AMERICAN FIELD ARTILLERY
1930-1939

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PREFACE

The majority of military history deals with the various wars in which man has been involved. Little literature exists describing the conditions and problems of an army during peacetime. This work describes the conditions in which the Field Artillery existed during the 1930s and analyzes some of the forces affecting it. The lingering effects of the World War, the financial impact of the depression and the advance of technology exerted tremendous influence on the Field Artillery in that decade. The response to the problems caused by these forces determined the efficiency of the branch when war came again.

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INTRODUCTION

Prior to 1917, the United States Army had been a comparatively small force whose primary mission, for the previous fifty years, had been securing the frontier. The Spanish-American War had not been of sufficient duration to justify calling it more than a summer campaign. The Field Artillery of the Regular Army had not even been recognized as a separate branch until 1907. It was seldom employed in units larger than battalion. The Great War had not only forced the Army to raise and equip a force of European proportions, but also deploy them effectively in combat against other massed armies. The lessons of World War I would last until a second World War demanded change.

The Field Artillery was subject to the same organizational and tactical problems as the Regular Army after peace "broke out" in 1919. The normal trials and tribulations of a peace time Army were intensified when the nation was plunged into the depression. During the 1930s, the American Field Artillery was affected by three tremendous pressures: the retention of wartime doctrines and equipment necessitated by limited funds, the struggle for new and improved equipment, and the modification of wartime procedures in the light of

advances in weaponry and technology. For the Field Artillery, the 30s were a time of pressure and transition.

CHAPTER II

THE GREAT WAR AND ITS EFFECTS

The American Field Artillery had become a distinct branch of the Army in 1907. It was then recognized, by the General Staff, that there was a need for an organization especially designed to support the cavalry and infantry by cannon fire. Prior to 1917, the branch seldom conducted exercises with more than a few batteries. The doctrinal basis of artillery employment was borrowed largely from the French and British. Because of the closing of the American West, the branch was not able to test the chain of command in anything approaching combat conditions. For the Field Artillery, the Great War was the first conflict where equipment could be tested, tactics refined, and in which commanders could gain experience in the battlefield application of textbook doctrine. For this reason, the impact of the Great War on the branch would be a lasting one.

In April, 1917, the Unites States Army, and its Field Artillery, were no more prepared for a major conflict than at any other time in its previous 140 years. On the day before the declaration of war, the Field Artillery was organized into nine regiments comprising a total of 368 officers and 8,252 men.[1] Three of the regiments were serving in overseas

possessions such as the Panama Canal Zone, Hawaii and the Philippines; the remaining six regiments were deployed along the southwestern border of the United States. Scattered throughout the states of Texas, New Mexico, Arizona and California, the regiments were not fully manned with either officers or enlisted men. In order to man the artillery units participating in the punitive expedition into Mexico, 1916-1917, the School of Fire, the artillery training school at Fort Sill, Oklahoma, had to be closed. Although the European war had been in progress for three years, the United States had taken no steps to strengthen its artillery with either men or equipment.

In 1915, a House subcommittee on military affairs conducted hearings on increases in the Coast Artillery Corps. The topic of Field Artillery was also raised during the proceedings. The subcommittee was informed that during the Russo-Japanese War in 1904, a total of 2,126 guns had been used in a single battle. The number of Russian guns, 1,204, was approximately twice the number of cannons the United States possessed in 1915. The subcommittee was reminded that the War Department had submitted appropriations in 1914 asking for 226 new guns, but had cut the allocated funds from the request of the following year. The logic was that war was no closer in 1915 than it had been in 1914. The committee was told that Russian artillery strength in 1913 was 6,000 guns compared to 4,800 for the French and 5,000 for the Germans. Citing these figures, Representative

Augustus P. Gardner (Rep.-Mass.) called for a committee of inquiry for the purpose of investigating the nation's defensive posture. Rep. Gardner went on to recall that General Leonard Wood had testified that, working day and night, the entire production capacity of the nation was only 500 guns a year. The total number of artillery shells on hand, 580,000, would last for only four days. The daily production of artillery ammunition would supply only eight guns for one day.[2] The situation had not measurable changed im the first months of 1917. A memo from the Chief of Ordnance to the Chief of the War College Division stated that it would take two and a half years to equip the Regular Army and National Guard with artillery.[3] The war in Europe did not wait two years.

When the war began, the General Staff was uncertain how much manpower and logistics were required to insure victory. Early in the war, it was recognized that American industry could not convert to war production fast enough to arm the troops going overseas. Therefore, the decision was made to purchase French and British artillery for use by American forces in Europe. Although the British and French were willing to sell the cannons, they consistently stated the desire for infantry replacements for their badly bloodied divisions. In spite of the time required to train artillery units, the commanders of the American forces in Europe steadfastly refused to use American troops other than as organized fighting elements complete with organic

artillery. Using French and British material and doctrine, the American artillery was eventually able to provide support to the ground forces.

General Snow's Report

The effects of World War I on American Field Artillery can best be seen in the numerous reports submitted at the close of hostilities in 1918. The conduct of the Field Artillery and the effects of the war were described in the Annual Report of the Chief of Field Artillery-1919.[4] Hastily organized in 1917, the Office of the Chief of Field Artillery was eventually recognized as the controlling element of the branch. In his report of 1919, Major General William Snow outlined the activities of the branch during the eighteen months of war. General Snow had found the system for training personnel to be inadequate. The replacement depots at Camp Jackson, South Carolina and Camp Taylor, Kentucky gave only rudimentary training to inductees. This lack of training required the reorganization of the School of Fire at Fort Sill, Oklahoma, and the establishment of training centers in France.[5] Likewise, the equipment was woefully lacking. The shortage of guns had forced the Army to adopt the French 75mm gun as its standard light weapon. Divisions left for France without equipment and were furnished guns by the French and British upon their arrival. American manufactured guns, what few were produced, were used in the United States for training. As

a result of these shortcomings, General Snow made extensive recommendations in his report of 1919.

Recognizing that his position existed because of the war, Snow first recommended that the Office of the Chief of Field Artillery be made a permanent position. Upon his arrival in Washington, he had found confusion over his authority, and a reluctance by any of the ranking bureau chiefs to make difficult decisions on artillery matters. Snow felt that a permanent chief would control this and would represent the branch when decisions were made concerning the development of Field Artillery equipment and doctrine. To remedy any future problem with the lack of trained personnel, he advised the formulation of a Field Artillery School, which, along with the School of Fire, would be responsible for the training of Regular Army and National Guard personnel. Expanded military training in civilian colleges and universities would also alleviate the shortage of qualified men. Snow suggested that Field Artillery units be organized into brigades for training purposes, and be able to use selected camps for firing exercises.[6] The annual report of 1919 also included the recommendations of a board of officers which had convened in France at the close of the war.

The Hero Board

Pursuant to Special Orders Number 335, dated December 9, 1918, a board of officers was convened "to make a study of

the experience gained by the artillery of the A.E.F. (American Expeditionary Force) and to submit recommendations based on such a study."[7] The board, led by Brigadier General Andrew Hero of the Coast Artillery Corps, was comprised of both Field Artillery and Coast Artillery officers. The board interviewed all the commanders of artillery brigades, regiments, ammunition trains, and schools in France. A total of fourteen major units were visited by General Hero and his board in the four months that the board met. The board made specific recommendations on schools, artillery organization, weapons, motorization, and tactics. The report was accompanied by a detailed endorsement by Major General Ernest Hinds, the Chief of Artillery for the American Expeditionary Force.

