley J. McNair, who had served with the test triangular division in the late 1930s, took command of the new organization.[6]

General McNair, like General Pershing before him, believed that the division should be kept lean and that, based on operational requirements, units and equipment could be drawn from pools maintained at the next higher level. By keeping organic elements of the division at a minimum, greater flexibility could be realized through the use of attached units as needed. In April 1942, a general revision of tables of organization occurred, reflecting some of General McNair's concepts. The division artillery was reduced by about 200 personnel, largely through the elimination of the antitank battery of 75-mm. guns in the 155-mm. howitzer battalion (*Table 13*). More success in streamlining the division artillery appeared in tables prepared in 1943 by the AGF Reduction Board established in 1942 to cut the existing tables because of shortages in shipping space. McNair pronounced the new tables "a monumental advance in de-fatting."[7] Most of the cuts were made in headquarters and maintenance personnel and did not adversely affect the actual weapons crews. For example, the firing batteries in the 105-mm. howitzer battalion were each reduced from 111 to 93, but each howitzer crew lost only one man. The greatest savings were accomplished by consolidating the headquarters battery and service battery of each battalion into a single unit and by eliminating the antitank and antiaircraft sections within the headquarters batteries. The primary armament of the division artillery remained the same—thirty-six 105-mm. howitzers and twelve 155-mm. howitzers. An increased number of .50-caliber machine guns and 2.36-inch rocket

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[5] Ltr, AG 320.2 (8-31-40) M (Ret) M–C, TAG to CG, All Corps/Corps Areas, 10 Sep 40, sub: Reorganization of Triangular Divisions, copy in CMH files; TO 70, 1 Oct 1940; TO 7, 1 Sep 1939; TO 6–80, 1 Oct 1940.

[6] WD Cir 59, 2 Mar 42; Frederick S. Hayden, "War Department Reorganization, August 1941–March 1942," pts. 1 and 2, *Military Affairs* 16 (Spring 1952): 12–29 and 16 (Fall 1952): 97–114; James E. Hewes, Jr., *From Root to McNamara* (Washington, D.C.: Center of Military History, United States Army, 1975), pp. 67–76, 78–82.

[7] As quoted in Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Organization of Ground Combat Troops* (Washington, D.C.: Historical Division, Department of the Army, 1947), p. 304.

Table 13—Aggregate Authorized Strength, Infantry Division Artillery, 1940–1945[a]

Unit	*1 Oct 1940*	*1 Aug 1942*	*15 Jul 1943*	*24 Jan 1945*
HHB, Division Artillery	148[b]	144[b]	114	114
105-mm. Howitzer Battalion (3)	584	576	509	497
HHB	142	165	132	126
Service Battery	82	78	77	74
Howitzer Battery (3)	120	111	100	99
Firing Section (4)	12	11	10	10
155-mm. Howitzer Battalion	785	607	519	506
HHB	142	158	115	112
Service Battery	95	89	77	76
Howitzer Battery (3)	134	120	109	106
Firing Section (4)	15	13	12	12
Antitank Battery	146			
Total Division Artillery	2,685[b]	2,479[b]	2,160	2,111
Total Infantry Division	14,811[b]	14,987[b]	13,688	13,469

[a]Except as noted, the figures do not include attached, medical, chaplain, or band personnel.
[b]Includes band(s).

launchers (bazookas) replaced the 37-mm. antitank guns. Personnel were cut from 2,479 to 1,949, a reduction of over 20 percent. To attain these savings, artillerymen were expected to perform basic tasks common to all branches (although each battalion did include a medical detachment in its table of organization). Artillerists operated their own telephones and radios, managed their own trucks and supply systems, engaged in rudimentary engineering functions, and provided first- and second-echelon maintenance for their weapons and vehicles without the aid of personnel from other branches.[8]

These severely reduced tables were short-lived, however, and the only units organized under them were the field artillery battalions serving with the Americal Division on Guadalcanal. Because of sharp reactions from the field against the reductions and because the number of divisions to be mobilized was lowered, the tables of organization published on 15 July 1943 were a compromise between the old ones and those of 1 March. The division artillery as a whole grew by 211 officers and men to 2,160, which was still 319 fewer than it had been in the 1942 tables. The service batteries were also restored to the battalions. Antiaircraft and antitank functions remained, for the most part, with the infantry, and the .50-caliber machine guns and bazookas from the March tables were retained.[9]

[8] Ibid., pp. 304–08; TO 6–10, 1 Apr 1942, and related tables.
[9] TO 6–10, 15 Jul 1943, and related tables.

L–4 from the 29th Infantry Division Artillery flying over a 105-mm. howitzer battery

A chief feature of the new division artillery was the addition of ten light slow-speed airplanes, two in each headquarters battery, for observation. The concept was tested in 1942, and aerial observers first saw action in the invasion of North Africa in November of that year. Except for minor reductions, the infantry division artillery remained essentially the same throughout the remainder of the war (*Table 14*).[10]

The functions of the division artillery batteries also remained essentially as they had in previous years. The headquarters batteries furnished communications, fire direction, survey, and administrative support. The headquarters batteries of both the 105-mm. and 155-mm. howitzer battalions each had an operations platoon and a communications platoon, the former having an operations and fire direction section and an instrument and survey section and the latter having wire and radio sections. Battalion personnel and battery maintenance sections, along with headquarters personnel, completed the headquarters batteries. The howitzer batteries each contained a headquarters, battery detail, a firing battery of four howitzer sections, a fifth (ammunition) section, and a maintenance platoon. The service batteries, each consisting of a headquarters, a service platoon (with supply and motor maintenance

[10] Memo, WDGCT 320.2 (2-5-42) for CG, AGF, 6 Jun 1942, sub: Organic Air Observation for Field Artillery, copy in Richard Tierney, *The Army Aviation Story* (Northport, Ala.: Colonial Press, 1963), pp. 68–69; TO 6–10, 15 Jul 1943, and related tables.

Table 14—Principal Artillery Equipment, Infantry Division, 1940–1945

	1 Oct 1940		*1 Aug 1942*		*15 Jul 1943*		*24 Jan 1945*	
Equipment	*Entire Div*	*Div Arty*	*Entire Div*	*Div Arty*	*Entire Div*	*Div Arty*	*Entire Div*	*Div Arty*
Airplanes, liaison					10	10	10	10
Antitank guns, 37-mm.	60	24	109	24				
Guns, 57-mm.					57		57	
Guns, 75-mm.	8	8						
Machine guns, .50-caliber (HB)	77	60	133	84	236	89	237	89
Howitzers, 75-mm.			18					
Howitzers, 105-mm.	36	36	42	36	54	36	54	36
Howitzers, 155-mm.	12	12	12	12	12	12	12	12
Rocket launchers, 2.36-inch					557	166	558	166

HB = heavy barrel

sections), an ammunition train (with a headquarters and three ammunition sections), and a battery maintenance section, furnished ammunition and other supplies and services not only to the firing and headquarters batteries but also to the battalion as a whole.[11]

In addition to the howitzers under the tactical control of the division artillery commander, the infantry division also had light field artillery weapons assigned to each infantry regiment. In 1920, a so-called howitzer company had been added to the infantry regiment anticipating that an accompanying howitzer would be developed for it. When initially organized, the company used Stokes mortars and one-pounder cannon. Because of shortages in personnel, the Regular Army howitzer companies were soon reduced to platoons, although the National Guard continued to support full companies. Various weapons were used in the interwar years—mortars, 37-mm. guns, and .50-caliber machine guns among others. Because no adequate accompanying howitzer was developed, the howitzer company was eliminated in the 1939 triangular reorganization and 37-mm. guns were placed in the new antitank company within each regiment. In the spring of 1942, the infantry was to receive its long-awaited accompanying howitzer with the addition of a cannon company to each regiment that was to be equipped with six 75-mm. howitzers and two 105-mm. howitzers, all self-propelled. But the AGF Reduction Board eliminated the cannon company in its revisions of early 1943. Restored in July, the company was now

[11] TOE 6–26, 15 Jul 1943; TOE 6–36, 15 Jul 1943; TOE 6–27, 15 Jul 1943; TOE 6–37, 15 Jul 1943; TOE 6–29, 15 Jul 1943; TOE 6–39, 15 Jul 1943.

authorized six 105-mm. towed howitzers. The M3 model howitzer was standard for the infantry cannon company during World War II, as it was for some of the airborne division artillery. This model differed slightly from the M2A1 model used in the infantry division artillery, and because it was twenty-seven inches shorter, artillerymen often called it the "snub-nosed" or "sawed-off" 105. The cannon company was not an unqualified success, primarily because of its lack of mobility and because in many situations it was tied in with the fire direction center of the supporting division artillery in mass fire missions. Most division commanders felt that many problems would have been solved by using self-propelled howitzers (as those in the armored division artillery) instead of towed ones.[12]

Other Division Artillery

The field artillery battalions organized for motorized, light, and mountain divisions were similar to those in the infantry division. The battalions authorized for the motorized division (deleted from the force structure in 1943) were the same as those authorized for the standard infantry division. The light division artillery organizations (for use in mountain, jungle, and amphibious operations) were each authorized a headquarters and headquarters detachment, three 75-mm. pack howitzer battalions, an antiaircraft artillery machine-gun battalion, and an antitank battery. Each howitzer battalion had a headquarters and service battery and three four-piece firing batteries, for an aggregate personnel strength of 469. The antiaircraft artillery battalion of 292 officers and enlisted men was armed with .50-caliber machine guns, and the antitank battery, with an authorized aggregate strength of 133, was equipped with an additional twelve pack howitzers and eight 2.36-inch bazookas. Eight airplanes for observation were also included in the light division's artillery. One division (the 89th) was authorized trucks instead of animals for the artillery, and the tables were adjusted accordingly. The organization of the light division was approved in the summer of 1943, but experience gained in maneuvers and in the Pacific proved that such forces had to be reinforced immediately and that they needed artillery heavier than the 75-mm. pack howitzer. Two of the three light divisions were reorganized as standard infantry divisions by 1944, while one remained in the force structure as a mountain division having a total strength of 13,459.[13]

The 1944 tables called for the mountain division artillery to be organized with an aggregate strength of 1,783 in a headquarters and headquarters battery and three 75-mm. pack howitzer battalions (twelve howitzers in each battalion). The antiaircraft artillery battalion was converted to an infantry antitank battalion, and

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[12] Mahon and Danysh, *Infantry*, pp. 53–54, 63–64, 66–67; General Board, USFET, "Organization, Equipment, and Tactical Employment of the Infantry Division," Study no. 15, pp. 5–6, copy in CMH files; Charles B. MacDonald, *The Siegfried Line Campaign* (Washington, D.C.: Office of the Chief of Military History, 1963), p. 621. For background on the idea of an accompanying gun, see Groteluesch en, *Doctrine Under Trial*, pp. 78–81, 128–29.

[13] TOE 72T, 21 Jan 1944, and related tables; TOE 72T (Truck), 21 Jan 1944, and related tables; Greenfield, Palmer, and Wiley, *Organization of Ground Combat Troops*, pp. 339–50; Robert C. Gildart, "Artillery on New Georgia, *Field Artillery Journal*, February 1944, pp. 88–89.

the antitank battery was deleted. For transport, the artillery was authorized 1,266 animals (209 horses and 1,057 pack mules). Animal transport often proved useful in the Italian campaigns.[14]

Initially an experimental division like the light and mountain units, the airborne division proved to be a more lasting organization. The 1942 airborne division had an aggregate authorized strength of 8,203, of which 1,424 were in the division artillery. The division artillery contained two glider battalions and one parachute battalion, each with twelve 75-mm. pack howitzers, and a headquarters and headquarters battery. The entire division fielded thirty-six howitzers in nine firing batteries. The headquarters and service functions were formed into a single headquarters, headquarters and service battery, and each parachute battalion included an antiaircraft and antitank battery.[15]

Experiences in combat influenced the War Department to increase the strength of the airborne division for sustained fighting. The size of the division grew to 12,979, while its artillery increased to 1,977, chiefly through the addition of another parachute field artillery battalion. The number of howitzers expanded from thirty-six to forty-eight (plus twelve spares), but few changes were made in the internal organization of the division artillery, except that the three four-piece batteries in the glider battalion were reorganized into two six-piece batteries. One of the glider units was authorized 105-mm. howitzers, based on the practice in Europe and the Pacific. The 11th Airborne Division in the Pacific organized both its glider battalions with 105-mm. howitzers instead of the 75-mm. pack howitzer.[16]

While the Army was reorganizing the infantry division under the triangular structure in 1940, armored force developments in Europe and German successes with tank warfare increased the Army's awareness that an effective armored force was needed. A few days after the fall of France, the War Department created the Armored Force, with Brig. Gen. Adna R. Chaffee, Jr., as its chief. At the heart of the force were the 1st and 2d Armored Divisions, each organized with a 75-mm. howitzer regiment within its armored brigade and a 105-mm. howitzer battalion in its support echelon. As in the infantry division, 105-mm. howitzers soon replaced the 75-mm. howitzers in the armored brigade's artillery regiment. A division artillery officer with a small staff was authorized in the division headquarters as an adviser and special staff officer,

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[14] TOE 70, 4 Nov 1944, and related tables. Because of problems in shipping, the animals used in Italy were purchased locally.

[15] TO 71, 15 Oct 1942, and related tables. The figures cited include bands, but not attached medical and chaplain personnel.

[16] TOE 71, 16 Dec 1944, and related tables; Ltr, AG 322 (30 Jun 45) OB–I–GNGCT–M, TAG to CinC, USAF, Pacific, 4 Jul 1945, sub: Reorganization and Redesignation of Certain Airborne Units, copy in 11th Abn Div fldr, CMH files; General Board, USFET, "Organization and Equipment of Field Artillery Units," Study no. 59, pp. 15–17, copy in CMH files (hereinafter cited as USFET Study no. 59). Except for the 11th, all inactivation orders for the airborne divisions show that all four field artillery battalions in each were organized with 75-mm. howitzers. The unit histories of the 82d and 101st Airborne Divisions, however, show that each had one 105-mm. howitzer battalion (320th and 907th Glider Field Artillery Battalions) in their divisions as early as the summer of 1944 (after Normandy and before Operation MARKET GARDEN).

Airborne troops loading a 75-mm. pack howitzer into a cargo glider during training

but he had no command function. The 105-mm. howitzer regiment in the armored brigade contained twenty-four howitzers (four batteries, each with six pieces), and the 105-mm. howitzer battalion in the support echelon contained twelve howitzers (three batteries, each with four pieces), thus giving the division as a whole thirty-six field artillery weapons. In addition to the howitzers, the antitank battery in the field artillery battalion was armed with eight 75-mm. guns.[17]

In practice, having the field artillery regiment under the armored brigade and the field artillery battalion under the division commander was not effective since it resulted in a divided command. The need for centralized control was severely felt in maneuvers conducted in 1941. The exercises also demonstrated that there would be times when three or four field artillery battalions would be needed, much the same as in the triangular infantry divisions. In addition, although the half-track prime movers worked reasonably well, artillerymen believed that an artillery piece on a self-propelled mount was desirable. In 1942, the Army thus reorganized the armored division, and the artillery was restructured into three self-contained battalions under the tactical command of an artillery section, still within the division headquarters. Each battalion had three six-howitzer firing batteries, making a total of fifty-four 105-mm. self-propelled howitzers in the

[17] TO 17, 15 Nov 1940, and related tables.

Self-propelled 105-mm. howitzer ("Priest")
from the 58th Armored Field Artillery Battalion

division. The M2A1 howitzer was the same as that used in the infantry division but was mounted on an M4 mount (105-mm. howitzer motor carriage M7), which the British nicknamed the "Priest" because of the pulpit-like appearance of its machine-gun compartment. As in the supporting field artillery battalion of the infantry division, the antitank battery was deleted.[18]

Around the same time the 1942 tables appeared, the Armored Force became a component of the Army Ground Forces. General McNair decided to postpone any reorganization (and reduction) of the armored division until after some combat experience had been gained. New tables were published in September 1943, and all but two of the armored divisions were reorganized; the 2d and 3d Armored Divisions remained under the 1942 (heavy) tables with modifications. Although the reorganization did little to change the basic structure of the armored division artillery (except to separate its headquarters from the division headquarters), personnel were cut about 25 percent through a severe reduction of headquarters and service batteries. Nevertheless, the division's firepower remained unchanged. Elimination of the tank and infantry regiments and the creation of self-contained tank and infantry battalions allowed the

[18] TO 17, 1 Mar 1942, and related tables; Lawrence Collins, "Armored Field Artillery in the Tennessee Maneuvers," *Field Artillery Journal*, September 1941, pp. 698–99; Edward H. Metzger, "Artillery Support of an Armored Division," ibid., November 1941, pp. 818–20; F. A. Doniat, "Field Artillery Organization Armored Force," ibid., March 1941, pp. 147–53.

artillery battalions to function with the tank and infantry battalions as combat teams, similar to the manner in which they operated in the triangularized infantry division. Also, as in the 1943 reorganization of the infantry division, two liaison airplanes for observation were authorized within each artillery headquarters battery, making a total of six airplanes in the armored division artillery. Except for minor modifications, the armored division continued under this organization for the remainder of the war (*Tables 15 and 16*).[19]

Each of the two heavy armored divisions (2d and 3d) normally had an additional armored field artillery battalion (105-mm. self-propelled howitzers) attached during combat operations. Medium artillery was added in varying amounts, but at least one battalion of howitzers or guns usually was attached during combat. Both divisions operated with three combat commands—A, B, and R (Reserve). Although improvised, the Combat Command R was actually a third fighting combat unit and was used in the same manner as Combat Commands A and B. Each combat command normally consisted of two tank battalions, one organic armored infantry battalion, one infantry battalion (whenever an infantry regiment was attached to the division), and tank destroyer, engineer, and antiaircraft artillery elements. Usually two combat commands were committed to action and the third held in reserve. An armored field artillery battalion normally directly supported each of the two forward commands, while the medium artillery battalion was used for general support. The remaining armored divisions also operated with three combat commands, and most commanders used the reserve command as a third fighting combat command. As in the heavy armored divisions, combat commands of light armored divisions usually operated with two task forces, one consisting of a tank battalion (less one medium tank company), an armored infantry company, and tank destroyer and engineer platoons. The other task force usually consisted of an armored infantry battalion (less one rifle company), one medium tank company, and tank destroyer and engineer platoons. Armored artillery was either attached to or in direct support of each combat command.[20]

A major exception to the standardization of divisions was the 1st Cavalry Division. The 1st remained a square division, organized as infantry, but its artillery was authorized a structure similar to that of the triangularized infantry division. In 1940, it had one field artillery regiment of two battalions, armed with horse-drawn 75-mm. pack howitzers. In 1941, the regiment was broken up into two separate self-contained battalions, and another battalion of truck-drawn 105-mm. howitzers was authorized. The division artillery then consisted of the three battalions plus a headquarters and headquarters battery. Because horses and their forage required so much shipping space and because the animals were difficult to keep fit for service, no plans were made to ship any horses with the cavalry units. Just before deploying to Australia, the two horse-drawn artillery battalions traded in their horses for jeeps. The division still had

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[19] TOE 17, 15 Sep 1943, and related tables. Two more airplanes were authorized in the division headquarters company.

[20] General Board, USFET, "Organization, Equipment, and Tactical Employment of the Armored Division," Study no. 48, pp. 7–8, copy in CMH files.

Table 15—Aggregate Authorized Strength, Armored Division Artillery, 1940–1945[a]

Unit	*15 Nov 1940*	*1 Mar 1942*	*15 Sep 1943*	*12 Feb 1944*	*24 Jan 1945*
HQ Element	8[c]	34[c]	21	99	95
105-mm. Howitzer Bn (3)	839	709	534	534	510
HHB	142	173	111	111	106
Service Battery	109	152	93	93	89
Howitzer Battery (3)[d]	145	128	110	110	105
Firing Section (6)[e]	12–18	10	7	7	7
Antitank Battery	153				
105-mm. Howitzer Regt	1,054[b]				
HHB	195[b]				
Service Battery	81				
Ammunition Train	114				
Howitzer Battery (4)	166				
Firing Section (6)	12–19				
Total Div Artillery	1,901	2,161	1,623	1,701	1,625
Total Armd Division	12,308[b]	14,192	10,610	10,998	10,670

[a]Except as noted, these figures do not include attached medical, chaplain, or band personnel.

[b]Includes band.

[c]Artillery personnel within headquarters, armored division.

[d]Only one 105-mm. howitzer battalion in 1940. Remainder of field artillery was in the 105-mm. howitzer regiment of the armored brigade.

[e]Only four firing sections in 1940.

one 75-mm. howitzer battalion directly supporting each cavalry brigade (two cavalry regiments) and one 105-mm. howitzer battalion for general support.

Because excess personnel were available in Australia and because additional artillery was needed, another 105-mm. howitzer battalion was organized for the division in October 1943. Campaigns in the Admiralty Islands showed that the 75-mm. howitzers were too light and that heavier general-support artillery was critical. With only four battalions to support four cavalry regiments, the division was hard-pressed to find enough artillery without withdrawing some of the direct-support artillery. The division requested the Sixth Army to reorganize all four field artillery battalions as 105-mm. howitzer units and to provide a 155-mm. howitzer battalion for general support. In October 1944, three days before loading for the Leyte operation, one 75-mm. howitzer battalion was reorganized with 105-mm. howitzers; the other received its 105-mm. howitzers toward the end of the Luzon campaign. By the end of the war,

Table 16—Principal Artillery Equipment, Armored Division, 1940–1945

Equipment	15 Nov 1940			1 Mar 1942		15 Sep 1943		24 Jan 1945	
	Entire Div	105 How Regt	105 How Bn	Entire Div	Div Arty	Entire Div	Div Arty	Entire Div	Div Arty
Airplanes, liaison						8	6	8	8
Antitank guns				194	30				
Assault guns				42					
Guns, 37-mm.	30	8	6						
Guns, 57-mm.						30		30	
Guns, 75-mm.	8								
Howitzers, 75-mm.						17		17	
Howitzers, 105-mm.	36	24	12	54	54	54	54	54	54
Machine guns, .50 caliber (HB)	233	23	15	103	24	404	78	382	80
Rocket launchers 2.36-inch						607	120	609	126
Tanks, light	273			158		77		77	
Tanks, medium	108			232		168		168	
Tanks, 105-mm.						18		27	

HB = heavy barrel

all four battalions were tractor-drawn. Several times during the Leyte campaign, the 947th Field Artillery Battalion, a 155-mm. howitzer unit, was attached to the division for specific operations. During the Luzon campaign, the battalion accompanied the division and remained attached to it throughout the fighting there.[21]

Nondivisional Field Artillery

Because of the desire for mobility and maneuverability and because of the belief that the newly developing Army Air Corps would provide much of the support formerly furnished by the field artillery, the War Department did not place a very high priority on heavy artillery. In September 1942, the AGF recommended one hundred one battalions of heavy artillery (155-mm. and 8-inch guns and 240-mm. howitzers) and one hundred forty battalions of medium artillery (155-mm. howitzers and 4.5-inch guns) to be organized in addition to the division artillery units, but the following year, the War Department drastically reduced this number

[21] Bertram C. Wright, *The 1st Cavalry Division in World War II* (Tokyo: Toppan Printing Co., 1947), pp. 199–202; unit histories for 1st Cav Div, 1st Cav Div Arty, 82d FA, 62d Armd FA Bn, and 61st, 99th, and 271st FA Bns, CMH files.

to fifty-four heavy and eighty-one medium battalions. The low number of authorized battalions made impossible the planning figure of 3.93 nondivisional field artillery battalions for each division as devised by the AGF. At no time during the war did the nondivisional field artillery battalions ever exceed the ratio of 2.89 battalions per division. From one hundred forty-two nondivisional field artillery battalions (thirty-two heavy, fifty-three medium, and fifty-seven light) active on 31 December 1942, the number expanded to three hundred twenty-six by 31 March 1945, of which one hundred thirty-seven were heavy, one hundred thirteen medium, and seventy-six light. The AGF had proposed considerable increases in heavy and medium artillery that the War Department did not accept in 1942. After combat experiences in Italy (especially Cassino in early 1944) proved that air support could not altogether replace heavy artillery, the department authorized more heavy and medium artillery than the AGF had originally requested.[22]

The medium and heavy battalions were organized along lines similar to the division artillery battalions. Each had a headquarters and headquarters battery, a service battery, and three firing batteries. Each battalion was authorized two liaison airplanes for observation. With the exception of those in the 8-inch gun and 240-mm. howitzer battalions, each firing battery had four field artillery weapons, giving the battalion a total of twelve guns or howitzers. The 240-mm. howitzer and 8-inch gun battalions all had three firing batteries each, but the batteries had only two guns or howitzers each, for a total of six howitzers or guns in each battalion (*Table 17*).[23]

Nondivisional medium artillery usually served with divisions and corps in reinforcing and general-support missions. The 155-mm. howitzers were the same as those used in the division artillery, while the 4.5-inch field gun, capable of firing a 55-pound projectile over 11 miles (17.7 kilometers), was based on the British gun of the same caliber. Almost all artillerymen agreed that the howitzer was a splendid weapon suitable for its tasks, but few considered the 4.5-inch gun of much value except in long-range harassing missions.[24]

In the heavy artillery category, the 155-mm. gun ("Long Tom") was used for interdiction and counterbattery fire in the same manner as the 155-mm. howitzer, the gun permitting the attack of targets beyond the howitzer's range. The weapon was also used for missions requiring greater velocity than the howitzers were capable of producing. Caterpillar tractors eventually replaced trucks as prime movers of all heavy artillery weapons. A self-propelled version of the 155-mm. gun was

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[22] Greenfield, Palmer, and Wiley, *Organization of Ground Combat Troops*, pp. 177–78, 211, 232–35; Russell A. Weathersby, "The Field Artillery Group in Support of the Corps and Field Army, 1942–1953" (thesis, U.S. Army Command and General Staff School, 1965), pp. 10–11.

[23] TOE 6–35, 15 Jul 1943, w/changes through 12 Sep 1944; TOE 6–335, 27 Sep 1944; TOE 6–355, 31 Jul 1943, w/changes through 26 Aug 1944; TOE 6–125, 24 Apr 1943, w/changes through 7 Aug 1944; TOE 6–65, 20 Oct 1944; TOE 6–365, 2 Jul 1943, w/changes through 26 Aug 1944; TOE 6–395, 18 Aug 1943, w/changes through 26 Aug 1944; TOE 6–155, 4 May 1943, w/changes through 7 Aug 1944; TOE 6–215, 16 Dec 1944; TOE 6–25, 27 Sep 1944.

[24] TM 9–2300, *Standard Artillery and Fire Control Materiel*, 7 Feb 1944, pp. 54–75; USFET Study no. 59, p. 20, copy in CMH files; General Board, USFET, "Field Artillery Materiel," Study no. 67, p. 3, copy in CMH files (hereinafter cited as USFET Study no. 67).

Table 17—Nondivisional Cannon Battalion Organization, 1944

Battalion Type	*Aggregate Battalion Strength*[a]	*Gun/Howitzer Section Strength*[a]	*Weapons per Battery*	*Weapons per Battalion*
75-mm. pack howitzer, mountain	456	19	4	12
75-mm. howitzer, parachute	577	12	4[b]	12[b]
105-mm. howitzer, truck	482	10	4	12
105-mm. howitzer, tractor	478	10	4	12
105-mm. howitzer, self-propelled	520	7	6	18
155-mm. howitzer, truck	495	12	4	12
155-mm. howitzer, tractor	503	12	4	12
4.5-inch gun, truck	495	12	4	12
4.5-inch gun, tractor	503	12	4	12
155-mm. gun, truck	521	16	4	12
155-mm. gun, tractor	529	16	4	12
155-mm. gun, self-propelled	476	12	4	12
8-inch howitzer, truck	548	18	4	12
8-inch howitzer, tractor	556	18	4	12
8-inch gun, tractor	475	24	2	6
240-mm. howitzer, tractor	475	24	2	6

[a]Strength figures do not include attached medical personnel.

[b]The battery had two spares, and the battalion had six spares.

used effectively in support of armor. The 8-inch howitzer, slightly heavier than the 155-mm. gun, fired a heavier projectile at a shorter range. Considered by some to be one of the most accurate field artillery weapons in the inventory, its destructive and concussive effect was significant. The weapon was used effectively in operations against cities, heavy fortifications, communications lines, gun emplacements, and bridges behind enemy lines. The 8-inch gun was primarily used for long-range destruction of enemy communications lines and fortifications, but care had to be exercised in selecting targets because of its inaccuracy at long ranges. The 240-mm. howitzer, which fired the heaviest projectile then available, was used for all types of missions except close support.[25]

The light nondivisional artillery battalions were organized under the same tables as their counterparts in the division artillery with minor differences. For example, nondivisional units were not authorized forward observer sections, which had been added to the divisional units in 1944 in response to numerous requests from field commanders for increased liaison and coordination between the divisional field artillery units and their supported infantry.[26]

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[25] USFET Study no. 67, p. 3, and Study no. 59, pp. 20–21, copies in CMH files; TM 9–2300, pp. 54–75.

[26] "Historical Record of the Field Artillery Section (US) AFHQ, 3 August 1943–17 May 1945," copy in FA School files.

155-mm. gun ("Long Tom") during the battle for Leyte Gulf in October 1944

An additional source of nondivisional field artillery came from the armor. The American answer to the urgent need for a weapon to stop the German tank was a high-velocity gun (3-inch, 76-mm., or 90-mm.), either towed or self-propelled, called a *tank destroyer*. Having an authorized strength in 1944 of almost 800 men, the tank destroyer battalion was intended as a direct-support weapon to knock out enemy tanks. Nevertheless, the battalions were frequently employed in a general-support artillery role. Although use of the tank destroyers as general-support artillery was not stated as a secondary role in the field manual, artillerymen assigned to tank destroyer units realized that no commander would allow a battalion of thirty-six artillery-type weapons to remain in reserve. When using indirect fire, individual officers first devised crude methods of laying the guns, which were equipped with direct-laying sights. Units tested the techniques and improved upon them, and finally panoramic sights were added to some tank destroyers. Eventually, the azimuth indicator method of laying the self-propelled gun was adopted, while the towed weapons were equipped with panoramic sights. In the spring of 1943, the Tank

Destroyer Training Center at Camp Hood, Texas**,** conducted indirect fire tests, and a demonstration of indirect fire was included in the curriculum of the school. The field manual was changed that year to include indirect fire as a secondary mission.

Actual employment of tank destroyer units varied in Europe according to the degree of proficiency attained by the individual unit. Initially, it was customary for a tank destroyer company to be attached to a field artillery battalion. The field artillery provided the target area survey, and the tank destroyer unit executed the position area survey. Until the artillery was satisfied that the tank destroyers could deliver fire accurately, an officer was usually sent to the tank destroyer fire direction center to assist and supervise. The range and flat trajectory of the tank destroyer guns made their employment as corps artillery more suitable than as division artillery. Tank destroyers played an indirect fire role as general-support artillery several times during the war, one of their more notable successes occurring during the Roer River crossing in western Germany by the XIX Corps in February 1945. Tanks, too, sometimes functioned as auxiliary artillery when the need arose.[27]

240-mm. howitzer from Battery B, 697th Field Artillery Battalion, preparing to fire during the Italian campaign in 1944

The development of rockets led to the organization of another type of artillery battalion for the field army. The 4.5-inch rockets, originally produced for use on aircraft, were tested as artillery in the Pacific in 1943 and in Europe a year later. Artillerymen in the Pacific rejected them, but when the First Army reorganized a 105-mm. howitzer battalion with the 4.5-inch rockets in November 1944 and employed them a few times in the Hürtgen Forest, First Army commander Lt. Gen. Courtney H. Hodges reported "excellent results."[28] Artillerymen, however, disliked

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[27] Mary Lee Stubbs and Stanley Russell Connor, *Armor-Cavalry* (Washington, D.C.: Office of the Chief of Military History, United States Army, 1969), pp. 66–69; General Board, USFET, "Organization, Equipment, and Tactical Employment of Tank Destroyer Units," Study no. 60, pp. 23–24, copy in CMH files; Ernest C. Hatfield, "Utilizing Tank Destroyers as Artillery," *Field Artillery Journal*, August 1945, pp. 495–97; Paul B. Bell, "Tank Destroyers in the Roer River Crossing," ibid., pp. 497–98. See also FM 18–5, 15 Jul 1944**.**

[28] As quoted in Lida Mayo, *The Ordnance Department* (Washington, D.C.: Office of the Chief of Military History, United States Army, 1968), pp. 333–34.

A tank destroyer, painted white to blend with the snow-covered terrain of a Luxembourg field

the rocket's inaccuracies and the smoke and flash that gave away its position. A shortage in artillery ammunition, however, spurred increased use of rockets. A tank battalion in the Third Army also employed the rockets briefly and reported that the morale effect was good.[29]

In 1944, a table of organization and equipment (TOE) for the rocket battalion was developed, authorizing the unit thirty-six multiple rocket launchers in three batteries (twelve per battery). Each battery had three rocket platoons, and each platoon four rocket sections. This organization was later changed to two rocket platoons, each platoon having six rocket sections. The tables authorized the battalion to be truck-drawn. In practice, rocket field artillery battalions were to be used as War Department reserve units and attached to an army or task force as necessary. Rockets were most effective in attacking area targets, relieving the artillery of massing battalions.

[29] Ibid., pp. 333–34, 361. The 18th Field Artillery Battalion and the 702d Tank Destroyer Battalion both employed 4.5-inch rockets in Europe. These two units are not included in the six battalions cited as being organized as 4.5-inch rocket battalions in the following paragraph. See also USFET Study no. 67, p. 4, copy in CMH files.

Firing 4.5-inch rockets in the Hürtgen Forest in late 1944

Because of large probable errors, rockets could not be used on pinpoint targets or in close support of ground troops. Of the six battalions organized under the TOEs during the war, only two served overseas but neither saw combat.[30]

When the Army adopted the triangular division, it eliminated the fixed field artillery brigade with its organic elements. The new arrangement of four self-contained battalions proved more responsive in providing artillery support to the division's maneuver elements. Corps artillery, however, retained the fixed brigade organization. The corps artillery brigade in 1940 consisted of a headquarters and headquarters battery, two 155-mm. howitzer regiments, one 155-mm. gun regiment, and an observation battalion. The number of field artillery weapons in the brigade was seventy-two.[31] No action to correct the deficiencies of the fixed organization occurred until 1942, when General McNair reviewed the structure of the nondivisional units and recommended that artillery be organized into self-contained battalions that could be allocated to an army and then further attached to corps as necessary. The corps could then vary the number and types of units attached to the divisions to meet the requirements of the situation. The units were also to be capable of being combined into task forces to carry out specific missions.[32]

In place of the regiment, McNair recommended the artillery group—a tactical headquarters with limited administrative capabilities and a variable number of administratively self-contained attached battalions. This concept had already been used to a certain degree in the organization of nondivisional armor units. Artillery officers also had previously advocated grouping two or more batteries, battalions, or regiments to perform a common mission. Temporary grouping of units for counterbattery fire, long-range fire, or reinforcement of division artillery had been routine.

In December 1942, the War Department authorized the separate battalion arrangement for nondivisional field artillery units and a group headquarters and headquarters battery for every three to four battalions. The fixed field artillery brigade disappeared, and the new brigade (only a headquarters and headquarters battery) was authorized for the control of three to four groups. Except for a few brigades of heavy artillery at the field army level, however, field artillery brigades were seldom seen. Groups instead were usually attached directly to the headquarters and headquarters battery of the corps artillery, as it was not generally considered necessary for an army to maintain tactical control of field artillery units. The principal missions of nondivisional artillery were the neutralization or destruction of hostile artillery (counterbattery fire), destruction of hostile defenses, long-range interdiction fire, and reinforcement

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[30] TOE 6–85, 30 Nov 1944; "The Rocket Field Artillery Battalion," *Field Artillery Journal*, September 1945, pp. 515–22. The 421st Rocket Field Artillery Battalion was present during the Ryukyus campaign in the Pacific, but the 422d Rocket Field Artillery Battalion arrived in the Philippines too late to participate in combat. The other four battalions never left the United States. See Cmte on New Developments, Question 1, Artillery Conference, 18–29 March 1946, pp. 1–9, copy in FA School files.

[31] TO 6–50, 1 Nov 1940, and related tables. The number of seventy-two weapons for the corps field artillery brigade does not include 75-mm. guns and 37-mm. guns used for antitank defense.

[32] The best analysis of the organization of nondivisional field artillery is contained in Weathersby, "Field Artillery Group," thesis.

of division artillery fires. Instead of the fixed corps brigade, the new headquarters, corps artillery, commanded by a brigadier general, had only a headquarters battery and an observation battalion assigned to it. Flexible groups with varying numbers of battalions were attached as needed (*Tables 18 and 19*).[33]

The transition from regiments to groups was slow because considerable time was required to structure the battalions into administratively self-sufficient units and because the reorganization of units already in combat was difficult. Except for the units in combat, however, the reorganization was accomplished in 1943, and the first TOE for the group headquarters and headquarters battery appeared in April of that year. The TOE authorized the unit eleven officers and seventy-eight enlisted men, provided the bare essentials for exercising tactical control of its attached battalions, and gave the group two liaison airplanes for observation. The TOE for the headquarters and headquarters battery, field artillery brigade, authorizing it an aggregate strength of 103 in 1944, was similar to that of the group. The groups and brigades were not originally designed to function administratively, but combat experience showed the necessity of their doing so, and they were later augmented by supply and administrative personnel.[34]

Because the War Department delayed implementation of the group organization for those units already in combat, the new field artillery groups that deployed from the United States to North Africa fought alongside the fixed brigades already serving there. The divisions had already been streamlined under the triangular structure, and any additional support had to come from corps level. Because the corps artillery in the theater was limited in flexibility under the fixed brigade structure, the new groups and their battalions were used almost exclusively as a pool from which the divisions drew additional field artillery support. When the battle area shifted to Italy, the use of the field artillery group changed little. Its capabilities were not fully met or tested even though it was performing its limited functions well. The fixed field artillery brigade continued to function as corps artillery, but all newly arriving nondivisional field artillery units were organized under the new concept. By March 1944, all the regiments of the fixed corps artillery brigade in Italy were reorganized under the new system. Although the reorganization provided a uniform structure for the artillery for the first time in combat, in actuality, the intent of greater flexibility was not immediately realized.[35]

By the time the nondivisional field artillery units were fighting in western Europe, their organization was standardized and their role more defined. One reason for the field artillery group's success was that, unlike its earlier service in North Africa and Italy, the units had ample time to train together. The centralized employment of nondivisional artillery gave way to decentralization, although in some instances

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[33] Ibid., pp. 7–10, 62; Greenfield, Palmer, and Wiley, *Organization of Ground Combat Troops*, pp. 351–59, 362, 374–82; WD Cir 256, 16 Oct 1943; John J. Burns, "The Employment of Corps Artillery," pts. 1 and 2, *Field Artillery Journal*, March 1943, pp. 208–11, and April 1943, pp. 283–90. See also General Board, USFET, "The Field Artillery Group," Study no. 65, and "Field Artillery Operations," Study no. 61, copies in CMH files (hereinafter cited as USFET Study no. 65).

[34] Weathersby, "Field Artillery Group," thesis, p. 10; TOE 6–12, 16 Jun 1943, w/changes through 16 Sep 1944; TOE 6–12, 20 Oct 1944, w/changes through 11 Aug 1945; TOE 6–20–1, 10 Jan 1944, w/changes through 7 Aug 1944. Authorizations do not include medical personnel.

[35] Weathersby, "Field Artillery Group," thesis, pp. 30, 47–50, 57–62.

Table 18—Third Army Field Artillery Organization, 1 October 1942

Non-Corps	*IV Corps*	*VIII Corps*	*X Corps*
1 FA Brigade, with	1 FA Brigade, with	1 FA Brigade, with	1 FA Brigade, with
1 155-mm. Gun Regt	1 155-mm. Gun Regt	1 155-mm. Gun Regt	1 155-mm. Gun Regt
2 155-mm. How Regts	2 155-mm. Gun Regts	2 155-mm. How Regts	2 155-mm. How Regts
	1 Observation Bn	1 Observation Bn	
1 155-mm. How Regt			
1 105-mm. How Regt			
4 105-mm. How Bns			

Table 19—Third Army Field Artillery Organization, 10 November 1943

Non-Corps	*VIII Corps*	*IX Corps*	*X Corps*	*XVIII Corps*	*XIX Corps*
1 HHB, FA Gp	1 HHB, Corps Arty	1 HHB, Corps Arty	1 HHB, Corps Arty	1 HHB, Corps Arty	1 HHB, Corps Arty
2 155-mm. How Bns	1 Observation Bn	1 Observation Bn	1 Observation Bn	1 Observation Bn	1 Observation Bn
		2 HHB, FA Gps	4 HHB, FA Gps	2 HHB, FA Gps	4 HHB, FA Gps
		4 155-mm. Gun Bns	4 155-mm. Gun Bns	2 155-mm. Gun Bn s	2 155-mm. Gun Bns
		1 155-mm. How Bns	8 155-mm. How Bns	2 155-mm. How Bns	4 155-mm. How Bns
		5 105-mm. How Bns	2 105-mm. How Bns	4 4.5-inch Gun Bns	

the former was preferred. Such flexibility would not have been possible under the old fixed corps artillery brigade structure. For example, in July 1944, when the First Army launched an attack to break out of Normandy, the VIII Corps Artillery was centralized in order to act as a "direct pressure force" in the early phases of the corps effort. But on 1 August, the four groups of the VIII Corps Artillery were decentralized by attaching them to divisions in order to render the divisions the most effective support.[36]

The group headquarters was the organization that provided the corps artillery commander the capability of employing his resources in the most effective and flexible manner. It could perform as a second corps artillery fire direction center, as a control headquarters for field artillery attached or in direct support of a task force, as a subordinate tactical headquarters of the corps in controlling battalions with similar missions, and as a tactical headquarters to assist the division artillery headquarters when several nondivisional artillery battalions were attached to the division. The group's flexibility, both in tactics and in organization, enabled the artillery commander to meet his requirements.[37]

One defect in the group structure was the lack of continuity of command. Mindful of the problem, the War Department in 1944 issued Circular 439, advocating that battalions serve with specific groups, if feasible, to enhance the continuity of command and to improve morale; however, by the time the circular reached the theaters, the commanders had become too accustomed to enjoying the group's flexibility and in most instances opted not to make any substantive changes in their routine.[38]

The group organizational concept had limited use in the Pacific, where divisions played a more important role than corps. As a whole, the nature of jungle warfare, the limited size of island operations, and the policy of defeating Germany first restricted employment of field artillery there. Army nondivisional field artillery units within the Pacific area were almost nonexistent until 1944. When the 32d Infantry Division participated in the Buna operation on New Guinea, the division artillery remained in Australia on the premise that artillery other than pack howitzers could not be used and that Buna could be taken without field artillery support by using air support and infantry mortars. The assumption was an error, and support had to be obtained by borrowing artillery from the Australian 7th Division. Although nondivisional Army field artillery units were not used on Guadalcanal, the XIV Corps Artillery commander coordinated the artillery battalions of the Americal, 25th Infantry, and 2d Marine Divisions to maximize field artillery support. From this point on, field artillery played a more important role in the Pacific. While the groups were few in number, they contributed significantly to the effective support of the maneuver units. In the campaign on Okinawa in 1945, the employment of nondivisional artillery was widespread because of the large number of such units available on a fairly large battle area with strongly organized defenses and because of the growing awareness of the value of artillery

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[36] Ibid., pp. 69–72 (quoted words, p. 70). See also Bailey, *Field Artillery and Firepower*, pp. 312–13, 324.

[37] Weathersby, "Field Artillery Group," thesis, pp. 85–86.

[38] Ibid., pp. 91–92; WD Cir 439, 14 Nov 1944; USFET Study no. 65, pp. 17–19, copy in CMH files.

support. In the battle for Manila the same year, primarily Army field artillery, tanks, and tank destroyers cleared the city.[39]

Triangularization of the divisions had led to the use of task-organized formations for flexibility, and this concept was subsequently extended to nondivisional units. By the end of the war, task forces or regimental combat teams (RCT), whereby combat and support units were grouped temporarily around an infantry unit to perform a particular mission, were employed more and more. A typical one might include an infantry regiment, a 105-mm. howitzer battalion, a combat engineer company, a medical collecting company, and a signal detachment. Other units could be attached or detached as necessary. The flexible nature of the RCT in adapting to terrain and combat conditions made it particularly useful, and the grouping could be discontinued when the mission was over.[40]

On the Battlefield

Advancements made during World War II in target location played an important role in the success of field artillery employment. Methods for locating targets included sound and flash ranging; ground and aerial observation; photo interpretation; prisoner of war, military intelligence, and "shell rep" (report on enemy shells fired on Allied positions) analyses; radar sightings; and other intelligence means. Except for radar, all had been used in World War I.

The tables of organization authorized the field artillery observation battalion in the corps artillery two sound and flash batteries in addition to its headquarters and headquarters battery.[41] In September 1944, the War Department authorized additional observation battalions at the army level in Europe, where they were normally deployed by battery to support divisions. Of the twenty-six observation battalions active on 30 June 1945, nineteen were in Europe, four in the United States, and three in the Pacific. When a corps operated as a unit, the observation battalion was to maintain centralized control of its batteries. When the divisions in the corps acted independently, the observation batteries were to be detached from the corps to support the divisions. Additional support in 1944 in Europe came from the field army observation battalions. More success was achieved with centralized control in stabilized conditions than with decentralized control during periods of rapid movement. The observation battalions were supposed to provide their own position and target area survey and to tie into a general control survey net provided by topographical engineers. Artillery survey requirements were underestimated, however, and the observation battalions had to improvise to achieve higher order survey control in the field. After the war,

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[39] Weathersby, "Field Artillery Group," thesis, pp. 93–96, 112–33; Bernard S. Waterman, "The Battle of Okinawa, An Artillery Angle," *Field Artillery Journal*, September 1945, pp. 523–28; Robert Ross Smith, *Triumph in the Philippines* (Washington, D.C.: Office of the Chief of Military History, 1963), p. 291. Approximately 75 percent of the field artillery groups served in Europe; the rest were more or less evenly divided between the United States and the Pacific. Only one field artillery brigade went to the Pacific, and it was disbanded in Australia in 1943. In Europe, 53 percent of the field artillery battalions were divisional and 47 percent nondivisional. In the Pacific, 73 percent were divisional and 23 percent nondivisional.

[40] Mahon and Danysh, *Infantry*, p. 67.

[41] TO 6–75, 1 Nov 1940; TOE 6–75, 9 Mar 1944.

15th Field Artillery Observation Battalion soldiers operating sound-ranging equipment in Italy in March 1945

the tables added separate survey platoons to each battery. In the latter stages of the war in Europe, some antiaircraft radars were made available to observation units. The radars were used for obtaining better weather data and for battlefield surveillance at night.[42] Flash ranging was only about one-tenth as successful as sound ranging in Europe because of adverse terrain and weather conditions and inadequate flash-ranging equipment. Observation battalion commanders reported that German use of flashless powder neutralized the value of flash ranging and that the Germans used flares as camouflage for their artillery. Civilian experts also considered the Army's sound-ranging equipment about ten years behind commercial equipment used by oil companies, and newer sets were developed during the war. Sound ranging, however, was often the best source for counterbattery intelligence, and target locations by sound were invaluable in confirming locations determined by other means.[43]

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[42] General Board, USFET, "The Field Artillery Observation Battalion," Study no. 62, pp. 2–4, 15, copy in CMH files (hereinafter cited as USFET Study no. 62); Hercz, "History and Development of Field Artillery Target Acquisition," pp. 15–20. In addition to the twenty-six observation battalions, there were five separate sound-ranging platoons.

[43] USFET Study no. 62, pp. 8–9, copy in CMH files; General Board, USFET, "Field Artillery Gunnery," Study no. 64, p. 8, copy in CMH files (hereinafter cited as USFET Study no. 64); D. S. Somerville, "Corps and Non-Divisional Artillery," *Field Artillery Journal*, September 1944, pp. 622–23.

Ground observers included forward observers, those in the observation battalions, and those in teams manning surveyed observation posts. In Europe, most targets were located by map coordinates, and forward observers adjusted the majority of the artillery fire missions. Men in static observation posts conducted only a limited number of fire missions because many of the observers had insufficient training and little experience in the conduct of observed fires.[44]

Artillery commanders were insistent that the number of forward observers not be less than one per tank or rifle company, including those in reserve, about forty per division. Maintaining enough forward observers was a difficult problem. When they were furnished on the basis of one per infantry or tank company, the direct-support artillery battalion sometimes found it necessary to send as many as twelve observers. But forward observer sections were not included in the infantry division TOEs until after the Normandy invasion (three forward observers in each direct-support battalion). The Army had authorized them for some time in the armored division, although not in the quantity needed, and other personnel in the artillery battalions had to perform the function. In addition to the forward observer himself, an officer, the tables authorized each forward observer section one wireman and one radioman for communications. Two forward observer sections were needed per battery, but the tables only authorized three per battalion.[45] The medium battalions needed between four and six forward observers, but were only authorized one per battalion.[46] Some units maintained a forward observer pool, made up of the younger battalion officers and run by roster to ensure coverage. The physical strain on these officers was great because their casualties were high.[47] Most battlefield promotions in field artillery units serving in Europe were awarded to enlisted men serving as forward observers.[48] It was reported that personnel using forward observation methods, usually by map coordinates, adjusted up to 95 percent of observed fires during the war.[49]

A key link between the forward observer sections and fire-support resources was the liaison officer. Each direct-support battalion maintained one liaison officer with each battalion in its supported infantry regiment. The liaison officer's primary functions were to plan fires in support of infantry operations and coordinate target information. A large number of direct-support battalion fire missions resulted from communications through fire-support channels. Forward observers would funnel target information through the liaison officer to the battalion fire direction center (FDC), which, when supplementary fires were needed, could request additional fire support from higher echelons. Corps and division artillery,

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[44] USFET Study no. 64, pp. 2–4, 29–30, copy in CMH files.

[45] Ibid. and Study no. 59, pp. 4, 5, 12, 13, 16, 40, 43, 45, copies in CMH files.

[46] USFET Study no. 59, pp. 4–5, copy in CMH files.

[47] N. P. Morrow, "Employment of Artillery in Italy," *Field Artillery* Journal, August 1944, pp. 499–505; John F. Casey, Jr., "An Artillery Forward Observer on Guadalcanal," *Field Artillery Journal*, August 1943, pp. 562–68; "How It Actually Works Out," p. 128.

[48] USFET Study no. 59, p. 4, copy in CMH files.