The most detailed recommendations dealt with schools. Like General Snow, the Hero Board was concerned with the lack of training shown by the divisions arriving in France. To remedy this, the board recommended the establishment of a school system for both officers and enlisted men. The schooling of officers should be handled by several different agencies. Initially, all new officers should undergo basic training in their particular branch in the first year of duty. The school for Coast Artillery officers, for example, would be located at Fort Monroe, Virginia. Field Artillery officers should be trained at some appropriate post. Both groups should receive instruction on drill regulations, firing manuals, gunnery, communications, and topography.

Coast Artillery officers should be given additional courses in elementary electricity and power, and CAC materiel. Officers of the Field Artillery should train on field guns and master hippology (the study of horses). Written exams and tests would eliminate unacceptable officers and the graduates should then be assigned to active units. At their assigned posts, officers of both corps would receive additional training in order to maintain their proficiency. There would also be special schools for selected officers who had gained unit experience. These schools would offer instruction on ballistics, mechanical and electrical engineering, artillery materiel, tactics, and the theory of explosives. Qualified officers would also be sent to Regular Army schools such as the School of the Line and the Command and General Staff School.[8]

A similiar system of schooling was suggested for the enlisted men. Initially, enlisted men would attend schools held at the post where they were assigned. These schools should concentrate on basic civilian education courses and fundamental military subjects applicable to all branches. Upon the successful completion of these schools, the men should be sent to the appropriate specialty school for their branch. Course instruction at the Coast Artillery School should include basic electricity, clerical duties, radio and wire communications and motor transport. The Field Artillery School should also give instruction on radio and wire, but the bulk of the curriculum would deal with animal

transport. Instruction, in addition to stable management, horse shoeing, and saddle mending, should include training on field guns and fire control instruments.[9] The training of officers and enlisted men should be extended to members of the National Guard and the Organized Reserves.

In his endorsement to the Hero Board report, General Hinds, amplified the recommendations of the board in the area of schools. He stressed the need for the extension of military instruction at all principal educational institutions. This would provide a reserve of trained officers who could be used during mobilization. Hinds also urged the intensive training of Regular Army artillery officers in staff functions. The need to retain experienced officers in firing units had impeded the organization and development of staffs at higher echelons.[10]

The majority of the board's recommendations on organization concerned the addition or deletion of certain officer positions and functions. The vast majority of these recommendations were incorporated into the post-war units. The board also made specific reference to a proposed consolidation of the Coast and Field Artillery Corps. The board defined field artillery as all mobile and fairly mobile guns and howitzers which directly support the army in the field. Coast Artillery included anti-aircraft artillery, trench artillery, heavy caliber howitzers and railway guns. They were primarily responsible for seacoast fortifications and the mine defense of harbors. The two

branches, according to the board report, possessed two separate and distinct functions and should remain independent. General Hinds concurred in the separation of the two branches but did not agree on the definition of the respective functions. He considered any artillery which accompanied the army in the field to be field artillery. That artillery deployed along the seacoast for the defense of coast and harbors was coast artillery.[11]

Acknowledging the existence of another board of officers which was considering ordnance material, the Hero Board never-the-less made specific comments on artillery material. The board concluded that Field Artillery research in the post-war period should concentrate on six weapons. An extremely lightweight gun of about a 3" caliber, capable of being disassembled for transportation on pack animals, was needed. A battalion equipped with this weapon should be assigned to the division artillery brigade. The primary use of the gun would be to accompany advancing infantry in offensive operations. In addition, a regular 3" or 75mm gun was needed in the division. The French 75mm gun, the primary light gun used in the war, was considered satisfactory in all respects. It possessed the needed power, accuracy and rapidity of fire. The gun should be modified for future use by altering the carriage for high angle fire and more rapid transport. To complement the French gun at division, the board recommended the adoption of a 120mm howitzer. Although a howitzer of that caliber did not exist,

it was felt that one was needed to replace the 155mm howitzer currently assigned to the division. The larger gun was too heavy to occupy firing positions in the division area, especially if the ground was torn up with shell craters. The greater weight of the 155mm shell complicated the already over taxed supply lines. For corps artillery, the board recommended three weapons; a 4.7" gun, a 6" or 155mm howitzer, and a 6" or 155mm gun.[12]

General Hinds emphasized the inadequate nature of American ordnance.

> Had we not been able to obtain ordnance from the French and British, we would have been a negligible factor in the war until the end of 1918. When the Armistice went into effect, nineteen months after we entered the struggle, with the exception of twenty-four 8" howitzers made from British plans by the Midval Steel Co., we had in the line not a single piece of divisional, corps or army artillery manufactured in America after our entry into the war.[13]

He went on to say that adequate reserves of war materials were critical to the future success of the Army.[14]

The tactical problems that the board considered were primarily ones which dealt with artillery-infantry coordination. The liasion detachments of the artillery battalions had been unable to coordinate artillery fires with infantry operations. For this reason it was recommended that the size of the liasion detachments be doubled and the chief of the detachment be made a captain. Hopefully the infantry would place more confidence in its artillery with a higher ranking officer in charge of coordination. The second aspect of tactics that the board considered was the concept

of accompanying artillery. The British and French periodically assigned a gun or a battery directly to the infantry. The guns would use direct fire techniques to engage those fortifications that the infantry was unable to seize. The infantry approved of this primarily because of the morale factor of having guns on the front lines with the troops. Artillerymen were generally unreceptive to the idea because the presence of a gun or a battery in the front lines diminished the total effectiveness of the battalion's fire and offered a tempting target to enemy machine gunners and artillery. The board reluctantly advised the continuation of the concept because of the morale factor.[15]

The last significant topic covered by the Hero Board was the idea of mechanization. The poor condition of horses sent as replacements, the shortage of forage, and the lack of care and understanding for the animals convinced the board members that animals should be replaced with vehicles as soon as possible. They specifically recommended the adoption of the five ton tractor to pull the 155mm howitzer. The weight of the medium and heavy howitzers and guns demanded that they be mechanized first. Lighter artillery should be pulled by motor vehicles as soon as adequate transportation could be found. General Hinds agreed that the mechanization of the Field Artillery should occur as soon as vehicles were found.[16]

The question of mechanization was specifically addressed by another group of officers. Major General

William Lassiter, the Chief of Artillery for the U.S. Third Army, convened a board of officers to study the motorization of the Field Artillery and make appropriate recommendations. This board found that motor vehicles were capable of traveling over all roads and any type of terrain. Some vehicles did experience some difficulties in streams and marshes, but animals would have undoubtedly encountered the same problems. The tractors' ability to occupy a position satisfactorily was demonstrated. The main problem discovered was the inexperience of the drivers. The American society had not become sufficiently motorized by 1919 to teach driving skills to most of its young men. Of the 154 officers who observed all or part of the tests conducted by the board, only two per cent were opposed to the concept of motorized artillery. The Lassiter Board recommended that all regiments of 155mm howitzers and one regiment of 75mm guns be motorized immediately. The remaining artillery units should be motorized as soon as equipment and funds permitted.[17] It is important to note that the vast majority of the officers connected with the board had no motor experience prior to the experiments. They had no basis for bias against animal movement and for vehicles.

The Caliber Board

The final board to be considered was probably the most important. Responding to the need for a developmental plan for artillery ordnance, the Chief of Field Artillery,

General Snow, took steps which resulted in the convening of a board of officers in December 1918. The board was chaired by Brigadier General William Westervelt, an officer with extensive experience in artillery ordnance. Because of the nature of their work, the board has been called the Caliber Board. The purpose of the board was to develop criteria which could be used for the future development of artillery materiel. To accomplish this, the board reviewed the use of artillery in the war and studied the recommendations of American and Allied officers. The board first analyzed the missions to which artillery ordnance must respond. The missions were grouped into three categories depending on the tactical echelon where they were found. The type of mission commonly encountered would determine the characteristics of the weapon at a particular level.

The division was considered the lowest echelon which the board would deal with. At the divisional level, the primary objective of the artillery was the destruction of the enemy forces, especially infantry. The division also had to have some ability to attack hostile artillery positions. In order to accomplish the primary mission, division artillery had to possess sufficient range to attack enemy troops and mobility to keep up with the movement of friendly infantry. In many cases the range could be achieved by the deployment of units at varying distances from the main line of battle. There was no simple solution to acquiring the necessary mobility to keep up with the advancing infantry.

Typical missions of division artillery would include harassment, the prevention of enemy movement, the destruction of light fortifications and the delivery of intense barrages to prevent enemy penetration of defensive lines. Therefore it was decided that there should be a field gun for use against troops and a field howitzer for counter-battery work in the division. Both should weigh under 4,500 pounds and have a range of at least 11,000 yards. The weight limitation of 4,500 pounds was considered the maximum that a six-horse team could pull cross-country. The range of 11,000 yards was the average distance to the enemy machine gun line from friendly artillery positions.[18]

The primary mission of corps artillery was the destruction of enemy artillery. To achieve this, range was an important consideration, but the need for mobility was not as critical. The guns at corps could be called upon to harass the enemy, interdict the use of road junctions, and fire on enemy artillery positions. As with the artillery at the division level, the board felt that there was a need for a gun and a howitzer. Corps artillery should not weigh over 11,000 pounds, the maximum weight of guns which the vehicles at that time could adequately pull. Both weapons should be able to achieve a range of 16,000 yards. This was considered the average distance between the opposing artillery forces. The ratio of guns to howitzers at the division was two to one. Because of the requirement to attack hostile artillery, this ratio was reversed, two

howitzers to each gun.[19]

There had been some discussion concerning the need for organic artillery at army level. It was felt that the artillery at that level should constitute a pool from which the army commander could allocate additional artillery to the corps and divisions. The Caliber Board indirectly supported organic artillery at army by making positive recommendations on the appropriate weapons. The main objective for guns at army level was the long range destruction of strategic targets. The range factor, as opposed to mobility was the overriding requirement. With a gun possessing a range of 25,000 yards and a howitzer firing 18,000 yards, army artillery could reach strategic targets and still support corps and divisional weapons.[20]

In illustrating their findings and recommendations, the board described the characteristics and transport for the ideal weapon and then stated the practical solution. In the category of light guns, those normally found at division, the recommended caliber was about 3". This cannon should be able to elevate its tube from -5 degrees (0 degrees= horizontal) to +80 degrees. It should possess the ability to shoot in any direction (traverse 360 degrees). It should be able to fire a 20 pound projectile, either shrapnel or high explosive, 15,000 yards. The practical answer to the division light gun was the retention of the French 75mm gun and the American 75mm gun. The French cannon had a maximum elevation of only 19 degrees and a

traverse of only 6 degrees. The American 75mm gun was able to attain an elevation of +53 degrees and a traverse of 45 degrees. The range of both weapons was approximately the same, 9,200 yards. The board considered mechanization to be the prime mover of the future and stated that the ideal transport for the light gun should be a motor vehicle. The pragmatic approach was to motorize four regiments immediately and gradually motorize the remaining units as funds permitted.[21]

The ideal companion to the light gun was a field howitzer of about 105mm. The elevation requirement for this weapon was from -5 to +65 degrees with 360 degrees of traverse. It should fire a 30-35 pound shell 12,000 yards. The realistic answer to the division howitzer was the retention of the French 155mm howitzer. This weapon possessed a maximum elevation of 42 degrees and a traverse of 6 degrees. It had a range of 12,400 yards with a 95 pound projectile. The ideal transport for the light howitzer, like that of the light gun, was a motor vehicle. Because the weight of the French 155mm weapon exceeded the maximum weight for a six-horse team, it was pulled by vehicle.[22]

The medium artillery discussed by the Caliber Board was to be found at corps level. The ideal gun for corps artillery could achieve a maximum range of 18,000 yards and a maximum elevation of +80 degrees. Like the light gun at division, it should be able to traverse a full 360 degrees. The caliber of this gun, in the opinion of the board,

should be 4.7" and its shell should weigh approximately 60 pounds. The 4.7" gun which the American Army currently possessed was considered an acceptable temporary replacement. The American 4.7" could only elevate a total of 15 degrees and was limited to 8 degrees of traverse. Its maximum range was 12,000 yards with a 45 pound projectile. Due to the weight of both the ideal and practical weapons, motorized transport was considered necessary.[23]

The corps companion piece to the medium gun was a 155mm howitzer. The medium howitzer had the same firing characteristics as the light howitzer, -5 to 65 degrees elevation and 360 degrees traverse. Its maximum range with a 95 pound shell should be 16,000 yards. The replacement for the ideal weapon in the corps artillery was also of 155mm caliber. This was the same weapon that was recommended as the practical solution to the ideal light howitzer at division level. The ideal transport and practical transport for the medium howitzer at corps was motor vehicle, again due to the weight restrictions on animal-drawn weapons.[24]

The ideal characteristics for a heavy gun at army level were; a caliber of about 155mm, a possible elevation of +60 degrees, the ability to traverse 360 degrees, and a range of 25,000 yards with a 95 pound projectile. The pragmatic solution to this weapon requirement was the continued use of the French 155mm gun. Its maximum elevation of 35 degrees could achieve a range of 16,000 yards

with a 95 pound shell. It could traverse 60 degrees. The proposed companion weapon at army level was an 8" howitzer. A unique recommendation made for the army howitzer was that it should have a carriage on which the howitzer or the 155mm gun could be mounted. This would give the howitzer the same traverse and elevation characteristics as the ideal gun. The recommended range for the howitzer was 18,000 yards with a 240 pound shell. The temporary solution to the army howitzer was the current 8" howitzer. It was capable of firing a 200 pound shell 13,000 yards. The maximum traverse of the weapon was only 8 degrees and the total elevation was 45 degrees. Motor transportation was the only feasible draft for these weapons.[25]

Although artillery materiel was the primary consideration of the Caliber Board, they did make definitive recommendations concerning motorization. They maintained that mobility and force were essential to artillery effectiveness. The initial deployment on the part of the guns required great exertion by man and animal. The same elements that were instrumental in creating the breech in the enemy's lines (mobility and force) would be unable to exploit the rupture of the enemy's position due to the exhaustion of the animals and men. The inability of the artillery to maintain its mobility and therefore its support could prove to be a fatal shortcoming. In summary, they said, "Against an organized enemy, a breakthrough is not possible with animal transport."[26] They recommended that all field

artillery weapons of a caliber greater than 3" be motorized. Secondly, the 3" and 75mm guns of the National Guard and Organized Reserves should be converted to vehicular draft. Finally the light artillery of the Regular Army would be changed from animal-draft to vehicular-draft. All of this would occur as soon as suitable vehicles were purchased or developed.[27]

With reference to artillery ordnance, the Caliber Board report served as the blueprint for the research and development of future guns. It is important to point out several consistent aspects of the board's report. In every case, the ideal cannon was far superior to the practical answer. The current ordnance had clear deficiencies in range and firing characteristics. In each case, the practical solution was the retention of a weapon in abundant supply. In several cases, weapons with superior performance capabilities were available, but not in numbers large enough to justify their continuation. There is no doubt that the board recognized that post-war funds for research and equipment modification would be scarce. Finally, the members of the board were greatly impressed by the efficiency and potential of a new weapon on the battlefield, the airplane. Aware of a possible future threat from the air, the board felt that each division and corp gun should double as both a field artillery weapon and an anti-aircraft gun. The requirements for an elevation of +80 degrees and a traverse of 360 degrees were essential if the gun was to

engage low or medium altitude aircraft. Although the Hero Board was considered the most significant board of the war by Generals Hinds and Snow, the effect of the Caliber Board would last for forty years.[28]