[49] Ulrich G. Gibbons, "Let's Use Forward Observation," *Field Artillery Journal*, May 1946, p. 269. Also see James Russell Major, *The Memoirs of an Artillery Forward Observer, 1944–1945* (Manhattan, Kans.: Sunflower University Press, 1999).

as well, passed missions down to the direct-support battalion FDCs. When the supported infantry regiment went into reserve, the direct-support artillery battalion usually stayed on line to furnish supplementary fire for other direct-support artillery battalions as necessary.[50]

Artillery observation post near Barenton, France, in 1944

Aerial observers supplemented the ground observers in locating targets and adjusting artillery fire. The Hero board had recommended aerial observers as an integral part of the artillery, but airplanes did not become organic equipment until 1942. With the virtual separation of the air arm from the ground forces in that year, the need became more acute. In late 1941, the War Department, influenced by reports from observers and by news items about the war in Europe, had authorized field testing of aircraft for artillery observation and approved the addition of aerial observers in field artillery TOEs published the following year.[51] Each field artillery headquarters, from battalion through corps artillery, included an air observer section, with two aircraft and their pilots, along with maintenance personnel, vehicles, supplies, and equipment. No observers were authorized, but were obtained by using other officers and sometimes enlisted men in the organizations. An artillery air officer was later added to the artillery staff of each group, brigade, division, corps, and army to advise the respective commanders in all matters pertaining to aerial observation. In Europe, infantry and airborne division air observers usually operated from a common airfield, resulting in centralized control of air observation at the division. Most individual battalion requirements were met by closely coordinating and scheduling flights. Nondivisional battalions attached to field artillery groups operated in a similar manner. Centralization resulted in more efficient coverage, facilitated economical use of aircraft and personnel, and was more suitable for proper maintenance and service of the aircraft. Armored divisions, on the other hand, operated air observation sections at the battalion level because of the rapid movement of the divisions

[50] Comments by Robert W. Coakley, July 1979, McKenney files.

[51] General Board, USFET, "Organic Field Artillery Air Observation," Study no. 66, pp. 1–2, copy in CMH files (hereinafter cited as USFET Study no. 66); Lowell M. Riley and Angus Rutledge, "Organic Air Observation for Field Artillery," *Field Artillery Journal*, July 1942, pp. 498–501; W. W. Ford, "Grasshoppers," ibid., September 1943, p. 651; C. H. Donnelly, "The Artillery Aerial OP," *Military*

during combat. Their air sections did operate on a common channel, however, so that any unit was free to obtain information from any aircraft.[52] Air superiority and the fact that the U.S. Army field artillery had organic air observation were key reasons why the U.S. field artillery dominated the European battlefield.[53]

Aerial observation for adjusting artillery fire, as well as for other missions, also proved invaluable in the Pacific. Lush vegetation and mountainous terrain at times hindered the ground and air observers' view, but generally much of the fighting occurred along the shore and in other relatively open areas. As in Europe, the sections usually operated under centralized control. Navy bombers provided assistance, although their relatively high speeds often made observation difficult. The Army Air Forces also provided artillery adjustment and observation in both theaters with high-performance aircraft for medium and heavy battalions. Difficulties in communications and a lack of knowledge of field artillery gunnery on the part of the observers caused most of the problems in the inability of high-performance aircraft to complete artillery adjustments.[54]

The use of aerial reconnaissance photographs in conjunction with maps and firing charts were of tremendous value and provided a high percentage of artillery targets. Field artillerymen began taking an interest in aerial photography with the development of cameras that could capture large areas without undue distortion. While recognizing the usefulness of such pictures for reconnaissance purposes, field artillerymen were more interested in producing photo maps to use for firing charts. In the North African campaign of 1942, it became apparent that American facilities for producing aerial photographs were inadequate, even though the British in the same theater were making excellent use of such pictures in intelligence work. But American expertise in this area steadily increased, and by 1943 in Sicily the Army Air Forces were providing aerial photography support at the army level. At the corps artillery fire direction centers, photo interpretation teams confirmed sound and flash locations and targets reported from other sources. Army air observers also took some aerial photographs, which were especially useful when inclement weather grounded Army Air Forces planes. Most commanders, however, believed that they could not replace the Army Air Forces photographs, which covered areas deep into enemy territory. Poor visibility over jungle areas, a lack of wide-area photographs (making it necessary to piece a useful picture together from many

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Review 23 (April 1943): 36–38; William Wallace Ford, *Wagon Soldier* (North Adams, Mass.: Excelsior Printing Co., 1980), ch. 8 (see also ch. 7, p. 9). Raines's *Eyes of* Artillery is the definitive history of aerial observation in World War II.

[52] USFET Study no. 66, pp. 3–5, 16–17, 35, and Study no. 64, pp. 5, 30, copies in CMH files; N. S. P. Stitt, ". . . In Italy," *Field Artillery Journal*, May 1944, pp. 280–81; Frederick C. Shepard, "Coordination of Air OPs," *Field Artillery Journal*, July 1945, pp. 402–04.

[53] Charles von Luttichau, "Notes on German and U.S. Artillery," p. 4, copy in CMH files; Bailey, *Field Artillery and Firepower*, pp. 314–15.

[54] Gildart, "Artillery on New Georgia," p. 83; William B. Craig, "Aerial Observation, SW Pacific Style," *Field Artillery Journal*, April 1944, pp. 252–54; Robert M. White, ". . . in New Guinea," ibid., May 1944, pp. 278–80; John R. Crossen, "Artillery Liaison With the Navy," ibid., August 1945, pp. 461–62; Ralph MacDonald, "Artillery Cubs in Mountainous Operations," ibid., October 1945, pp. 614–16; C. V. Clifton, "Arty/R Again," ibid., July 1945, p. 404; USFET Study no. 64, pp. 5–7, 40, copy in CMH files.

photographs), and poor reproduction facilities often limited the use of aerial reconnaissance photographs in the Pacific. But when these problems did not exist, aerial photography was even more valuable in the Pacific than elsewhere as suitable maps were unlikely to be available.[55]

Radar, which was still in its infancy, was tested in Europe from late 1944 through the end of the war. The results were limited partly because the sets, not designed for the purpose of spotting field artillery targets, were extremely heavy and partly because of wet weather. The XV Corps found them extremely useful, and by February 1945, 9 percent of the corps artillery missions were based upon radar findings. Most commanders felt that the possibilities of using radars would be increased through the development of small portable sets.[56]

The study of shell craters to determine the direction and range of enemy artillery had fallen into disuse before the war. In December 1942 in Tunisia, Capt. George Morgan of the 32d Field Artillery Battalion became interested in the subject and compiled a personal reference manual. Later, while serving as the assistant counterbattery officer in II Corps, he combined the results of his research with those of two British armies and subsequently produced a manual that influenced the use of "shellreps" in the entire theater. These reports usually contained pertinent information on impact areas as well as the time and direction of the shelling; when possible, they also included the number of shells and any duds, the type of target, and the amount of damage. They were extremely useful in confirming locations made by sound, photographs, and other means.[57]

Other means of locating targets were coordinated at corps level. Reports from prisoner-of-war interrogation teams, spies, friendly civilians, and other sources were compared with photographs and sound, radar, and shelling reports to give accurate target locations.[58]

The development of improved gunnery techniques and standardized training for all field artillery units, including those of the Marine Corps, contributed to the ability of field artillery to deliver effective massed fire support. The evolution of centralized fire control was one of the most significant improvements in the branch. The policies and procedures in fire direction developed at the Field Artillery School

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[55] USFET Study no. 64, pp. 10–13, and Study no. 66, pp. 9–11, copies in CMH files; MacDonald, "Artillery Cubs in Mountain Operations," pp. 614–16; Henri Bourneuf, "'Grasshopper' Survey—Part II," *Field Artillery Journal*, July 1944, pp. 452–53; John C. Guenther, "Artillery in the Bougainville Campaign," ibid., June 1945, pp. 330–34; P. A. del Valle, "Marine Field Artillery on Guadalcanal," ibid., October 1943, pp. 722–23.

[56] USFET Study no. 62, pp. 13–14, and Study no. 64, pp. 8–9, copies in CMH files; Edward S. Ott, "Employment of Radar by XV Corps Artillery," *Field Artillery Journal*, August 1946, pp. 462–67.

[57] USFET Study no. 64, pp. 13–17, copy in CMH files; Arthur J. Peterson, "Shellreps," *Field Artillery Journal*, November 1944, p. 747; Lee O. Rostenberg, "Shell Crater Analysis for Location and Identification of Enemy Artillery," ibid., pp. 738–44.

[58] USFET Study no. 64, pp. 17–18, copy in CMH files; Carl F. Maples, "Let PWs Help You Plan Your Fires," *Field Artillery Journal*, May 1945, pp. 264–67.

during the interwar years proved basically sound and were generally followed by all Army and Marine field artillery units in Europe and the Pacific.[59]

The high degree of centralized control reached during the war permitted maximum use of prearranged fire. Division artillery was most effective against enemy infantry in the open, and secondly in blinding enemy observation, preventing the movement of reserve troops, and assisting in counterbattery fire. Continuous fire was always possible by moving only part of the artillery, keeping the rest firing in positions until the displacing batteries were ready to resume action. The heavier corps and army artillery reinforced the divisions and provided their conventional roles of counterbattery fire, interdiction missions, destruction of hostile defenses, and fire on rear areas. As General Hodges later remarked, "Of the principal arms that could be brought to bear directly on the enemy, infantry, armor, and air were seriously handicapped by the weather and terrain. Through all, however—day and night, good weather and bad—the flexibility and power of our modern artillery were applied unceasingly."[60]

When lack of time precluded use of prearranged fire, it was necessary to develop a rapid means of massing all available firepower. While there were several procedures, the most common was the "serenade." Only corps, division, or group artillery commanders could authorize serenades, which were controlled entirely by radio. Commanders had to ensure that the target warranted the expenditure of ammunition and that the map location of the target was accurate enough to achieve the desired result. Missions were fired "when ready," or a time was designated for all battalions to fire on a target simultaneously. A better known method was "time on target" (TOT). Procedures were similar to those of the serenade, but the missions were controlled chiefly by telephone, and the rounds for all units were to land on the target at the same time. The TOT required frequent synchronization of time and the determination of flight time for all projectiles.[61]

The introduction of the proximity fuze, commonly referred to as the pozit or VT (variable time) fuze, during the German counteroffensive in the Ardennes in December 1944 greatly increased the effectiveness of artillery fire. Unlike a time fuze, it required no setting and contained a tiny electronic device that caused the shell to explode when it came near the target. Although employed more extensively by antiaircraft artillery, it was used by field artillery to burst shells at an ideal height over enemy trenches and foxholes. Considerable concern was expressed because of the danger to air observation posts, and its use was restricted to daylight hours.[62]

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[59] USFET Study no. 64, pp. 21–23, copy in CMH files; del Valle, "Marine Field Artillery," pp. 722–33; "How It Actually Works Out," *Field Artillery Journal*, February 1943, p. 128; H. S. Dillingham and J. O. Hoenigsberg, "Fire Direction Must Be Flexible," ibid., July 1944, pp. 457–58. Almost all *Field Artillery Journal* articles written by officers between 1941 and 1945 on their war experiences praised the teachings of the Field Artillery School in fire direction techniques and commented on their value in the war effort.

[60] General Courtney H. Hodges quoted in Joseph R. Reeves, "Artillery in the Ardennes," *Field Artillery Journal*, March 1946, p. 138 (sidebar).

[61] USFET Study no. 64, pp. 24–26, copy in CMH files.

[62] Ibid., pp. 26–27, and Study no. 67, p. 7, copies in CMH files. For the development of the VT fuze, see Ralph B. Baldwin, *The Deadly Fuze* (San Rafael, Calif.: Presidio Press, 1980).

After nearly six years of warfare, the Germans surrendered in May 1945, and the War Department redirected its efforts toward winning in the Pacific. But World War II ended abruptly in August after the atomic bombs were dropped on Hiroshima and Nagasaki, ushering in a new era of warfare. Field artillery had been a decisive factor in the Allied victory, prompting Third Army commander General George S. Patton, Jr., to later remark: "I do not have to tell you who won the war. You know our artillery did."[63]

[63] As quoted in Dupuy and Dupuy, *Military Heritage of America*, p. 642.

CHAPTER 8

Postwar Reorganization

Myriad modifications and refinements of field artillery's World War II organizations, weapons, and techniques became the norm during the postwar years up to the advent of the missile age in the mid-1950s. The Army devoted a great deal of time and effort to evaluating and analyzing performance and effectiveness in much the same manner as it had immediately after World War I. As early as February 1945, the Army Ground Forces began to develop new tables of organization and equipment for the infantry division that incorporated nondivisional artillery units, among others, formerly attached to the division. The new tables were published in June 1945, but no infantry division was organized under them before the end of the war. In that same month, the Army established a review board in Europe, specifically to analyze the strategy, tactics, and administration employed by the United States forces in the European Theater of Operations. Of the board's one hundred thirty-one reports, ten were devoted to field artillery.[1]

Many of the board findings were reiterated during a two-week artillery conference of Army, Navy, Marine Corps, and foreign military representatives held at Fort Sill in March 1946. The conferees, headed by Army Ground Forces commander General Jacob L. Devers, recommended that the number of medium artillery battalions in both the infantry and armored divisions be increased; that the strength of all 105-mm. howitzer batteries be raised from four to six howitzers; that a third battery be added to the observation battalion; that the number of forward observers be increased in all battalions; and that field artillery, antiaircraft artillery, and coast artillery be consolidated into a single arm. They also proposed that short-range countermortar radar detachments be made organic to divisions, that self-propelled weapons be provided to all field artillery units except pack and airborne organizations, and that the development of missiles be encouraged. Many of these recommendations became reality by the end of the decade.[2]

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[1] As stated in each study, the board was established by ETO GO 128, 17 Jun 1945, as amended by USFET GO 182, 7 Aug 1945, and USFET GO 312, 20 Nov 1945. Field artillery is covered in USFET Study nos. 58–67.

[2] "Recommendations for Future Developments in Field Artillery, Organization, Equipment, and Technique Based on Studies Conducted at the Artillery Conference, Field Artillery School, Fort Sill, Oklahoma, 18–29 March 1946," copy in FA School files; "Artillery Conference at the Field Artillery School," *Field Artillery Journal*, May 1946, pp. 273–75; Louis E. Hibbs, "Report on the Field Artillery Conference," ibid., July 1946, pp. 407–13; *War Department Equipment Board Report* (Stilwell Board Report), 1946. On the six-gun batteries and self-propelled artillery, see also Ltr, Lt Gen Jacob L. Devers to Comdt, FA School, 23 Feb 1944, sub: Development of the Field Artillery Fire Direction Center, copy in FA School files.

Forward observers in Korea

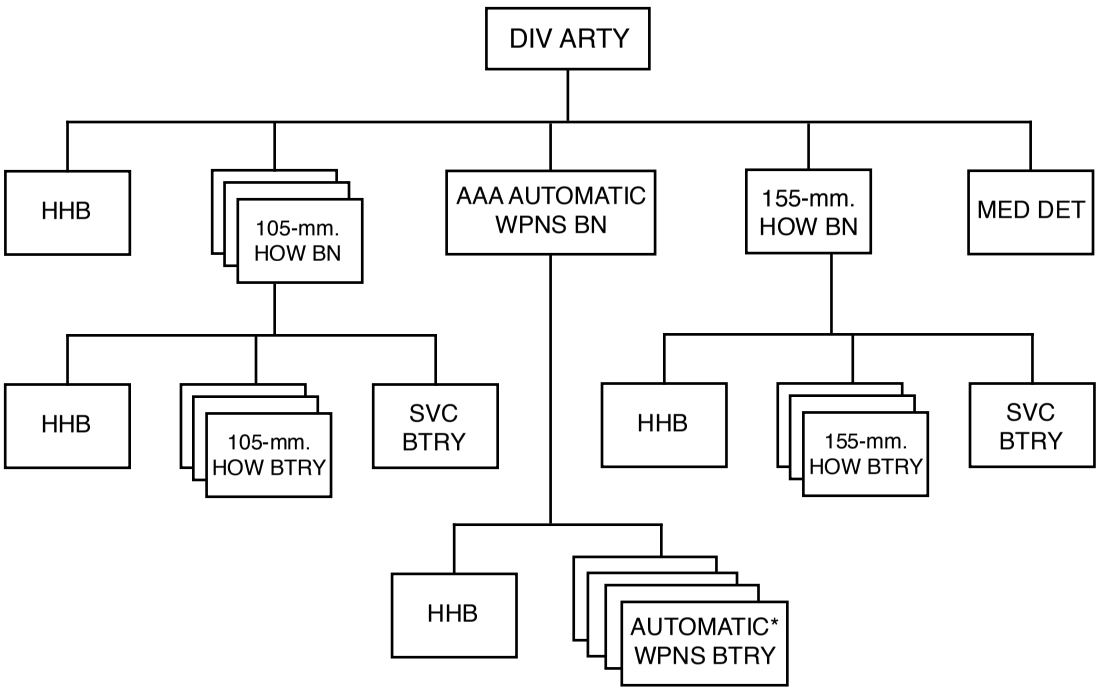
Division Artillery

The Army published new tables of organization and equipment for the infantry and armored divisions in 1948. Under these tables, the artillery of both was organized similarly (*Chart 1*), except that the howitzers in the infantry division were truck-drawn and those in the armored division were self-propelled. The provision for towed weapons, however, was regarded as an interim measure until new self-propelled weapons could be developed. The tables confirmed the rank of the infantry division artillery commander as brigadier general but retained that of the armored division artillery commander as colonel until 1950, when the position received equal rank. The 1948 tables authorized each 105-mm. howitzer battery three forward observer sections, one for each supported maneuver company, and each 105-mm. howitzer battalion four liaison officers. Each 155-mm. howitzer battalion was authorized two forward observers in the headquarters battery and one liaison officer. In the armored division, a tank in each of the line tank companies replaced the forward observer tanks. (During World War II, vehicles differing in appearance from those around them were usually hit first.) Another personnel change added two enlisted computers to the battalion fire direction center and one enlisted computer to each firing battery, for a total of five additional computer personnel.[3]

The new structure of both the armored and infantry division artillery resembled the infantry division artillery of World War II, except that an antiaircraft automatic weapons battalion was added and each infantry division artillery firing battery was increased by two howitzers. The number of field pieces in both the armored and infantry divisions totaled seventy-two, consisting of fifty-four 105-mm. howitzers and eighteen 155-mm. howitzers. The authorized strength of the infantry division artillery stood at 3,688 and that of the armored division artillery at 3,735. The authorized aggregate strengths of the infantry and armored division artillery were

[3] TOE 7N, 2 Jun 1948, and related tables; TOE 17N, 8 Oct 1948, and related tables; TOE 17N, change 1, 2 Oct 1950; Ralph M. Click, "Armored Artillery in the Team," *Field Artillery Journal*, July-August 1949, pp. 168–70.

Chart 1—Division Artillery Organization, 1948



* Three batteries are in the airborne division and four are in the infantry and armored divisions.

decreased by 1952, reducing the former to 3,541 and the latter to 3,572, although the artillery firepower remained unchanged.[4]

As field artillery officers had recommended in 1945–46, countermortar radar sections were added to each of the light artillery battalions, and antiaircraft artillery automatic weapons battalions were added to the divisions. A countermortar radar section was authorized for the headquarters battery of each light artillery battalion for locating enemy mortars and adjusting friendly fire on them. In anticipation of the merger of field, antiaircraft, and coast artillery, the antiaircraft artillery automatic weapons battalion, armed with thirty-two self-propelled quadruple .50-caliber machine guns and thirty-two dual 40-mm. guns, was assigned directly to the division artillery rather than to the division headquarters.[5]

The changes in organization and equipment that occurred after World War II added considerable personnel to the divisions and made it possible for the divisions to have permanently assigned units under their direct control. In addition, the firepower of the infantry division was increased by a half and that of the armored division by a third.

Reorganization of the infantry divisions in the Regular Army began in the fall of 1948, followed by those in the National Guard and Organized Reserve Corps, but only the 1st Infantry Division in Germany and the 2d Infantry Division at Fort Lewis, Washington, were authorized at full war strength. National Guard divisions were authorized at reduced strength, with some field artillery batteries having only four howitzers instead of six; the Organized Reserve Corps divisions were authorized officers and cadres only. The same year saw the reorganization of the armored divisions. The process started with the 2d Armored Division in the Regular Army, followed by the two National Guard and three Organized Reserve Corps divisions the next year. The National Guard armored divisions were also authorized at reduced strength, and the Organized Reserve Corps divisions were authorized only officers and enlisted cadres.[6]

New tables for the airborne division artillery did not appear until 1 April 1950. Reflecting the desire for a unit that could withstand sustained combat and the general trend toward uniformity among the different types of divisions, the airborne division artillery structure was the same as that in the armored and infantry divisions except that each firing battery contained four howitzers instead of six and the automatic weapons battalion comprised three firing batteries instead of four. Altogether, an airborne division could field thirty-six 105-mm. howitzers in its three parachute battalions, twenty-four 40-mm. guns, and twenty-four .50-caliber machine guns. Each 105-mm. howitzer battery also had four 75-mm. pack howitzers, but no crews for them. The authorized aggregate strength of the division artillery was 2,862; the division as a whole numbered 17,490.[7]

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[4] TOE 7N, 2 Jun 1948, and related tables; TOE 17N, 8 Oct 1948, and related tables; TOE 7, 15 May 1952, and related tables; TOE 17, 30 Dec 1952, and related tables.

[5] Antiaircraft artillery units will be discussed in more detail in *Air Defense Artillery*, a future volume in the Army Historical Series.

[6] Wilson, *Maneuver and Firepower*, pp. 225–27.

[7] TOE 71, 1 Apr 1950, and related tables.

The 82d Airborne Division had been reorganized under a similar structure developed by the Army Ground Forces in 1948. Gliders were eliminated. Both the 75-mm. and 105-mm. howitzers could be parachuted from the larger Air Force cargo planes, which negated the use of the large, unwieldy, and often dangerous gliders. In the spring of 1949, the 11th Airborne Division, which had returned to Fort Campbell, Kentucky, from occupation duty in Japan, was similarly organized. The 82d Airborne Division was organized for sustained combat, and the 11th was organized at reduced strength. In planning for the divisional organization, an airborne division at reduced strength was authorized three 105-mm. parachute howitzer battalions and a fourth 155-mm. howitzer battalion to be attached only when necessary for general support after landing; the 155-mm. howitzer could not be delivered by parachute. The 11th Airborne Division also lacked one of its regimental combat teams (including its direct-support 105-mm. howitzer battalion). Both the 82d and 11th Airborne Divisions were reorganized under the published TOEs in July 1950, but the 11th still lacked one regimental combat team. In 1953, the number of field artillery weapons increased to seventy-two, as in the infantry and armored divisions, with the four-howitzer batteries being changed to six-howitzer units, but neither division was reorganized under these tables until after the war in Korea ended. The number of howitzers had expanded from forty-eight at the end of World War II to seventy-two, an increase of 50 percent. In addition, the firepower of the airborne division had risen considerably through the use of heavier weapons, 105-mm. and 155-mm. howitzers, rather than 75-mm. howitzers.[8]

Nondivisional Artillery

Postwar changes in nondivisional artillery also included the addition of considerable firepower. The major change in the 105-mm. and 155-mm. howitzer battalions, their reorganization with six-gun batteries like those in the infantry and armored division artillery units, added 50 percent more firepower to each battery. Each of the 105-mm. and 155-mm. howitzer battalions, as a result, had eighteen cannon except for the airborne units, which had twelve. (As in the field artillery of airborne divisions, the nondivisional airborne field artillery batteries became six-gun units in 1953.) The nondivisional 105-mm. howitzer battalions had fewer forward observers than did their divisional counterparts, and they had no countermortar radar sections, these elements being available from corps or army levels. Each battalion was authorized a medical detachment, while the divisional battalions pooled theirs into a single division artillery medical detachment. There were no major changes in the organization of the heavy artillery battalions, but plans called for the development of self-propelled 8-inch guns, 8-inch howitzers, and 240-mm. howitzers. New tables were prepared for these battalions in 1950. The 4.5-inch gun was dropped from the inventory. Minor changes were made

[8] See 11th and 82d Abn Divs fldrs, CMH files; TOE 6–200A, 1 Jan 1953; William N. Gillmore, "Airborne Artillery," *Field Artillery Journal*, November-December 1947, pp. 348–54.

in the 4.5-inch rocket battalion, which lost its service battery; a platoon in the headquarters battery took over the function.[9]

Because wide corps zones averaging 25 to 40 kilometers (15.5 to 24.9 miles) in the European theater during World War II had prevented the corps observation battalions, each consisting of a headquarters and two observation batteries, from providing adequate coverage with their sound, flash, and survey instruments, new tables published in 1948 authorized a third observation battery. Also provided were a countermortar radar platoon in each observation battery and additional personnel and equipment for a survey information section, a meteorological section, and a topographical platoon in the headquarters battery. The changes almost doubled the authorized aggregate strength of the battalion, raising it from 439 to 836. Minor reductions later lowered the figure to 787.[10]

In 1952, field artillery took over the function of battlefield illumination from the engineers. Thereafter, one field artillery searchlight battery was allotted to each corps and given the mission of furnishing indirect and direct illumination in support of night operations. Each battery was authorized three platoons and a total of eighteen searchlights. A platoon comprised six sections, each equipped with a searchlight, and was capable of providing battlefield illumination for a division.[11]

Major reorganizations in the nondivisional artillery command structure were recommended, but they were never implemented. Some officers considered the flexibility of the group-brigade design used during World War II to be unsound because the constant shifting of battalions within organizations reduced teamwork and esprit de corps. They proposed a return to the regimental organization. Other officers believed the field artillery group structure had been a decisive factor in enabling corps and army commanders to give maneuver elements adequate support in varying tactical situations, suggesting that the field artillery group be redesignated as a regiment and that all corps field artillery be organized into an "artillery division," commanded by a major general.[12] Sixty-seven of the eighty-two representatives at the artillery conference in March 1946 at Fort Sill agreed that an artillery division should replace the corps nondivisional artillery organization and recommended that corps artillery be organized with a headquarters and headquarters battery, an observation battalion, and a minimum number of

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[9] TOE 6–55, 31 Jan 1946; TOE 6–65, 31 Jan 1946; TOE 6–365, 31 Jan 1946; TOE 6–415, 18 Jul 1950; TOE 6–515, 18 Jul 1950; TOE 6–25N, 21 Apr 1948; TOE 6–165N, 5 Aug 1948; TOE 6–195N, 11 Aug 1948; TOE 6–225, 1 Apr 1950; TOE 6–225A, 1 Jan 1953; TOE 6–235, 1 Apr 1950; TOE 6–335N, 12 May 1948; TOE 6–395, 31 Jan 1946; TOE 6–435, 18 Jul 1950; TOE 6–85, 5 Jan 1949. No 8-inch gun units were organized after World War II, although tables continued to be published for them.

[10] TOE 6–75, 16 Nov 1948; TOE 6–575, 15 Jun 1953; Arthur B. Hercz, "On Target Acquisition . . . Again," *Field Artillery Journal*, November-December 1975, pp. 35–41; "The Field Artillery Observation Battalion," pts. 1 and 2, *Field Artillery Journal*, November-December 1948, pp. 252–57, and January-February 1949, pp. 14–20; H. P. Rand, "Meet the FA Observation Battalion," *Combat Forces Journal*, February 1953, pp. 24–27.

[11] TOE 5–27T, 11 Sep 1950 (redesignated TOE 6–558 by DA Cir 44, 4 Jun 1952, as amended by DA Cir 54, 18 Jun 1952); TOE 6–558A, 14 Jul 1952.

[12] General Board, United States Forces, European Theater, "Organization and Equipment of Field Artillery Units," Study no. 59, pp. 47–48 (quoted words), copy in CMH files.

organic battalions to be determined by future studies. They also recommended that all nondivisional artillery battalions be organized into permanent groups or regiments of mixed or similar caliber weapons.[13]

For planning and instructional purposes, the Army Ground Forces in 1947 outlined a table for a field army organization in which regiments were the parent units of nondivisional battalions. As outlined, the nondivisional field artillery in each of the three corps in a typical field army consisted of a headquarters and headquarters battery, an observation battalion, four field artillery regiments, an armored 105-mm. howitzer battalion, and a rocket battalion. In addition, either an 8-inch gun or 240-mm. howitzer battalion was allocated to each field army. But the proposed TOE was never published, and the field artillery group remained the tactical headquarters for nondivisional artillery. When a new TOE for the group headquarters and headquarters battery was published in December 1948, no real changes were made except to increase the personnel to 21 officers and 109 enlisted men. In July 1949, when the Army Field Forces, the successor to the Army Ground Forces, revised the model field army organization, the nondivisional artillery organization closely resembled the 1947 outline except that the field artillery group replaced the regiment. The group was reduced through minor changes to 188 officers and men by 1953. The principal changes in the corps artillery headquarters and headquarters battery were the addition of an administrative section, a light aviation section with three liaison aircraft (an increase of one plane), and five liaison sections, bringing the aggregate authorized strength of the unit up to 189 from 112. Through minor reductions, the personnel decreased to 168 by 1953.[14]

Peacetime cuts in defense spending and strength ceilings were the primary causes of deficiencies in postwar Army organizations. Of the ten Regular Army divisions active at the outbreak of the Korean War in 1950, only one was at full strength. The others averaged about 70 percent of their authorized strengths. All had major shortages in equipment. Of the fifty-nine active field artillery battalions in the Regular Army (*Table 20*), about two-thirds were divisional units. Most of the 105-mm. howitzer battalions had only two active firing batteries instead of three. In addition to the twenty nondivisional field artillery battalions, one corps artillery headquarters and headquarters battery and two field artillery group headquarters were active. Heavy artillery was virtually nonexistent.[15]

The Korean War

Jumping off on 25 June 1950, North Korean troops achieved surprise and substantial initial success. The slow U.S. intervention, the uncertainty regarding the intentions of the Soviet Union, and the wavering position by the United Nations blunted the

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[13] Cmte on Organization, Question 5, Artillery Conference, 18–29 March 1946, pp. 1–2, copy in FA School files.

[14] Weathersby, "Field Artillery Group," thesis, pp. 117–18, 120; TOE 6–12, 2 Dec 1948; TOE 6–401, 4 Jan 1953; TOE 6–50–1, 8 Aug 1949; TOE 6–501A, 11 Sep 1953.

[15] Directory and Station List of the United States Army, July 1950. Field artillery battalions in the four training divisions (3d Armored and 4th, 9th, and 10th Infantry Divisions) are not included.

Table 20—Regular Army Field Artillery Units, July 1950

Battalion Type	*Divisional Battalions*	*Nondivisional Battalions*	*Total Battalions*
75-mm. pack howitzer, mountain		1	1
105-mm. howitzer, truck	26	8	34[a]
105-mm. howitzer, self-propelled	3	2	5
155-mm. howitzer, tractor	9	3	12[b]
155-mm. howitzer, self-propelled	1	1	2
155-mm. howitzer, self-propelled/tractor		1	1
155-mm. gun, self-propelled		1	1
8-inch howitzer, tractor		1	1
Rocket		1	1
Observation		1	1
Total	39	20	59[c]

[a]Plus one separate battery. Divisional battalions include airborne units.

[b]Plus one separate battery.

[c]In many cases, these units were not at full strength, nor did they have all their authorized equipment.

Western response. Task Force Smith, consisting of 24th Infantry Division elements, including the 52d Field Artillery Battalion, entered the conflict from Japan on 2 July. The remainder of the division, the 1st Cavalry Division, and the 25th Infantry Division soon followed. By 13 August, all of the 1st's and 25th's field artillery battalions had arrived in Korea, as well as the first nondivisional one—the 17th, armed with 8-inch howitzers. To help compensate for the eleven missing batteries in the two divisions committed, the 9th Field Artillery Battalion from the 3d Infantry Division, the 92d Armored Field Artillery Battalion from the 2d Armored Division, the 555th Field Artillery Battalion with the 5th Regimental Combat Team in Hawaii, and the personnel and equipment of two batteries in the 14th Regimental Combat Team were ordered to Korea.[16]

Lacking nondivisional artillery, General of the Army Douglas MacArthur, commander-in-chief of the Far East Command and newly appointed commander of the United Nations Command in Korea, asked the Joint Chiefs of Staff on 13 July for fifteen battalions, including six 155-mm. howitzer battalions with self-propelled weapons. MacArthur projected a commitment of four Army divisions and one provisional Marine brigade in Korea. Because of wide frontages, broken terrain, and lack of adequate roads, he believed that the division commanders would employ their units by regimental combat teams and expected that at least ten regiments would be on the front lines at the same time; having only four 155-mm. howitzer battalions among the divisions, he wanted six more so that each regiment could have a medium artillery battalion when operating as a regimental combat team. For general support, MacArthur requested 8-inch howitzer and 155-mm. gun battalions,

[16] James F. Schnabel, *Policy and Direction* (Washington, D.C.: Office of the Chief of Military History, United States Army, 1972), pp. 90–92; Weathersby, "Field Artillery Group," p. 124.

as well as more 105-mm. howitzer battalions to reinforce the divisional artillery and to support South Korean units, which were decidedly weak in field artillery.[17] In June 1950, the artillery in the Republic of Korea (ROK) Army consisted of only ninety-one 105-mm. howitzers.[18]

There was, however, too little artillery in the Army to meet all of General MacArthur's requests. Eleven of the twenty active nondivisional field artillery battalions were in the United States, and all were understrength. The Department of the Army, therefore, ordered only five of MacArthur's fifteen requested battalions to the front—three 155-mm. howitzer battalions and the one 8-inch howitzer and one observation battalion active in the entire Regular Army. For control, the 5th Field Artillery Group was sent from Fort Sill. MacArthur again pointed out that fifteen was the minimum number of nondivisional field artillery battalions needed for ten infantry regiments and further stated that he now felt that twelve infantry regiments should be committed into action at all times. He believed that experience during World War II had shown the necessity for adequate nondivisional artillery support for successful offensive operations against a strong enemy, especially in difficult terrain, and asked for nine additional battalions.[19]

MacArthur's persistence led to the slow buildup of Army artillery in the theater. By July 1951, he had forty-one field artillery battalions in Korea, of which eighteen were nondivisional units (one observation, seven 155-mm. howitzer, six 105-mm. howitzer, two 8-inch howitzer, and two 155-mm. gun battalions). Even so, General Matthew B. Ridgway, who succeeded MacArthur in April, wanted still more artillery. A year of battle had shown the enemy to be particularly susceptible to massed artillery fire and asked for the addition of five 155-mm. howitzer battalions, four 8-inch howitzer battalions, one 155-mm. gun battalion, and two observation battalions. On 17 August, the Joint Chiefs of Staff approved an increase of four battalions, even though such action reduced the General Reserve in the United States and delayed a scheduled buildup of forces in Europe.[20]

Heavy combat losses early in the war increased the Army's inherent personnel and equipment shortages. To alleviate the manpower problem, the Army arranged to use Korean nationals in American units under the Korean Augmentation to the United States Army (KATUSA) program, which began in mid-1950. As planned, each American division would receive 8,300 Korean soldiers, with 50 to 90 assigned to each artillery battalion. Although cultural differences, language barriers, and lack of training and familiarity with American weapons, organization, and techniques were problems, the KATUSAs enabled the Army to conduct 24-hour operations by furnishing additional manpower for the many nontechnical aspects of firing. The program created a continuity of experience that would not have been possible under the personnel system adopted in 1951, permitted nearly normal operations

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[17] Schnabel, *Policy and Direction*, pp. 96, 109, 136.

[18] Ibid., p. 40.

[19] Ibid., p. 97.

[20] Walter G. Hermes, *Truce Tent and Fighting Front* (Washington, D.C.: Office of the Chief of Military History, United States Army, 1966), pp. 58–59; Directory and Station List of the United States Army, July 1951.

when the units were seriously understrength, and eventually provided cadres for ROK artillery units.[21]

A call-up of the reserve components into active service furnished yet another source of manpower. The majority of units called up from the Army Reserve and Army National Guard replaced units in the United States that had been deployed overseas or went to Europe. Units sent to Korea included two infantry divisions from the National Guard, the 40th and 45th, each having the usual four field artillery battalions. By the end of the war, thirty-three nondivisional field artillery battalions had been called into federal service from the National Guard, of which twelve saw action in Korea. Most of the field artillery support from the Army Reserve came from individuals rather than from units, but thirteen reserve battalions were placed on active duty, two of which served in Korea.[22]

Field artillery weapons used in Korea included the standard calibers, with the weapons of the divisional light and medium battalions furnishing most of the fire against personnel and the corps artillery weapons concentrating primarily on materiel targets. The speed, flexibility, and volume of 105-mm. howitzer fire were extremely important in halting massed enemy attacks. The 155-mm. howitzer, the most versatile weapon, could also deliver effective volume fire, and its range accuracy and increased projectile weight fitted it for many destruction missions not requiring a heavier caliber or longer range. The 155-mm. gun was the least popular and least versatile field artillery piece used in Korea. Its longer range, however, somewhat compensated for its relative inaccuracies. It was an excellent field piece for use in forcing back or pushing underground enemy supply points, bivouacs, and command posts, which otherwise would have operated more freely aboveground and closer to the front. The use of the proximity fuze, introduced in World War II, increased the effectiveness of the 155-mm. gun, as it also strengthened the effectiveness of the other field pieces. Although the 8-inch howitzer could destroy or neutralize most fortified artillery positions, the exceptions were sufficient reason to convert two battalions to 240-mm. howitzer units, the 240-mm. howitzer having a heavier and more powerful projectile. The 8-inch howitzer was a particularly good weapon for observed counterbattery fire and was used extensively against enemy strongpoints. The 240-mm. howitzer was employed only during the last three months of the war, but it lived up to expectations through its ability to destroy or neutralize strong bunkers and cave-type emplacements. There was a question, however, as to whether it was economical to use such expensive equipment when it could deliver only ninety rounds per day.[23]

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[21] David C. Skaggs, "The KATUSA Experiment," *Military Affairs* 38 (April 1974): 54–58; "A Study of the Employment and Effectiveness of the Artillery With the Eighth Army During the Period October 1951–July 1953," pp. 5–6, copy in CMH files.

[22] "Induction and Release of Army National Guard Units, 1950–1956," copy in CMH files; list of Army Reserve units ordered into active military service during the Korean War, copy in CMH files. In 1952, the term *Army Reserve* replaced the term *Organized Reserve Corps* and is used throughout the paragraph for clarity. The two Army Reserve battalions were the 424th and 780th Field Artillery Battalions.

[23] "Employment and Effectiveness of the Artillery with the Eighth Army," pp. 2–3, copy in CMH files.

155-mm. howitzer crew of the 160th Field Artillery Battalion (above) *and self-propelled 155-mm. gun crew of Battery C, 204th Field Artillery Battalion* (below)*, firing at enemy positions north of Yang-gu and north of Yonch'on*

Throughout the war, a major weakness of the Eighth Army artillery was an insufficient number of nondivisional artillery units. The 150-mile (241.4-kilometer) five-corps front that existed in Korea during the last two years of the war could have justified between fifty and sixty corps artillery battalions, using the ratios of the European theater during World War II. Instead, by June 1953, there were only twenty nondivisional field artillery battalions in all of Korea. The lack of field artillery groups resulted in corps artillery battalions being controlled directly by the corps artillery headquarters in addition to their usual duties. Efforts made in the spring of 1951 to obtain six more group headquarters failed because of stringent troop ceilings. Yet, although the corps artillery battalions received less than normal control and supervision, the lack of group headquarters posed no serious problem as long as the tactical situation remained stable. Eighth Army felt the shortage briefly, however, when mobile warfare returned to the battlefield just before the armistice.[24]

During the war, the 5th Field Artillery Group, the only one in Korea, acted as a corps artillery headquarters for the ROK II Corps. It also controlled ROK field artillery groups being trained as division artillery headquarters. Although the makeshift arrangement was satisfactory in static periods, the group lacked the necessary personnel and communications equipment needed to control the up to nineteen battalions under its supervision during fluid tactical situations.

During the final two years of the war, deployment of corps artillery battalions was based on the width of the front, the most likely avenues of enemy approach, and the estimated amount of artillery opposing each corps. The ROK I Corps, operating in a comparatively inactive sector on the east coast, had no attached field artillery battalions but depended on naval gunfire support furnished by the U.S. Navy's Seventh Fleet. The ROK II Corps had three U.S. field artillery battalions attached—two 105-mm. howitzer armored (self-propelled) battalions and one 8-inch howitzer battalion. The remaining corps artillery battalions (seventeen in June 1953) were allotted to the American I, IX, and X Corps. Because there was never more than one 155-mm. gun battalion in a corps, the battalion was deployed by battery across the corps front. For most of the war, the same was true of the 8-inch howitzer battalions (*Table 21*).[25] Until January 1953, the 1st Field Artillery Observation Battalion, the only observation unit in Korea at the time, was deployed by battery, one each to the three American corps. Topographical and meteorological detachments reinforced the two batteries separated from their battalion headquarters. Later, when the 235th Field Artillery Observation Battalion arrived, the I and IX Corps each received a battalion less one battery. The two detached batteries went to the X Corps and the ROK II Corps. A third

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[24] Ibid., pp. 3, 13, 14, copy in CMH files. Of the corps, three were U.S. Army and two were ROK Army. On 27 July 1953, eighteen divisions—ten ROK Army, six U.S. Army, one U.S. Marines, and one British Commonwealth—were on the front.

[25] Ibid., pp. 3–4, copy in CMH files. This study counts only nineteen nondivisional field artillery cannon battalions as of the end of the war. It omits the 555th Field Artillery Battalion serving with the 5th Regimental Combat Team, probably because it was employed more like division artillery than corps artillery.

Table 21—Field Artillery Units in Korea, June 1953

Battalion Type	*Divisional Battalions*	*Nondivisional Battalions*	*Total Battalions*
105-mm. howitzer, truck	18	1	19
105-mm. howitzer, self-propelled		2	2
155-mm. howitzer, tractor	6	6	12
155-mm. howitzer, self-propelled		2	2
155-mm. gun, towed		1	1
155-mm. gun, self-propelled		2	2
8-inch howitzer, tractor		3	3
8-inch howitzer, self-propelled		1	1
240-mm. howitzer, tractor		2	2
Total	24	20	44

Note: Three corps artillery headquarters, one artillery group headquarters, two observation battalions, three searchlight batteries, and one rocket battery were also in Korea.

observation battalion, scheduled to arrive in Korea in late August 1953, would have been adequate for the observation mission.[26]

Lack of trained artillery personnel, along with the need for additional battalions, continued to be a problem throughout the war. Although a liberal rotation policy adopted in early 1951 did much to raise morale among the troops, it adversely affected the performance of artillery units. Each month following initiation of the policy, there was an approximate 7.5 percent turnover of personnel in the field artillery units. Between October 1951 and July 1953, artillery personnel in the Eighth Army were completely replaced almost three times. Cuts in the Army budget for fiscal year 1952 exacerbated the problem by reducing Army strength ceilings. That same year, the terms of service of those who had been called up for the war in 1950 were also ending, making about 750,000 soldiers eligible for discharge. Proficiency was hard to maintain as a result, especially in the artillery. General James A. Van Fleet, who commanded the Eighth Army between April 1951 and January 1953, complained that the artillery had lost its ability to shoot quickly and accurately because the rotation program had depleted the units of their veteran gunners. The replacement system simply was unable to supply enough trained specialists to fill the requirements, and the replacements that were furnished needed further training. Fortunately, because of the static nature of the war during the last two years, the replacement problem was not as severe as it might have been.[27]

The shortage of trained, experienced artillerymen was serious, but the shortage of artillery ammunition received far more attention. Even though adverse tactical and geographical conditions caused local shortages, total stocks in the Far East Command often fell below the full ninety-day authorized level of supply and sometimes dropped below the safety level of sixty days. A chief cause of the ammunition shortage was

[26] Ibid., p. 3, copy in CMH files.
[27] Ibid., pp. 1, 35–36, copy in CMH files; Hermes, *Truce Tent*, pp. 186–87, 333–34, 349–51.

8-inch howitzer in action

a tremendous rise above what was considered normal rates of fire, which was, in turn, caused by the shortage of artillery pieces. Initially, the ammunition expenditure rate was based on experiences during World War II, but the reduced number of field artillery battalions per mile of front meant that each gun had to shoot more rounds than the expenditure tables allowed for achieving the required effectiveness. Soon after the war began, the Far East Command was allowed a temporary three- to sixfold increase in the so-called *day of supply* (average number of rounds a gun was expected to fire in one day). Because the day of supply determined the number of shells held in reserve in the Far East Command, the larger allotment decreased the reserves in terms of the number of days it would last.[28]

During operations in the spring of 1951, artillery ammunition expenditures skyrocketed, especially between 16 and 21 May, when the X Corps fought a defensive battle at and below the Soyang River in eastern Korea. At the beginning of the counteroffensive the enemy, thrown back in disorder, fled. The X Corps brought artillery to bear on all types of targets unmercifully, as the rapid and unexpected advance of the corps drove the enemy forces into the open and forced them back across the river. During this phase, task forces, often built around regimental com-

[28] U.S. Congress, Senate, Committee on Armed Services, *Hearings on Ammunition Supplies in the Far East*, 83d Cong., 1st sess., 1953, p. 18; Mark S. Watson, "Ammunition Expenditures in Korea," *Ordnance*, September-October 1952, pp. 251–52; Hermes, *Truce Tent*, pp. 225–30.

bat teams and always augmented with artillery, fought aggressively and caused large groups of the enemy to be isolated, thus providing lucrative artillery targets. Medium and heavy artillery were kept well forward, and they employed harassing and interdicting fire with great effect. Enemy prisoners confirmed that the incessant bombardment of artillery had inflicted heavy casualties, greatly eroding their morale and fighting ability.[29]

During the Soyang battle, the equivalent of twenty artillery battalions fired 381,136 rounds from 17 to 26 May, more than 17,400 tons of ammunition. In comparison, thirty-five battalions at Bastogne from 22 to 31 December 1944 fired only 94,230 rounds. Artillery expenditures went even higher the following summer, and commanders began to make charges of waste. Army Chief of Staff General J. Lawton Collins reported that artillery expenditures from June 1950 to 31 December 1952 equaled that shot during all of World War II in the Mediterranean and Pacific theaters combined. All told, American artillery fired more than 600,000 tons of 105-mm. ammunition, more than 300,000 tons of 155-mm. ammunition, and more than 75,000 tons of 8-inch howitzer ammunition during that eighteen-month period in Korea.[30]

From October 1951 until near the end of the war in July 1953, the static nature of the war tested the field artillery's weapons and equipment under conditions similar to those of World War I. Both sides occupied fortified positions, and both forces grew in strength. Ammunition expenditures increased as greater emphasis was placed on disruptive and defensive artillery fire. Because more harassing and interdicting fire was needed to keep the enemy from operating closer to the front, the day of supply again had to be raised. Increased demands on stockpiles and the knowledge that there was no possibility of replenishing the heavy consumption of artillery rounds until late in 1952 or early 1953 caused much concern. Also, enemy artillery strength grew progressively after the war stabilized in 1951. On 1 October 1951, the field artillery pieces in the United Nations Command numbered 1,050, while it was estimated that the enemy had only 530 pieces. On 1 July 1953, the command's field artillery pieces numbered 1,862, while the estimate of enemy field pieces had risen to 1,570, an increase of 196 percent. The enemy's supply system, ammunition stockpiles, and firing techniques also improved significantly during the stalemate.[31]

The condition of the huge amounts of ammunition left over from World War II also contributed to the problem. At the end of the war, the United States had a

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[29] "Battle of the Soyang River: An Analysis of Artillery Support, X Corps Sector, 1 May–29 May 1951," pp. 6–7, copy in CMH files.

[30] Ibid., annex to Encl 4, copy in CMH files. Army artillery units included eight 105-mm. howitzer battalions, four 155-mm. howitzer battalions, two 8-inch howitzer batteries, and two 155-mm. gun batteries. The 11th Marine Regiment (three 105-mm. howitzer and one 155-mm. howitzer battalions) plus a 4.5-inch rocket battery also participated in the battle. Two 105-mm. howitzer battalions from the ROK Army were also present. See Huston, *Sinews of War*, pp. 631–32; *Hearings on Ammunition Supplies in the Far East*, 1953, p. 75.

[31] Hermes, *Truce Tent*, pp. 225, 510; "Employment and Effectiveness of the Artillery With the Eighth Army," p. ix and app. I, p. 42, copy in CMH files.

937th Field Artillery Battalion firing 155-mm. guns during the Soyang River battle

tremendous stock of ammunition, but it was not a balanced one. Hasty demobilization depleted the Army of personnel who could have assessed and cared for the ammunition, and as a result, much of it deteriorated. The Army drew on the large stock without replacing it, and the lack of postwar orders caused the ammunition industry to close down. Prosperity in 1950 made the business community reluctant to reconvert factories to wartime needs, especially when many believed that the war would be short and that reconversions would not be necessary with the large World War II stockpiles available. Because an eighteen-month to two-year lead time was necessary under the best of conditions to produce ammunition in quantity, ammunition was not supplied in adequate amounts until late 1952 and early 1953. The piecemeal financing of the war also increased the difficulties, as did the steel strike in the spring of 1952, which, in particular, affected ammunition production.[32]

By the spring of 1952, it was apparent that if ammunition were fired in Korea at the authorized rates, complete replacement would not be possible and theater levels would drop. Stocks, globally, were reaching critically low levels. The Far East Command, therefore, reduced the number of rounds a weapon could fire per day. Orders required that, wherever possible, air support and support from heavy

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[32] Hermes, *Truce Tent*, pp. 224–25; *Hearings on Ammunition Supplies in the Far East*, 1953, p. 145; Rpt, Maj Gen William O. Reader, Dep ACofS, G–4, [1954–55], sub: The Korean War Ammunition Shortage, pp. 2–7, 11–12, 69, copy in CMH files (hereinafter cited as Reader Rpt).

Table 22—Field Artillery Missions in the Korean War

Type of Fire	*Percent of Missions*
Harassing and Interdicting	22
Observed Fires on Targets of Opportunity	21
Defensive Fires (including support of patrols)	20
Countermortar	10
Counterbattery	9
Registrations	6
Counterflak	5
Offensive Fires	4
Tests and Training	3

artillery weapons, which were not as critically short of ammunition, be used instead of light and medium artillery. Nevertheless, in the event of an enemy attack, a gun could fire whatever amount was necessary to repulse it. To ensure the amount necessary would be available, basic loads (ammunition actually carried with the troops) remained unchanged.[33]

Although the troops could not fire as much artillery as they might have desired, the ammunition shortage affected the Army worldwide more severely than it did the war in Korea as long as the demands of the war remained stable. Only by the spring of 1953 was the Army supplying ammunition to the theaters in more adequate amounts.

The field artillery learned few new lessons during the war, but the importance of the arm was reconfirmed. Artillery played an important role in keeping the enemy confined to trenches and bunkers, and the large expenditures of ammunition made it possible for the United Nations Command forces to compensate for being outnumbered and, in the end, to keep their casualties low. Counterbattery, interdictory, and harassing fires pressured the Communist forces continuously. The ability of the gunners to put down heavy fire quickly and accurately was an influential factor throughout the war. The types of artillery fire support employed in Korea between October 1951 and July 1953 are shown in Table 22.

Fire support coordination centers[34] operated at all corps and division fire direction centers, and the principle was also applied at the infantry regimental and battalion levels. Coordination of air and artillery operations was maintained, but the formal screening of targets to determine the most suitable means of attack was rarely attempted. The artillery effort was limited except during enemy attack, by ammunition allotments, but the air effort compensated by maintaining available airpower at peak operating efficiency. The use of naval fire support was limited to the ROK I Corps sector, with intermittent naval long-range heavy fire employed in X Corps.[35]

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[33] Reader Rpt, [1954–55], p. 69, copy in CMH files.

[34] A fire support coordination center is a single location in which communication facilities and personnel needed to coordinate all forms of fire support are centralized.

[35] Reader Rpt, [1954–55], pp. 7–8, copy in CMH files.

A complete system of fortified observation posts stretched out across the front, with the forward observer bunkers usually adjacent to the bunker of the supported infantry company commander. Fire missions were commonly initiated by coordinates, and the time to compute and transmit data after target identification by the observer varied, normally between one and three minutes, depending upon the ability and experience of the observer. The scarcity of targets of opportunity led to greater use of photo interpretation to develop targets for observed fire, and in most divisional and corps fire direction centers, the photo interpreter teams worked around the clock. As in World War II, light aircraft played an important part in artillery operations, and air surveillance of the battlefield was continuous during daylight hours, weather permitting. The division artillery aircraft were used for close-in surveillance, while corps artillery aircraft operated throughout the depth of enemy artillery positions. Difficult terrain and lack of visibility across much of the front hampered survey operations, but the static nature of the war during the last two years permitted the eventual establishment of excellent survey control. Little stress was placed on target area survey, for the few point targets visible from observation posts were fired on with enough frequency to establish adjusted coordinates. Artillerymen usually tried to select and check registration points that would be identifiable on a map. When they did not wish to use an identifiable point, the target was usually assigned map coordinates based on aerial photographs. The emphasis on map coordinates was probably justified in spite of numerous indications of map inaccuracies, and these inaccuracies seriously affected only a small percentage of artillery fires.[36]

Europe and the "New Look"

The Korean War was a limited conflict for which the Army never fully mobilized. Moreover, the partial mobilization that did occur was aimed primarily at placing the United States and its allies in a better position to contain Soviet and Chinese ambitions worldwide. The emphasis on rearmament was on preparing for the defense of Europe, where the nation believed the chief threat to be. For operations in Korea, money, manpower, and materiel were provided on an ad hoc basis, with after-the-fact budgeting that furnished supplements each year to take care of replacing expended materiel. Budgets prepared for fiscal years 1952, 1953, and 1954 were each based on the assumption that the war would end during the respective year and were developed for meeting the specific goals recommended by the Joint Chiefs of Staff in 1951 to quell the worldwide Communist threat.[37]

Forces committed to the North Atlantic Treaty Organization (NATO), formed in 1949, were the foundation of European defense, but in 1950 the Allied strength in Europe equaled only seven combat divisions, two of them American (counting the constabulary as a division). The outbreak of war in Korea stimulated a growth

[36] Ibid., pp. 9–13, 17–18, copy in CMH files.

[37] Robert W. Coakley, Karl E. Cocke, and Daniel P. Griffin, "Demobilization Following the Korean War," OCMH Study no. 29, p. 1, copy in CMH files.

of forces. By 1952, NATO had raised its troop commitments to twenty-six combat divisions, including the equivalent of six from the United States.[38]

There was a corresponding rise in the number of American field artillery units in Europe. In July 1950, the Army had nine field artillery battalions in Europe, four divisional battalions and one 155-mm. howitzer and four 105-mm. howitzer nondivisional battalions. By August 1953, it had twenty divisional battalions, two corps artillery headquarters, six group headquarters, and twenty-five nondivisional field artillery battalions on the continent. The expansion amounted to a fivefold increase over a three-year period.[39]

The political climate and administration changed in January 1953, when General of the Army Dwight D. Eisenhower became president. Shortly thereafter, key administration officials spearheaded a thorough review of American military policy. They considered the objective of "preparing for a year of maximum danger" to be fallacious. Defense appropriations, they believed, should be long term, "a matter of adequate protection to be projected as far into the future as the actions and apparent purposes of others may compel us." When completed, the review concluded that a continuation of the high level of military spending on the scale of that during the Korean War years would seriously damage the national economy.[40]

A definite military policy, popularly known as the "New Look," emerged by the end of 1953. The new policy envisioned an increased reliance on nuclear firepower rather than on forces armed with conventional weapons and introduced the concept of "massive retaliation" and the prospective use of nuclear weapons on future battlefields. Airpower was seen as a means of delivering nuclear firepower that would permit an economical use of manpower. Greater mobility in the use of armed forces was to be achieved through the development of strategic reserves that could be readily deployed to meet sudden aggression against the United States or its allies. Under the new concept, the United States was to furnish naval and airpower, complicated and expensive equipment and weapons, and highly mobile combat forces, while the Allies were to provide the bulk of the ground troops needed to defend their own territories. These policies, with their emphasis on airpower and nuclear firepower, seriously threatened the rationale of the Army's ground forces. Although the Army managed to maintain its strength and combat structure more or less on Korean War levels, "massive retaliation" clearly deemphasized conventional ground troops and their supporting artillery.[41] By the mid-1950s, the Army had reacted to these threats along two lines. One was to achieve a nuclear role for the Army in its missile program, and the other was to reorganize its ground combat forces for employment on the nuclear battlefield, to include the development and use of tactical nuclear weapons.

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[38] Directory and Station List of the United States Army, July 1950 and August 1953. The U.S. units in Europe actually consisted of five combat divisions plus three regimental combat teams.

[39] Ibid.

[40] Coakley, Cocke, and Griffin, "Demobilization," p. 4, copy in CMH files.

[41] Ibid., pp. 5–6, 11, copy in CMH files.

CHAPTER 9

The Nuclear Arena

The Korean War and the desire to meet any potential threats by the Soviet Union intensified the efforts begun during War World II to develop rockets[1] and missiles. In 1952 and 1953, tests with the hydrogen bomb confirmed the fact that long-range ballistic missiles[2] were a potentially efficient means of delivering thermonuclear warheads to distant targets. A key factor was the great reduction in the weight-to-yield ratio of nuclear warheads. Technological advances seemed to warrant the great expense that research, development, and production of such missiles entailed. Despite War Department reports favoring missile development, the bulk of the reduced peacetime budget had gone into more potent atomic bombs and jet-propelled aircraft to transport them. Missile research had remained a minor item in the defense budget during the early postwar years. Thus, with technological breakthroughs in the development of nuclear warheads, the Army, which stood the most to lose with the downgrading of its conventional forces, made a special effort to share prominently with the other services in the development and employment of missiles and rockets.

Early Missile Developments

The Army became interested in the development of rockets and missiles during World War II. To pursue this objective, the Joint Chiefs of Staff in early 1942 constituted what became known as the Joint Committee on New Weapons and Equipment, chaired by Office of Scientific Research and Development director Vannevar Bush, a renowned scientific administrator who enjoyed a distinguished career in applied mathematics and electrical engineering at the Massachusetts Institute of Technology in the two decades following World War I. The committee had two principal functions: to coordinate military and civilian research during the war and to advise the Joint Chiefs on any technical advances that directly affected strategy. There remained, however, an absence of controlling directives, and the missile programs of the several military departments were uncoordinated. A spirit of rivalry sprang up that further frustrated overall missile development. Even though

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[1] A rocket is a self-propelled vehicle without an installed or remote control guidance mechanism, whose trajectory or flight path cannot be altered after launch.

[2] A ballistic missile is one that is guided during the first part of its trajectory, but becomes free-falling in the latter stages of its flight to the target.

many efforts were made throughout the years to delineate the areas of responsibility according to mission, confusion continued in the development of the various rocket and missile systems.[3]

During the war, the Army arranged with its Ballistics Research Laboratory at Aberdeen Proving Ground, Maryland, and the Jet Propulsion Laboratory at the California Institute of Technology to study the possibilities of long-range guided missiles.[4] Based on the report, a contract was made with the Jet Propulsion Laboratory for general research on guided missiles. The results were so encouraging that two more were let. The first contract with the General Electric Company in 1944 led to the development of long-range surface-to-surface missiles, later named the Hermes Project. Although a tactical weapons system never materialized from the ten-year project, it made valuable contributions in the areas of propulsion systems, rocket fuels, aerodynamics, and guidance and testing equipment. Dubbed the Nike Project, the second contract with Bell Telephone Laboratories and the Western Electric Company in February 1945 was for the development of high-altitude antiaircraft missiles. On 9 July, the Army established the White Sands Proving Ground (later called White Sands Missile Range) in New Mexico for the practical testing of missiles.[5]

After the end of World War II, the United States managed to obtain a few completed V–2 rockets and enough parts to assemble about one hundred more. The government also brought under contract the German team of Walter Dornberger and Wernher von Braun, two of the most important figures in the history of guided missiles, as well as one hundred thirty other German scientists and engineers. The group initially established itself at Fort Bliss, Texas, which was convenient to White Sands, and began to integrate the V–2 program with American efforts. Nevertheless, until the early 1950s, progress was slow because the missile program was not conducted on a high-priority level.

Shortly after the German team arrived in Texas, the Jet Propulsion Laboratory fired the first of the Without Altitude Control, or WAC, Corporal series of supersonic liquid-fueled rockets at White Sands. In what became known as the Bumper program, the WAC-Corporal was later combined with a V–2 rocket as a booster to produce a very high-altitude supersonic missile. On 24 February 1949, a V–2 Bumper boosted a WAC-Corporal into space at a speed of 5,150 miles (8,286.4 kilometers) per hour. It was the first man-made object outside the earth's atmosphere. It was also the first

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[3] On the committee's mission, see Subject File, 1942–46, General Records of the Joint New Weapons Committee, Entry 92, RG 218, NARA.

[4] A guided missile contains a built-in guidance system that may be preset prior to flight or that may be controlled during flight either by internal homing devices or by external radio signals.

[5] Charles H. Donnelly, *The United States Guided Missile Program*, prepared for the Preparedness Investigating Subcommittee of the Senate Committee on Armed Services, 86th Cong., 1st sess., 1959, pp. 7–8.

time that radio contact was achieved with an object almost 250 miles (402.2 kilometers) above the earth.[6]

Late in 1949, when missile and rocket research was still in the evolutionary phase, the Joint Chiefs of Staff announced a new policy for the development and use of guided missiles. Generally, each arm was to employ guided missiles in the manner and to the extent necessary to perform its assigned mission, and each service was authorized to develop its own weapons. Under the policy, the Army was assigned the responsibility for antiaircraft guided missiles and for ground-launched short-range surface-to-surface guided missiles supplanting or extending the capabilities of conventional artillery. Despite the policy, the development of missiles and rockets in the United States continued to be fraught with duplications of effort and confusion.[7]

Wernher von Braun

The decision to accelerate the development of rockets and missiles in the late 1950s represented the culmination of a frustrating period in which the program had depended upon the extent of cuts necessary to remain within the annual defense budget ceiling. In early 1950, Army Chief of Staff Collins established the Army Equipment Board under V Corps commander Lt. Gen. John R. Hodge, to review the Army's equipment requirements and to establish a revised research and development guide. Although

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[6] DA Press Release, "Army Rocket Goes Over 250 Miles Into Outer Space," 25 Feb 1949, copy in CMH files; Donnelly, *Guided Missile Program*, pp. 9–10; James W. Bragg, "Development of the Corporal: The Embryo of the Army Missile Program," Historical Monograph no. 4, 1961, 1:xiv, files of U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, Alabama, and copy in CMH files. For additional information about the American program to bring German scientists to the U.S. for research after World War II, see: Harriet Buyer and Edna Jensen, "History of AAF Participation in Project Paperclip, May 1945–March 1947 (Exploitation of German Scientists)," August 1948, files of Historical Office, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio; David S. Akens, "Historical Origins of the George C. Marshall Space Flight Center," December 1960, files of National Aeronautics and Space Administration, Huntsville, Alabama; James McGovern, *Crossbow and Overcast* (New York: William Morrow and Co., 1964); Clarence G. Lasby, *Project Paperclip: German Scientists and the Cold War* (New York: Atheneum, 1971); and Paul H. Satterfield and David S. Akens, "Army Ordnance Satellite Program," 1 November 1958, AMCOM files and copy in CMH files.

[7] Memo 1620/12, JCS for SecDef, 17 Nov 1949, sub: Assignment of Responsibility for Guided Missiles, cited in Mary T. Cagle, "History of the Lacrosse Guided Missile System, 1947–1962," 10 September 1962, p. 16, AMCOM files and copy in CMH files.

earlier boards had given priority to the development of atomic bombs and strategic aircraft, the Hodge board gave precedence to the development of modern equipment needed to make the Army's ground forces effective. The Corporal, Honest John, and other artillery weapons eventually fulfilled the specific requirements outlined in the guide and subsequent revisions.[8]

Honest John Rocket

The Ordnance Corps responded promptly to meet part of the Hodge board's recommended requirements with a special-purpose large-caliber rocket, later known as the Honest John.[9] Conceived in 1950 as a direct-support atomic weapon carrier and fielded four years later, the 762-mm. Honest John was a solid-propellant fin-stabilized supersonic free-flight rocket developed by the Douglas Aircraft Company to complement medium- or long-range tactical-support artillery.

The earliest Honest Johns were hastily improvised weapons to augment existing artillery when ammunition problems in Korea were still acute and when the threat from the Soviet Union seemed particularly great. Although capable of firing high-explosive conventional warheads, it was the first large-caliber rocket to carry an atomic warhead. The rocket was based partly on a crude German experimental rocket and partly on a rocket designed by the Navy. The launcher was a simple track, mounted on a standard Army truck, but the mechanism provided the United States with the first opportunity of linking a nuclear warhead with a mobile surface vehicle. Because of their makeshift nature, the rockets soon needed replacement. The improved Honest Johns, which finally reached the field in 1961, had a range of 25 miles (40.2 kilometers) compared to the earlier rocket's 16-mile (25.7-kilometer) range and had greater accuracy and reliability. Weighing several tons, the rocket's self-propelled launcher was so light and its fire control so simple that the system had greater battlefield mobility than conventional heavy artillery. The Honest John was aimed and fired in the same manner as cannon, and it could be used in terrain where it was impossible to move an 86-ton atomic cannon that had also been developed. The Honest John presented less of a camouflage problem in position than the heavy gun, but because the back blast upon firing was plainly visible, the rocket launcher had to move out of position quickly to reduce the

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[8] Mary T. Cagle, "History of the Basic (M31) Honest John Rocket System, 1950–1964," Historical Monograph Project no. AMC 7M Part 1, 7 April 1964, pp. 17–19, AMCOM files and copy in CMH files; Army Equipment Development Guide, 29 December 1950, copy in MHI files.

[9] Maj. Gen. H. N. Toftoy, commander of Redstone Arsenal, recounted in an article that the name Honest John derived from the fact that he had overheard a Texan making some questionable statements and thus challenged the latter, who exclaimed: "Why around these parts I'm called 'Honest John!'" General Toftoy applied the name to the rocket because, prior to the first test firing, the project was nearly canceled on the grounds that such a large unguided rocket could not possibly have had the accuracy to justify further funds. See H. N. Toftoy, "Army Missile Development," *Army Information Digest*, December 1956, p. 32.

Honest John rocket

effects of enemy counterfire. The U.S. Marine Corps and numerous foreign nations also adopted the rocket.[10]

The original Honest John rocket batteries each had three rocket platoons, each with two sections. Each of the six sections had one self-propelled rocket launcher. Until 1957, one battery was attached to each 280-mm. atomic cannon battalion for administrative and operational control. But between 1956 and 1957, the batteries were reorganized as single-firing battery battalions. The firing battery had two firing platoons of two launchers each. Sufficient personnel and equipment were provided to employ the firing sections individually, either as platoons or as battalions, giving the desired flexibility.[11]

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[10] Mark S. Watson, "New Trend in Weapons," *Ordnance*, January-February 1961, pp. 488–92; Mary T. Cagle, "Design, Development, and Production of Rockets and Rocket Launchers," Special Historical Monograph, 21 July 1954, 2:152–54, AMCOM files and copy in CMH files. See also idem, "History of the Basic Honest John," AMCOM files and copy in CMH files, and Mary T. Cagle and Elva W. McLin, "History of the Improved (M50) Honest John Rocket System, 1954–1965," Historical Monograph no. AMC 7M Part 2, 23 August 1965, AMCOM files and copy in CMH files.

[11] TOE 6–525C, 1 Mar 1956; TOE 6–525D, 5 Dec 1958; Thomas E. DeShazo, "Field Artillery Missiles," *Army Information Digest*, December 1956, p. 106. The 280-mm. gun is discussed in chapter 10.

Fielding the New Missiles

Spurred in its development by the Korean War and by the Army's desire to gain a nuclear role in national defense planning, the Corporal, the first surface-to-surface ballistic guided missile with a range of 25 to 75 nautical miles (46.3 to 138.9 kilometers),[12] was an outgrowth of the WAC-Corporal. So named because it was an advance over those in an earlier series known as Privates, the Corporal was developed to provide the Army with a weapon that could deliver a nuclear warhead, extend the range of field artillery, and furnish a readily available means of all-weather heavy fire support. Although it was fielded in 1955, it was never altogether satisfactory. The liquid-fueled Corporal was susceptible to countermeasures, requiring many items of specialized ground equipment and a correspondingly large number of personnel; its mobility was poor and its fueling process slow; and the intervening time between target assignment and actual firing was excessive, given the fuel's highly corrosive nature. All defects were to be avoided in the second generation of the missile. Despite some improvements, however, many of the criticisms of the earlier missile also applied to later models. The program's original objective was to provide a total of sixteen battalions in a state of combat readiness by July 1954, but only three battalions were active by that date and none was operational. With the end of the Korean War, however, the goal was reduced. By 1957, eight Corporal battalions were assigned in Europe and five in the United States, the latter number subsequently reduced to four. Despite its shortcomings, the Corporal set the stage for improved tactical-support guided missiles and remained operational until 1964, when the solid-propellant Sergeant replaced it.[13]

The objectives of field artillery missiles and rockets were to provide all-weather fire support for land, airborne, and amphibious combat operations beyond cannon-range coverage; great destruction against "hard" targets, such as tank formations and fortifications; and fire support for combat troops making deep penetrations, such as airborne assaults or armored breakthroughs. Initially, the missile and rocket units were organized in much the same manner as conventional artillery units, with a battalion headquarters and headquarters battery, medical detachment, three firing batteries, and a service battery. In the case of the Corporal, a battalion had an aggregate strength of about 850. This structure was soon reduced by one missile battery, to an aggregate strength of 531.[14] Tests, however, showed that so large an organization was unsatisfactory for any unit whose primary mission was the delivery of nuclear firepower. To achieve a sufficiently large volume of fire with conventional artillery, several guns were grouped in batteries and several batteries

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[12] A nautical mile is a unit of distance used in navigation based on the length of a minute of arc of the great circle of the earth, now replaced officially in the U.S. by the international nautical mile equal to 6,076.11549 feet or 1,852 meters.

[13] Bragg, "Development of the Corporal," 1:162, 172–78, AMCOM files and copy in CMH files; Earle G. Wheeler, "Missiles on the Firing Line," *Army Information Digest*, December 1956, p. 40. See also C. R. Clark and J. T. McIntyre, "Operational Effectiveness of the Corporal Guided Missile with Clustered GB Warhead," Technical Memorandum ORO–T–317, November 1955, copy in CMH files.

[14] TOE 6–545A (Tentative), 13 Feb 1953; TOE 6–545A, 1 Jul 1953; DeShazo, "Field Artillery Missiles," pp. 103–04.

Corporal missile

to battalions; however, to achieve the same volume of fire with the nuclear-capable Corporal and Honest John, only one missile was needed. Therefore, to exploit the potential of three missile-firing batteries in a battalion, the batteries and missiles would have to be dispersed over a very large area, thus counteracting the operational and logistical advantages of centralized battalion control. These considerations resulted in a single-fire unit organized with a headquarters, headquarters and service battery, and one missile battery with two missile-launching sections.[15] All support functions, including ammunition supply, motor maintenance, and personnel administration, were consolidated at battalion level. The units had limited capability for simultaneous defense against ground attack and no capability against an air attack, thereby requiring that other units provide local security support. The missiles were employed in pairs to ensure timely atomic artillery fire support.[16]

The batteries of the Corporal and Honest John battalions were similar except that the Corporal's firing battery included a guidance platoon since the missile received commands from the ground during flight. The principal difference in employment

[15] DeShazo, "Field Artillery Missiles," pp. 103–04; TOE 6–545P (Proposed), 10 Aug 1955; TOE 6–545C, 17 Nov 1955; TOE 6–545D, 20 Feb 1957; TOE 6–545E, 1 Mar 1960.

[16] DeShazo, "Field Artillery Missiles," p. 105.

of the Honest Johns and Corporals was the time needed to occupy a position and fire. Generally, three battalions each of Honest Johns and Corporals were allotted to a corps.[17]

A battalion practiced four methods of operational deployment. The first was for the battalion to operate in a single area, its batteries colocated until the mission was accomplished, thereby not only reducing command, administrative, mess, local security, and launcher reloading problems but also making it possible to engage targets of opportunity in a minimum amount of time. Its main disadvantage was the increased possibility of the entire unit being detected and destroyed by the enemy and, if that failed, the impending need to displace immediately from the now compromised firing site. The second was for the battalion to split off the firing battery, thereby on the one hand reducing the former's vulnerability to enemy attack but on the other hand making administrative, mess, and other command functions to the latter more complicated. The third, a variation of the first, involved deploying the battalion to an assembly area with natural cover or camouflage and then temporarily relocating the firing batteries to predesignated firing positions to execute their mission. In this way, with the firing batteries separated for only short periods of time, centralized battalion functions remained unhampered and the assembly area essentially secure. The fourth entailed deploying the firing batteries in their initial firing positions. After the mission was completed, the elements would displace to the vicinity of their alternate firing positions for reloading, thus being ready to attack targets of opportunity without any appreciable loss in time. But survey and communications problems were more pronounced than in the other three methods, and displacement was just as difficult as in the third method. Also, sustained and maximum rates of fire were hard to achieve. Army leaders felt, however, that the high degree of protection against nuclear attack outweighed these disadvantages.[18] On balance, the method employed thus depended on the tactical situation, the operational mission, and the current intelligence on enemy capabilities.

From the Redstone to Satellites

Shortly after von Braun and the German team moved from Texas to Redstone Arsenal in 1950, they began work on the missile that later became known as the Redstone, named for the arsenal. Although early studies had contemplated a missile with a range of several hundred miles, the Ordnance Department decided that it should be equipped with a thermonuclear warhead larger and heavier than originally specified, thus reducing the range of the proposed missile to around 175 nautical miles (324.1 kilometers). Operational from 1958 to 1964 and with a range of 200 miles (321.8 kilometers), the Redstone was a liquid-fueled missile that had a self-contained inertial guidance system. It was to supplement and extend the range

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[17] Ibid., p. 106; TOE 6–525C, 1 Mar 1956; TOE 6–525D, 5 Dec 1958.

[18] Kenneth B. Stark, "Methods of Deploying Cannon and Missile Field Artillery," *Artillery Trends*, October 1958, pp. 5–8; DeShazo, "Field Artillery Missiles," pp. 106–07.

and firepower of existing artillery and shorter-ranged missiles, give deeper support to ground combat troops, and compensate for the expanding dimensions of the battle area. It also was to augment army and corps artillery fire and provide ballistic missile artillery fire on all targets of interest to the field army commander. Potential targets included troop concentrations, command and logistical installations, missile launching sites, airfields, and communications centers.[19]

Redstone missile

The field artillery missile group was the basic command-and-control organization directing employment of the Redstone, a field army or theater-level weapon. During the period when the Redstones were active, the group normally consisted of a headquarters and headquarters battery, two firing batteries, an engineer company, and an ordnance company. The headquarters battery performed administrative, communications, security, and other command and support functions; the engineer company provided the liquid oxygen and the overall engineering support for the firing batteries; and the ordnance company furnished the missiles, warheads, tools, parts, and maintenance support for weapons and equipment peculiar to the missile. Each firing battery had one launcher and carried one missile as a basic load, but was highly mobile and air transportable.[20] Three Redstone missile groups were eventually activated, two in Europe and one in the United States. Nevertheless, even before the Redstone became operational, the Army decided to replace it with the more promising solid-propellant Pershing missile.[21]

Although the Redstone missile system was viewed as a temporary arrangement in its operational phase, it contributed to significant achievements in the field of

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[19] John W. Bullard, "History of the Redstone Missile System," Historical Monograph Project no. AMC 23M, 15 October 1965, pp. 121–22, 133, AMCOM files and copy in CMH files.

[20] TOE 6–631T, 3 Mar 1958, w/change 1, 21 May 1958; TOE 6–630T, 3 Mar 1958, w/change 1, 21 May 1958; TOE 6–634T, 3 Mar 1958, w/change 1, 21 May 1958; TOE 6–635C, 15 Jun 1956; TOE 6–635D, 15 Mar 1957; TOE 6–635E, 11 Sep 1961. The 1958 and 1961 tables, under which the groups were organized for most of the time, authorized a group headquarters and headquarters battery, two missile batteries, an engineer company, and an ordnance company. The 1956 tables authorized a missile battalion with a headquarters, headquarters and service battery, and one firing battery. The 1957 tables were similar except that two firing batteries were authorized.

[21] Bullard, "History of the Redstone," pp. 102, 120–25, AMCOM files and copy in CMH files.

missile technology. Because the Redstone had been developed with only a 200-mile (321.8-kilometer) range, the need for a long-range missile had not yet been met. After the Soviet Union succeeded in developing a 1,800-mile (2,896.2-kilometer) missile in the spring of 1955, the Army accelerated development of a longer-range weapon. To meet this objective, the research and development group at Redstone Arsenal felt that the Redstone could be modified, and in the fall of 1955, Secretary of Defense Charles E. Wilson authorized the Army to develop an intermediate-range ballistic missile, subsequently called the Jupiter, based upon Redstone technology. The Army and Navy were to undertake the project jointly, but the Navy was never particularly interested in a liquid-propelled missile because of the difficulties of shipboard storage, handling, and launching. Instead the sea service sought approval to develop a solid-propellant missile and became more removed from efforts to adapt the Jupiter missile for shipboard use. Once Secretary Wilson approved the development of the Polaris missile for the Navy on 8 December 1956, it withdrew from the Jupiter program.[22]

In the meantime, an Air Force proposal for the 1,500-nautical-mile (2,778-kilometer) range missile Thor had been accepted and given top priority, with the Douglas Aircraft Company as the primary contractor. Because the Air Force and the Army were developing missiles with essentially the same characteristics, considerable controversy arose as to their employment. The Army wanted a mobile long-range missile to support theater forces and believed that the launching of such a missile from a relatively rear area might prove quite effective and economical. Its leaders regarded fixed missile sites as too vulnerable in a battle theater. With a missile that had sufficient ground mobility to maneuver with a field army, the Army thought it would be able to strike massive blows on ground targets focusing on distant troop formations, communications centers, missile sites, atomic stockpiles, and airfields. In contrast, the Air Force wanted missiles that would serve at fixed sites to support its Strategic Air Command bases. The Air Force reasoned that with missiles ready to fire against enemy airfields or missile sites, penetration of enemy territory by manned bombers would be improved.

In his memorandum of 26 November 1956, Secretary Wilson limited the Army to a 200-mile (321.8-kilometer) range in its tactical surface-to-surface missiles and gave operational control of the Jupiter to the Air Force. Although the Air Force believed that the employment of long-range missiles should be under its control, the Army had the scientific ballistic missile experience and talent to develop them. Wilson, therefore, allowed the Army to continue its development of the Jupiter but directed that it was to be employed by the Air Force.[23]

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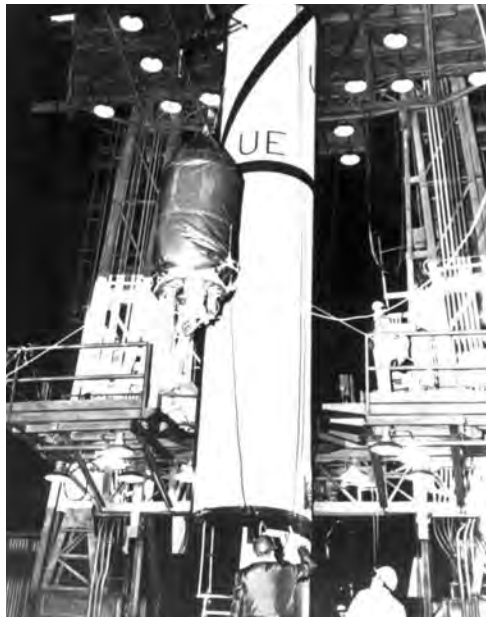
[22] James M. Grimwood and Frances Strowd, "History of the Jupiter Missile System," 27 Jul 62, pp. 3–13, 23–36, AMCOM files and copy in CMH files.

[23] Memo, SecDef for Members of the Armed Forces Policy Council, 26 Nov 1956, sub: Clarification of Roles and Missions To Improve the Effectiveness of Operations of the Department of Defense, cited in Grimwood and Strowd, "Jupiter Missile System," app. 1, pp. 1–9, AMCOM files and copy in CMH files; W. G. Wyman, "Impact of Missiles on Tactical Doctrine," *Army Information Digest*, December 1956, pp. 114–24; Donnelly, *Guided Missile Program*, pp. 28–31, 67–69, 95–96, 114–18; James M. Gavin, *War and Peace in the Space Age* (New York: Harper, 1958), pp. 9–10, 76–77, 145–46, 154, 160–61, 167–68.

In light of nuclear weapons, jet aircraft, and ballistic missiles, one assumption open to question was that the Army's combat zone would be limited to 100 miles (160.9 kilometers) forward and back of the front line. The Army planned to disperse its forward forces widely until ready to strike, mass quickly for the attack, and then rapidly disperse again before the enemy could retaliate. Under such a scenario, the depth of the battle area would certainly exceed 200 miles (321.8 kilometers). Also, if nuclear weapons were used, it could be expected that each side might hold sizable pockets in each other's area, resulting in a much deeper combat zone and in an extremely hazy battle line. In January 1958, Secretary of Defense Neil H. McElroy relaxed the 200-mile (321.8-kilometer) limit on the Army's tactical missiles so that the Army could compete with Soviet medium-range missiles.[24]



Hoisting Explorer I atop Jupiter-C

Besides being instrumental in the development of the Jupiter missile for the Air Force, the Redstone was selected as the main booster for launching satellites. The booster was a modified Redstone, but called the Jupiter-C because of its use in the Jupiter program. Well before the Soviet Union's successful launch of Sputnik I on 4 October 1957, the Army had the capability of placing a satellite into orbit with the Redstone booster, but the satellite mission had been assigned to the Navy's Vanguard program. On 8 November, Secretary McElroy directed the Army to modify two Jupiter-C missiles and place a satellite into orbit by March 1958. Eighty-four days later, on 31 January 1958, the Army launched Explorer I, the first American satellite. During the satellite program, the Army gathered valuable knowledge about space and demonstrated the feasibility of using television reconnaissance vehicles in surveying missile impact areas. On 1 July 1960, the Army's satellite program was transferred to the National Aeronautics and Space Administration (NASA). Under NASA's

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On the two missile programs, see Michael H. Armacost, *The Politics of Weapons Innovation* (New York: Columbia University Press, 1969). Although seven squadrons of Thor and Jupiter missiles were procured for overseas deployment, the European allies in the end were reluctant to assume the inherent strategic risks. Eventually, both missiles were phased out of production. Interest in the missiles as mobile land-based weapons also waned, and in 1959, the United States announced its intention of not establishing any further bases for liquid-fueled missiles in Europe because of their vulnerability.

[24] Elizabeth C. Jolliff, "History of the Pershing Weapon System," Historical Monograph Project no. AMC 76M, 20 May 1974, p. 14, AMCOM files and copy in CMH files.

Jupiter-C blasting off, 31 January 1958

guidance, the most spectacular accomplishment of the Redstone occurred on 5 May 1961. The first manned space flight took place within the Project Mercury program on that date with Navy Comdr. Alan B. Shepard, Jr., riding in the capsule in a suborbital flight to an altitude of 115 miles (185 kilometers).[25]

Command and Control

By the end of 1958, a different kind of combined arms organization appeared in the Army in addition to corps and divisions. When the Southern European Task Force was organized in 1955 at Leghorn, Italy, the Army soon realized that new concepts of organization were necessary. Although the force was organized as a combined arms organization, its primary unit was not a maneuver element, but the Honest John battalion. Missile commands, based on experiences gained from the Southern European Task Force, were developed to provide accurate all-weather firepower for the United States and its allies. Six commands (three types) were originally planned, but strength cuts and funding shortfalls resulted in only four being organized.

The 1st and 2d United States Army Missile Commands were organized as "medium" missile commands, built around the Honest John rocket and the Corporal missile. The medium commands were the largest and most flexible, each numbering approximately 5,000 officers and men and, under tentative tables, having a headquarters and headquarters company, a field artillery rocket group with up to four Honest John battalions, a Corporal battalion, an engineer combat battalion, an armored infantry battalion for local security, a "sky" cavalry squadron for target acquisition, a signal company, and a service and supply group. Their mission was not to replace army and corps artillery but to augment them by supplying rocket and missile firepower to supplement conventional armament. The United States by law could not furnish foreign powers nuclear arms; however, with the deployment of

[25] Bullard, "History of the Redstone," pp. 139–59, AMCOM files and copy in CMH files; Satterfield and Akens, "Army Ordnance Satellite Program," pp. 54–66, AMCOM files and copy in CMH files; "History [of the] Army Ballistic Missile Agency, 1 July–31 December 1960," 1:2–3, AMCOM files and copy in CMH files; "Army Explorer in Orbit," *Army Information Digest*, April 1958, pp. 4–6. See also John B. Medaris, with Arthur Gordon, *Countdown for Decision* (New York: G. P. Putnam's Sons, 1960).

the missile commands, allied forces were assured of the immediate availability of nuclear firepower even though it remained under the control of U.S. authorities.

The 1st United States Army Missile Command, a major component of the Southern European Task Force, was operational in Italy between 1957 and 1965; the 2d, first at Fort Hood in Texas and later at Fort Carson in Colorado between 1957 and 1961. Neither was organized precisely as outlined in the tables. The 1st originally had two Honest John battalions and two Corporal battalions, but no group headquarters; the 2d had a group headquarters, but only two Honest John battalions and one Corporal battalion. In 1969 the 1st, which had turned over its Honest Johns to the Italian army in 1959, was reorganized around the Sergeant missile—the Corporal's replacement. The new structure consisted of a headquarters and headquarters company, a Sergeant battalion, a transportation detachment for aircraft repairs, an engineer company, an aviation company for surveillance, and an ordnance battalion.[26]

The 3d and 4th United States Army Missile Commands were organized as air transportable units, built around an Honest John battalion to support divisions with rocket and atomic firepower. The tables authorized each command a headquarters and headquarters company, an Honest John battalion, a signal company, a rifle company for local security, an engineer combat company, and a support company, with an authorized aggregate strength of about 1,100. The 3d served at Fort Bragg, North Carolina, from 1957 to 1963, and the 4th supported the Eighth Army and the First Republic of Korea Army in Korea from 1958 to 1978. Although plans were made for a heavy missile command, organized in much the same manner as the Redstone field artillery missile group, such a unit was never activated.[27]

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[26] On the 1st and 2d Missile Commands, see Ltr, AGAO–O (M) (19 Dec 1957) DCSPER, 26 Dec 1957, sub: Change in Status of Certain Units; TOE 39–61T, 1956; Ltr, AGAO–O (M) 322 (13 Jun 1958) DCSPER, 2 Jul 1958, sub: Change in Status of Certain Units; DOD News Release, "Two Missile Commands Now Included in Strategic Army Corps," 18 Nov 1958; Ltr, AGAO–O (M) 322 (12 Apr 57) DCSPER, 18 Apr 1957, sub: Activation of the 2d United States Army Missile Command (Medium); Ltr, AGAO–O (M) 322 (12 Feb 57) DCSPER, 5 Nov 57, sub: Activation of the Atomic Support Command (Medium). All in respective unit fldrs, CMH files. See also Kenneth F. Dawalt, "2d U.S. Army Missile Command (Medium)," *Army Information Digest*, March 1961, pp. 22–29; Monte Bourjaily, Jr., "Artillery Beef-up in Works," *Army Times*, January 1957, pp. 1, 10; "Missile Commands Near Firm Ground," ibid., October 1958, p. 20.

[27] On the 3d and 4th Missile Commands, see DA Msg 50671, DCSPER to CG, First Army, et al., 13 Mar 1957; Ltr, AGAO–O (M) 322 (12 Feb 1957) DCSPER, 14 Feb 1957, sub: Activation of the Atomic Support Command (Air Transportable); Ltr, AGAO–O (M) 322 (12 Apr 1957) DCSPER, 18 Apr 1957, sub: Activation of the 3d United States Army Missile Command (Air Transportable); Ltr, AGAO–O (M) 322 (24 Apr 1957) DCSPER, 11 Oct 1957, sub: Reorganization of the 3d United States Army Missile Command (Air Transportable); Ltr, AGAO–O (M) 322 (21 Oct 1958) DCSPER, 13 Nov 1958, sub: Change in Status of Certain Units; DOD News Release, "Two Missile Commands Now Included in Strategic Army Corps," 18 Nov 1958; GO 339, Third Army, 28 Sep 1958; DA Msg 936727, DCSPER to CG, Eighth Army, 7 Feb 1958; Ltr, AGAO–O (M) 322 (27 Mar 1958) DCSPER, 9 Apr 1958, sub: Organization of the 4th United States Army Missile Command; Ltr, AGAO–O (M) 322 (2 Jul 58) DCSPER, 31 Jul 1958, sub: Change in Status of Certain Units; 1st End, EACS–MH (16 Nov 1972), 3 Jan 1973, sub: Operational Reports—Lessons Learned, 4th United States Army Missile Command; Unit History, 3 Jan 73, sub: 4th United States Army Missile Command. All in respective unit fldrs, CMH files. See also TOE 39–51T, 1956; TOE 39–51D, 18 May 1960; TOE 39–51G, 26 Apr 1968; George C. Dalia, "Atomic Punch for the Ground Gainers," *Army Information Digest*, November 1958, pp. 2–10; "Missile Commands Near Firm Ground," ibid., October 1958, p. 20.

Although most Army missiles and rockets (as well as some cannon artillery) were capable of firing nuclear warheads, the firing units did not always maintain the warheads. To provide for control, custody, storage, maintenance, and monitoring of the warheads and to perform nuclear warhead projectile mating, field artillery missile detachments were organized usually on the basis of one detachment for each battalion-sized missile unit. These detachments also supported foreign missile and rocket battalions, but they operated under the control of U.S. Army artillery warhead support groups, which also controlled warhead detachments for air defense artillery battalions. Besides supervising the field artillery and air defense artillery nuclear warhead support detachments, the groups had the mission of advising the host nation on security, operational, technical, logistical, and administrative matters pertaining to warheads.[28] The authorization process required to release nuclear warheads was complex. After receiving the initial release order from the National Command Authority in Washington, the Supreme Allied Commander, Europe (SACEUR), then had full control of the authority to fire nuclear weapons in Europe. In 1961, SACEUR instituted procedures whereby another senior-ranking headquarters officer—either the chief of staff or the air deputy—had to also be present before the final release order could be issued. A dual control system was thus established, which applied to all levels of actions concerning the release of nuclear weapons.[29]

In 1962, the Joint Security Inspection Team, composed of representatives from the Atomic Energy Commission, from the Department of Defense, and from Congress, visited Europe and became concerned over the possibility of inadvertent or deliberate unauthorized firing of nuclear weapons. As a result of the visit, certain deficiencies were corrected, and standard criteria were developed for nuclear weapons storage sites. In addition to keeping the warheads physically separated from the weapons themselves, permissive action link (PAL) security devices were installed to prevent the weapons from detonating in a nuclear mode or from being disassembled to remove the nuclear material. These measures helped ensure against accidental detonation or terrorist threats.[30]

Lacrosse Missile

In 1959, a new missile came into use that promised to be of more value in tactical warfare than previous missiles. Conceived in 1947 by the Marine Corps, the Lacrosse was initially intended as a conventionally armed missile to supplement conventional artillery in close support of ground troops. Specifically, it was to destroy enemy strongpoints, such as concrete pillboxes and reinforced bunkers,

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[28] TOE 6–500T, 15 Dec 1958; TOE 6–500D, 23 Aug 1963; TOE 6–500G, 31 May 1967; TOE 6–500H, 28 Aug 1975; TOE 39–401T, 1959; TOE 39–401E, 19 Feb 1965; TOE 39–401G, 31 Aug 1967; TOE 39–401H, 30 Sep 1976.

[29] W. M. Glasgow, "USAREUR's Nuclear Weapons Responsibilities (1952–1964)," 1965, pp. 71–73, copy in CMH files.

[30] Ibid., copy in CMH files; Lawrence M. Greenberg, "To Harness Vishnu: The Army and Permissive Action Links," August 1987, copy in CMH files.

Lacrosse missile

not easily attacked or eliminated by conventional weapons. The missile was also to supplement naval gunfire and aerial bombardment in close support of landing forces. The Marine Corps had witnessed the need for a more accurate and powerful close support weapon again and again during World War II, particularly in the heavily fortified islands of the western Pacific Ocean. For example, seventy-four days of naval and aerial bombardment to soften up Iwo Jima had minimal effect before the Marines launched their assault on 19 February 1945; despite continuous naval and aerial support, the battle lasted twenty-six days, with the Marines sustaining heavy casualties. The Lacrosse missile was designed to overcome such strong defenses. Its principle of operation was to be comparable to the game of lacrosse, from which the missile received its name, in that the weapon was to be launched (from the ground or a nearby ship) in the rear area and thrown forward, where it was to be picked up by a forward observer with a radio and electronically directed to the target.[31]

Early in 1947, the Marine Corps presented plans for the feasibility of such a weapon to the Navy's Bureau of Ordnance. As a result, the bureau approved proposals made by the Applied Physics Laboratory of Johns Hopkins University in Baltimore, and Project Lacrosse began on 15 September. Overarching specifications

[31] Cagle, "History of the Lacrosse," pp. 1–2, AMCOM files and copy in CMH files; DOD News Release, "Lacrosse Successfully Test Fired by U.S.–Canadian Army Team," 19 Jan 1960, copy in CMH files.

related to accuracy and range. The missile was to have a circular error probable[32] of not more than 5 yards (4.6 meters), a requirement that made the development of its guidance system the most difficult aspect. Its range was to fall between a minimum of 1,000 yards (914.4 meters) and a maximum of 20,000 yards (18,288 meters), with anti-jamming and in-flight self-destruct devices to be incorporated into the design.[33]

In late 1949, the Joint Chiefs of Staff announced that the Army would have responsibility for ground-launched short-range surface-to-surface missiles supplanting or extending the capabilities of conventional artillery. The Navy-sponsored Lacrosse missile thus moved to the Army on 31 August 1950.[34]

With the impetus of the Korean War and increased support by the Army, development of the Lacrosse was stepped up. In time, however, myriad problems—funding restrictions, unsolved technical problems, poor management, schedule slippages, cost overages, mounting user criticism, and declining confidence in tactical utility—surfaced that plagued progress for almost nine years.[35] Also, significant changes were made in the requirements: an increase in warhead weight from 100 to 500 pounds; an increase in minimum and maximum ranges; a decision to use a solid propellant motor; and a decision to adapt both atomic and optimum fragmentation warheads for the missile, permitting employment of the system in a general-support role. The statement of military characteristics for a close-support field artillery guided missile system approved in January 1956 was in effect less than three months when the Army reclassified the weapon as a general-support field artillery guided missile system. The revised military characteristics, published on 13 June 1957, stated that the missile was to be employed as corps artillery in general-support and reinforcing roles against appropriate personnel and materiel targets, including heavy fortifications. It also was to be capable of delivering accurate close-support fire and have sufficient mobility to permit tactical employment similar to that of medium artillery. Under the new operational concept, the forward observer section was to be organized and equipped to work with division artillery in support of airborne, infantry, and armor units, and all forward observer guidance equipment was to be man-transportable. The new military characteristics required modifications of certain performance characteristics, further delaying the program.[36]

To resolve the electronic countermeasure problem, the Army decided in early 1956 to develop the Mod I (Modification I) Lacrosse system using all-pulse ranging and tracking techniques. This effort was never completed because of meager funding and other difficulties. When the Army conducted a complete review of the program in 1959, the study showed that twelve Mod I Lacrosse battalions would

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[32] Circular error probable (CEP) is an indicator of the accuracy of a missile or projectile, used as a factor in determining probable damage to a target. It is the radius of a circle within which half of the missiles/projectiles are expected to fall.

[33] Cagle, "History of the Lacrosse," pp. 2–3, AMCOM files and copy in CMH files.

[34] Ibid., pp. 16–17, AMCOM files and copy in CMH files.

[35] Ibid., p. 19, AMCOM files and copy in CMH files.

[36] Ibid., pp. 46–50, 199–211, 213–29, AMCOM files and copy in CMH files.

cost over $100 million more than twelve battalions without Mod I. Because the Army was already short of funds for other projects, this expenditure was out of the question, and Army Chief of Staff General Lyman Lemnitzer concurred in August 1959 with a recommendation to cancel the Mod I program. Cancellation of the Mod I system left the Lacrosse without the one feature that might have made the missile a reliable field-worthy weapon, and the Marine Corps announced its immediate withdrawal from the program. Marine Brig. Gen. Harvey C. Tschirgi later testified that

> it takes a very simple device to interfere with the control of the Lacrosse. Lacrosse, as you know, is controlled by a forward station and it must have the radio signals going back to it. If any radio transmitter gets on the same frequency, the missile is lost.
>
> If you put a nuclear warhead on one of these things, it is going to be a little bit unfortunate if somebody guided it to the wrong place, or if it got to the wrong place without any guidance. It is a $70,000 missile and it can be interfered with by another local station.[37]

Even though the Lacrosse was susceptible to electronic countermeasures and electronic interference, the Army's official position was that substantial immunity to these problems could not be accomplished without a costly and extensive redesign program. The Lacrosse was vulnerable during actual missile flight, particularly in cases of heavy interference on the operating frequency or adjacent frequencies or under concerted efforts of continuous jamming. Nevertheless, the Army concluded that the Lacrosse might be employed effectively under many conditions without serious results from interference or jamming.[38]

The Army decided to field the Lacrosse in late 1959, but throughout its operational phase the missile was beset with a multitude of problems. The decision to deploy the Lacrosse was based on "operational requirements, atomic stockpile planning, an analysis of Soviet tactical doctrine, timeliness of availability to [the] troops, world situation, investment of over $200 million and other considerations." Army leaders felt that "this decision and the decision to terminate the Mod I gave the Army an effective weapon in the field rather than on the drawing board, [and] saved over $200 million. . . ."[39] Ordnance personnel continued to urge that Mod I be reinstated, but to no avail.

The Lacrosse, with a range of 20 miles (32.2 kilometers), operated in a single-firing battery battalion with four launchers (mounted on standard Army trucks), four forward guidance sections, and two sets of assembly and loading equipment. The battalion had an authorized aggregate strength of about 250. The

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[37] Ibid., pp. 101, 115–16, 125–27, 150, AMCOM files and copy in CMH files. See also U.S. Congress, House, *DOD Appropriations for 1961: Hearings Before the Subcommittee of the Committee on Appropriations*, 86th Cong., 2d sess., 1960, pt. 5, p. 163 (source of quotation).

[38] DA Task Group, "Lacrosse Missile System: Army Fact Book on GAO Audit of the Lacrosse Weapons System for Use in Potential Congressional Hearings," June 1963, tab L, pp. 54–63, copy in CMH files. It was later reported that in Europe the missile operated on German television frequencies, which seriously affected unit training. See notes on draft manuscript, March 1989, Historian's files, CMH.

[39] DA Task Group, "Lacrosse Missile System," June 1963, tab A, encl. 3, pp. 12–17 (quoted words, p. 16), copy in CMH files.

first two battalions were activated at Fort Sill, Oklahoma, in the spring of 1959 and became operational the following year. The plans had called for eight full-strength battalions (four launchers); but, to conserve manpower, eight reduced-strength battalions (two launchers) were organized instead. By early 1961, the Lacrosse had been placed in a buyout status after a total expenditure of more than a quarter of a billion dollars, and in June of that year, four reduced-strength battalions were reorganized as two full-strength battalions. When the Army decided to inactivate all six Lacrosse battalions (in addition to the Corporal battalions) in 1963, allegations quickly arose that suggested the Army had spent $300 million for a missile system with major defects known at the time of procurement. But by the end of 1963, all the Lacrosse battalions had disappeared, and the system was declared obsolete in February 1964. With the successful development of the solid-fuel Sergeant missile and the new 175-mm. gun, the Army had more reliable and efficient systems than the Corporal and Lacrosse. Also, the deployment of the improved Honest John rocket in 1961 and the availability of increased numbers of nuclear warheads for the 8-inch howitzer had further strengthened the Army's fire-support capabilities.[40] Nevertheless, the failure of the Lacrosse left a gap that was not filled until the advent of the Lance missile in the 1970s. Even then, the Lance did not have the capability originally desired by the Marines—that of precision accuracy.

Sergeant Missile

The phaseout of the Corporal and Lacrosse battalions occurred concurrently with the deployment of the Sergeant missile, so named because it was superior to its predecessor—the Corporal. Six Sergeant battalions were authorized to be activated between June 1962 and June 1964. One battalion was to go to the Pacific, four to Europe, and one to remain in the United States. In addition, three West German double-strength battalions (four firing batteries rather than two) and one Belgian battalion were authorized through the Military Assistance Program.[41]

Although the Sergeant met its readiness date of June 1962 as programmed, it fell short of becoming the "workhorse" weapon that the developer had hoped. A major cause of the problem was an injudicious project schedule in the face of clear-cut warnings against accelerated programs. The weapon had a common history with other surface-to-surface missiles of the late 1940s and early 1950s, but the initiation of actual development did not occur officially until 1955. In

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[40] Ibid., tab A, encl. 2, pp. 10–11, and tab R_1, pp. 242–44, copy in CMH files; TOE 6–585T, 1960; "History, Army Ballistic Missile Agency, 1 Jul–31 Dec 60," 1:2–3, AMCOM files and copy in CMH files; U.S. Congress, House, *DOD Appropriations for 1965: Hearings Before a Subcommittee of the Committee on Appropriations*, 88th Cong., 2d sess., 1964, pt. 4, pp. 582–84, and pt. 5, pp. 204–05.

[41] Mary T. Cagle, "History of the Sergeant Weapon System," Historical Monograph Project no. AMC 54M, 28 January 1971, p. 198, AMCOM files and copy in CMH files; DA Fact Sheet, Maj Gen C. E. Hutchin, Jr., Dir, Strategic Plans and Policy, DCSOPS, to Dir, Plans and Policy, Joint Staff, 25 Dec 62, sub: Deployment of Sergeant Missile Battalions, copy in CMH files.

his proposal the previous year, Jet Propulsion Laboratory director Louis G. Dunn had declared that

> the successful completion of the Sergeant weapon is dependent upon a logical and orderly research and development program. Any attempt to place the program on a "crash" basis will inevitably result in compromise decisions and ill-chosen designs which will plague the system for many years. A properly planned development program will be no more costly in dollars than a "crash" program and will be more certain to produce a really usable weapon at its completion.

Sergeant missile

Eight years later, the Army, having insisted on a compressed schedule for earlier operational capability, acquired a costly weapon system full of engineering "bugs" that did indeed "plague the system for many years."[42]

Even with its defects, the Sergeant system fielded in 1962 fulfilled its objective as a substantial improvement over the Corporal. Equal to the Corporal in range and firepower, it was only half as large and bulky and required less than one-third the ground support equipment. Its highly reliable solid-propellant motor was ready to fire within minutes, while the Corporal's liquid propulsion system required hours of preparation and was susceptible to plumbing failures, fires, and explosions. Less complex to operate and maintain than the Corporal, the air-transportable Sergeant used a self-contained inertial guidance system that blocked any then-known electronic countermeasures and that obviated the ground equipment so critical for the Corporal's command-type guidance system. Because of its solid-propellant motor, fueling service equipment and personnel also were eliminated. Although development of a high-explosive warhead was originally planned for the Sergeant, the plans were later canceled on the recommendation of the assistant chief of staff for force development. Thus, the Sergeant was suitable only for nuclear warfare.[43]

The missiles were fielded in battalions, each organized with a headquarters and headquarters battery and two firing batteries, each battery having one launcher. The authorized aggregate strength of the battalion under its test tables of organization was about 240. Each missile battery had its own survey, communications, maintenance,

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[42] Cagle, "History of the Sergeant," p. 32, AMCOM files and copy in CMH files.