Surplus Material

There was one other legacy of World War I, a tremendous stock of war materials. During the summer of 1919, Congress conducted an investigation of War Department activities during the war. Particular attention was paid to the purchasing of war materials. On August 13, 1919, Colonel G.J. Jenks, of the Ordnance Department, testified before a subcommittee of the Select Committee on Expenditures in the War Department. He made several remarks which indicted both the American ability to produce war materials and the quality of the surplus ordnance on hand. At the time, the Army was due to receive 900 French 75mm guns although it already possessed sufficient ordnance material to equip a 1.5 million man army. Most wartime contracts had been cancelled on the day of the Armistice. The French contract however, had been maintained at the request of France. It was obvious that unemployment in France's war industries was the primary justification for this request. After listing the various weapons contracted for, delivered, and shipped to Europe (see Table 1), he went on to comment on the value of the current ordnance.

The United States Army had purchased guns which had

TABLE I

ARTILLERY OF THE GREAT WAR[29]

Gun	Contracted for (U.S.)	Finished	To Be Completed	Sent to France	Used in Combat	Total on hand (plus foreign purchase
75mm gun Fr.	6550	74	976	none	none	3904
carriage "	3049	291	1109	none	none	4153
75mm gun Br.	2868	724	185	124	none	909
carriage "	2927	724	197	124	none	921
75mm gun Am.	1402	695	115	31	none	754
carriage "	1327	206	157	26	none	403
155mm how Fr.	3000	1172	671	2	none	3009
carriage "	2641	144	532	none	none	2293
155mm gun Fr.	2160	71	491	16	none	993
carriage "	1446	368	432	16	none	1231
8" how Br.	295	173	72	96	24	617
carriage "	295	173	72	96	24	617
240mm how Fr.	1160	1	329	none	none	400
carriage "	1265	1	319	none	none	320

been developed either before or during the war. At the end of the war, it was recognized that these weapons required replacement by cannons with more range, power, and mobility. Col. Jenks stated that should a war begin in the near future, a research and development program for new weapons would be mandatory. The main value of the present stock of guns rested in the fact that there was nothing to replace them with.[30] The figures illustrated in Table 1 indicate both the inability of American industry to affect the effort in France and the huge quantities of guns on hand as a result of foreign purchase combined with the small domestic production.

The same situation was found in regard to ammunition. Testifying before the same committee, Colonel Charles T. Harris, also of the Ordnance Department, gave the committee the wartime statistical figures for ammunition. Using the 75mm gun as an example, he stated that 25,259,610 high explosive shells had been contracted for during the war. Of this amount, 7,440,742 had been completed, but less than 10,000 had been used in France. He went on to note that 16.4 million shrapnel projectiles had been ordered. Approximately 8,8 million were completed and 120,000 had been fired mostly in training. He concluded his testimony by saying, "We were still using French munitions at the end of the war."[31]

Conclusion

The American Field Artillery had entered the war with a frontier background and experience in small units only. At the end of the war, it possessed men and equipment equal to if not superior to any combatant nation. The ordnance used during the war had been of foreign design for the most part. The 19th century philosophy of massed artillery had been reflected in the design of these weapons. The surplus of war supplies tended to restrict appropriations in the coming years. In the 1920s, Congress was unwilling to allocate funds for the purchasing of new equipment when the warehouses were still full of usable, although outdated, materiel. Lacking other guide-lines, and forced to retain the weapons of that conflict, the Army and the Field Artillery would cling to the tactics and techniques of that war.

The recommendations of the Hero Board in the areas of organization and schools became reality. The observations of the board with respect to accompanying artillery reinforced the continuance of this tactic in spite of the development of infantry indirect fire weapons. The Caliber Board criteria for ordnance became the principal guide for research and development up to the Second World War. These suggestions, based on war experiences, became guide-lines and dominated the branch through the 1920s and into the 1930s. The decade of the 30s, however, brought the great depression. Previous Congressional reluctance to appropriate

money for a peace time army, now became a flat refusal. The thirties also witnessed the dwindling of the wartime stockpiles. The Army was then faced with the need to replace antiquated equipment at a time when the government was almost fanatically frugal. The growing tensions in Europe and the gradual advancement in technology would complete the list of factors which the Field Artillery would have to face and conquer.

FOOTNOTES

[1]Marvin A. Kreidberg and Merton G. Henry, History of Military Mobilization in the United States Army 1775-1945 (Washington D.C.: Department of the Army Pamphlet no. 20-212, 1955), pp. 221-222.

[2]U.S. Congress, House, Committee on Military Affairs, Hearings before a subcommittee of the House Committee on Military Affairs on the increase of the mobile army and Coast Artillery Corps. 63rd Cong., 3rd sess., 1915, p. 5.

[3]Kriedberg and Henry, p. 232.

[4]Office of the Chief of Field Artillery, Annual Report of the Chief of Field Artillery-1919 (Washington: War Department, 1919), p. 1. Hereafter cited as Annual Report-1919.

[5]Ibid., p. 5053.

[6]Ibid., p. 5233.

[7]Office of the Chief of Artillery, American Expeditionary Force, Report of a Board of Officers convened by the following order, Special Order 335, para. 32, December 9. 1918, p. 1. Hereafter cited as Hero Board.

[8]Ibid., pp. 32-33.

[9]Ibid., p. 34.

[10]Ibid., 1st Endorsement, Major General Hinds.

[11]Ibid., 1st Endorsement.

[12]Hero Board, p. 10.

[13]Ibid., 1st Endorsement.

[14]Ibid.

[15]Hero Board, p. 28.

[16]Ibid., 1st Endorsement.

[17]Office of the Chief of Artillery, 3rd Army, American

Expeditionary Force, Report of the Motorization Board. (Note. This document was a carbon copy of the original report. The condition of the document and the loss of several pages prevented the author from acquiring the authority for the board or the date of the special order).

[18]Office of the Chief of Artillery, American Expeditionary Force, Report of a Board of Officers convened pursuant to the following order, Special Order 289-0, December 11, 1918, p. 4. Hereafter cited as Caliber Board.

[19]Ibid., p. 10.

[20]Ibid.

[21]Ibid., p. 23.

[22]Ibid., p. 24.

[23]Ibid.

[24]Ibid., p. 25.

[25]Ibid., p. 26.

[26]Ibid., p. 41.

[27]Ibid., p. 54.

[28]Weapons meeting Caliber Board specifications were eventually designed in the late 1950s.

[29]U.S. Congress, House, Select Committee on Expenditures in the War Department, Hearings before subcommittee number 5, Ordnance, of the Select Committee on Expenditures in the War Department, 65th Cong., 3rd sess., 1919, pp. 10-10, 434, 435.

[30]Ibid., pp. 423-425.

[31]Ibid., p. 433.

CHAPTER III

FIELD ARTILLERY 1930-1939
MEN AND MATERIAL

For the Field Artillery and the Army in general, the interwar period began much like any other post-war period. The size of the branch and the funds for its maintenance and training were reduced by Congress. In the decade of the 20s, the Field Artillery was fortunate to have abundant equipment resources as a result of war surplus. Appropriations for artillery material could then be directed toward research rather than maintenance or replacement. With the arrival of the 30s, the stockpile of war material had almost been depleted. If funds for research and development were maintained at a constant level, the annual appropriations had to be increased to procure replacement materiel. The need for increased funds unfortunately occurred during the depression. The Field Artillery, then, became subject to three powerful forces: the need to replace outdated and worn-out equipment; the depression and the austerity it brought; and the impact of the developments that were made during the decade.