[43] Ibid., pp. 199–202, 240, AMCOM files and copy in CMH files; R[ichard] M. Hurst, "The Sergeant Takes Over," *Army Information Digest*, January 1962, pp. 9–16.

and administrative personnel, thus allowing it to operate separately from its battalion headquarters, but it had no target acquisition element. Although the equipment was deficient in many respects, the Sergeant was the first missile system to have a degree of automation designed into it for testing, firing, troubleshooting, and maintenance. The strength of the battalion was later increased with the reorganization of the headquarters battery as a headquarters and service battery. Thereafter, the authorized aggregate strength of the battalion was about 370, although actual strength was usually about 300.[44]

On 23 June 1970, four U.S. Army Sergeant battalions in Germany were reduced to two double-strength battalions (four firing batteries instead of two), which lessened personnel requirements by 268. This action was taken to save over $1 million in personnel and equipment costs. Besides these two battalions in Germany, one Sergeant battalion was serving in Italy, one in Korea, and one in the continental United States. Four double-strength battalions were also deployed in Germany through the Military Assistance Program.[45]

Even though the Lance missile was being developed as a replacement for both the Sergeant and Honest John, a definite retirement schedule for the Sergeant was not established until the 1970s because of uncertainties in the Lance missile program. In the meantime, the Sergeant's ground equipment was becoming obsolete and replacements were more difficult to procure, making support of the aging missile a serious problem.[46]

Little John Rocket

Along with the Sergeant, two other short-range systems were operational in the mid-1960s, the Honest John noted earlier and the Little John.[47] The Army deployed both divisional and nondivisional battalions worldwide. In 1965, it reorganized the nondivisional Honest John battalions with three firing batteries, each with two launchers. This reorganization did not affect the firepower of the battalions serving in Europe, for they had earlier been authorized three firing platoons (two launchers each) in their single-firing battery units. At reduced strength, the battalions were authorized four launchers in two firing batteries. The authorized aggregate strength of the battalion rose from about 250 to 350.[48]

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[44] Cagle, "History of the Sergeant," p. 204, AMCOM files and copy in CMH files; Herbert B. Powell, "More Power for the Army in the Field," *Army Information Digest*, January 1962, pp. 4–8; TOE 6–555T, 1 Dec 1961; TOE 6–555D, 1 Aug 1966; TOE 6–555G, 30 Apr 1967. See also unit folders of individual battalions in CMH files.

[45] Msg P 191703Z Jun 1970, CINCEUR to JCS, 19 Jun 1970, sub: Sergeant Battalion Consolidation, copy in CMH files; Cagle, "History of the Sergeant," p. 243, AMCOM files and copy in CMH files.

[46] Cagle, "History of the Sergeant," p. 244, AMCOM files and copy in CMH files; Walter Andrews, "Pending Lance, MARS, Decisions To Shape Army's Missile Future," *Armed Forces Journal*, September 1968, p. 20.

[47] The official name of the missile, according to the U.S. Army Aviation and Missile Command is Littlejohn. When the weapon was fielded, however, the TOEs and other Army documents, as well as those generated by the field artillery units themselves, identified it as Little John, which is the usage followed in this volume.

Little John rocket

The Little John, a smaller version of the Honest John rocket, evolved from a series of studies initiated in the early 1950s to fill the gap between the heavy Honest John and conventional artillery. Some valuable early work was accomplished before the development of the system began officially in January 1956. The immediate objective of the program was to develop an interim atomic-delivery vehicle for use in airborne operations. An interim rocket was produced but declared unsuitable for general troop use, although it did serve as a useful training weapon for airborne operations and contributed to the development of the 318-mm. Little John, which finally reached the field in 1961.[49]

Designed for all-weather use against enemy field forces and installations, the Little John was to provide long-range general artillery support and reinforcing fire for airborne units and other light troops. The rocket was fired from a lightweight helicopter-transportable launcher and could deliver both nuclear and conventional warheads within a 2- to 12-mile (3.2- to 19.3-kilometer) range. Seven units, each with four launchers, were organized: one battalion served at Fort Sill, Oklahoma, until 1968 in a training capacity; the nondivisional 1st Battalion, 57th Artillery, and the 25th Infantry Division's 2d Battalion, 21st Artillery, served in the Pacific until

[48] TOE 6–525E, 7 Dec 1964; TOE 6–525G, 19 Sep 1967; TOE 6–525H, 31 Dec 1974. See also unit folders of individual battalions in CMH files. Divisional Honest John battalions are covered in chapter 10.

[49] Mary T. Cagle, "History of the Littlejohn Rocket System, 1953–1966," Historical Monograph Project no. AMC 35M, 12 May 1967, pp. 1, 82–83, 87, 89, AMCOM files and copy in CMH files.

1968; one battery operated with the 82d Airborne Division and one with the 101st Airborne Division until 1965; a battalion served at Fort Bragg, North Carolina, and later at Fort Benning, Georgia, first with the 11th Air Assault Division (Test) and then with the U.S. Army Infantry Center until 1967; and a battalion operated with the 4th Infantry Division at Fort Lewis, Washington, until 1963.[50]

The Little John fulfilled its original military characteristics, but its value was limited. Its range was short and within the range of conventional artillery. When a nuclear warhead was developed for the 155-mm. howitzer in 1964 and when both the howitzer and Honest John became easily transportable by helicopter, the need for the light rocket diminished. The unguided rocket was much less accurate than conventional artillery, and accuracy was an absolute necessity with short ranges and nuclear warheads. In addition, while testing the airmobility concept in 1965, the 11th Air Assault Division determined that its elements could not operate effectively without tactical air cover and that its organic aircraft, along with its organic firepower, could supply the same support offered by the Little John battalion.[51] On 18 June 1968, the United States Army Materiel Command approved the Little John phaseout plan, and the Army declared the system obsolete on 20 August 1969.[52]

Pershing Missile

On 10 January 1958, Secretary of Defense McElroy announced that the Army would develop a solid-propellant ballistic missile to replace the liquid-propellant Redstone, which had become operational that year. The new missile was known as the Pershing, and its specifications were stringent. For maximum mobility, its launch weight was to be no more than 10,000 pounds; for optimum performance, its guidance system was to ensure a minimum range capability of 100 nautical miles (185.2 kilometers) and a maximum one of 200 to 300 nautical miles (370.4 to 555.6 kilometers). The development of the Polaris for the Navy had signaled a breakthrough in the use of solid propellants for longer ranged missiles. Up until that time, liquid propellants had been used for missiles with ranges of 200 nautical miles (370.4 kilometers) and above. Because the solid-propellant engines were filled at the manufacturing plant, the old servicing problems disappeared and fewer men and less equipment were needed at the firing site. The new missile was to be fired in two stages and was to be smaller, lighter, and more mobile than the Redstone. A mobile transporter-erector-launcher was to take the Pershing to its site, erect it, and

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[50] Directory and Station Lists of the United States Army, 1961–68, and unit folders of individual battalions in CMH files; TOE 6–565T, 1961.

[51] For comparison of ranges, see table 23. Approximate ranges for cannon artillery were as follows: 105-mm. howitzer, 7 miles (11.3 kilometers); 155-mm. howitzer, 9 miles (14.5 kilometers); 8-inch howitzer, 10 miles (16.1 kilometers); 175-mm. gun, 20 miles (32.2 kilometers). The U.S. Marine Corps rejected the Little John around the same time it undertook similar action with the Lacrosse; see *DOD Appropriations for 1961*, pts. 2 and 5. For the missions that the Lacrosse was meant to fulfill, the Marines substituted the Honest John, Zuñi, Bullpup, 120-mm. tank, and 8-inch howitzer. See also "1st Cav Div (Airmobile)," *United States Army Aviation Digest*, August 1965, inside back cover.

[52] Army Missile Command (AMC) Annual Historical Summary for FY 1968, p. 66, and FY 1970, p. 110, AMCOM files and copy in CMH files.

fire it within minutes and then evacuate—"shoot 'n' scoot." The use of solid propellant greatly reduced the time necessary to prepare the missile for firing and eliminated the danger of handling highly dangerous liquid propellants. All equipment to transport, to prepare, and to fire the missile could be carried on four fully tracked lightweight vehicles.[53]

Pershing missile

The first field artillery battalion to be equipped with the new missile was activated at Fort Sill in 1962, with an authorized strength of 615 officers and enlisted men. The Pershing battalion had a headquarters and headquarters battery, a service battery, and four firing batteries. Each firing battery had one launcher. Through maneuver of batteries, commanders gained access to a powerful means of influencing the course of the battle and gained the capability of delivering nuclear fire over a zone of great width and depth, shifting and concentrating fire according to the situation.[54] The missile, armed with a nuclear warhead, extended the field army commander's range up to 400 nautical miles (740.8 kilometers) and answered the artilleryman's requirement for a "shoot 'n' scoot" weapon with its capability for rapid mobility. Control of the widely dispersed firing batteries presented new problems for the battalion commander, for no other fire-support unit had such a wide span of control. Adequate communications and logistics were essential for effective command, control, and support of the dispersed units.[55]

When the Pershing units were first activated, the Army planned to form ten battalions, each organized with one launcher in each of its four firing batteries. The number of battalions was later reduced to five and in 1968 to four. Two battalions were stationed at Fort Sill (reduced to one battalion in 1968), while the other three deployed to Germany to replace the Redstone as the Seventh Army's general-support tactical weapon system. The controlling headquarters in Germany

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[53] Jolliff, "History of the Pershing," 20 May 1974, pp. 14–20, AMCOM files and copy in CMH files; Patrick W. Powers, "Our Tactical Missiles," *Ordnance*, January-February 1962, p. 512; R[ichard] M. Hurst, "Pershing: The Army's Four-Star Missile," *Army Information Digest*, April 1961, pp. 2–9.

[54] DOD News Release, "First Army Pershing Missile Battalion to be Activated at Fort Sill," 14 Jun 1962, copy in CMH files; TOE 6–615T, 1 May 1962; U.S. Army Fact Sheet, Sep 1966, sub: Missile Program, No. 1: The Pershing Missile, copy in CMH files.

[55] Patrick W. Powers, "Every Pershing in a Pickle Barrel," *Army Information Digest*, February 1964, pp. 1–13; TOE 6–615D, 20 Apr 1966.

was the 56th Artillery Group, which was charged with the mission of providing fires in general support of a field army. Pershing units were also employed in the air force of the Federal Republic of Germany under the Military Assistance Plan.

In the early 1960s, the NATO allies enjoyed a decided nuclear superiority over their Warsaw Pact counterparts, and this superiority led to the philosophy of the employment of nuclear weapons based on the "trip wire" theory. If the Warsaw Pact nations were to attack with their conventional forces, which were superior to those of NATO, then NATO could retaliate promptly with a theater-wide nuclear attack. The Pershing missile, which became operational in Germany in 1964, originally had the mission of tactically supporting Seventh Army. In late 1965, however, when SACEUR assumed control of the missile as a theater-wide weapon to augment command strike-force capability, that general-support tactical role then took second place. As a result, the Pershing was placed under operational control of NATO's Central Army Group. During the critical early phase of potential conflict, army and corps commanders had only cannon artillery and shorter-ranged missiles and rockets as organic fire support immediately responsive to their requirements. They had lost their organic long-range general-support nuclear firepower.[56]

In its quick-reaction-alert (QRA) mission for SACEUR, the Army envisaged that two of the four Pershing batteries in each battalion would be on constant alert at prepared firing sites, while the third battery would be on alert at its home station. The fourth battery would also be at the home station, but in maintenance status. Although crews could fire the first missile in a relatively short period of time, they needed considerably longer to reload the launcher and fire the second. To increase the quick-reaction capability and to provide more firepower, the Army authorized each of the Pershing battalions in Germany two additional launchers in February 1964 and, in 1966, revised the TOEs to increase the number of launchers in each battalion to eight. The authorized aggregate strength of the Pershing battalion rose to approximately 1,100.[57]

The changes in the Pershing's mission dictated revamping the missile's extensive ground-support equipment, including a shift from tracked to wheeled vehicles. The new system, called Pershing Ia, was fielded between 1969 and 1970. The wheeled carriers in the Pershing Ia system added speed and mobility to the battalion and improved its ability to move in and out of firing positions more rapidly. The softer ride was easier on the missile, and the wheeled vehicles were less costly and needed less maintenance than tracked ones. A new programmer test station provided means

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[56] Jolliff, "History of the Pershing," 20 May 1974, pp. 160–61, AMCOM files and copy in CMH files; Robert J. Baker, "Pershing—The Ultimate Challenge," *Field Artillery Journal*, May-June 1977, pp. 9–14; Alan L. Moore, Jr., "Pershing: A Weapon for Long-Range Fire Support," ibid., pp. 26–28; Eric C. Ludvigsen, "1978 Weapons Directory," *Army*, October 1978, pp. 142–46. See also John J. Nee, "The Pershing Missile System in Europe, 1964–1968," 3 February 1969, copy in CMH files.

[57] Nee, "The Pershing in Europe," 3 February 1969, pp. 5, 7–8, 23, 26, 28–33, 102, copy in CMH files; Jolliff, "History of the Pershing," 20 May 1974, ch. 14, AMCOM files and copy in CMH files; Glasgow, "USAREUR's Nuclear Weapons Responsibilities," 1965, p. 89, copy in CMH files; TOE 6–615D, 10 Apr 1966; U.S. Congress, House, *DOD Appropriations for 1966: Hearings Before a Subcommittee of the Committee on Appropriations*, 89th Cong., 1st sess., 1965, pt. 3, pp. 187–88.

for rapid checkout and countdown. Other improvements added later included a sequential launch adapter, which permitted as many as three missiles to be launched before shifting power and air supply cables, and an automatic reference (north-seeking gyroscope) system that ended dependence on pre-surveyed firing sites and allowed "on-the-spot" launches. These refinements greatly improved the Pershing's reaction time and rate of fire.[58]

The most significant change in fielding the Pershing Ia was the increase in the total number of launchers from eight to thirty-six per battalion. Thus, the three battalions in Europe could field one hundred eight launchers in comparison to the twelve they had available in 1964. New TOEs called for an authorized aggregate strength of 1,680 in each battalion, which was later reduced to about 1,300. The headquarters and headquarters battery differed slightly from those in other artillery battalions in that it was larger in order to administer the larger battalion. The battalion remained with four firing batteries and a service battery, although the number of launchers in each of the firing batteries increased from two to nine. The service battery, with an authorized aggregate strength of about 300, had a direct-support maintenance platoon of nearly 100 officers and men, which provided all the direct-support maintenance on the battalion's missile, engineer, and signal equipment. The battery also included an ammunition platoon, a security platoon, and other sections necessary for supply and maintenance of the battalion. The firing battery, commanded by a major, was also considerably larger than the average firing battery, with an authorized aggregate strength of about 200. The basic unit was the firing platoon, of which there were three in each firing battery. Commanded by a captain, each platoon had three complete Pershing missiles with associated launching and ground equipment. A new TOE was also developed for command and control above battalion level, which was expanded into a brigade. The 56th Artillery Brigade (later redesignated as the 56th Field Artillery Command) replaced the 56th Artillery Group, which was inactivated in 1970. The brigade included the three Pershing battalions, plus an infantry battalion for area security.[59]

New tables published in 1974 authorized each battalion an aggregate strength of 922, the biggest change being the elimination of one firing battery. Still, each battery had nine launchers for a total of twenty-seven launchers per battalion. Although the Pershing battalions were reorganized under the new TOEs, each continued to be supplemented with a fourth firing battery for a total of thirty-six Pershing launchers per battalion.[60]

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[58] Nee, "The Pershing in Europe," 3 February 1969, pp. 83–85, copy in CMH files; Jolliff, "History of the Pershing," 20 May 1974, ch. 14, AMCOM files and copy in CMH files; Baker, "Pershing," pp. 10–12; Edwin A. Rudd, "The Pershing Is 1-A," *Ordnance*, September-October 1968, pp. 179–82; "Pershing on the Move," *Army Digest*, September 1967, pp. 25–27; Alan C. Jacobson, "56th Field Artillery Brigade," *Field Artillery Journal*, May-June 1974, pp. 24–25; Ludvigsen, "1978 Weapons Directory," pp. 142–46; Samuel Skemp, Jr., "Pershing Missile Update," *National Defense*, May-June 1977, pp. 464–66.

[59] TOE 6–615G, 15 May 1968; TOE 6–615H, 15 Feb 1975; TOE 6–605H, 13 Aug 1971; Jacobson, "56th Field Artillery Brigade," pp. 24–25; Nee, "The Pershing in Europe," 3 February 1969, pp. 85–90, copy in CMH files; 56th FA Command fldr, CMH files.

In December 1979, new tables eliminated the service battery in each battalion. Instead, the functions passed to a maintenance battalion for the entire brigade (later command), which included a headquarters and headquarters company, three forward support companies, a maintenance and supply company, and an aviation support company.[61]

Following standard operating procedure, the Pershing firing units were required to serve at areas far from the rest of the battalion. The QRA mission necessitated the full-time commitment of one firing battery (or its equivalent) from each battalion. That battery maintained its "ready-to-fire" position at an improved but remote firing site located a considerable distance from its garrison. The QRA mission rotated among the four batteries about every six weeks, but the entire battalion stood ready to support the QRA battery on short notice.[62]

Lance Missile

While the Pershing battalions were being reorganized, the Lance missile became operational.[63] The Lance was conceived in a staff study in 1956, but the contract for its development was not issued until November 1962. At the time, the Army envisioned it as a replacement for the Honest John in a divisional and corps general-support mission. Later, it was also seen as a replacement for the Little John and Lacrosse. The concept for the Lance was based on simplicity, ruggedness, reliability, accuracy, and low cost. It was the first Army missile to use prepackaged storable liquid fuel. Liquid fuel provided complete and uniform burning, advantages that increased accuracy and resulted in a more efficient means of propulsion. Prepackaging eliminated the lengthy onsite fueling process, the ground-support equipment, and the attendant personnel of the Corporal and Redstone missiles. The simplicity of the equipment used to transport and launch the Lance gave the system far greater mobility than the Honest John. Its basic vehicle was similar to the M113 armored personnel carrier, which had adequate cross-country mobility and the ability to cross inland waterways without assistance. The second vehicle, also based on the armored personnel carrier, was a loader-transporter used to transport the missiles and load them on the self-propelled launcher. A lightweight launcher, towed by a standard Army 2½-ton truck, was available as an alternate launching method. The components were also transportable by helicopter and could be dropped successfully by parachute.[64]

In 1966, the Army began parallel development of an extended-range Lance (also known as XRL), which was intended to replace the Sergeant. Because of severe

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[60] TOE 6–615H, 15 Feb 1974.

[61] TOE 9–115H, 28 Dec 1979, Maintenance Battalion (Pershing), replaced TOE 6–619H, 15 Feb 1974, Service Battery, Pershing Battalion.

[62] Jolliff, "History of the Pershing," 20 May 1974, ch. 14, AMCOM files and copy in CMH files; Baker, "Pershing," p. 12.

[63] AMC Annual Rpt of Major Activities, FY 1974, p. 60, AMCOM files and copy in CMH files.

[64] AMC Annual Historical Summary, FY 1963, pp. 87–92, AMCOM files and copy in CMH files; Roger C. Laudati, "Lance," *Infantry*, September-October 1965, pp. 24–27.

Lance missile

design problems with the Lance's propellant-feed system, Secretary of Defense Robert S. McNamara in December 1967 suspended its development and continued work only on the extended-range Lance. The basic Lance equipped with either a nuclear or conventional warhead would have been accurate enough at shorter ranges. When only the extended-range Lance was to be developed, its dual role as a nuclear and conventional weapon changed to only nuclear. Thereafter, the Lance became a corps-support weapon rather than both a divisional- and corps-support weapon.

The first flight test of the extended-range Lance (renamed simply Lance) occurred on 6 May 1969, and an initial production model was delivered to the Army for testing in April 1971. The Army launched its first Lance in August of that year and completed service testing the following March. In May 1972, the Lance, designated as a standard missile, proved to be a vast improvement over the old Honest John, which was dependent upon roads for its wheeled launcher and support vehicles as well as upon a well-prepared firing area to carry out its mission. By contrast, the Lance's mobility over rough terrain made it possible for the crew (eight men) to fire from positions unsuitable for a rocket; it had a low silhouette and the general appearance of a vehicle common to the battlefield; it was small and easy to conceal and more difficult to identify as a nuclear-delivery vehicle; it could operate under all weather conditions in which infantry, armor, mechanized, or airborne troops might be committed; and its advanced guidance system was invulnerable to all known electronic countermeasures. Maintenance problems were minuscule in comparison to earlier missile systems, and the requirement for specially trained technical personnel diminished.[65]

The Army, at the time the Lance was adopted, did not have congressional approval to develop conventional warheads for the missile. With the replacement of the Honest John, NATO lost a certain degree of its conventional firepower. The major objection to equipping the Lance with a conventional warhead was its cost effectiveness. Those who favored the nonnuclear Lance pointed out that the alternative, close-support aircraft in a sophisticated air defense environment, required very expensive aircraft and highly skilled pilots; that the availability of close-support aircraft might not be immediately responsive to the ground force commander; and that, with an extremely limited peacetime force, Lance personnel might be of no tactical use during the critical early stages of a conflict prior to the initiation of nuclear warfare. Also, six battalions were already in place in Europe. The added expense of providing them with the ICM (improved conventional munitions) warhead appeared to furnish a good conventional capability with a relatively low increase in cost. Possible conventional warheads under consideration were the Air Force's cluster bomblet for use against high-priority stationary targets; a terminally guided submissile warhead that could seek, track, and destroy armor; a terminally guided "smart" version that could employ semiactive laser guidance for pinpoint accuracy; and a mine-dispensing area warhead that could block enemy approach routes and deny access to specific areas of the battlefield.[66]

Congress approved the procurement of the first nonnuclear Lance materiel for the Army in 1976 with delivery scheduled for the summer of 1978. When firing the conventional cluster bomblet warhead, based on the Air Force's design, the maximum range of the Lance was 75 kilometers (46.6 miles). The nonnuclear Lance provided the only means for a corps to attack targets beyond cannon range with a conventional warhead. The dual capability increased flexibility. By launching conventional strikes against the enemy's second-echelon and rear-support areas, the corps commander could add depth to the battlefield and relieve the burden of the frontline maneuver and conventional artillery units. The multiple bomblets were particularly effective against soft targets, such as surface-to-air missile sites, communications centers, command posts, forward airfields, large reserve troop concentrations, and logistical areas. On the minus side, the dual capability of the Lance program turned the missile into a much larger and more expensive system than originally planned because of the heavier payload necessary for the nonnuclear warhead, and it was questionable, in view of the Lance's weapon delivery error, if it really had offered a respectable conventional option. In sum, its development was a long delayed process, ending in a compromise weapon that did not completely satisfy anyone.[67]

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[65] Laudati, "Lance," pp. 14–17; Andrews, "Pending Lance," p. 20; "The Lance Tactical Missile," *International Defense Review*, April 1973, pp. 199–203; Lee O. Ringham, "Lance," *Field Artilleryman*, August 1971, pp. 4–11; and AMC Annual Historical Summary for FY 1966, pp. 57–63, FY 1967, pp. 50–59, FY 1968, pp. 39–44, FY 1969, pp. 31–34, FY 1971, pp. 31–38, and FY 1972, pp. 25–30, AMCOM files and copies in CMH files. The manufacturer's advertisements called for a six-man crew.

[66] AMC Annual Historical Summary for FY 1972, p. 28, and FY 1974, pp. 59–60, plus Annual Rpt of Major Activities, FY 1973, pp. 39–40, AMCOM files and copies in CMH files; "Lance Tactical Missile," pp. 199–203; Jim Rabon, "Lance," *Field Artillery Journal*, March-April 1974, pp. 8–10.

By the end of 1975, the Army had eight Lance battalions on active duty, two at Fort Sill and six in Europe. (Several foreign nations had also adopted the missile.) Organized in a manner similar to cannon artillery units, each battalion had a headquarters and headquarters battery, a service battery, and three firing batteries. Each firing battery had two platoons, each equipped with one launcher. The battalion had an authorized strength of about 450 and fielded six missile launchers.[68]

Throughout the Lance's development, the question was often raised concerning the justification for replacing nine divisional and corps Honest John battalions and three Sergeant battalions in Europe with only six Lance battalions (half the number of battalions with two-thirds the number of launchers). Because of their high cost and limited numbers, the Lance missiles had to be used selectively and employed in conjunction with cannon and tactical aircraft. Lance battalions operated under corps, normally on the basis of six battalions per field army, and the field artillery section of the corps headquarters coordinated their fires. Quick, decisive fires were vital. Effectiveness of the missile depended upon adequate fire planning, target acquisition, and command and control.[69]

When production of the Lance missile ended in 1980, the Army had begun research on a corps-support weapon system, proposed as the Lance's successor. Two modified existing missiles were in contention as the main delivery vehicle for the new missile—one was a surface-to-surface version of the air defense artillery missile Patriot and the other an improved variant of the Lance. The Patriot was proposed because it had ample surface-to-surface range capability and payload capacity, it could be airlifted, and it required minimal changes from the Patriot entering production. There seemed to be a cost advantage, however, in using a modified Lance; the new Lance could replace the Lance in service and would be readily adaptable to a large portion of existing Lance launcher and support equipment.[70] In the revised FY1981/82 defense budget, separate funding was canceled, with the Lance combined into a joint Army–Air Force program. In May 1984, the two services agreed to pursue separate development programs, while ensuring their

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[67] AMC Annual Rpt of Major Activities for FY 1975, pp. 78–80, and FY 1976, pp. 79–80, AMCOM files and copies in CMH files; Army Missile Materiel Readiness Command (AMMRC) Annual Historical Review for FY 1977, pp. 102–04, and FY 1978, pp. 105–06, AMCOM files and copies in CMH files; Notes from briefing at FA School, January 1979, Historians files. CMH; "Nonnuclear Lance," *Field Artillery Journal*, January-February 1977, p. 22; "Dual Capable Lance," *Field Artillery Journal*, May-June 1977, p. 56; "Nonnuclear Lance to Europe," *Field Artillery Journal*, May-June 1978, p. 42; William R. van Cleave and S. T. Cohen, *Tactical Nuclear Weapons* (New York: Crane, Russak, and Co., 1978), pp. 60–61.

[68] TOE 6–595T, 15 Aug 1970; TOE 6–595T, 8 Feb 1973; TOE 6–595H, 30 Sep 1974.

[69] Wilson A. Shoffner, "The Time Has Come . . . ," *Field Artillery Journal*, January-February 1976, pp. 46–53; AMC Annual Rpt of Major Activities, FY 1975, pp. 40–41, AMCON files and copy in CMH files.

[70] AMC Annual Historical Summary, FY 1974, pp. 172–74, AMCOM files and copy in CMH files; AMMRC Annual Historical Review, FY 1978, pp. 110–12, AMCOM files and copy in CMH files; "AUSA '79," *International Defense Review*, no. 1/1980, pp. 91–94; Mark Hewish, "Tactical-Missile Survey," ibid., no. 6/1980, pp. 857–59; idem, "The Assault Breaker Program," ibid., no. 7/1982, pp. 1207–11; Konrad Adler, "Assault Breaker," *Armada International*, January-February 1980, pp. 50–54.

Pershing II missile

separate systems were complementary. The Army was to develop a ground-launched missile with a shorter range of 70 kilometers (43.5 miles), and the Air Force was to cover deeper targets with an air-launched missile as well as direct aircraft strikes.[71]

Pershing II Versus Cruise Missiles

The role of the Pershing missile changed in the 1970s. Because NATO no longer had a clear-cut nuclear superiority, the old "trip-wire" philosophy was not as appealing as it had been in the early 1960s. Henceforth, the Pershing units served mainly as a deterrent. The Warsaw Pact nations enjoyed both superiority in conventional forces and nuclear parity. The strategy of the 1970s required that deterrence derive from a credible capacity to fight either a conventional or nuclear war. By January 1979, the third-generation Pershing II missile was in the engineering development stage. The major change in the weapon was its terminal guidance system, which resulted in accuracies so improved over the Pershing Ia that the use of very low nuclear yields, or even conventional warheads, for a "surgical" attack on targets became possible, with supposedly minimum collateral damage. An extended range of 1,000 nautical miles (1,852 kilometers) was also planned for the Pershing II. With the improved missile, there was the possibility that SACEUR could accomplish the command tactical mission with fewer missiles, thus releasing some of the Pershings for the use of regional commanders. Nevertheless, Congress voiced some opposition, fearing that commanders might be tempted to use lower-yield nuclear warheads and thereby cause events to escalate.[72]

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[71] Glenn W. Goodman, Jr., "Jockeying With JTACMS," *Field Artillery Journal*, January-February 1986, pp. 26–27.

[72] Jolliff, "History of the Pershing," 20 May 1974, pp. 157, 220–23, AMCOM files and copy in CMH files; FA School Fact Sheet, [1979], sub: Pershing Ia and II, prepared for author, Historians files, CMH; Moore, "Pershing," pp. 27–28; Skemp, "Pershing Missile Update," pp. 464–66; Henry T. Simmons, "Pershing II," *Army*, August 1974, pp. 17–20; "Pershing Go-Ahead," *International Defense Review*, no. 3/1979): 315; Larry H. Hunt, "Pershing II," *Field Artillery Journal*, May-June 1977, pp. 38–39; Lawrence J. Korb, "The Question of Deploying US Theater Nuclear Weapons in Europe," ibid., May-June 1981, pp. 30–34.

In the late 1970s, the role of the Pershing again came into question when the possibility arose that a ground-launched cruise missile could be developed for the Army. The former director of Defense Research and Engineering, Malcolm R. Currie, stated before the Senate Committee on Armed Services that the Tomahawk cruise missile (then under development for the Navy) would be compatible with the Lance's missile launcher for deployment with ground forces if desirable. The Navy and Air Force defined cruise missiles as unmanned weapons containing nuclear or nonnuclear warheads that were propelled by air-breathing engines and operated with wings like airplanes. When the United States had first sanctioned the development of strategic cruise missiles, it was generally seen as a ploy to gain leverage in the Strategic Arms Limitation Treaty (SALT) II talks. But as the program evolved, the weapon gained advocates because of its versatility and low cost. As strategic missiles, Tomahawks deployed in Europe with Lance launchers would pose a definite threat to the Soviet Union and thus would have significant arms control implications as well as require adjustment of Army roles and missions.[73]

Potential SALT limitations on the range of the ground-launched cruise missile to 600 kilometers (372.8 miles) subjected the cruise missile to comparison with the existing Pershing II. The Pershing II was accurate, and after launch, it was relatively invulnerable as a ballistic missile. The cruise missile, on the other hand, was at least as accurate as the Pershing II, and it was less vulnerable in its prelaunch state because it was more mobile than the Pershing. In 1978, the Defense Department undertook a study on whether to proceed with the Pershing II or the ground-launched cruise missile or both. Military officials leaned toward the acquisition of both weapons, stating that even though both missiles could be used to attack many of the same targets, each had unique capabilities that would make the combination attractive. The cruise missile could replace a portion of the theater nuclear aircraft strike force, while the Pershing II, with its earth-penetrating warhead, offered increased range and accuracy in hitting hard-point targets.[74]

As to which service would man the cruise missile, as well as the Pershing II, remained a question mark. When it was recommended to the House Committee on Armed Services in 1978 that the Pershing be transferred from the Army to the Air Force, Deputy Chief of Staff for Research, Development, and Acquisition Lt. Gen. Donald R. Keith stated that unless something were done to extend the range of the Pershing or to give it a different role from its existing one, it was more appropriate for the missile to remain an Army weapon primarily because its secondary mission was that of providing general support to theater forces in Europe. Manning of the

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[73] Loren G. Lundquist, "A Field Artillery Cruise Missile?"*Military Review* 57 (March 1977): 3–10.

[74] H. Lucas, "US Cruise Missile Progress," *International Defense Review*, 7/1978, pp. 1037–42; "NATO Seeks Way To Counter Threat From Soviet Missile," *Washington Star*, 22 April 1979, A–5; "Disagreement Over Medium Range Theatre Nuclear Weapons, *International Defense Review*, 2/1979, p. 158. Development of the earth-penetrating warhead was subsequently halted because of cost and because of the diversion of effort away from the more politically critical nuclear warhead. The CEP of the Pershing II was estimated at about 30 meters (32.8 yards).

system remained the responsibility of the Army, while the ground-launched cruise missile was assigned to the Air Force.[75]

The Defense Department approved full-scale engineering development of the Pershing II, which was deployed in the same manner as the Pershing Ia. In addition to its greater range and increased accuracy, the new Pershing had lower operating and support costs, plus improved flexibility in employment because of lower warhead yields and the earth-penetrator option. Under the 57-month engineering development program, which began in February 1979, it was estimated that a full-scale production decision would not be made before 1985, but in mid-1979 Secretary of Defense Harold Brown ordered an initial operating capability in 1983 rather than the previously planned December 1984.[76]

The new Pershing became operational in December 1983. The missile had a range of 1,200 miles (1,930.8 kilometers), an improved warhead, and rapid emplacement and displacement times. But in December 1987, the United States and the Soviet Union signed the Intermediate-Range Nuclear Forces (INF) Treaty, which spelled the end of the Pershing. The missiles were phased out gradually, and the last of the Pershing battalions was inactivated in 1991 (*Table 23*).[77]

End of an Era

In the mid-1980s, twelve field artillery missile battalions were on active duty in the Regular Army, four Pershing and eight Lance. None was organized in either the Army Reserve or Army National Guard. All but three, which were at Fort Sill, were serving in Europe with the NATO forces.[78] Although the Pershing was operating under SACEUR because of its long-range and nuclear warhead, the Pershing II, with its superior accuracy and expanded operational capability, was recommended for use in the tactical arena, at least at the shorter ranges. The Lance provided the battlefield commander the flexibility for a short-range missile with a powerful punch, using either nuclear or high-explosive warheads. Its rapid mobility and accuracy extended the commander's artillery range capability considerably.

But the INF Treaty, which took effect on 1 June 1988, signified the death of field artillery's strategic nuclear role in the Cold War. The Pershing was eliminated. The Army expected the new multiple-launch rocket system (MLRS) to take over the Lance missile's conventional role, freeing that weapon for nuclear use, but when the president ordered the withdrawal of all nuclear weapons in Europe in 1990, the MLRS and the new Army tactical missile system (ATACMS) replaced the Lance altogether.

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[75] *Hearings on Military Posture and H.R. 10929*, pt. 3, 1:728–32; "AUSA Reports on 1979 Defense Budget," *Pentagram News*, 30 November 1978, p. 9; *Army Times*, 30 October 1978, p. 2.

[76] "Pershing II Go-Ahead," p. 315; "The New Pershing II," *Casemate Chronicle*, October 1980, pp. 22–23; Benjamin F. Schemmer, "New Hardware Bow Wave Dries Army Budget, Jeopardizes Efficient Buys and Even Its Missions," *Armed Forces Journal International*, June 1979, pp. 20–21, 58–59.

[77] USAFAC and Fort Sill Annual Command History, 1991, pp. 232–38, FA School files and copy in CMH files.

[78] One battery from one of the Lance battalions at Fort Sill deployed to Korea in 1988; see PO 323–599, USAFAC and Fort Sill, 19 Nov 87.

Table 23—Field Artillery Rockets and Missiles, 1954–1992

Rocket/Missile	*Operational*	*Length (Feet)*	*Min/Max Ranges (Statute Miles)*	*Propulsion*	*Assignment*	*Comments*
Honest John	1954–79	25	4–25	Solid, rocket	Corps/Army/Division	Replaced by Lance
Corporal	1955–64	45	30–80	Liquid fuel	Corps/Army	Replaced by Sergeant
Redstone	1958–64	70	60–200	Liquid fuel (2 stage)	Army	Replaced by Pershing
Lacrosse	1960–63	19	5–20	Solid propellant	Corps	Mission assumed by 175-mm. gun, 8-inch howitzer, and Honest John
Little John	1961–68	14	2–12+	Solid rocket	Airborne division and other light troops	Mission assumed by aircraft, cannon artillery, and Lance
Sergeant	1962–77	35	30–85	Solid propellant	Corps/Army	Replaced by Lance
Pershing I/Ia	1964–83	35	115–460	Solid propellant	Army/Theater	Replaced by Pershing II
Lance	1973–92	20	5–80	Solid propellant (prepackaged)	Corps	Replaced by rocket artillery and tactical missiles (ATACMS)
Pershing II	1983–91	35	60–1,100	Solid propellant	Theater	Destroyed under INF Treaty

The ATACMS, which fired from the same launcher as the MLRS, was a semiballistic guided missile that fired faster and farther than the Lance while using less manpower. Employed at corps level with two missiles per launcher, the weapon could destroy targets with nonnuclear munitions beyond cannon and MLRS range.[79]

The Army had originally become involved in missile development during World War II, and it acquired the scientists, technology, and facilities to continue its research after the war. The Army's interest in missile development was predicated upon the desire to attain a nuclear capability, to overcome the limited ranges of cannon artillery, and to compensate for the numerical strength of the Soviet Union's post-World War II armed forces. Enemy air activity, antiaircraft artillery, and unfavorable weather conditions all restricted tactical and carrier aircraft, often used in place of long-range artillery. Guided missiles, on the other hand, had long ranges, could be fired from mobile carriers, could concentrate great amounts of firepower on selected targets, and could be employed without waiting for air superiority or favorable weather conditions. Missiles could be launched faster than airplanes, and they could reach the targets faster once launched. Being unmanned in flight, the missiles reduced crew danger.

Although some missiles were designed to carry both nuclear and conventional warheads, they were primarily nuclear weapons. Because they traded accuracy for mobility and range, guided missiles were a very expensive method of delivering conventional explosives. For ranges up to 20 miles (32.2 kilometers), conventional field artillery could deliver firepower cheaper and more effectively. For longer ranges, the lack of adequate target acquisition capabilities increased the ineffectiveness of the missiles.

The Pershing, Lance, and their predecessors were never fired in battle, primarily because they were most effective as delivery vehicles for nuclear warheads, which the United States has not used since World War II. In the early 1950s, the United States, faced with the constant Soviet threat, decided to depend upon its capacity to retaliate instantly, relying heavily on nuclear weapons. During the late 1950s, the vogue of reliance on massive retaliation and on nuclear weapons for all contingencies began to wane. In the 1960s, the strategy of flexible response emphasized conventional forces and essentially relegated nuclear weapons to a role of secondary importance in ground warfare. Indeed, the Army lacked a basic concept for operations on an integrated nuclear-conventional battlefield. By the late 1970s, however, with the existence of nuclear parity between the Soviet Union and the United States, an emphasis on strengthening the nuclear capabilities of NATO as well as extending the range of field artillery became the norm. The increased accuracy of the new generation of missiles and improved target acquisition capabilities, along with the development of low-yield nuclear warheads and precision-guided munitions, promised the possibility of missiles that would have a definite practical role on the battlefield. But in the late 1980s, with the collapse of the threat posed by the Soviet Union and the Warsaw Pact, the need for long-range missiles with nuclear payloads ceased, and the strategic role the Army had long played in the Cold War ended.

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[79] USAFAC and Fort Sill Annual Command History, 1991, pp. 232–38, FA School files and copy in CMH files.

CHAPTER 10

The Road to Flexible Response

Toward the end of the Korean War the global nuclear environment became more threatening to the United States, no longer the only nation with atomic weapons. While developing missiles as an efficient means of delivering nuclear warheads, thus extending the range of conventional artillery, Army leaders faced the fact that the Army itself needed to be reorganized to survive on the nuclear battlefield. Given the growing vulnerability of massed conventional forces to nuclear attack, they felt future ground forces should be smaller, highly mobile, semi-independent, and self-contained. Because the effectiveness of the artillery traditionally and primarily rested on its ability to mass fires, numerous problems arose in implementing the new organizational strategy. As had been the case after World War I, the desire for a leaner force structure and rapid mobility—survival—took priority over the desire for massed firepower during reorganization planning. Effective use of nuclear weapons was to compensate for the decrease in density of conventional firepower brought about by the reduction in conventional weapons and wide dispersal of units not centrally controlled. However, as the usefulness of massive retaliation receded, the strategy of flexible response influenced the Army to reorganize its forces along more conventional lines while retaining its nuclear capabilities.

The 280-mm. Gun

Endeavors to develop atomic warheads for tube artillery pieces led to the production of the first atomic cannon, a powerful 280-mm. gun nicknamed Atomic Annie. The bulk and weight of the atomic bombs used at Hiroshima and Nagasaki made their use in standard artillery pieces at the time impossible, but the United States Atomic Energy Commission and Army ordnance experts collaborated in the 1950s to compress nuclear components and firing devices into ever smaller packages. The heavy gun had its origin as a concept for replacing heavy artillery weapons used during World War II. Based on the 240-mm. howitzer, it employed a German double recoil concept, in which the upper carriage recoiled with the tube while the lower carriage recoiled horizontally on the base section. After the war the design was radically altered to provide a weapon for a nuclear projectile, despite a decrease in range. Suspended between two supporters (special tractors with hydraulic jacks), the gun had a cruising speed of 25 miles (40.2 kilometers) per hour. Hydraulic rammers loaded conventional or atomic shells, which could be fired up to 18 miles (29 kilometers) with great accuracy. A nine-man crew of

280-mm. gun firing the first atomic artillery shell at Nevada Proving Ground, 25 May 1953

Battery A, 867th Field Artillery Battalion, fired the first atomic shell on 25 May 1953 at the Nevada Proving Ground.[1]

The 280-mm. gun battalion, designed for assignment to an army or corps, was to support frontline infantry troops and to protect vulnerable stationary installations. A battalion of three gun batteries could field six 280-mm. guns. Until 1957, a rocket battery armed with 762-mm. rockets (Honest Johns) was normally attached to the battalion for administrative and operational control.[2] The 280-mm. gun was not used during the Korean War, but several battalions were sent to Europe to bolster the NATO forces there. Initially, the 280-mm. guns were the smallest weapons that could accommodate the size of a nuclear projectile, but the guns were too unwieldy

[1] Marvin L. Worley, Jr., *A Digest of New Developments in Army Weapons, Tactics, Organization and Equipment* (Harrisburg, Pa.: Military Service Publishing Co., 1958), pp. 8–10; John Batchelor and Ian Hogg, *Artillery* (New York: Charles Scribner's Sons, 1972), p. 38; Note, Lt Gen David Ewing Ott, USA (Ret.), to author, [Spring 1989], Historian's files, CMH. Ott was a noted expert and author on field artillery tactics, having served as a field artillery officer in three wars and, in the 1970s, as the commanding general and commandant of the U.S. Army Field Artillery Center and School at Fort Sill, Oklahoma.

[2] TOE 6–535, 1 Jan 1952; TOE 6–535A, 1 Jul 1953; TOE 6–535C, 10 May 1957; TOE 6–535D, 13 Jul 1960; TOE 6–538, 19 May 1952; TOE 6–538A, 1 Aug 1953; TOE 6–538R, 1 Apr 1955. A 280-mm. gun battalion consisted of a headquarters; a headquarters and service battery; a medical detachment (deleted in 1957); and three gun batteries, each with two guns.

and immobile to be entirely satisfactory. Subsequent developments allowed the Army to deliver nuclear warheads with conventional cannon artillery, rockets, and guided missiles of varying sizes in close support of ground troops, and the 280-mm. guns were phased out in the early 1960s.

Atomic Field Army

Soon after the 280-mm. gun was fielded, the Army began the first theoretical testing of divisions since World War II. On 19 April 1954, General Ridgway, who had become the Army Chief of Staff in August 1953, directed Army Field Forces to prepare a study for reorganizing divisions that would include the formation of smaller, more mobile and flexible units that would be less vulnerable to nuclear attack. Although Army Field Forces was to assume that atomic weapons would be available on the field army level, such weapons were not to be considered divisional. The artillery for the proposed atomic field army (ATFA) infantry and armored divisions consisted of a headquarters and headquarters battery, a medical detachment, and one 4.2-inch mortar and two 105-mm. howitzer battalions (self-propelled in the armored division). No heavier artillery was authorized because general-support artillery was to come from the corps level.[3]

The proposed division artillery headquarters and headquarters battery was similar to the existing organization except that its aviation assets were transferred to a divisional aviation company. On the battalion level, the headquarters batteries and service batteries were consolidated into single organizations to save manpower spaces. The test strength of the division artillery was 2,539 compared to 3,362 in the standard infantry division. The test firing batteries (four in each battalion, each with six howitzers) had none of the mess, supply, administrative, or personnel functions found in the existing batteries, and they had no forward observer functions. Firing data was computed in the batteries rather than at battalion level, but survey, communications, and communications-support functions remained with the headquarters battery. The mortar batteries were organized into two platoons, each capable of being attached to the infantry battalions when augmented with observers and ammunition resupply from the headquarters and service batteries. The divisional antiaircraft artillery battalion was eliminated, but each of the howitzer batteries included an automatic weapons platoon of four guns for antiaircraft and ground protection.[4]

Problems that had developed during the infantry division tests during the late 1930s reappeared in the reorganized divisions. The mortars' range and firepower made them unsuitable as division artillery weapons, and fire-support capability

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[3] TOE 6–300, ATFA, 30 Sep 1954; TOE 6–100, ATFA, 30 Sep 1954; Fact Sheet on Test Infantry and Armored Divisions, Encl to Ltr ATTIS 320, OCAFF to CINFO, 13 Sep 1954, sub: Fact Sheet, Project ATFA–1, copy in CMH files (hereinafter cited as ATFA–1 Fact Sheet); Ltr, CofS to CofAFF, 19 Apr 1954, sub: Organization Studies To Improve the Army Combat Potential-to-Manpower Ratio, copy in CMH files.

[4] ATFA–1 Fact Sheet, 13 Sep 1954, pp. 6–7, copy in CMH files; TOE 6–100A, 7 Jul 1954; TOE 6–300, 8 Sep 1952, w/changes through 25 Aug 1954; TOE 6–100T, ATFA, 30 Sep 1954.

was inadequate because of the reduction in number of 105-mm. howitzers and the absence of medium general-support artillery.[5] In the spring of 1955, General Ridgway directed the United States Continental Army Command (CONARC), which had replaced Army Field Forces in February, to redesign the ATFA division. As a result, the infantry and armored division artillery structure became more traditional again, organized with a headquarters and headquarters battery, a medical detachment, and one 155-mm. howitzer and three 105-mm. howitzer battalions. The antiaircraft artillery automatic weapons battalion remained deleted from the ATFA division, but each howitzer battalion retained one antiaircraft artillery battery. The authorized aggregate strength of the armored division artillery rose from 2,433 to 2,834, while that of the infantry division increased to 2,800 (*Table 24*). Whether such forces were any more agile than their predecessors was a question mark.[6]

As with divisional artillery, similar changes were also proposed in the organization of nondivisional field artillery in the atomic field army. The headquarters and headquarters battery of the field army artillery was to operate a fire support coordination center for planning and coordinating the fires of longer-ranged guided missiles and to assist in integrating Army guided missile fire support with close air support provided by the tactical Air Force. Army-level artillery units included four 155-mm. tractor-drawn howitzer battalions (normally attached to corps during operations) and three Corporal missile units. Three corps artillery headquarters were normally to be allotted each field army. Besides the headquarters and headquarters battery, other units organic to corps artillery were to include a field artillery observation battalion (to be increased from three to four observation batteries), a searchlight battery, and an aviation company, in which all the aviation resources of the corps artillery were to be concentrated. Four field artillery group headquarters, one armored 105-mm. howitzer battalion, nine 155-mm. howitzer battalions (five tractor-drawn and four self-propelled), two 155-mm. gun battalions (one tractor-drawn and one self-propelled), six 8-inch howitzer battalions (three tractor-drawn and three self-propelled), two 240-mm. towed howitzer battalions, one 280-mm. gun battalion, and one Honest John battalion were also planned for each corps.[7]

The organization of field artillery for the atomic battlefield developed by the U.S. Army Command and General Staff College (CGSC) at Fort Leavenworth was similar, except the corps artillery was authorized three rather than two 155-mm. gun battalions and five rather than six 8-inch howitzer battalions (but four 8-inch howitzer battalions were added to the field army artillery to compensate for their loss in the corps artillery). Another major difference occurred in the organization of the Corporal unit. The CONARC version proposed three units, each with an authorized strength of 200, whereas the CGSC plan included a Corporal regiment with a

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[5] Ltr, CONARC to TAG et al., Attn: G–D&R 322/50 (Div), 25 Apr 1956, sub: Concept and Technical Review of the Tentative 1956 ATFA Infantry Division, copy in CMH files; Rpt, 3d Inf Div, 13 Feb 56, sub: Final Evaluation on ATFA Infantry Division (TOE 7T), CGSC files.

[6] TOE 6–100T, ATFA, 30 Jun 1955; TOE 6–300T, ATFA, 30 Jun 55.

[7] Ltr ATTNG–D&R 320.2/26, CofAFF to ACofS, G–3, 29 Dec 1954, sub: General Concept of Organization of Nondivisional Combat Support Units in the Field Army, Project ATFA–1, CGSC files and copy in CMH files.

Table 24—Comparison of Divisional Field Artillery, 1954–1965

	ATFA 30 Sep 1954	*ATFA 30 Jun 1955*	*R Series TOEs 1955*	*ROCID/ROCAD/ ROTAD, 1956*	*D Series TOEs 1958–60*	*ROAD TOEs 1963*	*Abn Div 1965*	*Ambl Div 1965*
Unit Type	**Inf Div Arty**	**Inf Div Arty**	**Inf Div Arty**	**Inf Div Arty**	**Inf Div Arty (1960)**	**Inf Div Arty**		**Ambl Div Arty**
Aggregate Strength	2,539 (Div: 13,542)	2,800 (Div: 17,027)	3,362 (Div: 17,452)	1,763 (Div: 13,748)	2,165 (Div: 13,748)	2,516 (Div: 15,000)		1,848 (Div: 15,847)
FA Tubes	48	72	72	46	64	76		54
Other FA Weapons	36 4.2-inch mortars			2 Honest John launchers	2 Honest John launchers	4 Honest John launchers		36 Armored Helicopters
Unit Type	**Armd Arty**	**Armd Arty**	**Armd Div Arty**	**Armd Div Arty**	**Armd Div Arty (1960)**	**Armd & Mech Div Arty**		
Aggregate Strength	2,433 (Div: 11,930)	2,834 (Div: 13,971)	3,390 (Div: 14,651)	2,546 (Div: 14,647)	2,533 (Div: 14,617)	2,416 (Div: 15,000)		
FA Tubes	48	72	72	70	70	76		
Other FA Weapons	36 4.2-inch mortars			2 Honest John launchers	2 Honest John launchers	4 Honest John launchers		
Unit Type			**Abn Div Arty**	**Abn Div Arty**	**Abn Div Arty (1958)**	**Abn Div Arty**	**Abn Div Arty**	
Aggregate Strength			3,329 (Div: 17,078)	806 (Div: 11,486)	825 (Div: 11,486)	1,661 (Div: 15,000)	1,564 (Div: 12,972)	
FA Tubes			72	25	25	54	54	
Other FA Weapons				4 Honest John launchers	4 Honest John launchers	4 Little John launchers		

strength of 1,125; more importantly, the three units could field the same number of missiles as the regiment. On balance, the two plans exhibited other variations, but both followed the basic principles of pooling and consolidating functions wherever possible.[8]

PENTANA

The decision by Army Chief of Staff General Maxwell D. Taylor to abandon the ATFA plans in April 1956 shifted support to another study then being prepared by CONARC. Officially titled "Doctrinal and Organizational Concepts for Atomic-Nonatomic Army During the Period 1960–1970," the CONARC plan was more commonly referred to by the acronym PENTANA—the first four letters for the new division's five subordinate elements and the last three for its atomic-nonatomic configuration. In planning the PENTANA army, CONARC relied upon numerous other studies previously prepared by Army Field Forces, the Army War College, the Command and General Staff College, and John Hopkins University's Operations Research Office. As proposed, and eventually known by General Taylor's coined term, a *pentomic* organization with a pentagonal structure and an atomic capability was to replace the triangular division. Its five small semiautonomous combat, or battle, groups were to be capable not only of rapid and effective concentration for an attack and rapid dispersal but also of operating independently for long periods of time on the battlefield. For direct support, each group was to be authorized an artillery battery that had five sections for sustaining the five infantry companies; each section was to contain two "moritzers" (conceived as a cross between a mortar and a howitzer), two light guided missiles, and two forward observer parties. For more general support, the division was to be authorized an artillery battalion that consisted of a command and service battery, two antitank-antiaircraft missile batteries, a light surface-to-surface guided missile battery, and two boosted rocket batteries.[9]

Although the PENTANA division was conceived as a dual-purpose division, it was organized for operations on what Army planners visualized as the atomic battlefield. The domination of nuclear warfare by the Air Force and Navy at the expense of the Army's ground combat troops had been a long-standing area of concern. Thus in a revised version of the PENTANA division, published in 1957, each battle group still had one artillery battery but in addition had one antitank platoon (eight light antitank guided missiles in four sections) and two close-support platoons (each with four self-propelled moritzers). The divisional artillery battalion had three general-support batteries and one antitank battery. Because the group's close-support

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[8] Ibid.; Rpt, CGSC, 16 Sep 1954, sub: General Concept of Organization of Nondivisional Combat Support Units, Project ATFA–1, CGSC files and copy in CMH files.

[9] Study (abridged version), HQ, CONARC, 1 Dec 1955, sub: Doctrinal and Organizational Concepts for an Atomic-Nonatomic Army During the Period 1960–1970, copy in CMH files (hereinafter cited as PENTANA Army Study); Draft App. C of PENTANA Army Study, Encl to Ltr ATSWD–G 322/4 (Army), HQ, CONARC, 28 Oct 1955, sub: PENTANA Army, copy in CMH files; Maxwell D. Taylor, *Swords and Plowshares* (New York: W. W. Norton and Co., 1972), p. 171.

platoons would, with new ammunition, be able to provide substantially the same level of support that the existing divisional 105-mm. howitzer battalion furnished and because the coordination of fires could be achieved through a divisional fire support coordination center, Army leaders believed that additional direct-support artillery at the division level was not required.[10]

The next higher level was the corps, to be organized under the pentomic concept with five subordinate divisions. The corps artillery was programmed to have a headquarters and headquarters battery, an aviation company, a 700-man observation battery, a 600-man boosted rocket unit, and two guided missile battalions. Above the corps was the field army, containing five corps and having an artillery headquarters and headquarters battery, three guided missile battalions, and a fighter-bomber squadron. Of course, the replacement of conventional artillery weapons in the PENTANA army was dependent on successful development of accurate lightweight boosted rockets and a family of economical and reliable guided missiles, carrying 300- to 3,000-pound warheads with ranges up to 300 miles (482.7 kilometers). The addition of the fighter-bomber squadron was included to provide the field army commander with responsive tactical aircraft.[11]

Many objected to the proposed pentomic organization, providing critical commentary. For example, the Command and General Staff College reported that the PENTANA division lacked staying power, recommending that future organizational and operational concepts could be satisfied by slightly modifying the existing structure. Another critique came from the Artillery School, the new designation as of 1946. The school judged the capability of the division's conventional artillery to be insufficient for sustained operations and against hard targets. Its position, however, seemed to contradict studies that showed that a large proportion of targets engaged by the artillery were personnel targets and that a large number of the types of missions fired were neutralizing and harassing. As the CONARC commander, General John E. Dahlquist, stated in a letter to General Taylor, "Essentially the Artillery School wishes to wage a linear war using slightly improved versions of its current weapons."[12] While approving the pentomic concept in June 1956, Taylor specified that further studies were needed, especially in the areas of target acquisition, atomic capability for direct-support artillery weapons, and enhanced capabilities for conventional weapons.[13]

Division Artillery

The ensuing reorganizations took place in several stages. During the second half of 1956, new test TOEs were issued: Reorganization of the Airborne Division (ROTAD) on 10 August, Reorganization of the Current Armored Division (ROCAD)

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[10] PENTANA Army Study, 1 Dec 1955, copy in CMH files. See also Robert M. Young, "Artillery of the Pentomic Infantry Division," *Military Review* 38 (April 1958): 32–42.

[11] Draft App. C of PENTANA Army Study, copy in CMH files.

[12] Ltr 322/19 (Army), Gen Dahlquist to Gen Taylor, 12 Dec 55, copy in CMH files.

[13] Ltr, CofS to CG, CONARC, 1 Jun 1956, sub: Army Organization, Encl to DF Cmt 1 OPS–OT–DC, DCSOPS to DCSLOG et al., 15 Jun 1956, sub: Army Organization, copy CMH files.

on 1 December, and Reorganization of the Current Infantry Division (ROCID) on 20 December. By the summer of 1958, all the divisions in the Regular Army had been reorganized under the tables, and by the summer of the following year all but one of the thirty-seven divisions in the Army Reserve and Army National Guard had been reorganized. The final TOEs for the pentomic airborne organizations appeared in 1958, but the final tables for the infantry and armored divisions were available only in 1960. During the intervening years, pentomic concepts underwent numerous field tests, evaluations, and modifications.[14]

General Dahlquist had forwarded the CONARC proposal for a new airborne divisional structure to the Army staff in late 1955, before the PENTANA army study had been accepted. The proposed airborne division had features of both the PENTANA and ATFA studies. Its field artillery battalion was to comprise three 105-mm. howitzer batteries, each authorized eight howitzers, and one Honest John battery with four launchers. The Honest John rocket was to be an interim weapon for the division, to be replaced by either the Little John or Lacrosse still being developed. General Taylor approved the concept with some changes, including the addition of two more howitzer batteries so that one battery could support each of the division's five battle groups (*Chart 2*). Each battery was reduced to five howitzers, for a total of twenty-five in the division. Tests performed by the 101st Airborne Division in late 1956 and early 1957 showed that a major weakness in the new structure was the short range of the direct- and general-support cannon artillery. The test director, Third Army commander Lt. Gen. Thomas F. Hickey, recommended that 155-mm. howitzers replace the 105s and that four, not five, howitzer batteries be assigned to the division. He argued that the fifth battle group in the division would be held in reserve and, therefore, would not need additional support artillery. General Dahlquist disagreed, proffering two recommendations: that the 105-mm. howitzer be retained because it was lighter, more mobile, and air transportable and that the number of howitzers in each battery be increased from five to six, for a total of thirty in the division. The final tables published in July 1958, however, specified that each howitzer battery would remain with five 105-mm. howitzers, for a total of twenty-five, and that the total aggregate strength of the airborne division artillery would be 825, in comparison with its previous organization of seventy-two howitzers and 3,249 personnel.[15]

As with the airborne division, the proposed infantry division reflected the pentagonal concept of five battle groups, each with its own mortar battery. The division artillery, with an aggregate strength of 1,725, included a headquarters

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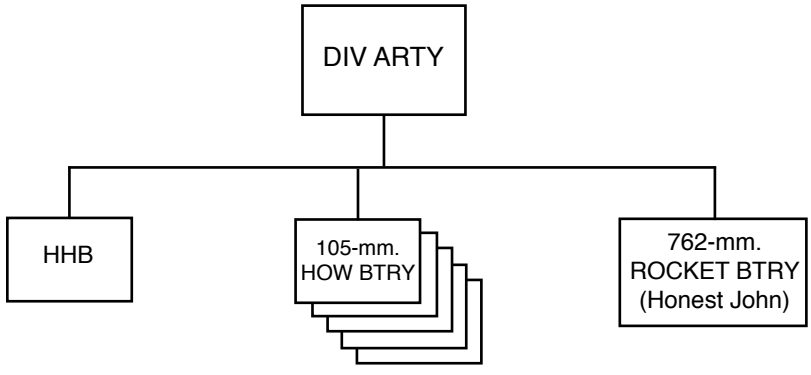
[14] Wilson, *Maneuver and Firepower*, pp. 276–84.

[15] Ltr OPS–OT–DC–2, DCSOPS to CG, CONARC, 20 Feb 56, sub: Reorganization of the Airborne Division; Ltr ATSWD–G 322/28 (Div), HQ, CONARC, to Comdts, Inf School, et al., 26 Nov 1955, sub: Reorganization of the Airborne Division, Short Title: ROTAD; Ltr ATSWD 322/31 (Div), HQ, CONARC, to CofS, 15 Dec 1955, sub: Reorganization of the Airborne Division. All copies in CMH files. See also T. L. Sherborne, "Reorganizing the 101st Airborne Division: An Interim Report," *Army Information Digest*, June 1957, pp. 12–23; TOE 6–200T, ROTAD, 10 Aug 1956; TOE 6–200D, 31 Jul 1958; TOE 6–200C, 14 Dec 1955; HQ, CONARC, "Summary of Major Events and Problems, 1 July 1956–30 June 1957," vol. 1, copy in CMH files (hereinafter CONARC, "Summary," FY 1957).

Chart 2—Airborne Division Artillery Organization, 1956–1963



and headquarters battery, a 105-mm. howitzer battalion, and a composite artillery battalion. The howitzer battalion of five batteries was to provide direct support to each battle group with one six-howitzer battery. The composite battalion was to provide general support, with its two six-howitzer batteries of 155-mm. howitzers (rather than the usual three batteries) furnishing the bulk of conventional fire support. The battalion was also to include one battery of four 8-inch howitzers and one battery of two Honest John launchers. The 8-inch howitzer was to furnish not only conventional fire but also, with its new atomic shell, extremely accurate close-support atomic fire. The Honest John battery would provide an economical atomic delivery capability with an increased range. In combination with other weapons, this capability ensured that the division had the strong fire support it needed for atomic warfare operations.

The artillery organization reflected the belief that atomic weapons had to be integrated with other weapons to the greatest extent possible. As in the ATFA and PENTANA studies, the antiaircraft artillery automatic weapons battalion was eliminated from the division. Such support was to come from area-type weapons or from pooled resources at higher echelons. The organization of the divisional field artillery was also to be flexible. For example, for an attack on a wide front, one battalion could control three 105-mm. howitzer batteries, a 155-mm. howitzer battery, and the 8-inch howitzer battery, while the other battalion could control the remaining firing batteries of the division artillery. The division artillery commander could also reinforce the fires of one of the mortar batteries organic to the infantry battle group by placing one or more of the 105-mm. howitzer batteries in a direct support role.[16]

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[16] Ltr ATTNG–D&R 322/44 (Div), HQ, CONARC, to Chief Sig Off et al., 2 Oct 1956, sub: Reorganization of Current Infantry Division, copy in CMH files; John H. Cushman, "Pentomic Infantry Division in Combat," *Military Review* 37 (January 1958): 19–30.

In October 1956, the divisional tables were increased slightly with the addition of fire direction centers at the battery level in the 105-mm. howitzer battalion, in the expectation that direct artillery support would come from the battery rather than from the battalion. The fire direction center in the battalion headquarters battery was reduced accordingly. Liaison, fire direction, forward observer, and forward air controller personnel were added to each mortar battery in the infantry units to perform responsibilities formerly those of the direct-support battalion. For experimental purposes, one division was to be organized with eight pieces in each of its 105-mm. howitzer batteries. The Continental Army Command did not plan any formal testing of the ROCID division, having judged it to be an adequate and effective combat organization for employment in future warfare and cognizant of the fact that division commanders were to make their own evaluations during the reorganization and subsequent training phases.[17]

Following two years of evaluation, major modifications were made in the ROCID division. The principal changes in the division artillery were designed to provide a substantial increase in conventional firepower and to centralize artillery fire support. Each of the five battle groups received a direct-support artillery battalion that had a headquarters, headquarters and service battery, a 105-mm. howitzer battery, and a 155-mm. howitzer battery. The reorganization was achieved by taking the five 105-mm. howitzer batteries from the old composite artillery battalion, deleting the 4.2-inch mortar battery in each battle group, and adding three new 155-mm. howitzer batteries. The 4.2-inch mortar in the infantry battle group was to have been an interim weapon to be replaced by the moritzer. It was apparent that such a weapon would not soon be developed, and other measures to improve fire support were necessary. Because of the shortage of self-propelled weapons, only two of the five new direct-support artillery battalions were to be armed with self-propelled howitzers. A general-support battalion with a headquarters and headquarters battery, a battery of four 8-inch howitzers, and a battery of two Honest John launchers replaced the former composite artillery battalion (*Chart 3*). The fire direction center was again centralized at battalion level, although one fire direction computer and one chart operator were retained in each firing battery. The new tables, which were finally published in February 1960, gave the division artillery an authorized aggregate strength of 2,165 (compared to 3,362 in the triangular division and 1,763 in the ROCID division) and sixty-four howitzers (compared to seventy-two in the triangular division and forty-six in the ROCID division).[18]

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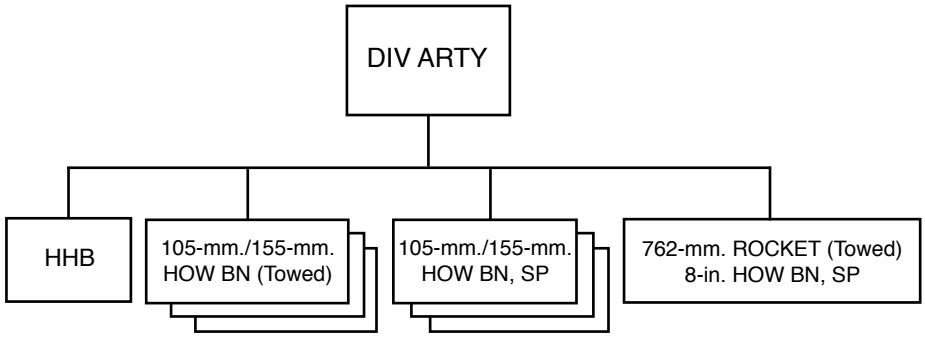
[17] Ltr ATTNG–D&R 322/53 (Div), HQ, CONARC, to DCSOPS et al., 15 Oct 1956, sub: Reorganization of the Current Infantry Division; CONARC, "Summary," FY 1957, vol. 1. Both copies in CMH files. See also TOE 6–100T, ROCID, 20 Dec 1956.

[18] Ltr ATTNG–D&R 322/17 (Div), HQ, CONARC, to DCSOPS, 28 Aug 1958, sub: Evaluation of ROCID, copy in CMH files. CONARC had proposed two 8-inch howitzer batteries (each with four howitzers), but DCSOPS deleted one; see 1st End, DCSOPS to CONARC, 29 Dec 1958, to ibid. See also Frank M. Izenour, "ROCID Changes," *Infantry*, April-June 1959, pp. 8–12; Mark S. Watson, "Guns in the Atomic Age," *Ordnance*, November-December 1959, pp. 386–94; C[lyde] D. Eddleman, "The Pentomic Reorganization—A Status Report," *Army Information Digest*, September 1958, pp. 3–11.

Chart 3—Infantry Division Artillery Organization, 1960–1963



The reorganizations did not affect the armored division as much as they had the infantry and airborne units. Basically, General Taylor was reluctant to reorganize it under a pentagonal structure that might make the division too large. As a result, the plans did not change the division artillery structure as drastically as that in other divisions. The antiaircraft artillery battalion was eliminated, as in the other organizations, but few changes were made in the 105-mm. howitzer battalions. To provide atomic fire support, a four-gun self-propelled 8-inch howitzer battery replaced one 155-mm. howitzer battery in the general-support battalion. On 5 November 1956, the Department of the Army approved the organization but directed that the general-support artillery battalion consist of two 155-mm. howitzer batteries, one 8-inch howitzer battery, and a battery of 762-mm. rockets (Honest Johns). As in both the airborne and infantry divisions, aviation assets were pooled at the division level.[19] The final tables, published in May 1960, gave the armored division artillery an aggregate strength of 2,533 and seventy howitzers (compared to the former strength of 3,411 personnel and seventy-two howitzers). The new tables authorized additional personnel for the fire support coordination center in the division artillery headquarters in order to operate the center on a 24-hour basis and to provide it with an uninterrupted displacement capability. Basically, Army planners believed that the intrinsic mobility and protection of armored vehicles precluded the need for a major reorganization.[20]

When the infantry regiment was eliminated from the force structure, the regimental combat team simultaneously suffered the same fate. But soon, a flexible separate combined-arms brigade replaced it. As with the regimental combat team, no fixed TOE existed for the brigade as a whole, but each of the first two such units

[19] CONARC, "Summary," FY 1957, vol. 1, copy in CMH files; TOE 6–300T, ROCAD, 1 Dec 1956.

[20] TOE 6–300C, 20 Jan 1956; TOE 6–300D, 1 May 1960.

to be activated included one artillery battalion in support of two infantry battle groups. The artillery battalion of one brigade was organized under the same tables as the 105-mm. howitzer battalion in the infantry division, but with two instead of five firing batteries, while the artillery battalion in the other brigade was organized as a composite unit with two 105-mm. howitzer batteries, one 155-mm. howitzer battery, and one Honest John battery. Three separate brigades were also organized in the Army National Guard.[21]

Combat Arms Regimental System

In conjunction with the reorganization of the divisions under the pentomic structure and with the collateral demise of the infantry regiment, Secretary of the Army Wilber M. Brucker on 24 January 1957 approved the new Combat Arms Regimental System (CARS), developed by the Army staff to maintain the continuity of distinguished combat units without restricting the organizational trends of the future. Before CARS, the ebb and flow of warfare directly affected the size and number of military formations. Whenever the United States entered periods of military retrenchment, units were invariably broken up, reorganized, consolidated, or disbanded; conversely, during periods of mobilization new units were created, often in large numbers. Furthermore, changes in weapons and techniques of warfare also produced new types of organizations to replace old ones. As a result, soldiers frequently served in units with little or no history, while organizations with long combat records remained inactive. CARS was created and adopted to alleviate some of these problems.[22]

Influenced by the British, the Army selected parent regiments as vehicles for perpetuating lineage and honors, even though the regiment itself was no longer a tactical unit (with the exception of the armored cavalry regiment). Field, antiaircraft, missile, and coast artillery units were combined into a single branch of seventy-five artillery regiments. Each regiment provided a base for a varying number of tactical elements, usually battalions or batteries. The number and size varied according to evolving force requirements. Each new regimental organization traced its heritage to an element of the regiment as it had existed prior to World War II. When the new unit was a battalion, its headquarters descended from one of the old batteries, and its organic elements were constituted as new units (*Charts 4 and 5*). Elements of the same parent regiment were assigned to

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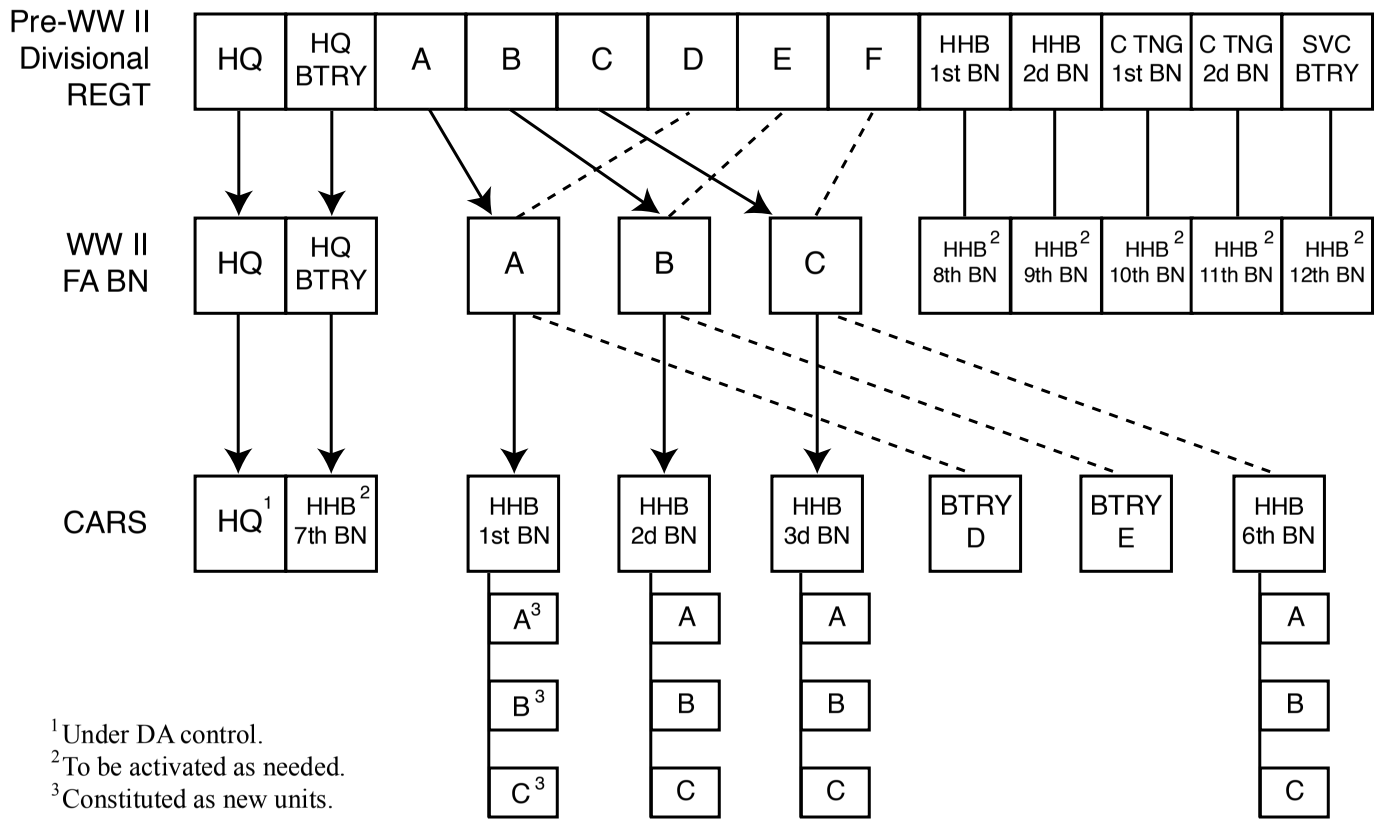
[21] Ltr AGAO–O (M) 322 (11 Jun 58), DCSPER, 8 Jul 1958, sub: Change in Status of the 1st Infantry Brigade and Other Units, copy in 2d Bn, 10th FA, fldr, CMH files; Ltr AGAO–O (M) 322 (5 Feb 58), DCSPER, 12 Feb 1958, sub: Organization of the 2d Infantry Brigade, copy in 1st Bn, 76th FA, fldr, CMH files. In 1959 the 29th, 92d, and 258th Infantry Brigades were organized, respectively, in Hawaii, Puerto Rico, and Arizona.

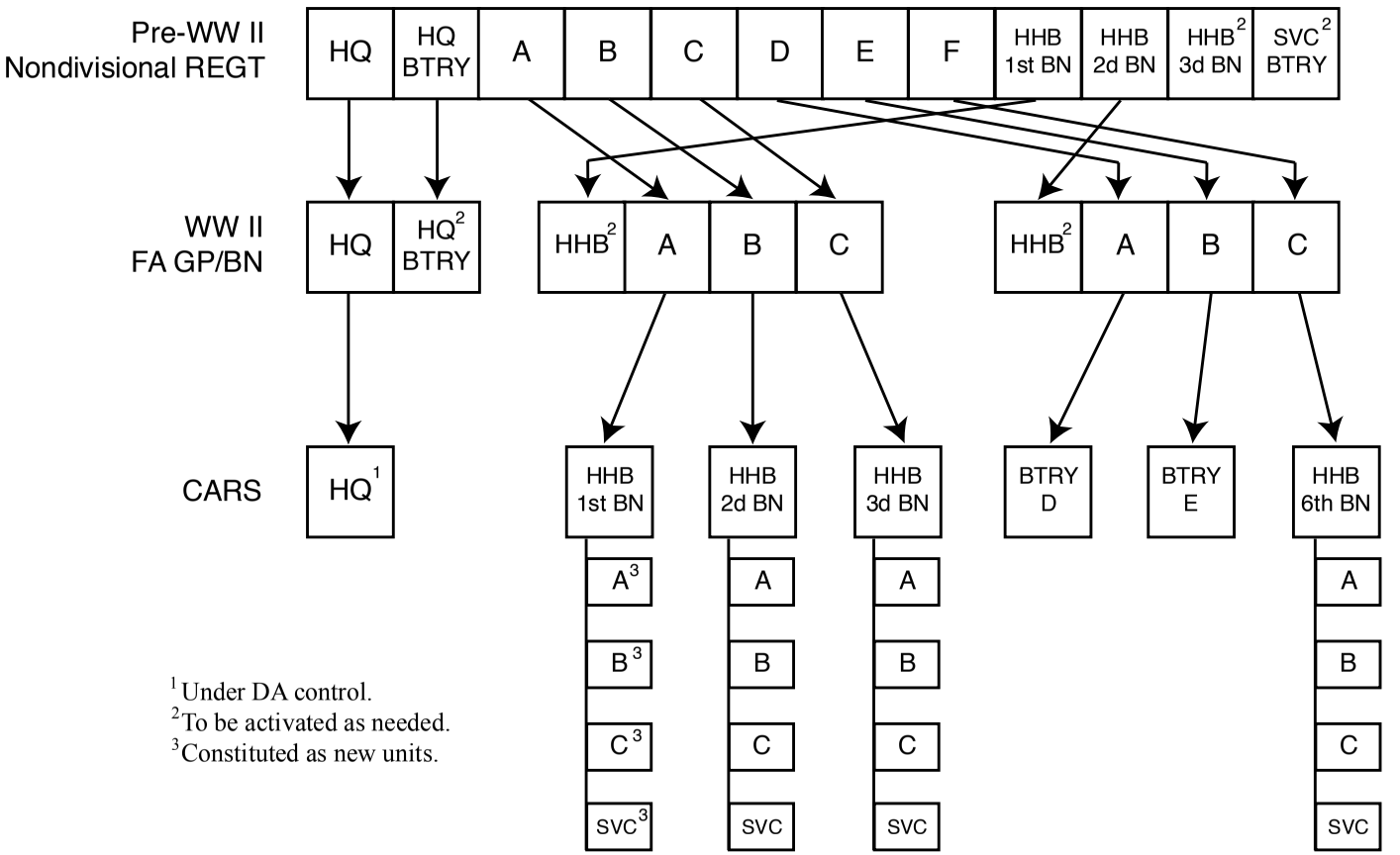
[22] CARS section based on AR 870–5, 22 Jan 1977; AR 672–5–1, 3 Jun 1974; AR 840–10, 23 Aug 1962; DA Cir 220–1, Oct 1960; DA Pam 220–1, Jun 1957; Janice E. McKenney, "Artillery Branches Out," *Soldiers*, December 1971, pp. 14–15; "The Combat Arms Regimental System: Questions and Answers" (Washington, D.C.: Center of Military History, United States Army, 1978); and documents in Artillery CARS Reorganization fldr, CMH files.

Chart 4—Reorganization of Regimental Elements Under CARS



[1] Under DA control.
[2] To be activated as needed.
[3] Constituted as new units.

Chart 5—Reorganization of Regimental Elements Under CARS



[1] Under DA control.
[2] To be activated as needed.
[3] Constituted as new units.

different divisions that fielded different weapons and that belonged to different components—either the Regular Army or Army Reserve. Although the latter shared their CARS regiments, the Army National Guard had its own, traditionally associated with specific geographic areas. Under CARS, units had both earned and shared honors. All elements of the parent regiment shared regimental campaign participation credit and decorations, and color-bearing units displayed their own contributions to these honors by means of earned honor devices on campaign and decoration streamers for their colors.

The original CARS plans included the establishment of regimental headquarters, not tactical ones like those that had existed prior to World War II, but as a "home" for all the members of the regiment. The headquarters was to be assigned a permanent location and was to maintain the regimental history and traditions; retain the regimental records; and display the regimental colors, trophies, and other properties. The Army staff also envisioned the regimental headquarters as regimental recruiting and training centers. Because of monetary constraints and other difficulties, Phase V (organization of the regimental headquarters) of CARS was suspended indefinitely, and the regimental headquarters remained at zero strength under Department of the Army control. Pending reestablishment of the regimental headquarters, the lowest numbered or lettered active element in the regiment normally retained custody of the regimental colors and properties. Members of all elements in each CARS regiment wore the same distinctive insignia, although they were authorized different shoulder sleeve insignia depending upon the division or other command to which their element was assigned.

Reorganization Objective Army Divisions

Because the pentomic structure was viewed as an interim measure in the first step toward adapting the Army to the nuclear battlefield and to other military situations that might arise, the Army staff continued to review various studies concerning the reorganization of the Army. One study, officially titled "Modern Mobile Army, 1965–1970," and referred to as MOMAR I, called for both medium and heavy pentagonal divisions but no corps echelon. The divisional artillery in each of the two types of divisions was to contain a self-propelled 155-mm. howitzer and a light missile battalion in support of five combat commands, which were each to have a moritzer battery in direct support. To replace the airborne division, CONARC proposed an air transportable brigade that would include two light missile batteries in support of two combat commands. Fire-support brigades, each containing two light fire-support groups (nine light fire-support battalions) were seen as replacements for the missile commands. A headquarters and headquarters battery was to be organized for the field army artillery, which was to include medium and heavy artillery battalions as well as the longer-ranged missiles. The Army rejected the study, with the Vice Chief of Staff General Clyde D. Eddleman on 16 December 1960 explaining the decision in his letter to the CONARC commander General Herbert B. Powell: "While MOMAR is useful as a reference, it does not provide

the simplicity, homogeneity, versatility, and flexibility required by the Army for its diverse, worldwide tasks in the coming decade."[23]

At the same time, General Eddleman directed CONARC to prepare another study to develop infantry, armored, and mechanized divisional organizations for the 1961–65 period. He stated that the creation of a mechanized division might enhance battlefield mobility and afford a greater degree of protection for personnel on the atomic battlefield. Echelons above the division level were not to be considered. The CONARC study was revolutionary, going beyond a mere modification of the existing pentomic structure with an Army-wide reorganization under the new concept known simply as ROAD (Reorganization Objective Army Divisions). Secretary of the Army Elvis J. Stahr, Jr., approved ROAD in April 1961.[24]

The pentomic structure had been based on the premise that nuclear warfare would be the most likely form of war in the future and that tactical nuclear weapons would be used. In contrast, the ROAD concept was designed to be flexible enough to handle both a nuclear threat and limited conflicts short of nuclear war. The pentomic organization had been part of the Army's effort to find a place within the framework of national policy in the 1950s; the ROAD structure was a reflection of the new administration's theory of flexible response.

Each of the brigades (usually three) in a ROAD division contained from two to five maneuver battalions, with the brigade being a tactical unit with no administrative role. As part of the division base, the infantry division artillery returned to a format similar to that in the old triangular division but retained its nuclear capability. Besides the headquarters and headquarters battery, the division artillery consisted of three self-propelled 105-mm. howitzer battalions (one in direct support of each of the division's three combat brigades), an Honest John battalion of four launchers, and a composite general-support battalion of 155-mm. and 8-inch howitzers, also self-propelled. Army Chief of Staff General George H. Decker approved the tables in April 1961, but he also asked CONARC to consider not only using towed artillery rather than self-propelled weapons but also reorganizing the rocket battalion to include the 8-inch howitzer battery. Towed weapons replaced the self-propelled ones in the final tables, with the composite battalion remaining as previously planned. The final tables also consolidated the service and headquarters batteries in the battalion. These tables, published in July 1963 (*Chart 6*), authorized the infantry division artillery an aggregate strength of 2,516 and fifty-four 105-mm. howitzers, eighteen 155-mm. howitzers, four 8-inch howitzers, and four 762-mm. rocket launchers (Honest Johns).[25] Overall, there was a 17-percent increase in conventional firepower. The addition of ten obser-

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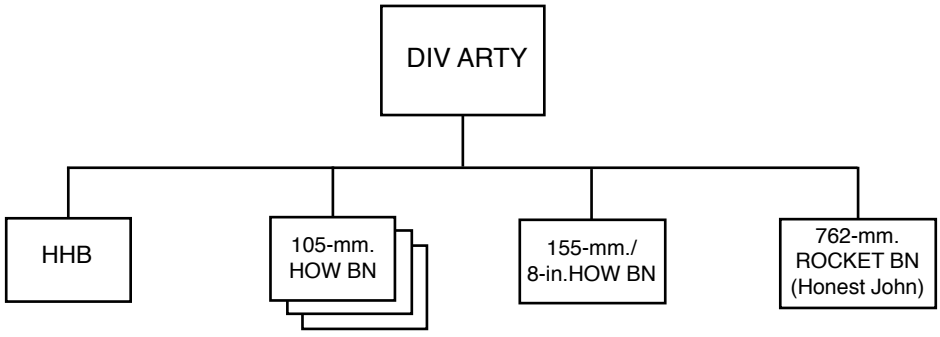
[23] Ltr CS 320 (13 Dec 60), VCofS to CG, CONARC, 16 Dec 1960, sub: Reorganization of Infantry and Armored Divisions and Creation of a Mechanized Division; "Modern Mobile Army, 1965–1970, Short Title: MOMAR I" (Fort Monroe, Va.: Headquarters, Continental Army Command, 1960). Both copies in CMH files. See also George T. Metcalf, "Trends in Organization of the Field Army," *Armor*, September-October 1960, pp. 27–31; Gordon B. Rogers, "Ground Mobility," ibid., pp. 24–26.

[24] Wilson, *Maneuver and Firepower*, pp. 293–96, 298.

[25] TOE 6–100E (draft), undated; TOE 6–100E, 15 Jul 1963; Ltr ATCG 322 (Div), CG, CONARC to CofS, 1 Mar 1961, sub: Reorganization Objective Army Divisions 1961–1965, copy in CMH files.

Chart 6—ROAD Infantry, Armored, and Mechanized Division Artillery Organization, 1963



Note: Infantry division artillery had towed weapons, while armored and mechanized division artillery had self-propelled weapons.

vation helicopters in the division artillery headquarters battery replaced aviation assets that had been eliminated under the ROCID tables. The artillery for the new mechanized infantry division artillery and armored division artillery contained the same armament, but all the field pieces were self-propelled.[26]

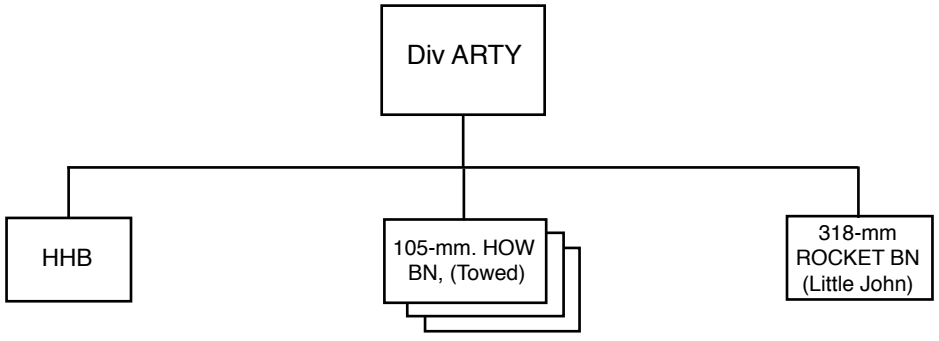
A ROAD structure was not initially planned for the airborne division. Nevertheless, as CONARC prepared to brief General Decker on ROAD–65, General Eddleman asked that a concept for the reorganization of the airborne division be available. Eddleman thought that a modified version of the ROAD concept could be applied to the airborne division, such as using towed artillery instead of self-propelled weapons, eliminating the 8-inch howitzer, and substituting the lighter 318-mm. rocket (Little John) for the Honest John. The proposed artillery organization for the airborne division included a headquarters and headquarters battery, three towed 105-mm. howitzer battalions, and a composite battalion of Little Johns and 155-mm. howitzers, but the final tables published in August 1963 eliminated the 155-mm. howitzers, which reduced the composite battalion to a single battery of four Little John launchers (*Chart 7*). As in the infantry division, ten observation helicopters were added to the division artillery headquarters battery.[27]

Although Army leaders wanted the ROAD reorganization accomplished as soon as possible, the Berlin crisis during the spring and early summer of 1961 delayed the effort. The Cuban missile crisis in the fall of 1962 and a scarcity of funds compounded the bottleneck even further. In January 1963, Defense

[26] Ltr ATCG 322 (Div), CG, CONARC to CofS, 1 Mar 1961, sub: Reorganization Objective Army Divisions 1961–1965, copy in CMH files; TOE 6–300E (draft), undated; TOE 6–300E, 15 Jul 1952.

[27] TOE 6–200E (draft), undated; TOE 6–200E, 15 Aug 1963; "Reorganization Objective Army Divisions 1965 (ROAD–65) Airborne Division" (Fort Monroe, Va.: Headquarters, Continental Army Command, 1961), copy in CMH files.

Chart 7—ROAD Airborne Division Artillery Organization, 1963



Secretary McNamara approved the activation of two divisions to serve as test units for the ROAD concept. Eight separate brigades were also planned, but only six were organized by 30 June 1964. Four brigades were also organized in the Army Reserve and four in the Army National Guard, in addition to three that had been organized in the Guard in 1959. Each separate brigade in the ROAD structure was to include one 105-mm. howitzer battalion, organized in a manner similar to that of the divisional 105-mm. howitzer battalion. The remaining Regular Army divisions and brigades were reorganized in 1964, and the reorganization of divisions and brigades in the reserve components was also completed that year.[28] None of the units in the reserve components was up to full strength, and because some of the critical equipment needed for the reorganization was lacking as well, certain reserve units were not organized, including five of the Honest John batteries in the composite artillery battalions of the National Guard.[29]

The Army considered a similar study for echelons above the division level in RODAC–70 (Reorganization Objective Division, Army, Corps, 1965–1970). The corps was to be retained as a tactical headquarters, with the capability of becoming an administrative echelon by attaching logistical elements when needed, and to be given control of most nondivisional combat and combat-support elements, including all nondivisional cannon artillery. For the field army, a fire-support command was proposed as a replacement for the existing missile command. Under ROAD-type TOEs published in the mid-1960s, the aviation resources of the corps and group artillery headquarters were transferred to separate aviation units and to the divisional artillery headquarters. In general, however, the nondivisional artillery units were

[28] DA Pam 355–200–13, "The New Army Division Structure," 18 Mar 1963. For the division and brigade reorganization letters, see the individual unit folders in CMH files.

[29] "The Guard Goes 'ROAD!'" *National Guardsman*, February 1963, pp. 2–4. For the division and brigade reorganization letters, see the individual unit folders in CMH files.

reorganized under structures very similar to those of the divisional battalions, and no drastic changes were made.[30]

Materiel Developments

Along with the reorganization of the forces, new developments in artillery weapons greatly improved conventional firepower. Between the Korean War and the early 1960s, the Army spent vast sums on missiles and rockets, while its tube artillery gradually became obsolete. After the Berlin crisis of 1961, Congress passed the largest peacetime defense appropriation to that time, and much of the Army's share went to update the artillery. Ranges in artillery weapons improved, and the number of self-propelled pieces grew compared to their towed counterparts, primarily because of the dramatic difference in emplacement and firing times. For example, it took only one minute to emplace and fire the self-propelled 8-inch howitzer but almost half an hour to prepare the towed version.[31]

Until the mid-1960s, the 105-mm. towed howitzer, the direct-support weapon for the infantry division, was virtually the same weapon used since World War II, although some improvements had been made in its range. In 1966, the new M102 105-mm. howitzer was introduced as a replacement. Despite the fact that the older model was easier to load and less expensive, the M102 was lighter, weighing 1.5 versus 2.5 tons. Thus, it could be towed on the ground by a lighter truck and, when airlifted, allowed for more ammunition to be carried. The new howitzer also had greater traverse, and its low silhouette made it a more difficult target for the enemy.

The M108 self-propelled howitzer, which had become the standard piece for the armored and mechanized divisions in 1963, experienced a similar fate two years later, starting to be replaced by the M109 self-propelled 155-mm. howitzer now having a nuclear-projectile capability. Conversion meant that all field artillery weapons in the mechanized and armored divisions became dual purpose, firing both

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[30] Summary Sheet on Reorganization Objective Division, Army, Corps, 1965–1970 (RODAC–70), Encl 1 to Ltr ATSWD–P 322 (Div), HQ, CONARC to USACGSC, 13 Jan 1961, sub: Organization for the Period 1965–1970. Aviation sections were in the augmentation tables for HHB, FA, groups for TOE 6–401D (30 Oct 1958) change 2, 11 Sep 1960, and deleted in TOE 6–401E, 22 Mar 1963. The aviation section in the corps artillery was deleted in TOE 6–501E, 11 Dec 1964. The main difference in the non-divisional battalions was that they included separate service batteries.

[31] Four artillery weapons paragraphs based on U.S. Army Ordnance Center and School, *Handbook of Ordnance Materiel* (Aberdeen Proving Ground, Md.: U.S. Army Ordnance Center and School, July 1962, March 1964, and March 1968); "155-mm. Guns to Replace 105s," *Army Times*, 8 December 1965, p. 21; Monte Bourjaily, Jr., "Seventh Army Going Nuclear," ibid., 18 December 1963, pp. 1; "Big Gun for the Army," *Army Information Digest*, October 1964, pp. 61–63; David Ewing Ott, *Field Artillery, 1954–1973* (Washington, D.C.: Department of the Army, 1975), pp. 49–50; DOD, Annual Rpts for FY 1962, p. 139 and FY 1964, pp. 140, 173, copies in CMH files; W. M. Glasgow, "USAREUR's Nuclear Weapons Responsibilities (1953–1964)," pp. 50–51, copy in CMH files; John S. Tompkins, *The Weapons of World War III* (Garden City, N.Y.: Doubleday, 1966), pp. 102–03; Robert G. McGlintic, "Army Artillery Slims Down," *Army Digest*, May 1969, pp. 28–29. TOE 6–365, 10 Sep 1965, specified self-propelled 155-mm. howitzers for armored and mechanized divisions. TM 9–3004, June 1953, stated that it took thirty minutes to six hours to emplace and fire a towed 8-inch howitzer.

M109 self-propelled 155-mm. howitzer passing through a German town during a 1983 exercise

conventional and nuclear warheads. By increasing the caliber of the mechanized and armored divisional artillery, Army leaders opined that the United States might overcome the superiority of the standard Russian 120-mm. direct-support howitzer. The 155-mm. towed howitzer was no match for the self-propelled version when supporting conventional ground operations against a heavily armed mobile enemy, but it could be transported by helicopter to support the infantry in roadless environments. The maximum range of the 155-mm. howitzer was about 9 miles (14.5 kilometers) and that of the 105-mm. howitzer was about 7 miles (11.3 kilometers).

Until 1963, the gap in range between the extremely accurate 8-inch howitzer and the Honest John was filled by the large and cumbersome 280-mm. gun, the world's first atomic cannon. Since initial development of Atomic Annie, nuclear warhead engineering had progressed so much that smaller packages—and therefore lighter and more flexible weapons—could be used. In November 1963, the M107 self-propelled 175-mm. gun, with its thirteen-man crew, replaced the last of the 280s. The new gun had the same carriage as the M110 8-inch howitzer and fired a 147-pound projectile a distance of 20 miles (32.2 kilometers). Like the other artillery battalions, the 175-mm. gun battalions were organized with a headquarters and headquarters battery, a service battery, and three firing batteries, each with four guns. The authorized aggregate strength of the battalion averaged about 500.

M18 field artillery digital automatic computer, commonly known as FADAC

In addition to the developments in field artillery weapons, the adoption of the M18 field artillery digital automatic computer (FADAC) in 1964 marked a major milestone in attempts to improve firing accuracy and to reduce response time. The result of five years of research and development, the 200-pound solid-state general-purpose computer was designed primarily to compute and display fire-control data for cannon and free rockets. The information fed into the M18 FADAC, such as target and battery locations, azimuths of lay, altitudes, weather, powder temperatures, projectile weights, and other facts needed to fire a mission, was derived through regular communication channels, reports, messages, maps, and similar sources. Although the new computer could not improve upon target location methods, its use produced consistently accurate ballistic computations; reduced the need for registration fire; facilitated achieving surprise engagements that were successful on the first try; and, most importantly, saved valuable time. To ready the Honest John rocket, for example, it took two men twenty minutes using manual computation but only one man three minutes using FADAC.[32]

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[32] Roger C. Laudati and Theodore B. Patterson, "Artillery Support—Push Button Style," *Infantry*, May-June 1964, pp. 71–73; Valerie Antoine, "FADAC Zeros In," *Army Information Digest*, January 1965, pp. 54–58. Recommendations for automating the computation of field artillery data had been made as early as 1946. See USFET Study no. 64, p. 42, copy in CMH files.

The M18 computer was placed in the fire direction center of the direct-support artillery battalion's operations section. One former chart operator ran the M18, while one member of the fire direction center operated the generator as an additional duty. The general-support battalion had a number of FADACs, one in each firing battery and one in the battalion headquarters battery.[33]

Airmobility

While the ROAD reorganizations were taking place, the Army began to study the impact of aircraft on ground warfare. On 3 May 1962, CONARC commander General Powell confirmed the appointment of the United States Army Tactical Mobility Requirements Board under Lt. Gen. Hamilton H. Howze. In its report of 20 August, the Howze board recommended the organization of an air assault division under the ROAD structure. Air transportable weapons and aircraft-mounted rockets were to be substituted for heavy and medium artillery. Because of the weight of the 155-mm. and 8-inch howitzers, the composite battalion was to be replaced with an aerial rocket battalion, having six UH–1B helicopters, each armed with forty-eight 2.75-inch rockets. Army helicopters were to transport the remainder of the artillery. Thus, when no helicopters were able to fly (because of weather or poor visibility), the new division would have roughly 80 percent of the artillery capability of the standard ROAD armored or infantry division and 100 percent of that of the standard airborne division. When the helicopters could fly, the division would have the capability, for short periods of time, of putting down more artillery fire than conventional divisions.[34]

In February 1963, the 11th Air Assault Division (Test) was activated at Fort Benning to experiment with airmobile concepts, from squad level to division level. Its division artillery consisted of a headquarters and headquarters battery; an aviation battery (equipped with twenty helicopters for observation and other aviation support); an aerial rocket artillery battalion; a Little John battalion; and three 105-mm. howitzer battalions, each capable of moving 40 miles (64.4 kilometers) to occupy a position and begin firing in the same time it took a standard infantry division's towed 105-mm. howitzer battalion to cover only 10 miles (16.1 kilometers).[35] Only six of the new M102 howitzers were available during the initial tests, but during maneuvers, the UH–1D helicopter's sling-load rigging made it possible to airlift them up to distances of 30 kilometers (18.6 miles). Two UH–1Ds could move a section, consisting of one howitzer, its eleven-man crew, and some ammunition in one lift. Three UH–1Ds were preferred for transporting the three-man fire direction center and additional ammunition along with a howitzer and its crew. For greater distances, the CH–47A helicopter was used to carry an entire section at one time.

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[33] FM 6–40–3, *Field Artillery Gun Direction Computer M18 Gunnery*, September 1964.

[34] Edward L. Rowny, "After the Air Mobile Tests," *Army*, May 1965, pp. 36–39; John J. Tolson, *Airmobility, 1961–1971* (Washington, D.C.: Department of the Army, 1973), pp. 16–24. See also Rpt, Howze Board, 20 Aug 1962, copy in CMH files.

[35] Ltr AGAO–O (M) (10 Jul 63), DCSPER to CG, Third US Army, and CG, Fifth US Army, 2 Aug 1963, sub: Change in Status of Air Assault Units, copy in HHB, 11th Abn Div Arty, fldr, CMH files.

UH–1D Iroquois in flight

The division's 11th Air Assault Aviation Group provided the helicopters for the maneuvers.[36]

The aerial rocket artillery battalion was a new organization for the Army. For the first time, aircraft were designated for use as artillery pieces. Each of the three UH–1B helicopters in the headquarters battery was armed with the M–6 kit (two M60 7.62-mm. machine guns on each side of the helicopter) and was used for command and control, liaison, and reconnaissance. The twelve helicopters in each of the three firing batteries were armed with the XM–3 kit (twenty-four 2.75-inch folding-fin rocket tubes mounted on each side of the aircraft). The rocket battalion was capable of providing only relatively fair-weather direct-fire artillery support, but because of its mobility, range, and speed, it was very responsive. Between missions, it could be staged out of range of enemy cannon and in areas extremely difficult for enemy ground units to penetrate. Most significant to the infantry was the role played by airmobile artillery during air assaults. The Army had been trying to reduce the time gap between cannon artillery preparation fire and the assaulting infantrymen's arrival at the objective. In the air assault division, the infantrymen rode UH–1D helicopters and set down on or near the objective as soon as the rocket-armed UH–1Bs shifted preparatory fires from the immediate vicinity of the landing zone.[37]

Like the aerial rocket artillery battalion, the Little John battalion was to provide conventional general support, but it was also to furnish the division with a nuclear

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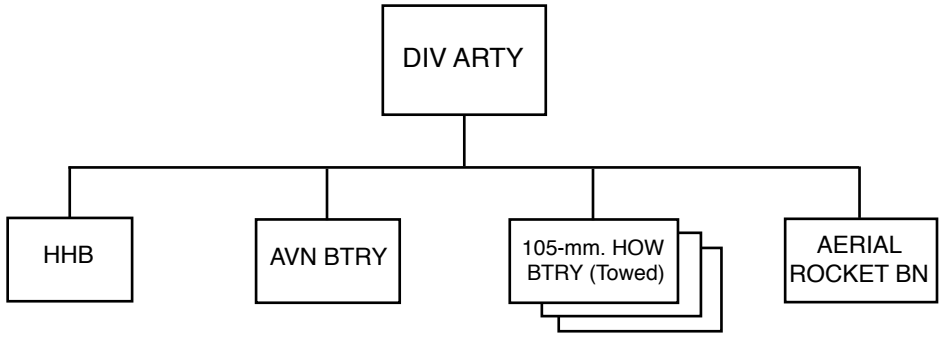
[36] Ibid.; William A. Becker, "Divarty Fullback," *United States Army Aviation Digest*, July 1965, pp. 1–7; David L. Johnson and James H. Fitzgerald, "Battlefield Artillery Airmobility Concepts," *U.S. Army Aviation Digest*, July 1965, pp. 8–11.

[37] Becker, "Divarty Fullback," p. 4.