Manpower

The elements of manpower levels will be considered first.

A basic understanding of the Army's organization and its mission are necessary for an appreciation of the effects of the depression on the Field Artillery. The Army of the United States, during the inter-war period, was organized under the National Defense Act of 1920. The land forces of the country were separated into three categories; the Regular Army, the National Guard, and the Organized Reserves. The act divided the country into nine corps areas and three overseas commands (Panama, Hawaii, and the Philippines) for command and administrative purposes. To support the national army in times of mobilization and train the civilian components (Guard and Reserves), a Regular Army division was assigned to each corps area.[1] The size of the Regular Army and its dispersal facilitated the training of the reserves. The Army was therefore structured to mobilize a national army much on the same scale of World War I. The main problem was that it was in contradiction to the mission of the service. Reflecting the isolationist attitude of the American people, the primary mission of the Army was the defense of the nation. To accomplish this, the Army should have been of moderate size, mobile, and concentrated in large units to facilitate deployment. Had a threat to the continent materialized, this type of Army could have been efficiently used. Consequently the Army was unable to support national policy because of its small size and dispersion over the country.

This dichotomy was further complicated when Black

Tuesday, 1929, plunged the nation into a depression. The administrations of Herbert Hoover and Franklin Roosevelt reacted to the depression by an almost fanatic desire to economize in government. Since there was no threatening conflict to justify its existence, the Army was subject to intense scrutiny in financial matters. The agency most critical of the Army's financial needs was the Bureau of the Budget. Organized under the provisions of the Budget and Accounting Act of 1921, the Bureau became the major coordinating agency within the executive branch. The influence of this agency increased significantly during the depression. For the Army, conflict with the Budget Office arose during the 30s when the Budget made arbitrary reductions in appropriations for specific items without consulting the War Department.[2] For example, the Air Corps had signed several contracts for equipment as soon as Congress had approved the War Department appropriations in 1930. The Bureau of the Budget, in an attempt at economy, withheld the funds for the Air Corps equipment. This required the War Department to cut other activities to secure the $36 million needed to meet the Air Corps' contract obligations.[3]

The first place appropriations reductions were felt was manpower. In 1933, President Roosevelt informed the Secretary of War that he was contemplating putting 3,000 to 4,000 officers on indefinite furlough. After much effort by Chief of Staff General Douglas MacArthur, the planned officer reductions were discarded.[4] A reduction in the

already skeleton force would even prevent the Army from training any reserve components. It would then be unable to act in any capacity to fulfill national policy. Reflecting this thought, the dominant view of the General Staff was that men and not machines were the final arbiters of war. Consequently, they sought to maintain the officer and enlisted strengths at as high a level as possible. In doing this, they readily acknowledged their willingness to accept drastic reductions in funds for equipment and training.[5] Experience had convinced them that equipment became obsolete, and replacement was a recurring financial strain. The majority of funds allocated to the Ordnance Department was for the upkeep of existing stocks. New equipment was developed only to the point of having a weapons or transport system which could be massed produced upon mobilization.

The Field Artillery, as an arm of the Army, was spread throughout the nine corps areas in the continental United States and the three overseas commands. The manpower levels of the branch did not reflect its capacity to support a field force with artillery fires. Table II reflects the manpower levels of the arm, both Regular Army and National Guard. This can be compared with the total strengths for the Regular Army. The average officer strength of the Regular Army Field Artillery for the period 1931-1939 was 1,583 men. Only a fractional part of this number was on duty with troop units. In the decade of the 30s,

TABLE II

MANPOWER LEVELS 1931-1939[6]

YEAR	REGULAR ARMY		FIELD ARTILLERY			
			RA		NG	
	OFF	EM	OFF	EM	OFF	EM
1931	12,322	125,467	1,515	14,815	2,610	32,639
1932	12,314	119,913	1,529	13,659	1,899	32,789
1933	12,301	121,788	1,573	14,258	2,727	32,716
1934	12,283	123,823	1,583	14,463	2,756	32,504
1935	12,043	125,098	1,569	14,924	2,768	32,647
1936	12,125	153,212	1,588	19,846	2,829	34,244
1937	12,321	164,993	1,599	21,883	3,018	35,937
1938	12,522	170,151	1,627	21,996	3,141	37,396
1939	13,039	174,079	1,662	22,638	3,195	38,133

approximately 50 per cent to 60 per cent of the officers were assigned to troop units. The remainder were on duty with various staffs, assigned to service schools as either instructors or students, or supporting the civilian components like the National Guard and the Reserve Officer Training Corps. If 60 per cent of the average strength of the officers were on duty with troops, this would be enough to support the manpower requirements for three division artillery brigades and one corps artillery brigade. During this same period, the average strength of enlisted men was 17,609. Like the officer corps, not all of the enlisted men were in troop units. Even if the average enlisted strength for the decade was considered to be in artillery

units, there would not have been enough to fill even the three division artillery brigades and corps brigade mentioned above.

The lack of funds for pay was not the only factor affecting the skeleton artillery force. During the inter-war period, a new part of the Army, the Air Corps, grew in importance, prestige, and strength. Due to the efforts of Brigadier General Billy Mitchell and influenced by civilian aviation accomplishments such as Lindbergh's trans-Atlantic flight, the Air Corps gained the public's interest and therefore found Congressional support. As a result of several Congressional inquiries during the late 20s and 30s, the government allocated increasing funds for aircraft and equipment. The real problem arose when it came to providing personnel to use the equipment. Manpower levels, as restricted by appropriations, were applied to the Army in general. Increases in Air Corps personnel therefore came from shifting personnel from other branches. From 1926 to 1930, approximately 1,000 artillerymen were transferred to the Air Corps. During the first four years of the thirties, 60 officers and 547 enlisted men were reassigned to aviation duties.[7] The trend continued throughout the decade as active units were dissolved to provide aviators and ground support personnel.

The last and most significant factor which affected the men of the Field Artillery and the Army was President Roosevelt's New Deal. In March 1933, acting upon a request

from the White House, Congress authorized the Civilian Conservation Corps. It provided for the enlistment of young people for the purpose of conservation in the public domain. Eventually, Roosevelt's "tree army" would contain 2.5 million youths.[8] With a group of this size, the Army was the only federal organization which possessed the administrative and logistic structure to support it. Initially, the Army was only responsible for the first four weeks of the program. It required about 4,900 officers to administer the initial processing for the CCC.[9] To furnish these men, the Army was required to close several branch and Army-level schools. The Field Artillery School at Fort Sill was one of those which closed because 60 per cent of the faculty were assigned to CCC duty. The Army handled the preliminary organization of the CCC so well, that Roosevelt decided to continue Army control of the program.

As the CCC began its work, the requirement for officers was reduced somewhat to 3500 officers. The majority of these men were from the combat arms. The organization of the basic CCC company called for four officers, three sergeants and one enlisted man. Of this group of officers and men, the Regular Army provided all except three Reserve officers.[10] As a combat arm, the Field Artillery was called upon to furnish a portion of the manpower requirements. In addition to providing officers and enlisted men for CCC companies and district headquarters, the Field Artillery organized, staffed, and maintained a reception center for

CCC inductees at Fort Sill. Between April and June 1933, 7,300 young men were processed through this center.[11] In addition to this, the Commandant of the Field Artillery School was in charge of 41 CCC companies in Oklahoma, Texas, Colorado, and Wyoming. The drain of officer and enlisted personnel for the CCC and the continuing scarcity of funds forced changes in the branch.