Chart 8—Airmobile Division Artillery Organization, 1965



capability. The rockets were moved primarily by the CH–47s, and sometimes by the UH–1Bs and UH–1Ds. One UH–1D, with 48-foot blades, and one UH–1B could move a section, which consisted of the missile and its launcher, the windset and its allied equipment, and a nine-man crew. In a typical mission, the Little John would be flown to a predetermined launch site, where it took the crew about fifteen minutes to set up, fire, and leave. Security was obtained mainly through speed and deception.[38]

The tests proved the validity of the airmobile concept, and by June 1965, the Army had decided to make this type of division a permanent part of the force structure and undertook a series of complex administrative changes to achieve this end. On 1 July, the 1st Cavalry Division became the Army's newly configured unit, replacing the 11th Air Assault Division. The 1st's division artillery had almost the same organization as that of the test division except that the Little John battalion was eliminated (*Chart 8*). The division needed tactical air support from the Air Force to compensate for the loss of the nuclear-capable Little John. Tactical air support, along with the firepower organic to the division, could provide the same support offered by the Little John, whose range was short and within the limits of conventional artillery. Because the 1st Cavalry Division was deploying to Vietnam, where nuclear warfare was not anticipated, the rocket's worth was diminished even further. At the same time, the Little John batteries were eliminated from the airborne divisions for similar reasons.[39] With the buildup in conventional firepower instead of reliance primarily on nuclear rockets and missiles, the Army had created a flexible artillery force that would be tested during the next seven years of conflict in Vietnam.

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[38] Ibid., pp. 5–7.

[39] "1st Cav Div (Airmobile)," inside back cover; Tolson, *Airmobility*, pp. 62, 131; TOE 6–700T, 11 Jun 1965; TOE 6–200F, 25 Jun 1965.

CHAPTER 11

Vietnam

During the 1950s and early 1960s, the Army had been preparing for a sophisticated war in Europe by developing new organizational concepts and weapons. As of 1965, the force structure had sixteen Regular Army divisions organized under the ROAD concept, as well as numerous other brigades and nondivisional units organized under the latest TOEs. Even though changes would continue to be made, the basic building blocks of the ROAD divisions and brigades had created more flexible combat units to meet the challenge of both nuclear and conventional fighting. By this time, however, the situation in the Republic of Vietnam was grim, and in May, the Army found itself embroiled in a totally different kind of conflict. Widespread, localized civil warfare was the norm; well-defined battle areas or front lines were nonexistent; and the enemy was elusive, often indistinguishable from the local populace.

The unconventional nature of the conflict clearly demonstrated that new field artillery procedures were needed. Because of insufficient numbers and a lack of mobility, the field artillery could not provide effective mass support to each hamlet subject to hit-and-run attacks by fast-moving guerrillas. At best, artillery positions were pre-positioned singularly or by platoon throughout the countryside so that a maximum number of government installations and civilian communities could be brought under their protection. This piecemeal, static application of artillery went completely against the usual American practice of massed battalion fires.

Artillery Buildup

As 1965 began, senior military and civilian officials realized that the South Vietnamese by themselves could not win the war against the North Vietnamese. Based on their advice, President Lyndon B. Johnson approved and ordered additional troop deployments to Vietnam. The first field artillery unit to arrive in the country was the 3d Battalion, 319th Artillery, in direct support of the 173d Airborne Brigade, which moved from Okinawa in May. Two months later, the 1st Battalion, 7th Artillery, supporting the 2d Brigade, 1st Infantry Division, and the 2d Battalion, 320th Artillery, supporting the 1st Brigade, 101st Airborne Division, followed. The entire 1st Cavalry Division deployed in the fall, and by the end of the year, the remainder of the 1st Infantry Division had arrived. The latter and subsequent divisions left their Honest John battalions in the United States, and no such rocket battalions served

during the conflict. By the end of 1965, artillery strength was about one-third of that for the peak year of 1969.

With the American troop buildup proceeding apace, an additional corps-level headquarters (like Task Force Alpha and the III Marine Amphibious Force) became critical for coordinating the ground war throughout the respective Army of the Republic of Vietnam (ARVN) corps areas. The ARVN remained primarily responsible for the IV Corps Tactical Zone; the III Marine Amphibious Force, functioning also as a service component command, controlled activities in the I Corps Tactical Zone; and in March 1966, when the II Field Force Vietnam began to coordinate operations in the III Corps Tactical Zone, Task Force Alpha in the II Corps Tactical Zone was renamed I Field Force Vietnam. Also in March, a similar administrative change occurred for controlling all nondivisional artillery resources. The XXX Corps Artillery, already in country, became the I Field Force Vietnam Artillery and the newly arrived Fort Sill unit, the II Field Force Vietnam Artillery. Under the command of a brigadier general, each field force artillery headquarters was organized in the same manner as a corps artillery headquarters and performed similar functions, although its target acquisition elements were at skeleton strength with only survey and meteorological elements. During the remainder of the year, three more divisions and two additional separate maneuver brigades, along with their organic artillery, arrived.[1]

With the buildup, the number of field artillery units also grew. The cannon battalions had more than doubled by December 1966, totaling forty-three; increased to fifty-four by end of 1967, the year of the so-called big battles; continued to rise in early 1968 after the Tet offensive and reached sixty-one by December; and then finally peaked at sixty-three in July 1969 (*Table 25*).

Of the seven additional field artillery battalions sent into the battle area in 1968, two were from the Army National Guard—the 2d Battalion, 138th Artillery, from Kentucky, and the 3d Battalion, 197th Artillery, from New Hampshire, both deploying full strength in the fall. The chaotic individual rotation policy, in existence in the Regular Army since the Korean War, did not adversely affect these federalized Guard battalions. Because they retained the same troops who had spent most of their time in their own particular skill specialties and in cross-training until redeployment in October 1969, they reported few problems in maintaining a high level of training and combat effectiveness. Three other field artillery battalions were called up from the Army National Guard in 1968, but they did not serve in Vietnam. No Army Reserve field artillery units were called to active duty.[2]

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[1] DA Msg 728790, 18 Aug 1965; USARPAC GO 56, 11 Mar 1966; and Ltr, AGSD–C (M) (30 Mar 66) ACSFOR, 30 Mar 1966. Copies in HHB, 420th FA Gp, and II FFV Arty fldrs, CMH files. See also historical unit card, 420th FA Gp, CMH files. Both field force artillery headquarters were organized as corps artillery under TOE 6–501E, 11 Dec 1964. On the selection of the term *field force*, see U[lysses] S. G[rant] Sharp and W[illiam] C. Westmoreland, *Report on the War in Vietnam* (Washington, D.C.: U.S. Government Printing Office, 1969), p. 103.

[2] U.S. Army Concept Team in Vietnam, "Final Report: Organization and Employment of U.S. Army Field Artillery Units in RVN," ACTIV ACG–58F, October 1969, p. 2-38, copy in MHI files (hereinafter cited as ACTIV Final Rpt); Army Directory and Station List, December 1966, 1967, 1968, and June 1969.

Table 25—Field Artillery Units in Vietnam, 1965–1971

Unit Type	*Dec 1965*	*Dec 1966*	*Dec 1967*	*Dec 1968*	*Dec 1969*	*Dec 1970*	*Dec 1971*
175-mm. Gun Bn/8-inch How Bn*	4	7	11	11	11	10	4
155-mm. How Bn/8-inch How Bn	1	4	4	5	4	2	
155-mm. How Bn	1	5	6	8	6	7	1
105-mm. How Bn	11	27	33	37	32	17	6
Total	17	43	54	61	53	36	11
Corps/FFV Artillery HQ	1	2	2	3	3	3	
Division Artillery HQ	2	5	7	7	6	4	1
FA Group HQ	2	4	5	5	3	3	1
Aerial Rocket Bn	1	1	1	2	2	2	1
Aviation Btry	1	1	1	2	2	2	1
Target Acquisition Btry		2	2	3	4	3	
Searchlight Btry	1	4	4	4	4	4	2

*The self-propelled (SP) 8-inch howitzer was interchangeable with the 175-mm. gun. Battalions were sometimes listed as 8-inch howitzer battalions (SP) and sometimes as 175-mm. gun battalions. Frequently, a battery would have two 8-inch howitzers and two 175-mm. guns.

The reserve components found 1968 and 1969 to be turbulent, for both underwent a massive reduction and reorganization. The Army Reserve lost its last six combat infantry divisions, leaving it with three combat brigades and thirteen training divisions; its nonbrigade artillery thereafter consisted of three groups, three searchlight batteries, and fifteen cannon battalions. The Army National Guard lost fifteen divisions, leaving it with eight divisions and eighteen brigades; its nondivisional artillery units thereafter consisted of two corps artillery headquarters, twenty groups, forty-six cannon battalions, four target acquisition battalions, and three searchlight batteries.[3]

This period of retrenchment did not affect the active component, its divisions being committed to counter the escalating Communist threat in Southeast Asia. By the spring of 1968, the U.S. ground forces in South Vietnam under General William C. Westmoreland included seven divisions, two separate maneuver brigades, and one armored cavalry regiment,[4] all with their supporting artillery. In addition to the division, brigade, and regimental supporting artillery, I Field Force Vietnam Artillery, operating in the II Corps area, had two groups and ten battalions, while II Field Force Vietnam Artillery, operating in the III and IV Corps areas, had two groups and eleven battalions. The 108th Artillery Group served under the control

[3] See Vietnam, Reserve Components in, and Army Reserve, 1967–1968 Reorganization, fldr, CMH files; *Reserve Components Troop Basis of the Army, Fiscal Year 1969*, ann. I.

[4] On the 11th Armored Cavalry, see Stubbs and Connor, *Armor-Cavalry,* pp. 81–83, 211–13.

of the III Marine Amphibious Force to provide support in the I Corps area. Because of the enemy offensive and the need for counterbattery fire along the demilitarized zone, the number of Army reinforcements in the I Corps area rapidly increased. To furnish additional control of the units and operations in that area, Westmoreland created a provisional corps on 10 March and placed it initially under the III Marine Amphibious Force. The new command subsequently became the XXIV Corps, and in March 1970, it relieved the III Marine Amphibious Force of its responsibility and assumed operational control of all activities in the I Corps area.[5]

Adapting to the Environment

The Vietnam firefights and battles tested the ROAD divisional concepts in an environment not envisioned by Army planners. In many divisions, modifications were made in the organization of field artillery units. In some battalions, particularly in the divisional 105-mm. howitzer battalions, a fourth firing battery was organized in response to the continuing clamor for additional fire support from ground commanders. It was not uncommon in the divisional brigades to have a fourth maneuver element resulting from the use of the divisional reconnaissance squadron as a separate maneuver unit. Also, the large areas of operation assigned to a division or brigade were often difficult to cover with the conventional artillery organization, and the fourth firing battery alleviated the problem. The extra batteries made it possible for maneuver elements to operate within range of a howitzer battery.[6]

Commanders created the fourth firing battery in a variety of ways. In some instances, the Army officially authorized the organization of the extra battery. For example, based on orders, Battery D, 3d Battalion, 319th Artillery, provided additional support for the 173d Airborne Brigade's maneuver battalions; and the 23d Infantry Division reorganized each direct-support battalion with two five-gun and two four-gun batteries, thereby retaining the authorized eighteen howitzers. In other instances, the fourth firing battery was organized provisionally. For example, the 1st Infantry Division took one or two 4.2-inch mortar platoons from the infantry battalions and attached them as Batteries D and E to each divisional 105-mm. howitzer battalion, even though the mortar's relatively short range limited its effectiveness in the direct-support role. Other battalions organized extra batteries from existing personnel and equipment using similar methods.[7]

The aerial rocket artillery battalion was supposed to provide general support for the airmobile division. In Vietnam, however, each of the three batteries in that

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[5] Ltr, AGSD–C (8 Apr 66) OCMH, 8 Apr 1966, sub: Change in Status of Certain Units; USARPAC GO 124, 13 Feb 1969; USARV GO 1053, 9 Mar 1968; USARPAC GO 397, 1968; and draft of congratulatory message on unit standdown. Copies in HHB, XXIV Corps Arty, fldr, CMH files. See also Willard Pearson, *The War in the Northern Provinces, 1966–1968* (Washington, D.C.: Department of the Army, 1975), pp. 68–71.

[6] ACTIV Final Rpt, October 1969, p. 2-30 and ann. G, copy in MHI files; Ott, *Field Artillery*, pp. 169–70, 172–73.

[7] ACTIV Final Rpt, October 1969, pp. 2-30 to 2-32, copy in MHI files; Ott, *Field Artillery*, pp. 169–70, 172–73.

CH–54 Tarhe lifting a 155-mm. howitzer

battalion was often attached to one of the division's three maneuver brigades. When helicopters proved able to lift the 155-mm. howitzer, a battalion of those weapons was permanently attached to the division for additional general fire support.[8]

The Army in Vietnam used lighter towed field artillery pieces. The most common was the towed 105-mm. howitzer. Although its projectile was smaller and not as destructive as that of the 155-mm. howitzer, the 105 was easier to handle, was more suitable for transport by helicopter, and had a higher rate of fire. Other pieces included the obsolescent 105-mm. self-propelled howitzer, the 175-mm. gun and 8-inch howitzer (mounted on identical carriages and therefore interchangeable), the towed 155-mm. howitzer, and rocket artillery. The self-propelled 105-mm. howitzer was too heavy for helicopters to lift but was used successfully in an area support role where terrain permitted.[9]

In conventional warfare, field artillery proved most effective when planning and control were centralized at the highest level consistent with a unit's capabilities and mission, but the nature of the Vietnam conflict soon tested this approach. With counterinsurgency operations being conducted over abnormally large areas, greater decentralization than previously experienced in modern times was needed

[8] Ott, *Field Artillery*, pp. 52, 54–55, 118; Lloyd J. Picou, "Call 'Falcon' for Aerial Fire Support," *Army*, June 1967, pp. 46–48, 53–54.

[9] Ott, *Field Artillery*, pp. 35, 49–51. The previous chapter contains additional information on the weapons used in Vietnam.

[10] ACTIV Final Rpt, October 1969, pp. 2-1, 2-2, 2-14, copy in MHI files.

to provide flexibility and responsiveness. Both offensive and defensive operations were often conducted at the same time within a brigade's area of operations. The Army positioned the artillery both to support tactical operations and to provide area support for installations and main supply routes. This practice made it possible for some artillery to be within range of a maneuvering force at all times and usually outweighed the desirability for massing battalion fires against the relatively small targets attacked in Vietnam.

The French had employed the majority of their field artillery in Indochina in area defense, a practice that the Republic of Vietnam later adopted. U.S. Army artillery units employed the concept in practice but with equal emphasis on supporting the maneuver elements. Nondivisional and nonbrigade artillery units concerned themselves primarily with providing area coverage, while the brigade and divisional artillery units devoted most of their assets to the support of the maneuver elements. Nevertheless, missions tended to overlap where both types of operations were taking place within an artillery piece's field of fire.[10]

Once artillery was in position, it was extremely vulnerable to attack, and infantry troops frequently provided a security force. Normally, an infantry battalion and its supporting artillery jointly occupied a position, called a firebase, under the control of the senior artillery or infantry commander. Artillery and infantry commanders selected a firebase location based on the adequacy of the position to support the maneuver elements throughout the area of operations. Other key factors included the presence of other artillery in range to provide indirect fire support if necessary, suitability of the soil to support the weapons, and the ability of aviation to defend and supply it and the infantry to defend it. Firebases were almost always built for direct-support artillery, and divisional and field force artillery commanders usually sited their general-support artillery in established bases. A large firebase, in fact, generally harbored two or more artillery units. Artillerymen defended their bases with direct fire, countermortar fire, and mutually supporting fire (indirect fire support provided by one firebase in support of another). For direct fire, the use of the so-called beehive round—an antipersonnel projectile filled with over 8,000 metal darts (*fléchettes*)—was particularly effective.[11]

The configuration of firebases depended upon the terrain and the type of weapons. The field pieces were arranged as much as possible in a pattern that would provide as much depth as width so that the need for adjusting the ground effects was eliminated when firing in any direction. The primary purpose of the so-called star formation and others employed in Vietnam was to be able to provide a 6,400-mil (or 360-degree) firing capability without having to adjust the fall-of-shot pattern. For example, six-gun batteries (all 105-mm. and 155-mm. howitzer units), emplaced with one howitzer on each of the five star points and one in the center, made it possible to achieve an effective pattern of ground bursts and the desired 6,400 mil shot patterns during fire missions and all-around defense. The center piece could fire illumination rounds at night while the other pieces could support with direct fire. The

[11] Ibid., p. 2-15, copy in MHI files; Ott, *Field Artillery*, pp. 55, 61, 69; John R. DeTreville, "Antipersonnel Shrapnel Rounds," *Field Artillery Journal*, March-April 1976, p. 28.

8-inch howitzer from Battery D, 8th Battalion, 6th Artillery, at Fire Support Base Thunder II in Tay Ninh Province

composite 8-inch howitzer and 175-mm. gun batteries (four pieces each) usually were arranged in a diamond pattern, the 175s emplacing farthest from the battery's fire direction center and administrative elements to reduce the effects of the blast upon personnel, buildings, and equipment.[12]

Individual artillery weapon emplacements (sometimes referred to as parapets) varied, but all were constructed in a manner reminiscent of defenses in siege warfare. Often circular, the designs gave all-around protection for the weapons and crews from direct fire through the use of sandbags, ammunition boxes, timbers, fencing, and other materials. Ammunition bunkers and quarters for the crew were built into opposite sides of the walls and given overhead cover. The longer a unit remained within the emplacement, the more the position was improved.[13]

The infantry maintained a continuous perimeter around the guns, dug in wherever possible or bunkered with overhead cover. Digging in was preferred, but in lowland central and southern regions where the water table was high, aboveground bunkers usually had to be built. Barbed wire, trip flares, and other early warning devices and explosives were placed forward of the infantry positions, while the infantrymen defended the positions with rifles, grenade launchers, machine guns, recoilless rifles, and 81-mm. and 4.2-inch mortars. Some firebases also had air defense artillery weapons on the perimeter—dual 40-mm. guns ("dusters") and M55 quad .50-caliber machine guns, both of which had also been used in a ground-support role during the Korean War.[14]

Units larger than a battalion occupied base camps, which were larger than the firebases and contained the headquarters for both combat operations and the necessary support activities. A perimeter of bunkers surrounded the camps, beyond which were barriers of barbed wire reinforced with flares and mines. Field artillery guns and howitzers fired harassing and interdiction fire on suspected enemy routes

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[12] Ott, *Field Artillery*, p. 59.

[13] Ibid., pp. 63–68, 70; Ltrs, Lt Col William G. McAninch, USA (Ret.), to author, 11 and 29 Jun 1988, Historians files, CMH.

[14] ACTIV Final Rpt, October 1969, pp. 2-17 to 2-18, copy in MHI files; Ott, *Field Artillery*, pp. 59–60; Rpt, 23d Arty Gp, 1969, sub: Artillery, Vietnam, copy in 23d Arty Gp fldr, CMH files.

175-mm. gun from the 23d Artillery Group firing near Tay Ninh

and positions, answered requests for observed fire, fired illumination rounds, and provided direct support against attacks.[15]

Warfare in Vietnam changed the role of the division artillery commander. Because the three light artillery battalions in the infantry division were almost continuously employed in direct support of their respective brigades, he had little flexibility in varying their missions. To provide additional firepower, he could use the general-support battalion with three 155-mm. howitzer batteries and one 8-inch howitzer battery; however, the common practice of attaching one of the 155-mm. howitzer batteries to the division's reconnaissance squadron mitigated this option. Distances and the prevailing situation also hindered the division artillery commander from using the remainder of his artillery as responsively as he might have in more conventional warfare, because the heavier artillery was usually positioned before an operation and displaced only rarely during the fighting. And with elements so widely dispersed, he saw his supply and maintenance responsibilities increase and his tactical ones decrease. In any event, the division artillery commander remained the division commander's adviser on all fire-support matters.[16]

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[15] Ott, *Field Artillery*, pp. 73–74.
[16] Ibid., pp. 43–45.

At each maneuver command level above the company, an artillery fire-support coordinator was responsible for coordinating all available firepower: field artillery, armed helicopters, tactical air power, air defense weapons in a ground-support role, and naval gunfire. At the company level, the company commander was the fire-support coordinator, although the field artillery forward observer was available for advice and assistance. The liaison officer from the direct-support field artillery battalion was the fire-support coordinator at the maneuver battalion level, while at higher levels the fire-support coordinator was the commander of the artillery supporting the force. Fire-support coordination centers were established at division and higher levels. The decentralized nature of the counterguerrilla tactical operations and the need to avoid civilian casualties increased the necessity for extensive fire-support coordination.[17]

In addition to coordinating all available firepower, the fire-support coordinator also had to control the airspace in his area of operations—a task made increasingly difficult with the extensive use of helicopters. Artillery-warning control centers were established, normally at the maneuver battalion and brigade levels, to advise the numerous aircraft over the area of existing fires. All support means were required to notify the warning centers before firing, and all aircraft entering the area were to radio the center to receive the necessary firing information as well as a safe route to travel. The air advisory agencies passed responsibility for all airspace above 5,000 feet to the Air Force. In such areas as Da Nang, Ton Son Nhut, and Bien Hoa, where Air Force traffic was heavy, the Air Force controlled the space.[18]

Because of the nature of the fighting, about half of all artillery missions were fired very close to friendly positions or into areas surrounded by converging friendly forces. Extreme care had to be exercised to avoid firing on those forces and to ensure that civilians in the area would not be harmed. The fire-support coordinator normally obtained clearance from the government district in which the supported force was operating, making arrangements to open and maintain the necessary radio nets in advance of the operation. He also maintained maps marked to show the specified strike (or free-fire) zones, as well as no-fire zones, based upon rules jointly agreed upon by the U.S. and South Vietnamese high commands. No-fire zones were usually those in the more heavily populated areas, although exceptions were made if a unit had to defend itself from attack or if an enemy force was positively identified with the area. Clearance requirements and multiple agency coordinations created serious problems, chiefly the loss of surprise and responsiveness. To reduce the time lost, area operations involving night firing on targets of opportunity and harassing and interdiction missions in less populated areas were often cleared in advance.[19]

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[17] Ibid., pp. 47–48; Frank D. Grossman, "Artillery in Vietnam," *Ordnance*, November-December 1967, p. 270; ACTIV Final Rpt, October 1969, pp. 4-2 to 4-9, copy in MHI files.

[18] ACTIV Final Rpt, October 1969, pp. 4-9 to 4-10, copy in MHI files; John H. Hay, Jr., *Tactical and Materiel Innovations* (Washington, D.C.: Department of the Army, 1974), p. 32; Ott, *Field Artillery*, pp. 48–49, 179.

[19] Ott, *Field Artillery*, p. 48; Hay, *Tactical and Materiel Innovations*, pp. 30–32; Grossman, "Artillery in Vietnam," p. 270; ACTIV Final Rpt, October 1969, pp. 4-28 to 4-31 and ann. I, copy in MHI files.

The far-reaching mobility of most Army field artillery units allowed them to be widely deployed and thinly dispersed, yet still operate effectively. Just after its arrival in South Vietnam, the 1st Cavalry Division moved north to Pleiku Province and saw combat in the Ia Drang Valley, popularly known as the battle of the Ia Drang. The fighting between October and November 1965 was noteworthy, validating two aspects of the airmobility concept—the use of helicopters to move and supply cannon artillery, and the use of aerial rocket artillery at night and in extremely close support of ground troops. A prolonged pursuit of the enemy by a large unit operating continuously over difficult terrain and relying primarily on aircraft in every aspect of the operation was a first. The helicopters, primarily CH–47s, made it possible to position and supply the artillery units, thus allowing the infantry to have almost continuous coverage in support of their ground operations.[20] During the 35-day battle, the 1st Cavalry Division Artillery fired 33,108 rounds of 105-mm. ammunition and 7,356 rockets (2.75-inch). The concept of displacing and supplying artillery by air proved valid, and during the campaign, the artillery made seventy-nine tactical moves, of which sixty-seven were by air.[21]

The aerial rocket artillery battalion was particularly responsive and effective in augmenting ground artillery fire, especially when it was needed beyond the range of the division's conventional artillery. Aerial rocket fire was also invaluable during the most critical phase of the airmobile operation—just after the unit's arrival in a landing zone. The aerial rocket artillery battalion was best employed in a reinforcing role, with one of its three batteries habitually attached to one of the division's three direct-support artillery battalions. The main armament of the battalion consisted of 2.75-inch folding-fin rockets, mounted first on UH–1 and later on AH–1 helicopters. Subsequently, some helicopters were equipped with SS–11 antitank wire-guided missiles, which were extremely effective against both enemy tanks and such point targets as bunkers and other fortifications.[22]

While Army planners had designed the 1st Cavalry Division, and later the 101st Airborne Division, to make maximum use of helicopters, the other maneuver units that followed also employed them extensively to move their troops, weapons, and supplies, getting them from the corps-level aviation groups. Thus almost all infantry units in Vietnam operated as airmobile infantry, and their supporting artillery served in an airmobile role alongside them. The airmobility concept allowed the artillery to travel deep into roadless areas in support of the infantry; the firebases, which were established, supplied, and evacuated by air, were the key for mobile large-unit operations deep into enemy territory.

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[20] AAR, Pleiku Campaign, 1st Cav Div (Ambl), 4 Mar 1966, pp. 4–5, 12, 18, 21, 24, 28, 60, 78, 84, 87–88, 90, 102, 123, 127–128, copy in CMH files.

[21] Ibid., pp. 4–5, copy in CMH files.

[22] Picou, "Aerial Fire Support," pp. 46–48, 53–54; William F. Brand, Jr., E. K. Johnson, and Morris J. Brady, "Airmobility Firepower—Hallmark of the 1st Cavalry Division," *United States Army Aviation Digest*, March 1967, pp. 18–23; Hay, *Tactical and Materiel Innovations*, pp. 28, 33; Elizabeth C. Jolliff, "History of the U.S. Army Missile Command, 1962–1977," Historical Monograph Project no. DARCOM–84M, 20 July 1979, pp. 117, 122–24, 127–39, AMCOM files and copy in CMH files.

CH–47 Chinook transporting the M102 105-mm. howitzer;
below, *UH–1B Iroquois firing 2.75-inch rockets*

105-mm. howitzer from Battery C, 2d Battalion, 17th Artillery, during the Ia Drang battle

During the troop buildup in 1965 and 1966, division-sized and smaller units executed most operations, using the principles of massed firepower and the newer airmobility concept along fairly conventional lines. The following year, 1967, was highlighted by large-scale actions, again along conventional lines, demonstrating that such operations did have a place in the conflict and that they could be successful. Multidivisional operations, such as CEDAR FALLS and JUNCTION CITY, further illustrated the decisive role played by artillery, verifying the need to put as much firepower as possible on the attacking enemy without delay. The many small battles, or firefights, also pointed out the necessity of having artillery fire available to support any unit, regardless of size, whenever contact with the enemy was a possibility.

Another innovation in Vietnam was the use of riverine artillery,[23] artillery designed for the waters of the Mekong Delta. Among the organizations that de-

[23] This and the following paragraph on riverine artillery based on "Mobility! Firepower! Accuracy!" *Octofoil*, July-August-September 1969, p. 11; Ott, *Field Artillery*, pp. 75–80; Hay, *Tactical and Materiel Innovations*, ch. 6; "Airmobile Artillery Platforms," *United States Army Aviation Digest*, March 1968, p. 64; Sharp and Westmoreland, *Report on the War in Vietnam*, p. 146; and William B. Fulton, *Riverine Operations, 1966–1969* (Washington, D.C.: Department of the Army, 1973).

ployed to Vietnam in late 1966 was the 9th Infantry Division's riverine artillery unit—the 3d Battalion, 34th Artillery—which operated in the delta in support of the division's 2d Brigade. The terrain in the delta was a serious hindrance to the howitzers. Roads were scarce, and hamlets and villages were built on what little hard dry ground was available. Even when the artillery could be positioned on dry land, the high water table made the ground soft and unstable. Without a firm base the cannons bogged down, were difficult to traverse, and required constant checks for accuracy. The artillery could not rely on ground vehicles for supply or transport but used helicopters successfully. An airmobile artillery platform, a 22-foot square (similar to a low table) with large footpads on four adjustable legs to distribute its weight, solved some of the problems. One helicopter first transported the platform, subsequently placing it in boggy or flooded areas; then a second helicopter brought in the M102 howitzer and a limited amount of ammunition and positioned them on the platform in the designated space. As beneficial as the platform was, it also had two disadvantages: the gun crew was too exposed to enemy fire, even with the protective sandbags positioned around the edges, and the limited space made ammunition resupply and storage difficult.

In December 1966, the 1st Infantry Division's 1st Battalion, 7th Artillery, tested a medium-sized LCM (landing craft, mechanized) as a firing platform. But the LCMs had some drawbacks. They were not easily moved to and from desirable locations, they were not wide enough to permit the howitzer full 360-degree traverse, they were not as stable as desired, and they did not reduce but increased the time needed to prepare for firing. Floating barges, conceived by the 3d Battalion, 34th Artillery, were more successful. In their first experiment, the artillerymen floated an M101A1 105-mm. howitzer on a borrowed Navy Ammi pontoon barge, but it was difficult to move and its draft too deep for the delta. A second barge was finally built on P–1 standard Navy pontoons fastened together. Armor plate was installed around the sides for protection of the crew, and ammunition areas were built on either end with living quarters in the center. As the M102 howitzers became available, they replaced the older M101A1s. An average riverine battery consisted of three pontoon barges and five LCMs—three as push boats for the barges**,** one as a fire direction center and command post, and one as an ammunition supply vessel. Thus equipped, the artillery could maneuver up and down the major rivers and even through some of the larger streams and canals in the delta region with relative ease. When a site was chosen, the LCMs pushed the barges into position along the riverbank, preferably a side without heavy vegetation to use for helicopter landings. The barges were usually secured on the riverbank opposite the target area so that the howitzers could fire away on the shoreline in support of the infantry. The weapons could then be fired at the lowest possible angles to clear the obstructions on the far bank and keep the landing zone out of the line of fire.

Another innovative technique, employed more often after mid-1968 than before, was the artillery raid. Such raids were normally combined arms efforts, with the maneuver forces supporting the artillery rather than the artillery supporting the maneuver elements. Designed to extend available combat power into remote areas and to mass fires on the enemy beyond the range of pre-positioned artillery at the firebases,

Riverine 105-mm. howitzer battery position, with the fire direction center on the center right barge

artillery raids involved the displacement of field pieces to supplementary firebases or firebases selected and occupied on the spur of the moment. To achieve surprise, the maneuver forces supporting the artillery conducted their operations as quickly as possible, while taking the utmost advantage of airmobility, aerial observation, and target acquisition capabilities. The artillery raid became increasingly important as the number of artillery organizations decreased in late 1969 and 1970, thus forcing the remaining units to cover larger areas of operation.[24]

Harassing and interdiction fire received conflicting comments on its effectiveness. Some officers felt that such fire had little effect on the enemy, while expending enormous amounts of ammunition. Others disagreed, citing reports that the enemy feared artillery firing at night and that the fire was indeed inflicting damage. In late 1968, a program of intelligence and interdiction fire was introduced, thus reducing harassing and interdiction fire missions. Targets for harassing and interdiction fire were usually based on map reconnaissance alone, while some type of enemy intelligence had to justify the use of the less arbitrary intelligence and interdiction fire. Artillerymen used the time-on-target technique, so familiar during World War II, to execute the intelligence and interdiction fire missions more effectively.[25]

Tube artillery firepower proved extremely effective and efficient in Vietnam. Still, some felt that aerial gunships and fixed-wing aircraft were preferable because their pilots could see the targets and then sweep down and strike. In contrast, the artillery depended heavily upon ground and aerial observers for accuracy. However, artillery fire was often available on a 24-hour basis, including periods of poor visibility when gunships and fixed-wing aircraft could operate only with severe restrictions imposed.[26]

Forward observers in Vietnam, "the eyes and ears of artillery," were usually flexible and ingenious enough to handle the difficult and unusual situations that

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[24] ACTIV Final Rpt, October 1969, ann. F, copy in MHI files; Ott, *Field Artillery*, pp. 184–87.

[25] ACTIV Final Rpt, October 1969, pp. 4-22 to 4-26, copy in MHI files; Ott, *Field Artillery*, pp. 187–88; Guenter Lewy, *America in Vietnam* (New York: Oxford University Press, 1978), pp. 99–100.

[26] "Eyes of Artillery," *Octofoil*, July-August-September 1969, pp. 3–5.

arose. A field artillery forward observer accompanied each maneuver company, and he moved with the company and called for and adjusted artillery fire. Although the TOE called for a lieutenant, the observer in Vietnam was often a noncommissioned officer or other enlisted man. Many harsh conditions confronted the forward observer. The terrain varied from mountains surrounded by triple-canopy jungle to flat marshlands, and monsoon rains and humid tropical heat characterized weather conditions. These environmental conditions, coupled with an insurgent-type enemy, made the job extremely difficult. The thick forests and jungles hindered the ability of the observer to see the target, which necessitated the adjustment of artillery by sound—an exceedingly difficult practice. Because infantry companies often performed diverse missions simultaneously as separate squads and platoons, the forward observer accompanying one maneuver element had to maintain accurate and up-to-date information on the locations of the other elements and attempt to provide adequate support to the other elements by relaying calls for fire from maneuver leaders to fire direction centers. Forward observers also had to learn techniques in adjusting the fire of aerial rocket artillery, a relatively new weapons system.[27]

Forward observers on the ground and aerial observers were the principal means of adjusting fire on a target in Vietnam. As in World War II and Korea, each infantry division artillery had ten aircraft—helicopters in Vietnam—plus observers and crew; observers and helicopters were also authorized for nondivisional artillery units, and additional air observers were used whenever possible, especially in support of overland ground movements. The role of aerial observation was, in fact, critical, declining only in the waning years of the conflict when the enemy began using sophisticated air defense weapons.[28]

Other means of acquiring targets in Vietnam were available. Five target acquisition batteries served during the conflict, including the headquarters batteries of two battalions. Both battalion headquarters batteries were assigned to the I and II Field Forces, where each coordinated the target acquisition operations in the respective corps areas. The remaining batteries operated along the demilitarized zone under the III Marine Amphibious Force (and later under the XXIV Corps) and under the Capital Military Assistance Command near Saigon between 1969 and 1970. Although one target acquisition battalion was authorized per corps in its TOE, none served in Vietnam. In-country studies recommended, however, that a target acquisition battalion, less its sound-ranging equipment and personnel, be

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[27] Ott, *Field Artillery*, pp. 130–31 (quoted words, p. 130); TOE 6–185G, 31 Aug 1966; TOE 6–215G, 30 Jun 1966; TOE 6–205G, 30 Jun 1966; TOE 6–405G, 31 Mar 1966; TOE 6–405E, 29 Jul 1966; ACTIV Final Rpt, October 1969, pp. 4-33 to 4-42, copy in MHI files.

[28] Ott, *Field Artillery*, pp. 96, 179, 228.

[29] ACTIV Final Rpt, October 1969, pp. 3-16 to 3-18 and 7-12, copy in MHI files. See also DA Msg 910341, ACSFOR, 23 May 1969, sub: Activation/Reorganization of Units in RVN, in 4th Bn, 25th FA, fldr; Ltr AGSD–C (M) (29 Jul 66) ACSFOR, 3 Aug 1966, sub: Activation of HHB, 8th Bn, 26th Arty (STRAF no. 19, FY 67), in 8th Bn, 26th FA, fldr; Ltr AGSD–C (M) (16 Feb 68) ACSFOR, 21 Feb 1968, sub: Change in Status of Units (USARPAC no. 16, FY 68) to CINCUSARPAC, in Bty F, 26th FA fldr; Ltr AGSD–C(M)(10 Aug 66) ACSFOR, 22 Aug 1966, sub: Activation of Headquarters and Headquarters Battery, 8th Battalion, 25th Artillery (STRAF no. 313, FY 66), in Btry H, 25th FA, fldr. All in CMH files.

deployed at the corps level.[29] Battery C, 2d Battalion, 26th Artillery, operating along the demilitarized zone in the I Corps tactical zone, was the only unit using sound-ranging equipment. That equipment (GR–8 sound-ranging sets) was originally issued in 1945. A limited supply of parts, a limited number of technically qualified maintenance personnel, the long wire lines and heavy equipment, survey requirements, and a lack of consideration of the need to modernize the old sets hindered the employment of the sound-ranging platoons considerably. Flash ranging was also used, primarily along the demilitarized zone.[30] Searchlights could produce either visible or infrared lighting, and they were oriented for direction on the same angular reference as the artillery pieces.

Sensors were also effective means of target acquisition. Intelligence elements were responsible for employing sensors, but they worked in close cooperation with the artillery; the best means of fire support that could respond quickly to sensor activities were the pre-positioned field artillery pieces. The sensors used in Vietnam were emplaced by hand or delivered from aircraft in an anti-infiltration role. They sensed the intrusion of enemy vehicles and troops seismically, acoustically, electromagnetically, or through infrared devices. Information on the direction of movement, the size of the force, and the length of the columns could all be gained through the use of sensor fields. Troops in Vietnam also used sensors in support of the barrier system south of the demilitarized zone. Many of the sensors designated for this role were diverted in the spring of 1968 to support the defense of Khe Sanh. As the sensors became available to ground force commanders, the results were noteworthy, and these successes spurred their further use and development.[31]

To locate targets, direct-support artillery battalions used countermortar radars, ground surveillance radars, and even the shorter-ranged infantry antipersonnel radars. Artillerymen in Vietnam considered the ground surveillance radar (AN/TPS–25) to be valuable equipment, although the heavy rainfall and dense foliage hindered its effectiveness. Less favorable evaluations accompanied the countermortar radar (AN/MPQ–4), which had had a small scanning sector and could not locate such low-trajectory weapons as rockets. The use of several radars to provide mutual and overlapping coverage eased the first problem, but the second was not easily correctable because the radars had been designed specifically for detection of high-trajectory weapons (such as mortars). For nondivisional units, radar detach-

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[30] Coffman, "Sound Ranging," p. 23. See also FA School Annual Historical Summary, 1969, pp. 14–15, copy in CMH files.

[31] Ott, *Field Artillery*, pp. 73–74; Louis C. Friedersdorff and John P. Bulger, "Field Artillery Applications for Remote Sensors," *Field Artillery Journal*, January-February 1977, pp. 54–56; Pearson, *Northern Provinces*, pp. 21–24.

[32] [Col] Hobby, "Artillery Target Acquisition in Kontum Province," 1971, copy in FA School files; Ott, *Field Artillery*, pp. 179–81; MTOE 6–517TP00 (countermortar radar detachment), 25 Jun 1968; MTOE 6–302GP02 (ground surveillance radar detachment), 5 Feb 1970; FA School Annual Historical Summary, 1969, pp. 15–16, copy in CMH files.

ments were authorized, using modified TOEs. These detachments operated under the control of the target acquisition batteries.[32]

Redeployment

In 1969, President Richard M. Nixon announced that the goal of the American effort in Vietnam was to enable South Vietnam to assume full responsibility for its own security. With that announcement, redeployment of American troops began. By December, Army field artillery strength was roughly equal to that in Vietnam prior to the Tet offensive of 1968. The redeployment accelerated rapidly over the next two years, while Army artillerymen made concerted efforts to improve South Vietnamese performance in the arm. In 1970 and 1971, more and more responsibility was given to the South Vietnamese, and American commanders began to experience operational difficulties because of the redeployments and reductions in personnel. By the end of 1971, artillery strength was well below that of 1965, the year that artillery units first went to Vietnam. The remaining field artillery units left the country in 1972.[33]

One of the greatest problems in Vietnam had been that of target acquisition, an area that had not kept pace with advancing technology, and following the withdrawal of U.S. forces, the Army initiated research to correct the deficiencies. A need for a target acquisition capability at the division level was experienced in Vietnam, and new organizational concepts were studied in the post-Vietnam years to incorporate some of the needed changes.

The importance of the fire-support coordinator and the forward observer had increased during the conflict in Vietnam. Artillerymen saw such personnel even more critical for conventional war on an extremely fluid battlefield, where planning would be ongoing in response to the changing situation and where the luxury of detailed planning for employing maneuver forces and their supporting fire would no longer exist. The expanding number of different types of ammunition, created for specific purposes, also increased the dependence of the artillery on the forward observer and fire-support coordinator for accurate information and decisions as to the necessary types of fire support.

Although field artillery in Vietnam was not always as responsive as its supported forces might have wished because of the numerous checks and clearances required, artillerymen showed that they could meet situations and environments different from those in which they had been trained and yet operate with the flexibility and ingenuity demanded by an unconventional battlefield.

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[33] Army Directory and Station List, December 1965, 1971, and 1972.

CHAPTER 12

Modernization Efforts

Despite the Army's demonstrable superior firepower and airmobile capability in Vietnam, the many years of fighting took its toll, not only on the war-weary troops but also on their force structure and materiel. Field artillerymen, in particular, believed that the conflict had delayed critical technological improvements needed to successfully meet an attack by a more formidable enemy in Europe. They maintained that Vietnam had been mainly a battery commander's war with small individual actions but that the European arena would be a division artillery commander's war with large operations requiring his constant effort to allocate scarce means of fire support, to know when to mass and when to disperse, and to execute his missions over vast frontages.

In the aftermath of Vietnam, the political dynamics shifted to the defense of Western Europe and NATO's role. Cognizant that the Soviet Union and its Warsaw Pact allies outnumbered and outgunned the United States, Army planners believed they had to reduce the opposition's superior firepower and numbers well before meeting on the battlefield and that Army organizations and equipment had to be improved drastically to contain such an adversary with any success. Consequently, they focused their attention on improving the force structure and arms and other equipment to meet the threat of a sophisticated war in Europe. Simultaneously, because of a growing assumption that crises were more likely to occur outside the European milieu, they also took appropriate measures to ensure that Army forces could respond immediately to any contingency within and outside the NATO sphere.

Materiel

The 1970s and 1980s saw myriad developments in cannon artillery—new weapons, integrated large-scale fire direction systems, longer-ranged and more varied ammunition, terminal guidance systems, and modernized target acquisition systems—that promised a virtual revolution in field artillery if successfully fielded. The Soviet tank threat and the fear that the Air Force would be occupied fighting an air war, thus reducing close air support, led to studies in the use of field artillery to fight armor. Direct fire was generally more effective than indirect artillery fire in destroying tanks, but direct fire had its limitations, notably range. Something was needed to engage enemy tanks beyond the range of direct-fire weapons. Cannon artillery, traditionally the weapon of deterrence and denial, could force the enemy to avoid the ground the artillery took under fire, but it had never been accurate

enough (especially at longer ranges) to be a weapon of sure destruction of such moving point targets. Additionally, cannon artillery could not fire a round powerful enough to penetrate and destroy tanks, often only slowing them down, disrupting their radio communications, and separating them from supporting infantry. But new developments promised a transformation of ordinary field pieces—technologically not far removed from their predecessors of World War I—into precision-destruction weapons nearly equaling the guided missile standard: one round, one target or one round, one kill.[1]

In the early 1970s, field artillerymen felt that firepower capabilities could be vastly improved in the area of munitions. Because of the large number of artillery and tank units fielded by the Soviet Union and its Warsaw Pact allies, Army planners wanted firepower capabilities strengthened. Manpower and cost constraints, however, precluded great numbers of weapons and crews being added. Yet the answer to this quantitative setback seemed to be a qualitative solution through advances in technology and training. One method of increasing firepower was to develop more deadly munitions. Another was to improve accuracy and delivery error to near zero.

The concept of smart rounds actually began during World War II, when proximity fuzes were introduced, but these devices could not steer the rounds to the target, only trigger them electronically when to explode. The development program for cannon-launched guided projectiles (CLGP), also known as Copperheads, began in the early 1970s. The munitions had the potential to revolutionize artillery firepower and accuracy against point targets by providing a probability of a single-round hit. The Copperhead round, designed for the 155-mm. howitzer, with a range between 3 and 20 kilometers (1.9 and 12.4 miles), had a laser-homing device to guide it to the target. Plans also existed for developing the Copperhead for other weapons, including the 8-inch howitzer, which would eventually allow the engagement of more targets because the amount of ammunition required to fire against each target would decrease.[2]

Approved in 1979 and fielded in 1984, the Copperhead system consisted of the 155-mm. laser-guided projectile and a ground or vehicle laser locator designator (G/VLLD). Laser designators were also developed for remotely piloted vehicles and other aircraft. The operator of the laser designator was to place a pulse-encoded laser spot on the target. After the call for fire, the CLGP would be fired on a ballistic trajectory, not with precise aim, but into the general area of the target. On entering

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[1] R. D. M. Furlong, "The U.S. Army's Cannon Launched Guided Projectile," *International Defense Review*, no. 1/1976, pp. 117–19; Earl W. Finley, "Attack of Armored Targets," *Field Artillery Journal*, July-August 1974, pp. 12–16; Joseph C. Antoniotti and William J. Krondak, "Development of Precision Guided Munitions," ibid., September-October 1978, pp. 24–25. For a differing view of cannon artillery's tank-killing capability, see George A. Durhane, "Who Says Dumb Artillery Rounds Can't Kill Armor?," ibid., November-December 2002, pp. 10–13.

[2] Robert A. Nulk, "Copperhead!" *Army R,D&A*, January-February 1979, pp. 9, 19; Furlong, "Cannon Launched Guided Projectile," pp. 117–19; Patrick F. Rogers, "The New Artillery," *Field Artillery Journal*, November-December 1980, pp. 38–39.

Copperhead round fired at White Sands Missile Range

the target area the on-board timer would activate the seeker head, which would pick up the laser energy projected by the laser designator and reflected off the target. The observer could then steer the Copperhead onto the target.[3]

The Copperhead had its drawbacks, including high cost. Because the system was dependent on target designation by a pulse-encoded source, ordinarily the G/VLLD, the designator's range and the operator's ability to maintain line of sight (the observer had to be relatively close to the target to "paint" it) were significant factors in the Copperhead's success or failure. Adverse weather conditions and smoke screening also inhibited the effectiveness of the G/VLLD. The National Training Center at Fort Irwin, California, reported a success rate of about 70 percent, with human error being the dominant cause of failure.[4]

In addition to the Copperhead program, other developments in ammunition included those for improved conventional munitions (ICM), for improved nuclear rounds, and for enhanced radiation warheads (neutron bombs). A high-priority program for ICMs coordinated and promoted the development of technology relating to terminal guidance of projectiles and to cargo-carrying projectiles (including submunitions, scatterable mines, and reconnaissance devices). The cargo-carrying artillery shells could dispense submissiles for direct action against troops or armor and could be used in barrier operations in which whole areas could be seeded with mines or sensors to deny territory to enemy units or keep track of their movements. The major reason for efforts to increase the range of nuclear artillery was that it could be easily overrun by enemy maneuver forces or suppressed by the longer-ranged Warsaw Pact artillery. The old 8-inch round, for example, had a range of about 18 kilometers (11.2 miles); the new round had a range of about 29 kilometers (18 miles). The 155-mm. nuclear projectile also underwent improvements in range.[5]

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[3] James F. Hall, "Precision Guided Artillery," *Field Artillery Journal*, May-June 1981, pp. 9–12.

[4] Ibid.; Michael W. Hustead, "Fire Support Mission Area Analysis," *Field Artillery Journal*, May-June 1981, p. 20; John K. Yager and Jeffrey L. Froysland, "Improving the Effects of Fires With Precision Munitions," *Field Artillery*, March-April 1997, p. 5.

[5] Joseph C. Antoniotti, "Precision Guided Munitions," *International Defense Review*, no. 9/1986, pp. 1269–76.

Because of efforts toward improving munitions, especially 155-mm. rounds, and because of the growing desire to standardize, the 155-mm. howitzer began to replace the workhorse of three wars—the 105-mm. howitzer. The 155 had several advantages: an acceptable rate of fire; a longer range capability; round for round, a higher degree of effectiveness; and an unequaled munitions versatility. With longer ranges, Army planners hoped to strike beyond the forward edge of the battlefield, overcoming the enemy's superior numbers and disrupting formations before the battle began. Disruption was considered a major factor, based on intelligence that flexibility in operational authority were lacking in the Soviet chain of command.[6]

Because of the wide dispersion of firing units on the modern battlefield and the 105's short range, the howitzers could not provide fire support throughout a brigade area of operations and massing of fires was limited. They lacked protection for the crew and ammunition; had longer emplacement and displacement times; and did not have the mobility of self-propelled weapons, although were easily transported by helicopters. Also, the 33-pound projectile was not thought powerful enough to inflict sufficient damage on armored targets, and the HMMWV (high-mobility multipurpose wheeled vehicle or "Hummer" or "Humvee") had difficulty towing the field piece.[7]

When the Field Artillery School made its recommendation in the early 1980s on the best weapon for easily deployable light forces, it still nominated the 105-mm. howitzer, at least for the time being. The results of studying the 5-inch and 155-mm. howitzers revealed that the 155 was not sufficiently mobile and the cost of the newly proposed 5-inch ammunition line was prohibitive. In May 1984, Army Chief of Staff General John A. Wickham, Jr., approved the development of the British L119 light gun (redesignated as the M119 105-mm. howitzer), the Army signed a production contract in 1987, and fielding began in 1990.[8]

The M109 self-propelled 155-mm. howitzer, in service since the 1960s, weighed 22 tons and required a six-man crew. Its cruising range[9] was 220 miles (354 kilometers), but its maximum firing range was only around 9 miles (14.6 kilometers), making it inferior to the up to 27 kilometers (16.8 miles) of the Soviet 122-mm. and 130-mm. weapons. During the 1970s and 1980s, the M109 155-mm. howitzer was modified several times, giving it a longer range, the ability to fire a wider range of modern, more lethal ammunition, a fully enclosed fighting compartment,

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[6] Karl Heinz Bodlien, "Artillery Projects of the Future," *Field Artillery Journal*, January-February 1976, pp. 10–15; "The Journal Interviews . . . LTG (Ret) James F. Hollingsworth," ibid., January-February 1977, pp. 30–31; Kenneth J. Mellin, "Letter to the Editor," ibid., November-December 1977, p. 7; Ludvigsen, "1978 Weapons Directory," pp. 136–38.

[7] Bodlien, "Artillery Projects," pp. 10-15; Ludvigsen, "1978 Weapons Directory," p. 138; "Auxiliary-propelled M101 Howitzer," *International Defense Review*, no. 4/1971, p. 376; Larry A. Altersitz, "Defending the Battery," *Field Artillery Journal*, May-June 1979, pp. 30–33; John L. Romjue, *The Army of Excellence*, TRADOC Historical Monograph Series, (Fort Monroe, Va.: Office of the Command Historian, United States Army Training and Doctrine Command, 1993), pp. 60–61.

[8] "Looking for a Light Gun," *Field Artillery Journal*, September-October 1985, pp. 17–18; Raphael J. Hallada, "On the Move," *Field Artillery*, October 1987, p. 1.