In 1933, as a result of low manpower levels, the Field Artillery was required to reorganize some of its units. Within each battalion, one battery of the three firing batteries was deactivated. This further reduced the effectiveness of the support of the infantry and cavalry. The battalion could not effectively train with one battery missing. Battalion commanders and staffs could not gain the necessary experience in controlling and employing that type of unit. When limited appropriations virtually eliminated practice ammunition, the tactical efficiency of the units deteriorated as training ceased.[12] The system of training schools, founded as a result of post-war recommendations, also suffered in the financial squeeze. The Field Artillery School at Fort Sill was forced to borrow an automobile from a local car dealer in order to conduct motor maintenance classes.[13]

One of the most unusual attempts at frugality had to do with the consolidation of various branches of the Army in an attempt to eliminate or reduce overhead. Consolidation in some respects had the support of military men; in other

respects it was viewed with contempt. The Hero Board had addressed the topic of the consolidation of the Coast Artillery and the Field Artillery. Their recommendation had been to leave the branches separate. In the early 30s, the subject was again raised in the interest of economy. Several high ranking officers favored consolidation in the belief that fixed harbor installations and fortifications were outdated.[14] They felt that with the viability of a Navy, the protection of ports would not be necessary. The Field Artillery opposed consolidation on the grounds that harbor defense was still necessary. The Navy should be used for offensive operations, in their view, and not confined to coastal defense.[15] In response to a request from Congress, the Army made a study of the feasibility of combining the two branches. The study concluded that the Coast Artillery was purely defensive and the Field Artillery purely offensive in nature. A consolidation of the two would be detrimental to both.[16]

There were Congressional proddings for consolidation that defied reason. In 1930, during hearings on the War Department appropriations, Representative Ross Collins (D.-Miss.) advocated the combining of the Field Artillery and the Cavalry. His reasoning was; both have some horses and some trucks, and both are organized to kill the enemy in combat. The Chief of Field Artillery, General Harry Bishop explained that the main Cavalry weapons were the sabre, pistol and rifle. The primary weapon of the Field Artillery

was the cannon. Rep. Collins considered this to be a minor detail of difference. He maintained that the Army "ought to have one general over both services, and then let them do the things that they are doing now, because they are the same."[17] In 1931, Collins raised the issue again, this time with the Chief of Cavalry, General Guy Henry. Collins, now the chairman of the subcommittee responsible for Army appropriations, stated, "It has been suggested by several that Cavalry ought to be made a part of the Field Artillery because of the similiarity of work..."[18] Henry replied that he doubted that any military man had recommended the amalgamation of the two. He went on to say that it would be better for the Cavalry to merge with the Infantry than the artillery.[19]

In the later half of the decade, Congress was made aware of the critical shortage of manpower. General MacArthur, in his last testimony as Chief of Staff, convinced the Congress to appropriate enough money to raise the strength of the Army to 165,000 in 1936.[20] General MacArthur's testimony and congressional attempts to enlarge the Army were always met with resistance from both the White House and the Bureau of the Budget. Finally, the resurgence of German militarism and its possible extension to the Western Hemisphere required the President to take serious steps to strengthen the Army.[21] As the depression reduced the strength of the Army to Lilliputian dimensions, the financial frugality of the times rendered the weapons of this Army

ineffective in a modern war.

Materiel

The depression affected the materiel of the Army and the Field Artillery more than it did manpower. The controlling forces in the War Department considered equipment to be a secondary factor in any armed conflict. They were aware that time and advances in technology would neutralize the effectiveness of materiel faster than use could wear it out. During the 30s, the approach to equipment problems changed from one of "researching to perfection" to "purchasing the best available". For the decade, considered as a whole, the money for the maintenance of existing stocks, research, and procurement simply was not there.

The quantity of artillery weapons, as illustrated in Table I, far exceeded the requirements of the existing force. The one and a half million men, envisioned by the wartime leaders as an appropriate peacetime force, were reduced to a tenth of that number. Material which was surplus to the existing needs of the field army was placed in storage or reduced to basic components for use as spare parts. During the 20s, the Army had little need of funds for replacement or maintenance.[22] When the war surplus began to run out, the appropriations requests from the Army increased. This caused repeated arguments in Congress, as the politicians could not understand increasing costs when the level of activity remained the same. Finally, in using war surplus

materiel, the Army was replacing worn out material with equipment of identical characteristics and capabilities. Developments in metals, fuels, or ballistics were not incorporated in the newly issued equipment. As a result of the limitation of funds, a decision had to be made on whether to conduct research on an ideal system, such as those recommended by the Caliber Board, or buy one slightly better than present stocks. For the first half of the 30s the emphasis was on research and development.

The Ten-Year Plan, announced in 1925, was an attempt to give direction to the research and development process.[23] With reference to artillery, it envisioned the development and procurement of the equipment listed in Table III.

TABLE III

ARTILLERY MATERIAL IN THE TEN-YEAR PLAN

Guns	Quantity	Units
75mm pack howitzer	48	2 regiments
75mm gun	24	1 regiment
105mm howitzer	72	3 regiments
4.7" gun	24	1 regiment
155mm gun	16	2 battalions
8" howitzer	16	2 battalions

The major problem with the Ten-Year Plan, and research and development in general, was that it sought perfection in the equipment.[24] The desire to eliminate even insignificant

deficiencies protracted the length of development. The normal progression from drawing board to standardization could easily take six to ten years. The Ordnance Department tested the equipment first, normally at one of the various proving grounds, such as Aberdeen. Then the equipment underwent testing at the respective branch board, such as the Field Artillery Board at Fort Bragg, North Carolina. Finally the equipment was placed in the hands of the units for extended service tests. Due to the lengthy process, changes in technology or concepts could render the equipment sub-standard before it was through the evaluation process.

A good example of this drawback was the development of the 105mm howitzer. The need for the cannon had been stated by the Caliber Board. During the 20s, a gun and carriage had been designed which embodied many of the Board's recommendations. It was too heavy, however, for animal draft, which was the primary means of transport for light artillery. A weapon, light enough for horses to pull, had limited traverse and elevation characteristics. Finally, in 1930, a carriage was designed which had good firing characteristics and could be pulled by horses. By this time, developments in vehicles had shown that motor transport was the trend of the future.[25] The new carriage was not designed for high speed towing, a necessity for truck drawn artillery. The budgetary strain on appropriations caused the cancellation of new types of carriages on several occasions which

further delayed the development of the weapon. A weapon meeting most of the Caliber Board specifications and transportable by truck was finally developed and adopted in 1940, 21 years after its recommendation.[26]

The limitations imposed by a frugal government even affected the direction that research and development would take. In the first years of the 1930s it was realized by the General Staff that the cost of developing a new weapon was only a fractional part of the total cost for the system. In addition to re-arming existing units, repair parts must be purchased, a war reserve of guns must be established, and most importantly ammunition for training and war reserve must be procured. When viewed in the light of limited funds, a new weapon was not practical. In the Annual Report of the Chief of Field Artillery-1934, Major General Upton Birnie stated

> ...while procurement of modern guns in quantity in peace time, or shortly after mobilization is considered out of the question, the modernization of the large numbers of French 75mm guns by providing new carriages for the tubes and recuperators appears to be a manufacturing problem that could fairly well keep pace with mobilization.[27]

Although research on new systems did continue, the vast majority of money spent on development was to modernize existing stocks.

Most of the light artillery in the Army consisted of the French 75mm gun (Model 1897). There were lesser stocks of the British gun (Model 1917) and the American gun (a converted 3" gun, Model 1916). Consequently the modernization

of existing materiel involved the modification of three completely different weapons. All of the guns had wooden wheels and wartime fire control devices. The Ordnance Committee addressed the topic of the modernization of the 75mm gun over 400 times between 1920 and 1939. There were over 53 different designs for completely new carriages. The idea of modifying existing carriages was expressed in the testing of 20 different modified carriages.[28] The 75mm gun continued to absorb research funds until 1940 when it was replaced by the 105mm howitzer. The incorporation of Caliber Board recommendations invariably exceeded the weight limitations of horse-drawn artillery, and there were insufficient numbers of vehicles to justify the motorization of the branch.

The dominating force of the Caliber Board impeded the development of some new material, and the modification of certain wartime equipment. In describing the specifications of light and medium guns, the board included characteristics which would enable the gun to engage aircraft. The Field Artillery and the Army were interested in a dual-purpose weapon because it would eliminate the need for specially designed anti-aircraft weapons. Once again, money was a determining factor. The Ordnance Department and the Field Artillery devoted almost five years and much money attempting to perfect the gun. In 1934, a weapon was finally ready for test by the Field Artillery and the Coast Artillery. It was found that although the carriage was rugged and easy to maintain, it was not able to serve effectively in a dual

capacity. The Field Artillery Board concluded that anti-aircraft artillery required unique abilities not necessary in the Field Artillery, and that further attempts at a dual-purpose gun be abandoned.[29]

The same type of limitations affected the medium and heavy artillery. The Caliber Board had recommended a 105 howitzer to replace the French 155mm howitzer at division. The Hero Board had recommended a 120mm howitzer for the same purpose. The adoption of either of these weapons would have required large appropriations for the guns and ammunition. As with the light guns, the Field Artillery decided to modify and modernize existing material where possible. With the exception of the 8" howitzer, all of the medium and heavy artillery was of French design. Due to weight, virtually all of the guns were towed by tractors, or later trucks. The necessity for the carriage to be able to be towed at moderate speeds was obvious. With the 155mm howitzer, the problem was solved with the replacement of wooden wheels with bus tires and wheels with bearings which could withstand the strain. The addition of air-brakes, completed the alteration of the weapon with respect to transport.[30] There were no significant attempts to change the carriage for better firing capabilities. The 155mm gun and the 240mm howitzer were successfully modified to permit high-speed towing. As late as 1938, the Ordnance Department was still conducting experiments on suitable wheel bearings, brakes and tires for the 155mm gun. The final tests of a new

replacement weapon, and its eventual adoption in 1938, eliminated the need for further expenditure on the old systems.

The most successful areas of development in the first half of the 30s were in sub-caliber weapons and ammunition. Reacting to continued reductions in training munitions, the Field Artillery designed a miniature gun which could be used to train personnel. Initially this device used a .22 caliber blank to fire a one inch steel ball. The sights for the gun were the same ones found on the main cannons.[31] Later in the decade, this device was replaced by a 37mm gun which could be mounted on top of the regular gun carriage. Both devices enabled the branch to train personnel at a greatly reduced cost in ammunition.

Ammunition stocks from the World War were sufficient to last the Army for the most part of the 1920s. Research was then directed toward designing new shells to replace war stocks which could then be rotated to training purposes. The improvement in the aerodynamic qualities of the shells resulted in increased range. The greatest improvement in munitions was in the area of fuzes. The ammunition used in the World War could be detonated prior to its impact on target. Such fuzes normally exploded while they were still inside the gun. The resulting casualities prompted the Caliber Board to call for a safer fuze. The Ordnance Department in the mid-thirties designed a fuze which would not detonate the round until it had left the tube. This

characteristic was eventually applied to all artillery munitions. By the end of the decade, fuzes had been developed which could be used on any type of projectile. Having the same weight, contour and ballistic identities, they expanded the capabilities of the munitions that were used. Time fuzes were developed which detonated after a pre-determined time interval had elapsed. Point detonating and super-quick fuzes exploded the shell upon contact with the target. Delay fuzes functioned a short time (tenths of a second) after impact, thus permitting penetration of the target's outer covering before the projectile exploded.[32]

It was only by the end of the 30s that research and development produced those weapons which would be used during the Second World War. By then, the funds for standardization and procurement were available. Because the equipment was ordered in large amounts, industry was willing to accept contracts. The weapons which dominated the Second World War might have been perfected earlier, had not the War Department shifted its emphasis from research to procurement in 1935-1936. Table IV shows the annual appropriations for the Army and the portion devoted to research and development on all Army materiel. Although the amounts do not vary significantly, the percentage with respect to the overall Ordnance budget does. The figures represent the total expenditures on research and development. Field Artillery equipment, either in development or testing, would obviously comprise a small portion of the total

Ordnance effort.

TABLE IV

ARMY APPROPRIATIONS[33]

Fiscal Year	War Department	Ordnance	Research and Development	% R&D
1930	$331,748,444	$ 11,858,981	$2,711,500	22.9
1931	347,379,179	12,422,466	1,137,148	9.2
1932	335,505,965	11,121,567	1,311,352	11.8
1933	299,993,920	11,588,737	1,291,764	11.1
1934	277,126,281	7,048,455	1,255,837	17.8
1935	263,640,736	11,049,829	1,266,500	11.5
1936	312,235,811	17,110,301	1,260,000	7.4
1937	394,047,936	18,376,606	1,350.000	7.3
1938	415,508,010	24,949,075	1,360,000	5.5
1939	462,252,553	112,226,412	1,360,000	1.2

The shift in policy from research to procurement, came as a result of the recognition that even with mobilization, improved weapons would be months in arriving in the hands of the troops. This meant that even though the size of the Army would grow, it would remain a second-class force due to the lack of modern weapons. The move to reduce the per cent of money allocated to research was made by Chief of Staff Malin Craig.[34] He wanted to equip the Army with the most modern equipment currently available and concentrate research and development on certain high priority items. This high priority equipment, such as improved anti-aircraft fire direction, anti-tank weapons,and aircraft detection material, was defensive in nature.[35] Even with

this decision for procurement, there is little doubt that the re-arming of the Army would have been a long and drawn out process had not events in Europe in 1938 forced Roosevelt to consider the effectiveness of his military forces.

The date of serious American re-armament can be set at November 14, 1938. That night, William Bullitt, the American ambassador to France, informed Roosevelt that the threat of German air forces had been the deciding factor in forcing the British and French to accept the Munich accords. In a meeting with his top civilian and military advisers, Roosevelt stated his insistence on procuring 10,000 airplanes. He made no mention, however, of acquiring the pilots or ground support facilities for them. General George C. Marshall felt that the President was desirous of supplying the planes to the British and French in an attempt to forestall the need for American intervention.[36] After weeks of discussion, Roosevelt finally approved a more balanced approach to re-armament. The appropriations for the following year would also contain more money for the modernization of artillery weapons (specifically the 75mm gun).

In the flurry of activity which characterized the last two years of the decade, the Field Artillery committed itself to new weapons, rather than the modernization of World War vintage guns. In September, 1938, the Field Artillery School had studied the comparative merits of the 75mm gun and the 105mm howitzer. The final report stated that the 105mm howitzer was superior in firing characteristics and

had more power, due to the heavier weight of the shell and the angle of its impact. A year later, the School recommended that testing cease on the new howitzer, that it be adopted as standard,and procured.[37] During 1939, the War Department circulated a questionaire to artillery commanders which asked if the specifications and recommendations of the Caliber Board were still viable. Of the responses from Fort Sill, the majority felt that the 75mm was no longer acceptable as a direct support weapon in the division. The 105mm howitzer was the most often mentioned replacement. The responses were unanimous that the requirement for 360 traverse was unnecessary.[38] Because of this demand for a larger caliber, the 105mm howitzer was adopted as standard in 1940. Although there was still some resistance to the acceptance of new equipment, primarily on economic grounds, the Field Artillery possessed modern weapons when the United States entered the Second World War in 1941.