[9] Cruising range is the distance a self-propelled artillery piece can travel on one tank of gasoline.

a turret providing all-around traverse, and aluminum armor to protect the crew.[10] Improvements on the 155-mm. howitzer continued and later included an on-board fire control system, navigation system, additional ballistic protection, a new cannon and mount, and secure communications. The upgraded 155-mm. M109A6 howitzer, known as Paladin, which began fielding in the early 1990s, weighed 32 tons, had a cruising range of 186 miles (299.3 kilometers), and fired at a maximum range of 30 kilometers (18.6 miles).[11]

The towed 155-mm. howitzer in use in the 1970s was the M114A1, first fielded in 1942, having a range of 9 miles (14.6 kilometers). Under development in the United States since 1968, the M198 towed 155-mm. howitzer, which replaced the older weapon, had a lower rate of fire; was two tons lighter, making helo-transport easier; and had the new feature of an all-around traverse. Range varied, increasing from 18.1 kilometers (11.2 miles) to 22.6 kilometers (14 miles) with improved conventional munitions and climbing to more than 30 kilometers (18.6 miles) with rocket-assisted projectiles. The first M198 howitzers were ordered in 1977, but production was delayed for a year pending studies on requirements for towed weapons in nondivisional artillery units. In May 1980, Army Chief of Staff General Edward C. Meyer directed that the new light infantry divisions would use the M198 as their direct-support weapon based on its munitions and range versatility, even though it proved more expensive and less mobile than the 105 model.[12] When the units were organized in the 1980s, however, they were not equipped with suitable prime movers for the M198s, which were still too heavy for many helicopters. The Army then decided to have a new 155-mm. weapons system designed that would weigh considerably less yet have the necessary stability, and the light divisions returned to using 105-mm. howitzers for direct support.[13]

In 1978, the Army began replacing existing 8-inch howitzers and 175-mm. guns with a new 8-inch model. The new howitzer had a maximum range of nearly 40 kilometers (24.8 miles) with rocket-assisted projectiles and 35 kilometers (21.8 miles)

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[10] "The M109 Medium Howitzer," *International Defense Review*, no. 1/1968, pp. 48–49; "U.S. Army Weaponry and Equipment in Mid-1980s," *Army*, October 1985, pp. 405–06; "The Journal Interviews . . . BG A. Bar-David," *Field Artillery Journal*, May-June 1978, pp. 15–17**,** in which the Israeli artillery chief stated that the first combat use of the M109A1 was in the Golan Heights in early 1974 and that the weapon proved to be excellent. The M109 series was authorized a nine-man crew.

[11] Because the M109A6 howitzer was to be an interim weapon, development began on a new 155-mm. self-propelled howitzer (XM2001), named Crusader, which was to be fully digitized and include a resupply vehicle. Ammunition handling, transfer, and loading were to be fully automated. It was also to have a 25-percent increase in range from the older models. See Donald L. Barnett, "Crusader," *Field Artillery*, November-December 1999, pp. 14–18; Charles J. Emerson, Jr., "Crusader," ibid., March-April 2002, pp. 42–45.

[12] "Army Weaponry," p. 406, 407; William Whelihan, "The M198," *Field Artillery Journal*, January-February 1978, p. 9; idem, "We've Got 30!" ibid., May-June 1979, pp. 9–12; "M198 Under Heavy Field Test," ibid., January-February 1979, p. 33; Walter B. Brown II, "The M198," ibid., July-August 1982, pp. 26–29; "New Howitzers Delivered," *Army Logistician*, November-December 1978, p. 41; R. B. Pengelley, "The U.S. Army's M198 Towed 155mm Howitzer," *International Defense Review*, no. 7/1979, pp. 1163–68.

[13] Suzann W. Voigt, "Much Ado About Something," *Field Artillery Journal*, July-August 1986, pp. 28–30.

with unassisted projectiles. It could move cross-country at 9 miles (14.5 kilometers) per hour and on roads at 34 miles (54.7 kilometers) per hour, with a cruising range of 450 miles (724 kilometers). It could fire a full range of modern ammunition, including improved conventional munitions and nuclear rounds. Served by a thirteen-man crew, the howitzer's sustained rate of fire was one round every two minutes.[14] The 175-mm. gun, destined for replacement by the new 8-inch howitzer, had been in service since 1961 and was an outgrowth of the older 155-mm. gun (Long Tom). The weapon fired a 147-pound projectile, and its maximum range was near 37 kilometers (23 miles) but at considerable cost in tube wear. The barrel life of the 175-mm. gun was equal to only around 1,200 full-charge firings. The tube was exceptionally long (sixty calibers), and its sustained rate of fire was one round per minute.[15] But, the gun was relatively inaccurate and could not generate the weight of fire deemed necessary for effective counterfire missions.[16]

According to some field artillerymen in the early 1970s, there had been no significant advances in nonnuclear artillery since the development of massed fire techniques in the early 1940s. Because the Soviets could build up a quantitative superiority in cannon artillery supporting their main efforts (estimates varied from 2:1 to 5:1), they could afford to deliver counterbattery fire while simultaneously delivering close support and other suppressive fires. Cannon artillery had to remain in position to provide continuous support, and the longer a battery remained in position firing, the better target it became. Displacement neutralized artillery. Piecemeal displacement reduced support to maneuver units, inhibiting the artillery's ability to provide both close support and suppressive fires. Some artillerymen believed the answer to the problem was the multiple rocket launcher. The ability to achieve surprise with heavy concentrations of fire in a matter of seconds was considered a major advantage of rocket systems. The main argument against such weapons had existed since they first appeared in the United States in the early 1800s: in comparison to cannon fire, rocket fire was less effective and more expensive because of its limited accuracy. Although rockets did have limitations in accuracy and took longer to reload, their proponents pointed out that rockets could deliver a far greater volume of firepower in a much shorter time than could cannon and that they did not have the weather limitations of tactical air support. While not envisioned for direct support, the multiple-launch rocket system was thought to be an ideal weapon system for use against area targets when a high volume of fire in a brief period of time was desired.[17]

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[14] Ludvigsen, "1978 Weapons Directory," p. 134; Truman R. Strobridge and Ronald H. Schriefer, "The US Army's Improved 203mm SP Howitzer," *International Defense Review*, no. 3/1978, pp. 389–92.

[15] Ludvigsen, "1978 Weapons Directory," p. 136; "Journal Interviews . . . BG A. Bar-David," pp. 15-17; Larry Carney, "Europe Artillery Upgrading Reported Near Completion," *Army Times*, 26 May 80, p. 24.

[16] Bailey, *Field Artillery and Firepower,* p. 67. Counterfire includes counterbattery fire, countermortar fire, and attacks on target acquisition devices, communications, and logistic organizations.

[17] Allan R. Stern, "Do We Need a Multiple Rocket Launcher?" *Field Artillery Journal*, July-August 1974, pp. 25–28; Kenneth D. McDonald, "GSRS," ibid., September-October 1974, pp. 12–15; W. H. Rees, Jr., "We Need an MRL," ibid., November-December 1976, pp. 30–34; Donald R. Keith, "Forward Observations," ibid., March-April 1977, p. 3; Charles J. Buel and Gary R. Miller, "GSRS Status Report," ibid., March-April 1979, pp. 13–15.

In March 1974, the Field Artillery School initiated a requirements study for a general-support rocket system. The study pointed out an urgent need for an indirect fire system to neutralize and suppress the enemy's indirect fire support and air defense capabilities in an environment characterized by increased mobility and dispersion of combat units. The anticipated enemy was expected to stress a doctrine of massive armored combat power, well supported with cannon, rocket, and air defense artillery fire. With a numerical superiority in weapons, the enemy was expected to suppress opposing direct and indirect fire support capabilities, thus allowing his armored units more freedom to maneuver on the battlefield. A rocket system was capable of achieving longer ranges without the great weight of cannon artillery, would permit a greater volume of fire support without displacement, and would provide the needed indirect fire support across a wider front. Maintenance costs were anticipated to be less than those for self-propelled cannon, and support costs were also expected to be lower because the rocket crews would be smaller.[18]

Eventually called the multiple-launch rocket system (MLRS), the new weapon was designed for mobility, flexibility, and range requirements expected on the modern battlefield. Mounted on a modified mechanized infantry combat vehicle, the twelve-round launcher-loader required a crew of three (commander, gunner, and driver). Its range was to be more than 30 kilometers (18.6 miles), ensuring coverage of about 90 percent of the targets capable of being acquired. The rockets could be fired singly or in rapid ripples; could be controlled by a computerized fire direction center; and could be adapted to other warheads, including smoke, scatterable mines, and terminally guided munitions. One launcher could deliver the same firepower as twenty-eight 8-inch howitzers. Primarily a counterfire weapon, the MLRS could be used in suppressing enemy air defenses, firing against high-density mechanized targets during surge periods, and providing certain interdiction fires.[19] Fielding began in 1983 and continued into the 1990s. Later MLRS developments included extending the range of the rocket and using the launcher to fire the new precision-guided Army tactical missile system.[20]

Force Structure

As early as 1970, Army planners had concluded that the maneuver divisions were too large and that they required too many nondivisional troops for support in combat. The United States Army Combat Developments Command thus received instructions to develop smaller divisions, and new TOEs were published in November of that year, but with few changes in division artillery units. In the standard infantry divisions, service batteries were reinstated as separate units in the field artillery battalions—a change that had been recommended during the war in Vietnam.

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[18] McDonald, "GSRS," pp. 12–15; Keith, "Forward Observations," p. 3; Buel and Miller, "GSRS," pp. 13–15.

[19] Keith, "Forward Observations," pp. 3, 14; Richard M. Bishop, "Multiple Launch Rocket System Tactics," *Field Artillery Journal*, May-June 1985, pp. 8–9; Michael J. Cummings and Stanley C. Preczewski, "New Kid on the Block," *Field Artillery Journal*, September-October 1983, pp. 11–17.

[20] See Chapter 9 for information on the Army tactical missile system.

Multiple-launch rocket system, commonly known as MLRS

In the mechanized and armored divisions, the composite battalion of 155-mm. and 8-inch howitzers gave way to a battalion armed with twelve 8-inch howitzers. In 1971, United States Army Europe commander General Michael S. Davison proposed inactivating the divisional Honest John battalions. The new Lance missile would replace the Honest John, and inactivating the rocket battalions early would provide needed personnel for the proposed reorganizations. All the divisional Honest John battalions were inactivated except for the battalion serving in Korea with the 2d Infantry Division, although the deletion was not reflected in the divisional TOEs until 1975. The 2d's Honest John battalion was inactivated in June 1979.[21]

In 1971, the Army decided to implement a Howze board recommendation and organize an air cavalry combat brigade to test the capabilities of such a unit in conjunction with airmobile and armored organizations, selecting as the test unit the 1st Cavalry Division, which had recently deployed from Vietnam to Fort Hood, Texas. On 5 May, the division was reorganized with three brigades—one armored; one airmobile; and one air cavalry combat, the latter's attack helicopters to be used against armor. The artillery of the triple-capable (TRICAP) division was to

[21] TOE 6–100H, 30 Nov 1970; TOE 6–100H, change 1, 1 Mar 1975; TOE 6–300H, 30 Nov 1970; TOE 6–300H, change 1, 1 Mar 1975; U.S. Army Concept Team in Vietnam, "Final Report: Organization and Employment of U.S. Army Field Artillery Units in RVN," ACTIV ACG–58F, October 1969, p. 2-12, copy in MHI files (hereinafter cited as ACTIV Final Rpt); US Forces Korea/Eighth Army PO 24–1, 23 Feb 1979, copy in CMH files.

include a headquarters and headquarters battery and two composite battalions (one a self-propelled 155-mm./8-inch howitzer unit and the other a towed 105/155-mm. howitzer unit).[22]

The original plans, as outlined in the Howze board, had envisioned the air cavalry combat brigade as a corps-level organization for the destruction, disruption, or hindrance of enemy armored forces by aerial-mounted combat units operating with other ground forces. Between 1973 and 1974, a 105-mm. howitzer battalion had the mission of directly supporting the divisional air cavalry combat brigade, but its fire support proved inadequate. The batteries of the light battalion could not cover the large area assigned to the brigade effectively, and the limited airmobile capability of the batteries for frequent, and often short, moves hindered the flexibility and responsiveness of fire support. Before the Army reorganized the brigade as a separate corps unit in 1974, consideration was given to providing it with organic artillery support. Representatives from the Field Artillery School argued that if the brigade were going to operate as a maneuver force, then the traditional principles for close, continuous, all-weather fire support applied. Suggestions included a 105-mm. howitzer battalion or an aerial field artillery battery.

Although the decision was made not to include any organic field artillery, the approved TOE for the 6th Cavalry Brigade, which was activated on 21 February 1975, included a fire-support officer and a fire-support section at the brigade and squadron levels. These positions were deemed necessary for the effective planning and coordination of fire support that divisional and corps artillery units would provide in combat. In the meantime, while continuing to test new organizational concepts, the 1st Cavalry Division was reorganized from TRICAP to armored in the summer of 1975.[23]

Aerial rocket artillery, which had provided noteworthy support to the airmobile divisions in Vietnam, transferred its assets to aviation and armor-cavalry units in the mid-1970s. The attack helicopter units in the new air cavalry combat brigade became cavalry rather than artillery organizations. In 1976, the TOE for the airmobile division artillery deleted the aerial rocket field artillery battalion, while retaining the 155-mm. howitzer battalion that had been added in 1971 because of combat experiences in Vietnam. The resources of the last aerial rocket field artillery unit remaining in the

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[22] TOE 6–800T, TOE 6–825T, and TOE 6–815T, all n.d., copies in fldr 1st Cav Div, CMH files.

[23] TOE 6–700T, 22 Jun 1965, and TOE 6–700H, 31 Dec 1971, copies in CMH files; William H. Schneider, "Fire Support for the Air Cavalry Combat Brigade," *Field Artillery Journal*, September-October 1974, pp. 18–24. When the 1st Cavalry Division (TRICAP) was reorganized in 1971, two field artillery battalions were organized with self-propelled 155-mm. howitzers, and one of these later became a 105-mm. howitzer battalion to support the airmobile brigade. No artillery was provided for the air cavalry combat brigade except briefly in 1974. More artillery was added when the division was reorganized as an armored division, although one of its three 155-mm. howitzer battalions was inactivated in March 1979 to build up artillery strength in Europe. See Chapter 10 for information on the development of airmobility. See Wilson, *Maneuver and Firepower,* pp. 357–59, for information on the 1st Cavalry Division (TRICAP).

Army were transferred to an aviation unit when the 101st Airborne Division's 4th Battalion, 77th Field Artillery, was inactivated on 21 January 1978.[24]

One of the changes made during the early 1970s was the redesignation of all artillery units as either field or air defense. Air defense artillery had become a separate branch in 1968 because of the growing divergence in weapons systems, training, equipment, and tactics; field artillery was established as a separate branch the following year. In both cases, the change was administrative in nature, involving artillery personnel and their career branches rather than the units. In 1971, the terms *field* and *air defense* became part of each regiment's official designation, giving each arm its own units as well as its own personnel. The first seven artillery regiments, which had resulted from consolidating the former coast and field artillery regiments in 1957, were divided into fourteen regiments, seven field and seven air defense. For example, the 1st Field Artillery descended from the former regiment of the same designation, while the 1st Air Defense Artillery descended from the old 1st Coast Artillery, which had been organized in 1821 as the 1st Regiment of Artillery. In each case, the historic heraldic items of the former organization were given to the reorganized regiment. Of the other nine regiments having backgrounds of both field and coast artillery, seven were redesignated as air defense artillery and two as field artillery. The remaining fifty-nine regiments were redesignated as field or air defense artillery depending upon their origin. The redesignations gave the Regular Army fifty-eight field artillery regiments. Changes in designation were not implemented for artillery groups or for any Army National Guard units until 1972.[25]

Counterbattery fire traditionally was the responsibility of the corps artillery commander who had the necessary resources, primarily longer-ranged weapons and the target acquisition battalion, and who controlled a relatively small and stable corps frontage for efficiently carrying out the mission. But by the mid-1970s, when the Army was small and not growing, corps sectors in Europe had increased far beyond those of World War II—from 25–40 kilometers (15.5–24.9 miles) to 80–110 kilometers (49.7–68.3 miles)—and as a consequence division sectors also expanded accordingly. Several factors affected mission accomplishment as well. First, the plethora of target data taxed communications systems tremendously. In comparison to 1944, when the Allies had a five-to-one advantage over the Germans and targets were scarce, the Army in 1975 expected four enemy divisions to oppose one American division and thus the targets to be more plentiful. Second, the

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[24] Richard L. Arnold, "Air Assault Artillery," *Field Artillery Journal*, May-June 1975, pp. 34–37; Judson B. Baggett, "Air Assault Artillery," ibid., January-February 1977, pp. 57–59; Winn McDougal, "Aerial Field Artillery for the Corps," ibid., March-April 1974, pp. 54–58; William C. Parnell III, "Field Artillery—Cav Style," ibid., September-October 1974, pp. 49–53; TOE 6–700T, 22 Jun 1965; TOE 6–700H, 31 Dec 1971; TOE 17–200T, 15 Apr 1972; TOE 17–200H, 20 Feb 1975, copies in CMH files. Although the 101st Airborne Division's TOE called for an organic 155-mm. howitzer battalion, the unit was only attached.

[25] McKenney, "Artillery Branches Out," pp. 14–15. See also fldr 1971 Arty Reorg, FA/ADA Split (Arty, Gen), CMH files. The Combat Arms Regimental System in field artillery became the U.S. Army Regimental System in the mid-1980s.

weapons themselves had changed. With the exception of the 175-mm. gun, which was in the process of being replaced by a newer model 8-inch howitzer and the Lance missile, the corps artillery weapons of the 1970s were essentially the same as those in the divisions. But compared to those of World War II that could range most of the corps area because of the small frontages, these weapons could hardly cover the area of a single division.[26]

Lessons from the Vietnam experience were also key. Artillerymen had an increased interest in improved target acquisition procedures and devices, recommending that these processes be decentralized. They acknowledged that the corps artillery in some situations would need to control a target acquisition system capable of serving the entire corps area but argued that such centralization in many other situations would inhibit the responsiveness of fire support. They then championed a sizeable target acquisition capability at the division artillery and direct-support battalion levels in order to acquire and destroy targets in response to localized needs on the modern battlefield.[27]

To give the division commander the full capability of handling the counterfire mission, three changes were made: the target acquisition mission was removed from the corps artillery and placed in a divisional target acquisition battery; the division artillery staff was strengthened with a tactical operations center that integrated all intelligence (S–2) and operational (S–3) functions and contained a target acquisition capability; and the division artillery commander was given control of the cannon battalions that could shoot in his sector. To accomplish the last action, field artillery doctrine was changed to give all corps artillery battalions a reinforcing role to one of the divisions or to attach them to a specific division. Although the corps still retained control of the allocation of their cannon battalions as a means of managing resources, the battalions were earmarked for certain divisions and fell under their control for positioning and firing.[28]

Because of the deletion of the corps target acquisition battalion and the attachment of the corps artillery battalions to divisions, the corps artillery staff was reduced to a small section within the corps headquarters company and the headquarters and headquarters batteries of the corps artillery organizations were inactivated. As a result, the command-and-control headquarters of the corps artillery battalions—the field artillery groups—needed new doctrine. The Army decided to redesignate the field artillery groups as brigades.[29]

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[26] Tng Cir 6–20–4, Sep 1975, copy in Historians files; "Counterfire, Part One," *Field Artillery Journal*, November-December 1975, pp. 14–21; Donald R. Keith, "Forward Observations," July-August 1977, pp. 3–4; "History and Development of Field Artillery Target Acquisition," Counterfire Dept Handout AT1009, December 1977, FA School files.

[27] Tng Cir 6–20–4, Sep 1975, copy in Historians files; "Counterfire, Part One," pp. 14–21; Keith, "Forward Observations," pp. 3-4; "History and Development of Field Artillery Target Acquisition," December 1977, FA School files; ACTIV Final Rpt, October 1969, pp. 3-16 to 3-22, copy in MHI files.

[28] Keith, "Forward Observations," p. 4; Edward R. Coleman, "Field Artillery Brigade," *Field Artillery Journal*, May-June 1977, pp. 40–43, 51; Draft FM 6–20-2, copy in FA School files; Jean Reed, "Conceptual Organizations and Doctrine for Field Artillery," n.d.[c. 1975], copy in FA School files.

[29] A number of reasons have been given for renaming the field artillery group TOE as a field artillery brigade TOE, but none is entirely satisfactory. After field artillery redesignated its groups as brigades, most of the other branches did the same.

Like the group, the field artillery brigade was a command-and-control organization for up to six subordinate battalions. Four specific functions envisioned for the brigades were: reinforcing a division artillery with a corps zone; serving as a force artillery headquarters in a corps or division covering force area operations; providing direct support within a section of the main battle area; and serving as an alternate division tactical operations center. The brigade's tactical operations center was modeled on that of the division artillery except that it did not have the same target acquisition capability. Field artillery brigades were to be assigned a direct-support mission only to subordinate maneuver elements of a division if distance requirements precluded effective command and control from the division artillery itself. If the brigade operated independently in a role other than that of providing support to a division artillery, it was recommended that a target production section be organized from corps military intelligence assets or from a divisional target production section. The only organic target acquisition assets in the brigade or group were four field artillery air observation teams, and therefore, it relied heavily on the divisions. The aviation assets in both the division artillery and the field artillery brigade (group), however, were transferred in the 1977 TOEs to the corps aviation company and to the divisional aviation battalion to centralize streamline functions and maintenance.[30]

The new counterfire doctrine was approved in April 1976, and the new TOEs were published the same year.[31] By the end of 1979, all Regular Army corps artillery headquarters and headquarters batteries had been inactivated, and by the early 1980s, all field artillery groups had been redesignated as brigades in all three components of the Army. In 1980, one of the two corps artillery headquarters and the one target acquisition battalion remaining in the National Guard were deleted from the force structure, and in 1984, the XI Corps Artillery in Utah was reorganized as the corps artillery headquarters for I Corps.[32]

Some officers had problems with various aspects of the restructured corps artillery units. Many objected to the deletion of a separate corps artillery headquarters and headquarters battery, citing the expansion of Soviet artillery and the need for an increased ability to command and control field artillery resources rather than decreasing them. In particular, some artillerymen felt that the section did not provide adequate control over the rocket and Lance battalions.[33]

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[30] Coleman, "Field Artillery Brigade," pp. 40–43, 51; TOE 6–401H, change 11, 1 Sep 1977, CMH files; FM 6–20–2, 7 Oct 1980, copy in FA School files. The aircraft and their pilots were transferred; the observers themselves remained in the field artillery units.

[31] TOE 6–307H, 31 Aug 1976; TOE 6–100H, change 2, 1 Sep 1976; TOE 6–200H, change 1, 1 Sep 1976; TOE 6–300H, change 2, 1 Sep 1976; TOE 6–700H, change 1, 1 Sep 1976. All copies in CMH files.

[32] The XXIII Corps Artillery (Kentucky) was deleted in 1980, leaving the XI Corps Artillery in Utah. In 1984, the XI Corps Artillery became I Corps Artillery. The last target acquisition battalion in the National Guard (1st Battalion, 171st Field Artillery) was reorganized in 1980 as an 8-inch howitzer battalion. See unit folders in CMH files.

[33] "The Journal Interviews . . . GEN John R. Guthrie," *Field Artillery Journal*, July-August 1978, p. 16; Richard D. West and Charles E. Motson III, "Decide, Detect, Deliver," ibid., March-April 1987, p. 9.

The new divisional target acquisition batteries were each organized with a processing section, a survey platoon, two sound-and-flash platoons, and a radar platoon. The processing section became the targeting element in the divisional artillery tactical operations center and served as a focal point for all target acquisition coming into the division artillery from all echelons. The two sound-and-flash platoons had a range capability of 20 kilometers (12.4 miles) as opposed to the 10-kilometer (6.2-mile) range of the old corps battery. The countermortar radars in the direct-support battalions were reassigned to the target acquisition battery's radar platoon, which was equipped with five countermortar radars and one artillery-locating radar. The planners of the target acquisition battery wanted eventually to include both a platoon of remotely piloted vehicles and Army Security Agency assets for radio intercept and jamming. The target acquisition battery became part of the divisional TOEs in all divisions except the air assault division in 1976, and by the end of 1979 all Regular Army and National Guard divisions had their authorized batteries. A TOE for the air assault division target acquisition battery did not appear until 1978, when authorization for the aviation battery was deleted and the existing battery in the division was reorganized as a target acquisition unit. The new organization was similar to other divisional target acquisition batteries except that it had an aviation platoon, an aviation maintenance platoon, and only one sound-and-flash platoon.[34]

Tied in with the reorganization of counterfire doctrine was the adoption of a new tactical fire direction system (TACFIRE), under development since 1967. Increases in armament and mobility had contributed to a reduction in the time available to modern defense forces to react to a threat effectively, resulting in a greater interest in development automated defense systems. The United States had led the world in computer technology and produced the most advanced fire-control systems. The first field artillery digital automatic computer (FADAC) model had been delivered in 1959, and its successor TACFIRE had been scheduled for delivery in March 1972, although numerous technical problems delayed operation of the system for several more years. A complicated system requiring extensive training, TACFIRE provided computations for both technical and tactical fire direction. Using a message entry device, the forward observer communicated directly with the computer at the fire direction center, and the computer verified the message, entered all relevant data, and decided which battery in the battalion should get the mission, automatically requesting action from a higher headquarters if beyond the battalion's capabilities. One weak link in the system was the lack of a secure, reliable communications net. VHF (very high frequency) FM radios were used but were limited to line-of-sight operations, thus restraining their use in urban or hilly areas; their weight, size, and power requirements also made them a burden for mobile forces.

Technological advances, especially the revolution in microprocessing, soon made TACFIRE obsolescent. In time a smaller version, the LTACFIRE (L for light)

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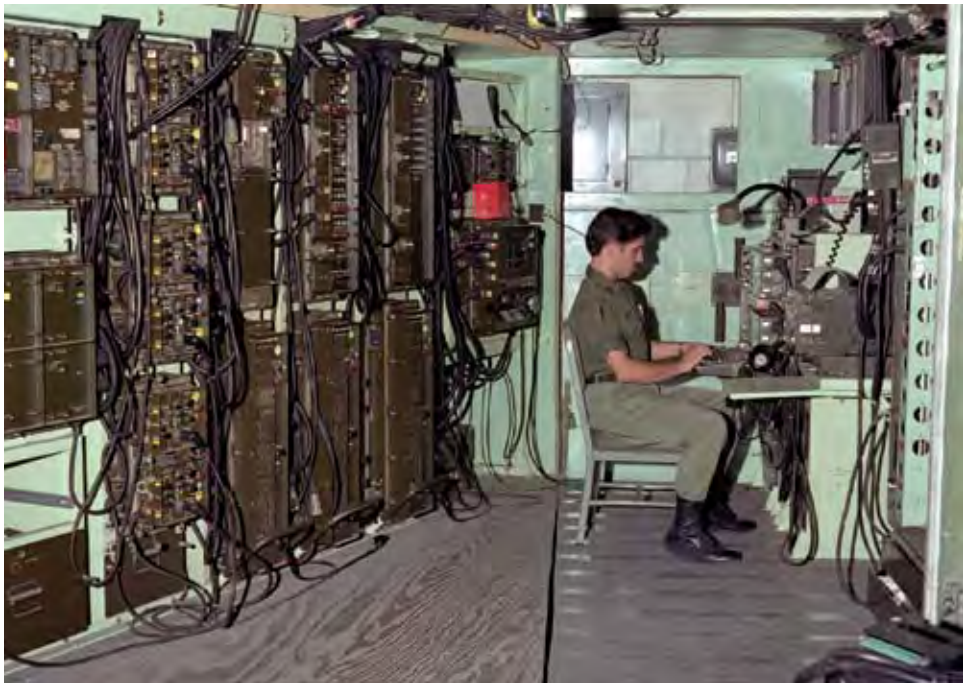
[34] TOE 6–307H, 31 Aug 1976; TOE 6–797H8, 19 Dec 1978; TOE 6–100H, change 2, 1 Sep 1976; TOE 6–200H, change 1, 1 Sep 1976; TOE 6–300H, change 2, 1 Sep 1976; TOE 6–700H, change 1, 1 Sep 1976. All copies in CMH files. Because they could perform a variety of missions other than adjusting artillery fire, unmanned aerial vehicles (UAVs) were eventually authorized for military intelligence organizations rather than target acquisition units.



Tactical fire direction system, commonly known as TACFIRE

with the same basic software, was fielded and used in the light divisions. Another development was the lightweight computer unit, designed with a removable hard disk drive and a multiple software capability ranging from the initial fire-support automation system (IFSAS) to the battery computer system to the MLRS fire direction system. Unfortunately the lightweight computer unit and the forward entry devices used by forward observers were not user friendly and required extensive training. As more sophisticated data had to be computed, the Army realized that the IFSAS could not perform all the necessary functions. Its replacement came in 1995, when the Army introduced the advanced field artillery tactical data system (AFATDS) to the field.[35]

While the organization of the divisional target acquisition batteries and the adoption of TACFIRE were to improve artillery effectiveness of artillery, another aspect of acquiring targets and adjusting fire was undergoing close scrutiny. Officers at the Field Artillery School became increasingly concerned about the size

[35] Eric C. Ludvigsen, "Lifting the Fog of War," *Army*, July 1972, pp. 30–35; "Army Weaponry," pp. 439; "The Journal Interviews . . . MG Albert B. Crawford," *Field Artillery Journal*, July-August 1975, pp. 38–41; John E. Martin, "TACFIRE," ibid., January-February 1979, pp. 8–13; Edward D. Ray, "TACFIRE," ibid., May-June 1979, pp. 54–57; Forrest G. Clark, "TACFIRE and the Maneuver Commander," January-February 1981, pp. 14–16; Note to letter "Getting Fired Up About Fire Support Computers," ibid., May-June 1985, p. 7; Henry D. Urna, "AFATDS," ibid., May-June 1987, pp. 32–33; "AFATDS Update," ibid., March-April 1998, p. 34. Fielding of AFATDS is scheduled for completion by 2007.

and composition of the forward observer sections. Three basic problems confronted them. First, the company sectors on the modern battlefield had grown increasingly wider, much wider than had been the case when forward observer sections were first instituted. This increase in frontage made it extremely difficult for the forward observer to locate targets across an entire company front. Second, the transportation for the forward observer was a 1/4-ton truck, and third, the new equipment being developed for the forward observer threatened to encumber the small section even further. In addition, the probable absence of air observers (because of the air defense threat posed by the Soviet Union and Warsaw Pact nations) added to the duties of ground observers. After looking at available resources to expand the capability and transportation of the section, the officers noted that infantry mortar sections had their forward observers operating in infantry platoons on a dedicated radio net and that a considerable number of armored personnel carriers were being used for purposes other than the transportation of mechanized infantry units. These observations led school commandant Maj. Gen. David E. Ott to ask TRADOC commander General William E. Depuy in June 1975 to establish a group to study the problems of forward observers. In response, General Depuy directed Fort Sill to head the effort and provided members from other service schools and activities.[36]

The study group developed the concept of a fire-support team (FIST), consisting of an artillery officer (a lieutenant) and enlisted observers. The lieutenant, who would control and direct the observers, was to be trained in close air support direction together with his key sergeant; the observers, who would work with platoons (except tank platoons), were to be trained in the adjustment of all types of indirect fire, both mortars and field pieces.[37] A new field artillery military occupation specialty—fire support—was to be created to incorporate the enlisted observers as well as the fire-support section personnel. The group tested the FIST concept at Fort Sill in September 1975, and between February and March 1976, the 3d Armored Division planned, prepared, and executed a battalion-level field test. The advantages of the proposed FIST structure were integration (fire-support troops became part of the maneuver forces, less the field artillery officers attached from the direct-support battalions), stability (each company was supported by a FIST, and each maneuver battalion by a fire-support element), professionalism (specialists were present at each fire planning echelon), flexibility (the FIST provided enough personnel and equipment to organize fire support according to specific tasks), and coverage (sufficient observers for the reconnaissance squadron and extra maneuver battalions).[38]

On 1 November 1976, TRADOC assigned FIST and fire-support sections to the divisional and brigade field artillery battalions, and on 27 June 1977, Vice Chief

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[36] Close Support Study Group Final Rpt, 21 Nov 75, copy in FA School files; David E. Ott, "Forward Observations," *Field Artillery Journal*, May-June 1976, p. 6; Paul F. Pearson, "FIST!," ibid., May-June 1976, pp. 7–8; Joseph J. Rozmeski, "FISTs of Fury," ibid., January-February 1983, pp. 9–11; David H. Petraeus, Damian P. Carr, and John C. Abercrombie, "Why We Need FIST," ibid., May-June 1999, pp. 3–5.

[37] Ott, "Forward Observations," p. 6; Rozmeski, "FISTs of Fury," pp. 9–11.

[38] Pearson, "FIST!," pp. 7–12; "FIST! Responses," *Field Artillery Journal*, July-August 1976, pp. 16–21, 33.

of Staff General Walter T. Kerwin, Jr., officially approved the concept.[39] At the same time, the TOEs for the divisional and brigade artillery battalions were also changed to allow for the FIST.[40] While most field artillerymen agreed that the FIST organization was sound, personnel and equipment shortages delayed full realization of its capabilities.[41]

One question remained regarding transportation for the new fire-support teams. The Field Artillery School believed that the best solution was the modified M113 armored personnel carrier with a ground laser locator designator for laser-guided projectiles, with suitable communications equipment mounted on the vehicle, and with an inexpensive position navigation system on board. In the interim, FISTs continued to use the 1/4-ton vehicles and trailers of the old forward observer teams. While the modified M113 was an improvement, its high silhouette proved a disadvantage and its speed insufficient for keeping up with maneuver vehicles in armored and mechanized divisions. In the late 1990s, a vehicle based on the infantry's Bradley fighting vehicle was adapted for the FIST, and for the combat observation and lasing teams (COLT), an adaptation of the HMMWV (high-mobility multipurpose wheeled vehicle) was developed, both of which incorporated the latest technological innovations in sights, navigation systems, communications, and other improvements.[42]

Army 86 and AirLand Battle

The invasion of Czechoslovakia in 1968 and the Arab-Israeli wars of 1967 and 1973, especially the Yom Kippur War in October 1973, influenced Army leaders to reevaluate divisional organizations once again. One principle distilled from their analyses of the recent wars was that the Army should be prepared to win the first battle and that it should develop tactics to do so within the existing force structure. National strategy gave the Army the primary task of preparing for combat in Europe, where estimates of the threat were such that the Army would most likely have very little time to mobilize and deploy forces from the continental United States. Army leaders saw the European battlefield as demanding mobility, survivability, and responsiveness, and they felt that the existing organizations at company and platoon levels had grown too large to control and support effectively. They also saw the battlefield as being dominated by firepower, a contest in which U.S. divisions would be massively outgunned by opposing artillery.[43]

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[39] "FIST Moves On," *Field Artillery Journal*, January-February 1977, pp. 21–22; Donald R. Keith, "Forward Observations," *Field Artillery Journal*, September-October 1977, pp. 2–3.

[40] TOE 6–366H, change 16, 1 Sep 1977; TOE 6–376H, change 15, 1 Sep 1977; TOE 6–396H, change 14, 1 Sep 1977; TOE 6–206H, change 8, 1 Sep 1977; TOE 6–706H, change 12, 1 Sep 1977; TOE 6–156H, change 16, 1 Sep 1977; TOE 6–166H, change 15, 1 Sep 1977; TOE 6–186H, change 15, 1 Sep 1977. All copies in CMH files.

[41] "FIST of the Future," *Field Artillery Journal*, November-December 1979, pp. 14–15.

[42] John S. Crosby, "On the Move," *Field Artillery Journal*, May-June 1984, p. 1; Neil J. Hamill, "BFIST Is on the Way," *Field Artillery*, May-June 1997, p. 45; FM 6–30, 16 July 1991.

[43] "Lessons Learned From the Czech Invasion," *International Defense Review*, no. 1/1969, pp. 27–29; FM 100–5, July 1976.

Bradley fire support team vehicle, commonly known as BFIST

TRADOC planners conducted a pilot study of a restructured armored division from April to December 1976. An important conclusion was that existing armored and mechanized divisions should be reorganized to create smaller maneuver battalions with additional firepower and with new logistical systems and procedures in support of the weapons systems to be fielded between 1980 and 1985.[44]

In the restructured division, field artillery gained in both personnel and equipment, and the division artillery commander was again a brigadier general rather than a colonel. The overall structure of the division artillery changed little, but the number of cannon increased 70 percent. The division artillery retained its headquarters and headquarters battery, three direct-support battalions, one general-support battalion, and one target acquisition battery, but each direct-support battalion had four firing batteries (rather than three), each with eight (rather than six) 155-mm. self-propelled howitzers. The firing battery was to be employed as two four-gun platoons, separated by 400 to 1,600 meters (1,312.3 to 5,249.3 feet). One of the platoons was to have the fire direction center and the primary technical fire direction responsibility; the other was to have a more limited fire direction capability in its battery operations center. Split-battery operations were intended to improve tactical operations and survivability. The four firing batteries would also allow more effective support of the maneuver brigades organized with four or more maneuver battalions (rather than

[44] Donald R. Keith, "Forward Observations," *Field Artillery Journal*, May-June 1977, pp. 3–4; Homer J. Gibbs, "A Report on DRS," *Field Artillery Journal*, May-June 1978, p. 36.

M110A2 8-inch howitzer

three) and enable the howitzers to be dispersed over the battlefield, thus increasing survivability. Other advantages of the eight-howitzer batteries were more responsive firepower, improved capability for continuous firepower, and more firepower without a corresponding increase in overhead. The number of 155-mm. howitzers rose from fifty-four in the existing armored and mechanized divisions to ninety-six in the restructured division. The general-support artillery battalion was also to have four firing batteries (rather than three), each with four M110 8-inch howitzers, thus raising the total number of 8-inch howitzers from twelve to sixteen. As a result, the cannon in the division climbed from sixty-six to a hundred twelve.[45]

In addition to the headquarters battery, each restructured battalion included a service battery (for handling battalion-level mess operations and ammunition and fuel resupply) and a maintenance battery (for maintaining the individual firing sections' equipment in the forward areas). The firing sections each lost one cannoneer, making a total of nine soldiers in each section. The loss of the ammunition and mess sections to the service battery and the wire sections to the headquarters battery, coupled with the loss of one cannoneer per howitzer section, reduced the firing battery's ability to maintain perimeter defense. Increased emphasis had to be placed on early warning to provide time to displace or prepare to defend an area. In all, the divisional direct-support battalions realized a 49-percent increase in personnel and a 78-percent increase in firepower.[46]

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[45] Phase I Rpt, USATRADOC, 20 Dec 1976, sub: Division Restructuring Study, copy in CMH files; Combined Arms Center, "Division Restructuring Evaluation. Independent Evaluation Report: Brigade Phase," December 1979, 1:1–6, 16–20, and 4:1–7, Command Historian files, USATRADOC, Fort Monroe, Va., and copy in CMH files; Keith, "Forward Observations," pp. 3–4; Darrell Morgeson, "DRS," *Field Artillery Journal*, November-December 1978, pp. 21–22.

[46] Gibbs, "DRS," pp. 36–40; Kenneth R. Knight, "DRS," *Field Artillery Journal*, January-February 1979, pp. 44–49.

To increase survivability, tactics called for only one battery within a battalion to open fire initially and for the others to remain silent. Upon completion of one or two missions, the first battery would displace and another battery would assume fire mission responsibility until ordered to displace, again after firing only a few missions. This pattern would continue until the tactical situation demanded the fires of more than one battery simultaneously. The general-support battalion was to be used primarily for counterfire and air defense suppression missions, although, when required, its fires could augment those of the direct-support artillery battalions supporting the maneuver brigades. Additional firepower could come from the field artillery brigades attached to the division artillery. Almost all the logistical and maintenance functions were the concern of the battalion commander and his staff rather than the subordinate firing elements.[47]

Difficulties with the restructuring, especially those experienced in the eight-gun batteries, were not unexpected. For example, command-and-control functions were spread thin; surveys were accomplished too hastily or not at all because of frequent moves; weather data was received only once every four hours; and centralized management and computerized control of both the technical and tactical fire direction made one lose sight of the basics necessary for accurate artillery fire. The firing batteries, organized with one fire direction center and one battery operations center (rather than two fire direction centers, one for each four-gun platoon), were rated inadequate for self defense. Also, the single authorized officer in the fire direction center could not provide continuous supervision during sustained operations. Other problems included net control difficulties with new fire direction computers, poor field mess operations, and a lack of sufficient communications equipment in the maintenance and service units. Through additional testing and changes in the structure of the units, TRADOC planners hoped to overcome most of the problems in managing the larger batteries. The number of batteries in the howitzer battalion subsequently reverted to three, but the number of howitzers fielded in each remained at eight, divided in two four-gun platoons, each with its own fire direction center.[48] As a result, General Donn A. Starry, commanding the U.S. Army Training and Doctrine Command since July 1977, directed in December 1979 that maintenance resources be consolidated at the battalion level. Cells from the division support command maintenance battalion were to be allocated to the battalions when deployed for training or combat.[49]

In June 1979, General Meyer, shortly before becoming Chief of Staff on the twenty-second, suggested that the Army's how-to-fight Field Manual 100–5 needed to be revised, pointing out that the 1976 version had been written chiefly for battle in central Europe and was lacking in worldwide doctrinal application. One of the

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[47] Gibbs, "DRS," pp. 36–40.

[48] Knight, "DRS," pp. 44–49; Stephen N. Magyera, Jr., "Troubleshooting the New Division Organization," *Military Review* 57 (July 1977): 53–60; John W. Foss, Donald S. Pihl, and Thomas F. Fitzgerald, "The Division Restructuring Study," ibid. 57 (March 1977): 11–21; Gary M. Stallings, "TOPFORM: 3x8 Tactical Operations," *Field Artillery Journal*, June 1988, pp. 49–51; FM 100–5, July 1976; FM 6–20, 30 Sep 1977.

[49] John B. Gavalas, "Division 86," *Field Artillery Journal*, March-April 1980, p. 25.

consequences was a coordinated effort by the United States Army Combined Arms Center at Fort Leavenworth, Kansas, with participation from every school and agency involved in the functioning of a combat division. Under the umbrella term *Army 86*, the test vehicle for the Division 86 concept was again to be the heavy armored division, with later studies addressing other types of divisions and higher echelons. In conjunction with this study, the Field Artillery School attempted to determine the weapons systems, force structure, tactics, and doctrine through the turn of the century that would enable field artillery to execute its part of a new doctrine that came to be known as AirLand Battle.[50]

The division artillery of the heavy division proposed in October 1979 was to have three basic responsibilities—direct support, counterfire, and interdiction. Supporting tasks included performing command-and-control functions, operating the target acquisition element, conducting remotely piloted vehicles, servicing the multiple-launch rocket system, planning for nuclear and chemical fires, and accomplishing the usual field artillery missions (*Chart 9*). By August 1980, after some minor structural changes, planners had fixed the strength of the new heavy division at 19,966 soldiers (3,524 in the artillery), making it the largest and strongest force to be fielded by the Army since World War I.[51]

With the completion of the studies for the heavy division, the Army turned to the light division. In 1979, the active component had sixteen divisions, nine heavy and seven light, the latter including standard infantry, airborne, and air assault units. At the outset, planners studied the existing standard infantry division, subsequently making their recommendations. The new light division's personnel strength was not to exceed 14,000; its equipment was to be limited to what the C–41 aircraft or its equivalent could carry;[52] and its missions were to include worldwide contingency operations, as well as reinforcement of NATO. The dual mission capability caused problems from the beginning, as planners found it extremely difficult to increase both mobility and firepower.[53]

To provide adequate counterfire and interdiction capabilities, artillerymen recommended a full division artillery, including a target acquisition battalion, three direct-support battalions (with three eight-gun batteries of M198 155-mm. howitzers), and a general-support battalion of 155-mm. and 8-inch howitzers and

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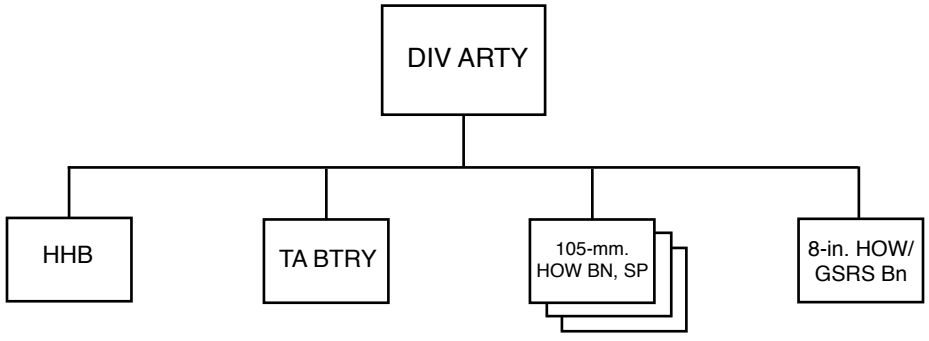
[50] John L. Romjue, *From Active Defense to AirLand Battle: The Development of Army Doctrine, 1973–1982*, TRADOC Historical Monograph Series (Fort Monroe, Va.: Historical Office, United States Army Training and Doctrine Command, 1984), p. 30.

[51] Idem, *A History of Army 86,* vol. 1, *Division 86: The Development of the Heavy Division, September 1978–October 1979* (Fort Monroe, Va.: Historical Office, United States Army Training and Doctrine Command, June 1982), pp. 53–54, 78–80, 111–12, 116, 120; idem, vol. 2, *The Development of the Light Division, the Corps, and Echelons Above Corps, November 1979–December 1980* (Fort Monroe, Va.: Historical Office, United States Army Training and Doctrine Command, December 1981), pp. 1–2, 14, 23; TRADOC Annual Historical Rpt, FY 1980, pp. 2, 9, 358. See also Rpt, Concepts Developments Directorate, Fort Leavenworth, 27 Jun 1988, sub: AirLand Battle Future Umbrella Concept (Draft), copy in Combined Arms Archives, CGSC, Fort Leavenworth, Kans.

[52] Romjue, *History of Army 86,* 2:25–35.

[53] TRADOC Annual Historical Rpt, FY 1980, pp. 15, 18.

Chart 9—Heavy Division Artillery Organization, 1980



multiple-launch rockets. The resulting structure, which totaled about 18,000 personnel, was rejected as being too heavy.[54] After several rework sessions, planners in September 1980 reached an accord on a division that numbered 17,773, with almost 3,000 in the division artillery that consisted of three direct-support battalions (with a total of seventy-two 155-mm. howitzers), a nine-launcher rocket battery, and a target acquisition battalion. A dual capability for fielding 155-mm. or 105-mm. howitzers in the direct-support battalions was included (*Chart 10*).[55]

An examination of corps support to the counterfire and interdiction missions of the division artillery continued at the Field Artillery School throughout 1979. Late in the year, the school developed a new concept of interdiction. Officers at the school argued that because of improved techniques in target acquisition communications and improved capabilities for executing long strikes deep into enemy territory, the interdiction mission should be divided between corps and divisions. The topic became a matter of discussion while planning for a nuclear systems program review at the school in December 1979, the main subjects being war-fighting strategy doctrine and implementation.[56]

A special group formed at Fort Sill to develop the *integrated battlefield*, a newly conceived term meaning integrated conventional and nuclear fire support, integrated maneuver and fire support, and integrated air-ground operations. The doctrine placed greater stress on extended operations rather than on winning the first battle. Because

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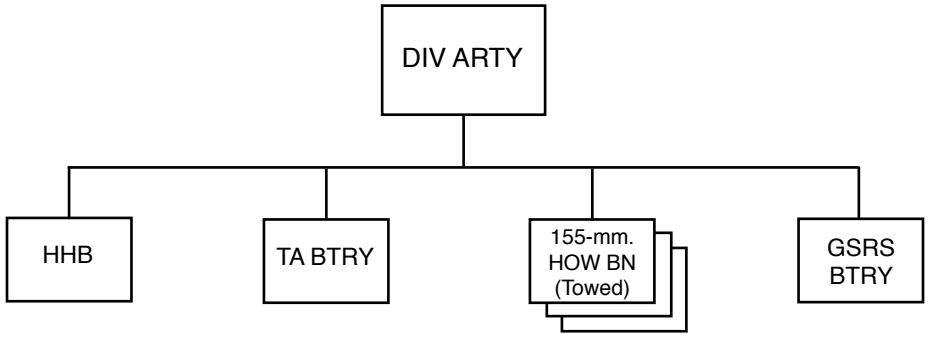
[54] Romjue, *History of Army 86,* 2:32.

[55] Ibid., 2:37, 40–41, 44–47, 53, 55; TRADOC Annual Historical Rpt, FY 1980, pp. 18–25, 370.

[56] Romjue, *From Active Defense to AirLand Battle*, pp. 33–34; Edward A. Dinges and Richard H. Sinnreich, "Battlefield Interdiction," *Field Artillery Journal*, January-February 1980, p. 15.

Chart 10—Light Division Artillery Organization, 1980



deep interdiction was to be a coordinated effort with the Air Force, the doctrine approved in 1981 became known as Airland Battle.[57]

The group also addressed other issues. With the elimination of the field armies in 1973, problems had appeared in the coordination of close air support, combat service support, and other areas. The corps had taken on many theater logistical responsibilities that hindered its mobility and fighting strength.[58] A proposed corps artillery included in the Corps 86 concept recommended 12,500 personnel to support three divisions and four field artillery brigades, one for each division, plus one for general corps support. Additional artillery was to be added as forces grew upon mobilization. At full strength, each corps artillery brigade supporting a division was to include one or two 8-inch howitzer battalions, one 155-mm. howitzer battalion, and one rocket battalion. For general support, the corps artillery was to have three Lance battalions and a rocket battalion. When the studies incorporated the concept of dividing the interdiction mission between the division and the corps, headquarters and headquarters batteries for the corps artillery were reinstated.[59]

Planning for a light corps had also been ongoing. The corps artillery organization proposed in October 1981 included a headquarters and headquarters battery, a target acquisition battalion, a Lance battalion, five 155-mm. towed howitzer battalions, and three rocket battalions, totaling approximately 5,200 soldiers. Further reductions were made, and the Lance and 8-inch howitzer battalions were eliminated. To compensate, the number of 155-mm. howitzer battalions was increased

[57] Romjue, *From Active Defense to AirLand Battle*, pp. 35, 37; FM 100–5, July 1976 and August 1982;TRADOC Annual Historical Rpt, FY 1982, pp. 1–2.

[58] TRADOC Annual Historical Rpt, FY 1980, p. 50.

[59] Ibid., pp. 69, 75, 84, 145, 381–82.

to eight. In early 1982, General Meyer expressed concern over the lack of tactical nuclear capability in the proposed contingency corps. The Field Artillery School confirmed the high price of the tradeoff of heavier delivery systems for a lighter force of increased mobility.[60]

Because of anticipated monetary and personnel constraints, a more balanced concept known as the Army of Excellence (AOE) evolved to replace the Army 86 design. Other influences on the change in focus were the Iranian hostage crisis and the Soviet invasion of Afghanistan, which alerted policymakers to the need for flexible contingency forces. The redesign effort was spent mostly on the organization of new light infantry divisions, the restructuring of heavy divisions, and the realignment of corps forces. The overall objective was to develop flexible combat-ready forces capable of deterring aggression or defeating the enemy within constrained resources.[61]

The proposed infantry division artillery in Division 86 had included 3,000 personnel in an 18,000-man division. Planners, however, believed that deploying this relatively heavy force to outlying geographic areas might be inappropriate, if not impossible, given the scarcity of strategic transport in times of crisis. They also saw the need for an artillery force to operate in low-intensity conflicts. Their proposed light infantry division included a headquarters and headquarters battery, three direct-support battalions with three batteries, each with eight M198 155-mm. howitzers, and a rocket battery. But in order to have a division that was easily deployable, the approved light division artillery (overall strength of 1,500) had a headquarters and headquarters battery, three 105-mm. towed howitzer battalions (three batteries in each, with six howitzers in each battery), and a 155-mm. towed howitzer battery (eight howitzers) (*Chart 11*). The crew for the 105-mm. howitzers was reduced from nine to seven men, and the 155-mm. howitzer crew from eleven to ten. The firing batteries were not authorized TACFIRE but were to use battery computer systems. The service battery was once again combined with the headquarters battery in each battalion. Aerial observers were deleted, and most of the target acquisition assets were transferred to the corps level.[62] Weaknesses of the new light division artillery included poor mobility in open terrain when opposed by motorized forces; limited protection against artillery, nuclear, and chemical fire; and dependence upon air superiority for mobility.[63] The division artillery envisioned for the airborne and air assault divisions was nearly the same as that for the approved light infantry division except that the 155-mm. howitzer battery was deleted.[64]

In all, five light divisions were formed. The existing 7th and 25th Infantry Divisions were reorganized, while the Regular Army 6th and 10th Infantry Divisions and the National Guard 29th Infantry Division were newly organized. Each

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[60] Ibid., FY 1982, pp. 71–73, 76, 79–81.

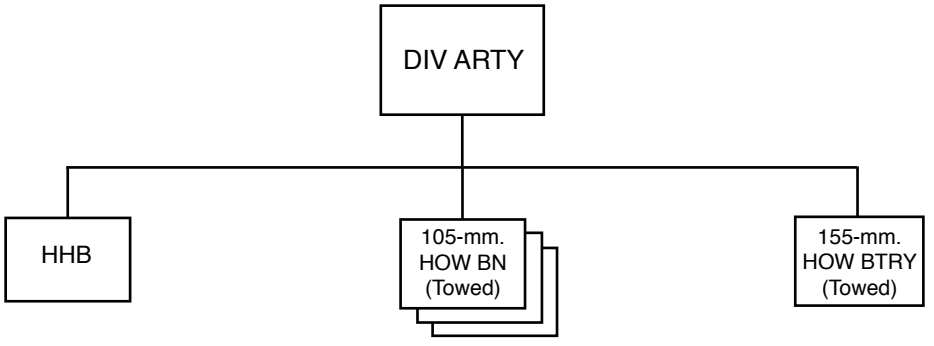
[61] Romjue, *Army of Excellence*, pp. 13–16.

[62] TRADOC Annual Historical Rpt, FY 1983, pp. 341–43; TOE 6–100J, TOE 6–125J, TOE 6-127J, all 1 October 1982, copies in CMH files; Robert S. Riley, "AOE," *Field Artillery Journal*, September-October 1985, p. 46; Voigt, "Much Ado," pp. 28–30.

[63] Heinz A. Schiemann, "Fire Support for the Light Division," *Field Artillery*, October 1987, p. 19.

[64] Wilson, *Maneuver and Firepower*, pp. 397–400.

Chart 11—Light Division Artillery Organization, 1983



Note: The 155-mm. howitzer battery was not authorized for the airborne and air assault divisions.

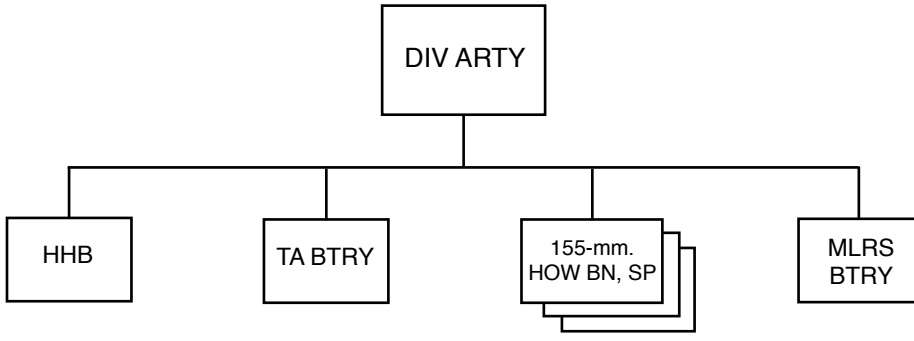
of the divisions was to have no more than 12,700 soldiers and be transportable in fewer than five hundred airlifts.[65]

Originally approved under the Division 86 concept, the armored and mechanized infantry (heavy) division were restructured rather than redesigned, the main objective being to lighten the divisions by about 2,000 soldiers. The 8-inch self-propelled howitzer battalion was moved to the corps level, sound-and-flash platoons were eliminated from the target acquisition battery, howitzer crews were reduced, and rocket batteries were added. The AOE heavy division artillery thus comprised a headquarters and headquarters battery, a target acquisition battery, three 155-mm. self-propelled howitzer battalions (three batteries each, with eight howitzers in each battery), and a rocket battery for general support (*Chart 12*). The 2d Infantry Division in Korea was to have a structure tailored for its mission based on the AOE standard heavy division artillery. The 9th Infantry Division was also authorized a specially tailored structure.[66]

Although the 8-inch howitzer had a slow rate of fire and low survivability, its transfer to the corps eliminated the division's primary tactical nuclear capability and to a large extent reduced its counterfire capability. United States Army Europe planners argued that the howitzers should be retained in the divisions because of the superiority in numbers of Warsaw Pact artillery pieces and that the reduction of tubes at the division level would aggravate an already inferior position. A reduction in the number of crew members for the 155-mm. howitzer increased the time needed to emplace and displace the pieces, and it diminished crew flexibility. Deletion of the sound-and-flash platoon eliminated the division's only capability for passive

[65] Voigt, "Much Ado," pp. 28–30.
[66] Wilson, *Maneuver and Firepower*, p. 401; Romjue, *Army of Excellence*, p. 49.

Chart 12—AOE Heavy Division Artillery Organization, 1983



TA = Target Acquisition
MLRS = Multiple-Launch Rocket System

detection of enemy systems.[67] Again, the difficulty of creating one artillery structure for both the European and non-European theaters proved troublesome.

The reduction of the heavy division resulted in a concomitant corps expansion. The corps artillery structure conceived to operate with Division 86 organizations had insufficient resources to operate with the AOE divisions. A new AOE corps artillery structure featured increased brigade strengths, an "up-gunning" of six-howitzer to eight-howitzer batteries, the addition of a rocket battalion, and the reinstitution of the corps target acquisition battalion and the corps headquarters and headquarters battery. Thus, the reliance for fire support in depth shifted back from the division to the corps.[68]

When the MLRS concept was first developed, Army planners determined that the minimum allocation of launchers per division should be twenty-seven, to be organized in one three-battery battalion. Force structure constraints precluded fielding that number of battalions, however, and only one nine-launcher battery was assigned to each division and one 27-launcher battalion to each corps. Such an organization could provide for the habitual attachment of one of the corps batteries to a division, thus supplying eighteen launchers to each division. Of the eighteen divisions active in the mid-1980s, twelve were authorized rocket batteries and each of the five corps was authorized a battalion. The light divisions were not authorized the new rocket system.[69]

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[67] TRADOC Annual Historical Rpt, FY 1983, pp. 359, 388; Romjue, *Army of Excellence*, p. 49.

[68] TRADOC Annual Historical Rpt, FY 1980, pp. 381–82; ibid., FY 1983, p. 403; ibid., 1 Oct 1983–31 Dec 1986, p. 72; Romjue, *History of Army 86,* 2:144–45.

[69] Roger L. McCormick, "More on How To Use MLRS," *Field Artillery Journal*, November-December 1984, p. 4.

Field artillery doctrine in the 1970s and 1980s stressed warfare on the European battlefield, and during that time, considerable effort was expended to improve materiel, doctrine, and training to meet the perceived Soviet threat. Developments in communications, ammunition, and automation systems were designed to give the field artillery the ability to perform the traditional role of supporting the maneuver forces by moving, shooting, and communicating continuously despite the opposition of a sophisticated enemy. AirLand Battle doctrine emphasized the role of fire support in the deep attack—the requirement to deliver fire in depth, to support deep strikes by maneuver formation, and to coordinate both these efforts to win the battle.

By the end of the eighties, however, the large disparity in numbers and capabilities of various conventional artillery systems between the Soviet bloc and NATO continued to disturb Army leaders, and once the Intermediate-Range Nuclear Forces (INF) Treaty took effect in 1988, the problem became exacerbated. With a greater reliance to be placed on conventional forces, the disadvantages of the United States and NATO in fire support were even more pronounced.

CHAPTER 13

Toward a New Century

The decade of the 1990s ushered in myriad regional threats to the security of the United States. By May 1991, the INF Treaty had contained the nuclear threat of the superpowers, and the official disintegration of the Warsaw Pact in July and the Soviet Union in December reduced the number of superpowers to one—the United States. Army commanders realized that Europe would not necessarily be the only battlefield, and they became increasingly concerned about other likely trouble spots, such as the Middle East and Latin America.

The first sign of the new challenges to come had occurred in October 1983 in Grenada. Field artillery played only a minor role in Operation URGENT FURY, chiefly because planners did not consider enemy artillery a threat and because they wanted to keep the deployed force light. Also, the desire to limit collateral damage and civilian casualties, requiring positive identification of a hostile enemy force, mitigated the use of indirect fire. Operations there did, however, point out the need for more planning at the joint level.[1]

The next involvement in Latin America came in 1990 during Operation JUST CAUSE in Panama. Here too the mission, enemy, terrain, troops, and time available also restricted artillery fire, although the presence of field artillery had a strong deterrent effect. For example, artillery in the 7th Infantry Division fired intermittently, discouraging sniper attacks, and similar positions at roadblocks and checkpoints enhanced security.[2]

Operation DESERT STORM

Full-scale warfare reappeared in early 1991 with the offensive in the Persian Gulf region against the Iraqi Army, which validated the U.S. Army's twenty-year effort to reform and modernize its forces. To be sure, for Operation DESERT STORM, the United States and its coalition partners possessed air superiority; had a six-month period to build up their formations during Operation DESERT SHIELD; enjoyed terrain and weather excellent for conventional fighting; and, most importantly, were highly trained and technologically sophisticated compared to the unmotivated, undisciplined, poorly trained and equipped Iraqi soldiers. Both sides employed a

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[1] Scott R. McMichael, "Urgent Fury," *Field Artillery Journal*, March-April 1985, pp. 8–13.

[2] Joseph E. DeFrancisco, "Bayonet Artillery in Operation Just Cause," *Field Artillery*, June 1990, pp. 6–11; Robert S. Ballagh, Jr., "Red Devil Redlegs," ibid., October 1990, pp. 40–42.

155-mm. howitzers during Operation DESERT SHIELD

considerable amount of artillery, with the Iraqis having the advantage in the number of mostly towed pieces that outranged comparable American models and were extremely well dug in and camouflaged. Yet, in battle, the Iraqi artillerists were no match for their well-trained counterparts. When it became clear that the enemy could not locate opposing artillery, allied batteries ceased their "shoot 'n scoot" tactics, remaining in position or closing in to deliver their devastating fire. And the coalition forces overcame the numbers gap by employing the multiple-launch rocket system (MLRS) as well as radar and aerial reconnaissance to acquire targets.[3]

For the Southwest Asia campaigns, the Army deployed two corps artillery headquarters, seven division artillery headquarters, and seven field artillery brigade headquarters, comprising forty-three battalions in all.[4] Two of the seven brigades and their six battalions, including the only multiple-launch rocket battalion in the reserve components, were Army National Guard units that performed with distinction. Both

[3] Alberto Bin, Richard Hill, and Archer Jones, *Desert Storm* (Westport, Conn.: Praeger, 1998), pp. 125–26; Frank N. Schubert and Theresa L. Kraus, eds.,*The Whirlwind War* (Washington, D.C.: Center of Military History, United States Army, 1994), pp. 164–65, 188; Robert H. Scales, Jr., *Certain Victory* (Washington, D.C.: Office of the Chief of Staff, United States Army, 1993), pp. 257, 365; Creighton W. Abrams, "The Gulf War and 'European Artillery,'" *On Point*, Spring 2001, p. 8.

[4] See DESERT STORM campaign participation credit fldrs, CMH files; Boyd L. Dastrup, *Modernizing the King of Battle, 1973–1991* (Fort Sill, Okla.: U.S. Army Field Artillery Center and School, 1994), pp. 56–57.

Steel Rain *by Frank Thomas*

artillery brigades were nearly fully trained in gunnery, and, unlike maneuver brigades, they were able to deploy without first going to the National Training Center in California.[5]

Although the 100-hour ground war was short for testing all aspects of field artillery, several conclusions were self-evident. The precision-munitions revolution made forces vulnerable throughout the battlefield, and any firing system that could be detected risked being detected, engaged, and destroyed within minutes.[6] Commanders at all levels praised the global positioning system (GPS), which freed soldiers from land navigation in a largely featureless area. The system was crucial in providing accurate and timely fire support.[7] The MLRS, or "steel rain" to the enemy, contributed significantly to counterbattery efforts and the suppression of enemy air defenses. Limitations included the rocket's 30-kilometer (18.6-mile) range; long-range communications that proved cumbersome and, at times, unworkable during

[5] Schubert and Kraus, eds., *Whirlwind War*, p. 125; Abrams, "Gulf War," p. 8.

[6] Scales, *Certain Victory*, p. 365; John L. Romjue, *American Army Doctrine for the Post–Cold War* (Fort Monroe, Va.: Military History Office, United States Training and Doctrine Command, 1996), p. 65.

[7] USAFAC/Fort Sill Annual Command History, 1991, pp. 210–11, FA School files; Schubert and Kraus, eds., *Whirlwind War*, p. 203; Abrams, "Gulf War," pp. 8, 9. GPS is vulnerable to satellite jamming, and jammers are sold on the open market. See W. Mark Barnes, "Artillery Surveyors," *Field Artillery*, January-February 2001, pp. 43–45.

Army tactical missile system, commonly known as ATACMS

long movements and rapid displacement; and maintenance and logistical support, especially ammunition resupply.[8] Five MLRS battalions and six divisional MLRS batteries supported the ground offensive and were particularly effective against preplanned targets and in attacking fixed targets of opportunity using the Army tactical missile system (ATACMS), with self-contained positioning and laying capabilities. But the ATACMS's use along with other weapons systems also created problems, especially in coordinating deep fire; its high trajectory could put aircraft at risk. To be more effective, the fires of artillery, gunships, and air strikes had to be better integrated. Nevertheless, precision-guided systems, such as the ATACMS, greatly enhanced the Army's field artillery capabilities.[9]

Operations also highlighted the need for an organic rocket battalion rather than a battery in the division artillery. The battery had an insufficient number of launchers to cover the division area and inadequate capabilities for command and control. There were simply not enough launchers to support the division aviation brigade and reconnaissance squadron, to suppress enemy air defenses, and to provide adequate counterfire. Additional rocket firepower was also deemed necessary because of the limited range and firepower of the M119 105-mm. howitzer and the lack of mobility of the M198 155-mm. howitzer.[10] A wheeled rocket system, with the ability to be transported on C–130 aircraft, was needed for light and early deploying contingency forces, and an extended range beyond 45 kilometers (28 miles) for the rocket itself was vital. An extended range for the Army tactical missile was also desired.

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[8] Interv, Patrecia Slayden Hollis with Lt Gen Barry R. McCaffrey, in "Artillery," *Field Artillery*, February 1994, p. 4; Joe G. Taylor, Jr., "Fighting With Fires," ibid., June 1992, pp. 32–35; USAFAC/Fort Sill Annual Command History, 1991, pp. 204–05, FA School files; Schubert and Kraus, eds., *Whirlwind War*, p. 204; Abrams, "Gulf War," p. 9.

[9] Martin L. Vozzo, James E. Rentz, and Diann Latham, "Who Should Coordinate Fires in the Battle Interdiction Area?," *Field Artillery*, September-October 1995, pp. 40–41; Abrams, "Gulf War," p. 8.

[10] Fred F. Marty, "State-of-the Branch 1992," *Field Artillery*, December 1992, p. 2; Christian C. Klein, "Building Down," ibid., pp. 37–39; USAFAC/Fort Sill Annual Command History, 1991, pp. 208–09, FA School files.

M119 105-mm. howitzer from Battery B, 3d Battalion, 6th Field Artillery, in Iraq

Desert Storm saw the first use of Copperhead precision-guided munitions in combat. Rounds fired by the 1st Battalion, 82d Field Artillery, scored successfully. Such an accomplishment, however, involved a large investment of resources and significant overhead and a great deal of coordination to put the observer with the laser designator in position and to survey the target if the observer did not have a reliable global positioning system.[11] The fire-support teams also needed better equipment. The FIST vehicle used in the heavy divisions lacked mobility and sustainability to keep pace with the maneuver elements, and the weight of the laser designator in the light forces caused difficulty in acquiring targets with speed. Other combat-support vehicles also needed to become more mobile.[12] Likewise, the 155-mm. self-propelled howitzer served well but did not have enough power to keep up with the M1 Abrams tank or the Bradley fighting vehicles.[13]

As in previous operations, Army doctrine for fire support above the corps level did not exist, which affected operations at the joint level. The number of fire-support elements was inadequate. As a remedy, the Field Artillery School recommended placing additional fire-support elements at echelons above corps, including a new

[11] Timothy R. Puckett, "Copperhead," *Field Artillery*, October 1994, pp. 20–23.
[12] USAFAC/Fort Sill Annual Command History, 1991, pp. 209–10, FA School files.
[13] Schubert and Kraus, eds., *Whirlwind War*, p. 205; Scales, *Certain Victory*, pp. 374–75.

31-man fire-support element for Third, Seventh, and Eighth Armies, as well as staff elements at the Army component and joint forces headquarters. Manning levels for the existing fire-support elements at brigade, division, and task force echelons also appeared inadequate for continuous and split operations.[14]

Other problems appeared in the area of target acquisition. The Firefinder radars—AN/TPQ–36 (countermortar) and the larger AN/TPQ–37 (counterartillery)—had been introduced in the 1980s utilizing technology from the 1960s. The radars could locate hostile indirect-fire weapons 20–25 kilometers (12.4–15.5 miles) away within a 100-meter (328-foot) accuracy, but lacked sufficient range, mobility, and processing power;[15] the AN/TPQ–36, in particular, often acquired false targets.[16] Many thought that in addition to the counterfire radars unmanned aerial vehicles, such as those used by the British, would have provided artillery the ability to acquire targets before enemy guns fired.[17] Operations also substantiated the need for field artillery observation helicopters to acquire targets and mark them for Copperhead munitions. But helicopters in DESERT STORM were almost always in use for division aviation to designate targets with the laser-guided HELLFIRE (helicopter-launched fire and forget) missile system, thus limiting their use by field artillery.[18]

Elements of a forward corps support battalion provided supplies and maintenance, as well as other support, for field artillery brigades during DESERT STORM. Problems appeared in repairing equipment as the battalion had had limited experience in supporting artillery brigades in peacetime. Also the battalion was usually positioned too far to the rear to provide adequate timely support. In short, new systems that allowed for greater dispersion on the battlefield and that increased firepower (more ammunition required) and mobility also placed greater demands on the support system.[19]

Reorganizing the Force

A by-product of the disintegration of the Soviet Union and the Warsaw Pact in 1991 was numerous regional threats from the emerging nations. Where the United States once faced a unified threat with a policy of containment, the focus became one of responding to a broad variety of contingencies. To fight a major land war, the Army's forces had been forward deployed and structured for conventional warfare under a doctrine of attrition and annihilation. The reduction of the Soviet threat, as

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[14] Klein, "Building Down," pp. 37–39; Jay F. Grandin, "Fire Support Coordination," *Field Artillery*, February 1992, pp. 19–23; USAFAC/Fort Sill Annual Command History, 1991, pp. 205–06, FA School files; Dastrup, *Modernizing the King of Battle*, pp. 58–59.

[15] Robert M. Hill, "Future Watch," *Field Artillery*, January-February 1996, p. 19; Mark Conrad, "Firefinder," ibid., January-February 1997, pp. 40–41.

[16] John Dornstadter, Maurice F. Posmanick, and David M. Patterson, "Mirages in the Desert," *Field Artillery*, February 1992, pp. 17–18.

[17] Dastrup, *Modernizing the King of Battle*, p. 60.

[18] Ibid., p. 61.

[19] Mark L. Morrison, "A Modest Proposal," *Field Artillery*, April 1995, p. 31; Schubert and Kraus, eds., *Whirlwind War*, p. 176; USAFAC/Fort Sill Annual Command History, 1991, pp. 206–07, FA School files.

well as competition with domestic requirements for declining resources, dictated an Army for the 1990s much smaller than that of the previous decade based primarily in the continental United States. National strategy changed from one based on a European scenario to one of power projection in contingency operations requiring a broader spectrum of forces than ever before. Deterrence remained the primary objective, with deployment forces to be tailored not only from the Army but also from the other services. New emphasis was placed on joint and multinational operations to achieve quick decisive results under any conditions. Coalition forces, such as those used in Southwest Asia in 1990–91, were projected to be the norm.[20] The doctrine shifted from deep attack to simultaneous attacks throughout the depth of the battlefield.[21] Until 2003, the precision weapons used by artillery forces in DESERT STORM were rarely employed. Instead, humanitarian and peace operations in northern Iraq, Somalia, Haiti, Rwanda, Bosnia, and Macedonia became more common, using deterrence and local diplomacy to ease tensions rather than engaging in combat.

With the loss of a creditable enemy, the Army faced substantial reductions. As the size of the Army decreased, so did that of the field artillery. The elimination of nuclear requirements precipitated the replacement of 8-inch howitzers by the MLRS and the retirement of nuclear ammunition for the 155-mm. howitzer. Force reductions also included the elimination of signal personnel in field artillery battalions, which resulted in the requirement for artillerymen to operate all communications and automation equipment—tasks that also included laying wire, installing telephones, and operating all switchboards as well as radios. Field wire terminals and devices formerly installed, operated, and maintained by signal personnel also became the responsibility of the artillery. All other signal soldiers in the line batteries and service batteries were reassigned to headquarters batteries.[22]

A total of 218 field artillery battalions (96 Regular Army, 17 Army Reserve, and 105 Army National Guard) and 38 batteries, including the batteries in armored cavalry regiments (27 Regular Army and 11 Army National Guard), existed in 1989 prior to the war in the Persian Gulf. By the end of the decade, only 141 battalions (50 Regular Army and 91 Army National Guard) and 22 batteries (12 Regular Army and 10 Army National Guard) remained (*Table 26*). Army Reserve field artillery was reduced by 100 percent as a result of the "bottom-up" review by Secretary of Defense Les Aspin in 1993, which in fact eliminated all Army Reserve combat arms units, allowing that component to focus on support and service organizations.[23]

Further reductions were made in conjunction with fielding the 155-mm. Paladin self-propelled howitzer to the heavy divisions, beginning in 1995; each firing battery was reduced from eight to six howitzers per battalion for a total of eighteen rather than twenty-four howitzers per battalion. The number of howitzers in the

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[20] Marty, "State-of-the Branch 1992," pp. 1–3.

[21] Romjue, *American Army Doctrine*, p. 117.

[22] Eugene J. Cantrell, "Communications for the Field Artillery by the Field Artillery," *Field Artillery*, June 1992, pp. 50–51.

[23] Wilson, *Maneuver and Firepower*, p. 424.

Table 26—Field Artillery Reductions, 1989–1999

Unit Type	Regular Army		Army Reserve		Army National Guard		Total Army	
	1989	*1999*	*1989*	*1999*	*1989*	*1999*	*1989*	*1999*
Corps Artillery Bde HQ	4	3			1	1	5	4
FA Bde HQ	9	6	3		17	17	29	23
Division Artillery HQ	18	10			10	8	28	18
Pershing Bn	4						4	
Lance Bn	7						7	
MLRS Bn	5	15			1	13	6	28
MLRS Btry	12	3				1	12	4
8-inch How Bn	17		9		23		49	
8-inch How Btry					3		3	
155-mm. How Bn (SP)	36	21	3		37	45	76	66
155-mm. How Btry (SP)	10[a]	3[b]			7[c]	8[b]	17	11
155-mm. How Bn (Tractor)	9	3	4		20	18	33	21
155-mm. How Btry (Tractor)	3	5[b]			1	1	4	6
105-mm. How Bn	18	12	1		24	14	43	26
105-mm. How Btry	2	1					2	1
Target Acquisition Btry	13	6			10	6	23	12
Target Acquisition Det	3	6				1	3	7
Total Field Artillery Bns							218	141
Total Field Artillery Btrys (excluding TA)							38	22

[a]Nine batteries in three armored cavalry regiments.

[b]Three batteries in one armored cavalry regiment.

[c]Seven batteries in armored cavalry regiments.

heavy divisions thus fell from seventy-two to fifty-four. The six-gun batteries allowed the Army National Guard to modernize its artillery with the Paladin in a more timely fashion, and it allowed more Paladin battalions to be organized. At the same time, the MLRS battery and target acquisition battery were replaced in the heavy division by a "command and attack battalion," each containing a combined headquarters and service battery, two rocket batteries (each with nine launchers), and a target acquisition battery equipped with Firefinder radars. The new battalion increased the division's organic fire support and provided more control to the formerly separate batteries. Another advantage of doubling the number of rocket launchers was that the division artillery could provide the direct-support battalions with reinforcing rocket platoons and still have rockets available for general support.[24]

These changes were in line with the interim Division XXI designs. While the Army of Excellence (AOE) division had been structured to conduct separate deep and rear operations to defeat the enemy in a close maneuver fight, Division XXI was organized to attack the enemy simultaneously throughout the battle space. The AOE division was designed to fight in mass, Division XXI to fight in a decentralized pattern. The division as a whole was to comprise 15,820 soldiers and have two reinforcing field artillery brigades supporting it, at least one of which was to come from the National Guard. Each brigade was to have one battalion of eighteen 155-mm. self-propelled howitzers and two MLRS battalions, each with twenty-seven launchers. Thus thirty-six 155-mm. howitzers and one hundred eight rocket launchers would reinforce each heavy division.[25]

Return to Iraq

After the attacks of 11 September 2001, the United States and its allies invaded Afghanistan, relying on special operation forces and airpower with precision-guided munitions rather than field artillery. Many, however, felt this was a serious error,[26] and two years later during Operation IRAQI FREEDOM field artillery troops were included as part of the force. The Army followed traditional practice, with direct-support battalions fighting alongside their respective brigades. Battalions from corps and division levels provided general support.[27]

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[24] Timothy P. Goldfish, "FA's New Command and Attack Battalion," *Field Artillery*, September-October 1997, pp. 38–41; Randall L. Rigby, "3x6 Cannon—2x9 MLRS Transition," ibid., September-October 1996, pp. 18–21.

[25] Randall L. Rigby, "Fires for Division XXI," *Field Artillery*, November-December 1995, pp. 1–5; David P. Valcourt and Lester C. Jauron, "Division Redesign," *Field Artillery*, July-August 1997, pp. 24–31; Wilson, *Maneuver and Firepower*, pp. 425–26.

[26] Joshua D. Mitchell, "A Case for Howitzers in Afghanistan," *Field Artillery*, November-December 2003, pp. 6–9; Bailey, *Field Artillery and Firepower*, pp. 425–27, 439–40. A few howitzers were later deployed. See Dennis D. Tewksbury and Joel E. Hamby, "Decentralized Fires in Afghanistan," *Field Artillery*, November–December 2003, pp. 10–15; James A. Sink, "First Lethal FA Fires in Afghanistan," ibid., pp. 16–19; and *Field Artillery in Military Operations Other Than War* (Fort Leavenworth, Kans.: Combat Studies Institute Press, 2004), pp. 36–40.

Nevertheless, some qualitative differences were evident. The ratio of artillery pieces to U.S. tanks and infantry fighting vehicles was the same or higher than in DESERT STORM, for the initial phase of IRAQI FREEDOM was won with fewer divisions. In fact, the Army used the lowest ratio of field artillery pieces to troops in combat since World War I. In the main combat operations of March and April 2003, the Army field artillery contingent consisted of one corps artillery headquarters, two division artillery headquarters, three brigade headquarters, and eleven battalions. Each of the cannon and rocket launchers delivered a greater volume and higher rates of fire than in DESERT STORM.[28] Field artillery once again proved itself, operating in the worst weather, including a severe sandstorm that stopped most other means of fire.[29]

Following DESERT STORM, the Army had made concerted efforts toward digitization in its Force XXI designs. Field artillery had previously led the way in its adoption of a computerized tactical fire control system, referred to as TACFIRE, and by 2003, Army units were interconnected with digital networks allowing for much improved communications and situational awareness. Using digital means, field artillery units could routinely deliver firepower within two minutes.[30]

The battle saw the debut of the ATACMS's unitary missile, a missile using GPS for guidance, having a maximum range of 270 kilometers (167.8 miles) and a low circular error probable, and dispersing over 400 improved conventional munition bomblets over a wide area. The missile was effective against personnel and lightly armored targets, as well as in attacking long-range command-and-control targets.[31] Other "firsts" were the combat use of the M109A6 Paladin 155-mm. self-propelled howitzer, the high-mobility artillery rocket system (HIMARS), search and destroy armor munitions (SADARM), and the Bradley fire-support vehicle, all earning high marks from artillerymen in Iraq.[32] Although Iraqi artillery systems compared reasonably well with those of the coalition forces, they rarely were effective because the Iraqis were deficient in their ability to acquire targets. With their superiority in this area, the coalition forces were often able to destroy enemy artillery before it could be a real threat.[33]

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[27] Gregory Fontenot, E. J. Degen, and David Tohn, *On Point* (Fort Leavenworth, Kans., Combat Studies Institute Press, 2004), pp. 95, 108, 117, 167, 179, 184, 201, 261, 263, 264–65, 273, 274–75, 287, 289, 297, 313, 316, 376, 398.

[28] Michael D. Maples, "FA Priorities After OIF," *Field Artillery*, September-October 2003, p. 5; William G. Pitts, "Overview," ibid., p. 2.

[29] Fontenot, Degen, and Tohn, *On Point*, p. 201; Williamson Murray and Robert H. Scales, Jr., *The Iraq War* (Cambridge: Harvard University Press, Belknap Press, 2003), pp. 67–68; Interv, Patrecia Slayden Hollis with Lt Gen W. Scott Wallace, in "Trained, Adaptable, Flexible Forces = Victory in Iraq," *Field Artillery*, September-October 2003, p. 8; Interv, idem with Brig Gen Lloyd J. Austin III, in "3d ID in OIF," ibid., p. 12.

[30] Fontenot, Degen, and Tohn, *On Point*, pp. 416–17.

[31] Ibid., p. 95; Pitts, "Overview," p. 2.

[32] Pitts, "Overview," p. 4; "3d ID in OIF," pp. 11–12; Robert W. Rooker, "Historical Recounting of Marne Thunder in OIF," *Field Artillery*, September-October 2003, p. 18; Richard R. Aaron, Jr., "3d ID BFIST in OIF," ibid., January-February 2004, p. 20; Interv, Patrecia Slayden Hollis with Lt Gen Victor E. Renuart, Jr., in "OIF Hallmarks," ibid., March-June 2004, p. 5.

[33] Murray and Scales, *Iraq War*, pp. 263–65; Bailey, *Field Artillery and Firepower*, p. 441.

M109A6 self-propelled 155-mm. howitzer (Paladin) moving toward the Euphrates River during Operation IRAQI FREEDOM

Room for improvement existed, however. Alternatives were needed for the dual-purpose improved conventional munitions, as unexploded bomblets proved a problem for both civilians and friendly forces.[34] Aerial systems delivered most precision-guided munitions, a problem in close combat where their explosive radius made them too dangerous to use. Artillery systems, with few exceptions, were still area fire weapons, their imprecision limiting use in close combat. Field artillery needed more precision to be effective in the close fight.[35] Better communications equipment also proved necessary, as well as more detailed maps and improved command-and-control vehicles.[36] Troops were reliant on close air support for counterfire, believed to be timelier. In practice, however, the usual response time proved too long, and the use of artillery could have been more effective. In addition,

[34] "Trained, Adaptable, Flexible Forces," p. 6; Bailey, *Field Artillery and Firepower*, pp. 520–21.

[35] Murray and Scales, *Iraq War*, p. 247.

[36] Ibid., pp. 11–12; "3d ID in OIF," p. 11; William L. Greer, Martin J. Holland, and Charles W. Kean, "101st Div Arty," *Field Artillery*," September-October 2003, pp. 14, 16; Theodore J. Janosko and Robert G. Cheatham, Jr., "The Sound of Thunder," ibid., p. 34; Michael D. Maples, "Relevant and Ready," ibid., November-December 2003, p. 2.

artillery could fire a variety of munitions, including illuminating rounds.[37] Clearance procedures for using MLRS and ATACMS also often proved cumbersome.[38]

At the same time the Army was deployed in Iraq, the institution was undergoing a major reorganization. The traditional twentieth-century concept that field artillery was never in reserve had resulted in pooling resources at the division level and above, allowing flexibility in supporting operations as required and enhancing branch training. Divisions normally had attached a direct-support field artillery battalion to each of its combat brigades, but the practice became formalized with the modular transformation of the Army. Although there are benefits in training for combined operations in the fixed brigade organization, commanders may find less flexibility designing task organizations for specific operations.[39]

In Retrospect

The purpose of field artillery, supporting the maneuver arms in combat, has not changed since 1775, when Henry Knox organized the first Continental artillery organizations. From then on, however, field artillery in the U.S. Army has been transformed from an arm having a relatively minor impact on the battlefield to one of dominant force. Technology played a major role in changing the clumsy, dangerous, and none-too-accurate direct-fire guns of the eighteenth century into the precision weapons of today. Improvements in technology provided weapons with the means to make more accurate and longer-ranging fire possible—advanced sighting and recoil mechanisms, communications systems that resulted in successful fire direction, positioning systems that reduced emplacement times, motorization and mechanization that provided more rapid means of transport and rate of fire, and munitions that improved range, precision, and lethality.

Methods of employment have also changed since 1775. During the Revolutionary War, artillery pieces were attached to infantry brigades for close support; by the end of the Civil War they were grouped into brigades or battalions assigned to divisions and corps. Employment of field artillery gradually became centralized, but at the dawn of the twenty-first century, decentralization is again in favor. With a more lethal battlefield and sophisticated electronics, artillery pieces were designed to be mobile with modern positioning, communications, and fire control systems that allow them to be widely dispersed yet deliver mass fire.

The debate over mobility versus firepower has also been a consistent theme in the history of field artillery. To displace, emplace, and move quickly, guns needed to be light, but light guns do not have the firepower and range of heavier weapons. Early guns, howitzers, and mortars often had to be moved by hand and largely depended on hired transport, and the weight that could be drawn by animals limited their size and force. During World War I, motorization was introduced, not necessarily to improve

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[37] Janosko and Cheatham, "Sound of Thunder," p. 38; Robert F. Barry II, "Why Organic Fires," *Field Artillery*, March-June 2004, pp. 16–17; Bailey, *Field Artillery and Firepower*, pp. 441-42.

[38] Janosko and Cheatham, "Sound of Thunder," pp. 36–38; Fontenot, Degen, and Tohn, *On Point*, pp. 250, 417.

[39] Fontenot, Degen, and Tohn, *On Point*, pp. 398–99.

mobility but to make better use of the valuable shipping space originally allotted to horses and their forage. Mechanization added more rapid movement, a higher rate of fire, and increased firepower, but the extra weight hindered transport overseas. The situation with the 155-mm. Crusader howitzer, planned for fielding around 2008, is illustrative of the problem. Although designed with its own automated resupply vehicle, crew protection, on-board navigation and fire control systems, and increased mobility and firepower, and although fewer were needed than the howitzers then in use, thus reducing lift requirements, the Crusader presented enough difficulties in overseas transport to precipitate its cancellation in 2002. Organic artillery pieces in light divisions were easily transported, but the disadvantage was their reduced firepower and lack of crew protection.

Funding also played a critical role in the development of field artillery, which is expensive both in armament and manpower. Prior to the twentieth century, field artillery as an offensive arm received little attention during peacetime. Defense of the continental United States was paramount in the minds of Army leaders, giving more prominence to coastal defenses. As a result, during World War I, the Army had to depend upon foreign armies for field artillery weapons; arming troops had to be accomplished more rapidly than was possible for the United States alone. Monetary concerns after the war, as well as isolationism, resulted in drastic reductions, even though Army planners accomplished some of their best theoretical work during the seemingly stagnant interwar years. Half a century later, with the end of the Cold War, the lack of a well-defined enemy is again affecting field artillery, as the U.S. Army undertakes wide-scale reductions while attempting to reorient itself toward an uncertain future.

Given limited defense resources, the defense budget is seen by many as favoring the Navy and Air Force. These services invest more heavily in technology, their larger and more expensive weapons systems providing greater civilian employment. They also are less manpower-intensive than the Army, an important consideration in an era without the draft and with a dwindling percentage of youth in the U.S. population. The destructive air wars over Bosnia and Kosovo provided further arguments for those in favor of reducing the nation's ground forces; the close fight appeared to many an anachronism. Operations in Afghanistan and Iraq reversed that impression somewhat, when the Air Force proved ineffectual without ground cooperation and when the burden of close-in fighting by necessity fell to the infantry. And if the ground soldier remains a critical element of warfare, so the services of the field artillery—the King of Battle—will remain critical as well.

Appendix A—Chiefs of Field Artillery

War Department [1]

Brig. Gen. William J. Snow	10 February 1918 to 8 July 1918
Maj. Gen. William J. Snow	9 July 1918 to 19 December 1927[2]
Maj. Gen. Fred T. Austin	20 December 1927 to 15 February 1930
Maj. Gen. Harry G. Bishop	10 March 1930 to 9 March 1934
Maj. Gen. Upton Birnie, Jr.	10 March 1934 to 24 March 1938
Maj. Gen. Robert M. Danford	26 March 1938 to 9 March 1942[3]

Field Artillery School [4]

Maj. Gen. John S. Crosby	1 October 1983 to 3 June 1985
Maj. Gen. Eugene S. Korpal	4 June 1985 to 17 August 1987
Maj. Gen. Raphael J. Hallada	20 August 1987 to 19 July 1991
Maj. Gen. Fred F. Marty	19 July 1991 to 15 June 1993
Maj. Gen. John A. Dubia	15 June 1993 to 7 June 1995
Maj. Gen. Randall L. Rigby	7 June 1995 to 6 June 1997
Maj. Gen. Leo J. Baxter	7 June 1997 to 11 August 1999
Maj. Gen. Toney Stricklin	11 August 1999 to 23 August 2001
Maj. Gen. Michael D. Maples	23 August 2001 to 9 December 2003
Maj. Gen. David P. Valcourt	9 December 2003 to 4 August 2005
Maj. Gen. David C. Ralston	4 August 2005 to Present

[1] From 1918 to 1942, the Chief of Field Artillery was located at the War Department in Washington, D.C. On 4 June 1920, the position was made permanent by statute.

[2] During the first half of 1919, Brig. Gen. Edward H. De Armond served as the acting chief on three occasions—22 to 31 January, 7 April to 22 May, and 17 to 20 June.

[3] With the implementation of the War Department Reorganization Plan on 9 March 1942, the staff position for the Chief of Field Artillery disappeared. At this time, the branch chief's authority was vested in the commanding general of the Army Ground Forces and subordinate elements were integrated with those of the newly created command. See Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Organization of Ground Combat Troops*, United States Army in World War II (Washington, D.C.: Historical Division, Department of the Army, 1947), pp. 148–55.

[4] In October 1983, as part of the Army-wide transfer of branch proponency to the U.S. Army Training and Doctrine Command service schools under School Model 83, the Field Artillery School commandant became dual-hatted as the reconstituted Chief of Field Artillery. Although not a mandated staff position as held by the former chiefs, the proponent branch chief had "responsibility for the development, documentation and integration of doctrine, organizations, equipment, training and personnel into the Total Army." See USATRADOC Annual Command History, 1 October 1982 to 30 September 1983, pp. 61, 308–09, plus Ltr, Gen William R. Richardson, CG, HQ, USATRADOC, to Comdrs, TRADOC Integrating Centers, and Comdts, TRADOC Service Schools, 26 Aug 83, sub: Proponency, in backup materials of ibid., Command Historian files, USATRADOC, Fort Monroe, Va.

Appendix B—Field Artillery School Commandants[1]

Capt. Dan T. Moore	19 July 1911 to 15 September 1914
Lt. Col. Edward F. McGlachlin, Jr.	15 September 1914 to 26 July 1916[2]
Col. William J. Snow	27 July 1917 to 26 September 1917
Brig. Gen. Adrian S. Fleming	26 September 1917 to 11 May 1918
Brig. Gen. Laurin L. Lawson	11 May 1918 to 18 December 1918
Brig. Gen. Dennis H. Currie	24 December 1918 to 10 June 1919
Col. Richard H. McMasters	26 July 1919 to 24 October 1919
Maj. Gen. Ernest Hinds	25 October 1919 to 1 July 1923
Maj. Gen. George LeR. Irwin	1 July 1923 to 1 April 1928
Brig. Gen. Dwight E. Aultman	6 April 1928 to 12 December 1929
Brig. Gen. William Cruikshank	8 February 1930 to 31 July 1934
Maj. Gen. Henry W. Butner	17 September 1934 to 10 May 1936
Brig. Gen. Augustine McIntyre	29 June 1936 to 31 July 1940
Brig. Gen. Donald C. Cubbison	1 August 1940 to 22 December 1940
Brig. Gen. George R. Allin	20 January 1941 to 30 June 1942
Brig. Gen. Jesmond D. Balmer	1 July 1942 to 11 January 1944
Maj. Gen. Orlando Ward	12 January 1944 to 30 October 1944
Maj. Gen. Ralph McT. Pennell	31 October 1944 to 30 August 1945
Maj. Gen. Louis E. Hibbs	30 August 1945 to 4 June 1946
Maj. Gen. Clift Andrus	20 June 1946 to 9 April 1949
Maj. Gen. Joseph M. Swing	9 April 1949 to 31 March 1950
Maj. Gen. Arthur M. Harper	2 April 1950 to 16 November 1953
Maj. Gen. Charles E. Hart	4 January 1954 to 28 May 1954
Maj. Gen. Edward T. Williams	8 June 1954 to 23 February 1956
Maj. Gen. Thomas E. de Shazo	12 March 1956 to 31 January 1959
Brig. Gen. Philip C. Wehle	31 January 1959 to 15 February 1959
Maj. Gen. Verdi B. Barnes	15 February 1959 to 25 March 1961
Maj. Gen. Lewis S. Griffing	6 April 1961 to 31 March 1964
Maj. Gen. Harry H. Critz	1 April 1964 to 15 May 1967
Maj. Gen. Charles P. Brown	5 July 1967 to 20 February 1970
Maj. Gen. Roderick Wetherill	24 February 1970 to 31 May 1973
Maj. Gen. David E. Ott	1 June 1973 to 24 September 1976
Maj. Gen. Donald R. Keith	9 October 1976 to 21 October 1977
Maj. Gen. Jack N. Merritt	22 October 1977 to 26 June 1980
Maj. Gen. Edward A. Dinges	27 June 1980 to 27 September 1982
Maj. Gen. John S. Crosby	28 September 1982 to 3 June 1985[3]
Maj. Gen. Eugene S. Korpal	4 June 1985 to 17 August 1987
Maj. Gen. Raphael J. Hallada	20 August 1987 to 19 July 1991
Maj. Gen. Fred F. Marty	19 July 1991 to 15 June 1993

Maj. Gen. John A. Dubia	15 June 1993 to 7 June 1995
Maj. Gen. Randall L. Rigby	7 June 1995 to 6 June 1997
Maj. Gen. Leo J. Baxter	7 June 1997 to 11 August 1999
Maj. Gen. Toney Stricklin	11 August 1999 to 23 August 2001
Maj. Gen. Michael D. Maples	23 August 2001 to 9 December 2003
Maj. Gen. David P. Valcourt	9 December 2003 to 4 August 2005
Maj. Gen. David C. Ralston	4 August 2005 to Present

[1] The organization for artillery education and training was known, successively, as the School of Fire for Field Artillery from 1911 to 1920, the Field Artillery School from 1920 to 1946, the Artillery School from 1946 to 1955, the Artillery and Guided Missile School from 1955 to January 1957, the United States Army Artillery and Guided Missile School from January 1957 to July 1957, the United States Army Artillery and Missile School from July 1957 to 1969, and the United States Army Field Artillery School from 1969 to present.

[2] The School of Fire was closed from 26 June 1916 to 27 July 1917.

[3] In October 1983, as part of an Army-wide transfer of branch proponency to the U.S. Army Training and Doctrine Command service schools under School Model 83, the Field Artillery School commandant became dual-hatted as the reconstituted Chief of Field Artillery. See Appendix A.

Bibliography

Most readers of this volume will more than likely have some knowledge of artillery. For those less versed yet ever inquisitive, a little background reading may be beneficial to acquire a basic understanding of such a complex technical arm. Phillip H. Stevens's *Artillery Through the Ages* is a popular work, the first four chapters covering pregunpowder artillery and the development of the arm from the invention of gunpowder to the eve of the American Revolution. Other useful general histories include John Batchelor's and Ian Hogg's *Artillery*; Fairfax Downey's *Cannonade*; H[ugh] C. B. Rogers, *A History of Artillery*; and editor Joseph Jobe's *Guns*. More serious researchers may wish to consult Carlo M. Cipolla's *Guns, Sails, and Empires*; Frank E. Comporato's *Age of Great Guns*; H[enry] W. L. Hime's *The Origins of Artillery*; O[liver] F. G. Hogg's *Artillery*; and volume 3 of Hans Delbrück's *History of the Art of War*, which includes a chapter on the rise of gunpowder artillery. Finally, Boyd Dastrup's *The Field Artillery* contains, as its second section, an exceptional bibliography of hundreds of works pertaining to the history of warfare in general and of artillery in particular.

Of the primary sources key to this study, many may be found in the voluminous holdings of the National Archives and Records Administration (NARA). In general, NARA records created prior to World War II are housed in Washington, D.C., and those created during and since World War II are located in the new Archives II facility in College Park, Maryland. The record groups that proved invaluable were 93, War Department Collection of Revolutionary War Records; 94 and 407, Records of The Adjutant General's Office, 1780s–1917 and 1917–; 98, Records of U.S. Army Commands; 107, Records of the Office of the Secretary of War; 120, Records of the American Expeditionary Forces (World War I); 156, Records of the Office of the Chief of Ordnance; 177, Records of the Chiefs of Arms; 319, Records of the Army Staff; and 360, Records of the Continental and Confederation Congresses and the Constitutional Convention. In addition, the personal papers of important personages, such as George Washington, Charles P. Summerall, Henry J. Hunt, and others, are housed at the Library of Congress in Washington, D.C.

Numerous sources at other repositories were also valuable. The collections at the U.S. Army Military History Institute, Carlisle Barracks, Pennsylvania, and the U.S. Army Command and General Staff College Library, Fort Leavenworth, Kansas, contain a wealth of information, and the records, documents, and periodicals consulted at the Morris Swett Library, U.S. Army Field Artillery School, Fort Sill, Oklahoma, proved invaluable as well, especially regarding the background of various organizational trends.

Official War Department and Department of the Army publications—administrative regulations, general orders, annual reports, circulars, bulletins, field manuals, and registers—were essential, and most are available at the U.S. Army Center of

Military History in Washington, D.C. Unpublished documents include the annual summaries submitted to the Center by the major commands and schools, with those of the U.S. Army Field Artillery School and those of the former U.S. Army Missile Command (Huntsville, Alabama) especially important.

The Center also maintains various mission-essential collections. The tables of organization and equipment (TOEs), particularly those issued from 1914 to the mid-1970s, were the basis for gleaning the organizational aspects of this history. In addition to the TOEs, both individual unit files and subject files, as well as historical data cards, supplied critical information not readily available elsewhere. Materials within these files include organizational studies, prepared by staff officers and Center historians; newspaper articles; letters of instruction for change in status of units and orders implementing those instructions; and many other valuable documents.

The following bibliography lists the books, articles, and dissertations/theses that were useful in the preparation of this volume and is divided into three alphabetically arranged sections.

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Abbreviations and Acronyms

AAR	after action report
Abn	airborne
Actg	acting
AEF	American Expeditionary Forces
AG	Adjutant General
AGF	Army Ground Forces
AOE	Army of Excellence
Arty	artillery
ACofS	Assistant Chief of Staff
AMC	U.S. Army Missile Command
AMCOM	U.S. Army Aviation and Missile Command
ann.	annex
app.	appendix
ATACMS	Army tactical missile system
ATFA	atomic field army
Attn.	attention
Bde	brigade
bk.	book
Bn	battalion
Btry	battery
CARS	Combat Arms Regimental System
CG	commanding general
CGCS	U.S. Army Command and General Staff College
CINFO	Chief of Information
Cir	circular
CLGP	cannon-launched guided projectile
CMH	U.S. Army Center of Military History
Cmte	committee
Co	company
CoAFF	Chief of Army Field Forces
CofArms&Svcs	Chief of Arms and Services
CofArty	Chief of Artillery

CofFA	Chief of Field Artillery
CofInf	Chief of Infantry
CofOrd	Chief of Ordnance
CofS	Chief of Staff
Comdt	commandant
comp.	compiler; compiled by
Compt	comptroller
CONARC	United States Continental Army Command
DA	Department of the Army
Dep	deputy
Det	detachment
Dir	director
Div	division
ed.	editor; edition; edited by
Encl	enclosure
End	endorsement
FA	field artillery
FADAC	M18 field artillery digital automatic computer
FIST	fire-support team
fldr	folder
FY	fiscal year
GHQ	general headquarters
GO	general order
Gp	group
GPS	global positioning system
GSRS	General Support Rocket System
G/VLLD	ground/vehicle laser locater designator
HHB	headquarters and headquarters battery
HOW	howitzer
HQ	headquarters
INF	intermediate-range nuclear forces

KATUSA	Korean Augmentation to the United States Army
LC	Library of Congress
Ltr	letter
Memo	memorandum
MHI	U.S. Army Military History Institute
Mil	military
Mins	minutes
MLRS	multiple-launch rocket system
MOMAR	Modern Mobile Army
Ms	manuscript
NARA	National Archives and Records Administration
OCAFF	Office of the Chief of Army Field Forces
PO	Permanent Order
PWA	Public Works Administration
QRA	quick-reaction alert
RCT	regimental combat team
RG	Record Group
ROAD	Reorganization Objective Army Divisions
ROCAD	Reorganization of the Current Armored Division
ROCID	Reorganization of the Current Infantry Division
ROTAD	Reorganization of the Airborne Division
Rpt	report
QMG	Quartermaster General

ROTC	Reserve Officers Training Corps
SACEUR	Supreme Allied Commander, Europe
SALT	Strategic Arms Limitation Treaty
SecWar	Secretary of War
SO	Special Order
suppl.	supplement
TA	target acquisition
TAG	The Adjutant General
Telg	telegram
TO	table of organization
TOE	table of organization and equipment
TRADOC	U.S. Army Training and Doctrine Command
TRICAP	triple-capable
USAFAC	U.S. Army Field Artillery Center
USFET	U.S. Forces, European Theater
VCofS	Vice Chief of Staff
vol.	volume
WD	War Department

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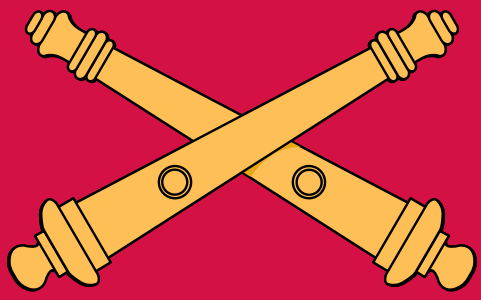

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