Motorization

There was one piece of equipment whose development during the thirties was not the responsibility of the Army. Its gradual appearance into the Field Artillery caused much controversy and eventually necessitated a change in weapons, fire direction, and tactics. Because of its unique importance, we will consider it, the motor vehicle, separately.

The advocates of animal power and the champions of vehicular movement had been waging a running battle since

Pershing had used trucks to supply his force in Mexico in 1916. Although all the major Field Artillery commanders of the World War favored at least partial motorization, the branch would not be completely converted to motor vehicles until the first year of the Second World War. The emotional attachment to the horse, the budgetary limitations imposed during the depression, and the self-restrictive Army regulations conspired to retard the replacement of the grass-burner by the gas-burner.

Several factors caused the resistance to motorized transport. During the late 20s and early 30s, the dependability of the motor vehicle was in serious question. Vehicles of that time, especially trucks, had difficulty negotiating rough terrain, or any terrain in adverse weather. The caterpillars and tractors that had proven traction under difficult conditions were too loud to be used near enemy listening posts, and too slow to justify the replacement of horses. Tractors and caterpillars were the primary transport for medium and heavy artillery due to the restrictive weights of the guns. These weapons were employed well to the rear of the front lines so noise and speed were not important considerations. Congress was definitely unwilling to allocate funds for expensive trucks and tractors, when they were told that these motor vehicles were not sufficiently developed to justify the replacement of animal-draft.[39] Animals, suitable for artillery purposes, were also in abundant supply. In 1929, Lieutenant-Colonel William Bryden,

the Executive Officer of the Office of the Chief of Field Artillery, told Congress that there were 3.5 million horses suitable for draft purposes in the United States. This was after allowances had been made for civilian use. This figure represented nine times the Field Artillery requirement for animals.[40] The arguments for the horse were best summed up in a poem printed in the Field Artillery Journal in 1935. The author chose to remain anonymous.

Sez the Stable Sergeant to the Motor Sergeant

O horse you've kept 'em rolling along;
When motors stall, you still go strong.
No horn to honk, nor valves to grind;
Nor snow, nor mud to mind;
No tires to pump, no grease nor gas;
When hay is short, you forage grass;
When radiators freeze, alas!
You need no chains in icy blast.
No speed cops chugging in your rear.
Yelling summons in your ear.
Your inner tubes are all ok,
And thank the Lord they stay that way:
Your spark plugs never miss and fuss
Your crank case never makes us cuss.
Your frame is good for many a mile;
Your body never changes style.
Your wants are few and easily met;
You've something on the motor yet.[41]

Even advocates of motorization could not reject the emotional and sometimes romantic element in the horse artillery. Major General Harry Bishop, one of the driving forces behind motorization, said in his book, Field Artillery, The King of Battle

> When the gas tank of a motor vehicle goes dry, the motor, though perfect in all other respects is hopelessly dead. There is not one inch of travel left in it. But, on the contrary, as long as the spark

> of life lingers in a horse, though his carcass be a skeleton, though his hoofs be broken, though he be cruelly wounded, there is always one more mile, one more rod, even a few more feet of travel can be coaxed out of him- one last remaining effort that may help to snatch victory from defeat.[42]

On the side of the motor vehicle was the vulnerability of the horse. A high explosive round could destroy both a vehicle and most of a six-horse team. A shrapnel round could likewise destroy the effectiveness of a team but have comparatively little effect on the vehicle. The same would be true if small arms fire, such as machine guns, were considered.[43] A second and more important advantage of the motor vehicle was its ability to pull heavy loads. With the advent of improved designs, trucks could more successfully cross terrain with an artillery piece in tow. The continuing development of trucks also signalled the replacement of the slow and loud tractors and caterpillars. These last two assets of motor transport were significant with respect to wartime experiences and the austerity of the depression.

A fact which influenced the commanders of the Field Artillery during the war, was the fatigue factor which had to be considered in operations' timetables. The Caliber Board had explained that the requirement for continuous mobility could not be met with animal transport. Fatigue also affected the men of horse units more than those assigned to motorized elements. A day spent in firing and moving the guns was not over until the animals had been cared for. In motor units, a few minutes to service the vehicle was

the only requirement. Marches were less exhausting for motorized units again because the minor maintenance on the vehicles at the end of the march did not adversely affect the men.

When the depression required the restriction of an already inadequate peacetime appropriations, anything that could save money was valuable. In the Field Artillery, it was a proven fact that motorized units were less expensive than those using horses.[44] The Ordnance Department had recognized the economy of motors as early as 1919. The Handbook of Ordnance Data, printed in that year, compared the logistical requirements of motors and horses. One regiment of horse artillery would consume 14.7 tons of forage on a fifty mile march. A motor regiment would require only 4 tons of fuel, oil, and grease to travel the same distance. Animals required feed and water even if they were not being used, whereas the vehicle, when stationary, had virtually no needs. In transportation, one tractor that could pull a 6" gun, obviously required less space than the corresponding 16 draft horses. The Ordnance Department along with some artillery officers also considered the motor vehicle to be less susceptible to the ravages and injuries of war.[45]

During the decade of the 1920s, motorized artillery units averaged about 34 per cent of the total active organizations. Horse units averaged 57 per cent, with pack artillery making up the remainder. These percentages would remain relatively constant until 1933. In 1930 Major

General Harry Bishop became the Chief of Field Artillery. Although an advocate of motors, he was unable to do much in the first two years he held the position. In 1932, the Field Artillery was almost 70 per cent short of its authorized vehicles, which rendered the majority of the motorized units completely ineffective. Of the 6,348 vehicles that the branch had on hand at the beginning of 1933, 4,432 were made prior to or during the World War.[46] The cost of maintaining these old vehicles increased from year to year, as parts became more scarce.

In June, 1933, Congress passed the National Industrial Recovery Act. Of particular benefit to the Army, was the creation of the Public Works Administration which could dispense money for certain items. Although primarily directed at construction projects, Public Works Funds were used to purchase motor vehicles for the service. By 1935, the Army had received a little more than $9 million for the mottorization of the National Guard and some Regular Army units.[47] With these funds, the Field Artillery was able to motorize all National Guard artillery and approximately 60 per cent of the Regular Army batteries. Throughout the thirties, the Regular Army took steps which benefited either the manpower or equipment of the Guard. A possible explanation was that the War Department desired to retain the support of the Guard due to its significant political strength in Congress. Although it appeared that the Field Artillery had embraced the concept of motorization, there

was still a great deal of conservatism. In the Annual Report of the Chief of Field Artillery-1934, Major General Upton Birnie stated that he was convinced that the branch had progressed far enough in motorization. He wanted to await further service tests on the vehicles before totally converting to vehicular transport.[48] Among some artillery commanders there was always the belief that the United States might become involved in a conflict where the lack of roads would eliminate vehicles and require animal-draft.

Even with this increased emphasis on vehicles, the motorization program of the Field Artillery and the Army had a major obstacle in the procurement system of the Army. In purchasing vehicles, the Army was its own worst enemy. Army regulations required vehicles to be purchased from the lowest bidder. It also prohibited the service from outlining certain specifications in new equipment. Service criteria was restricted to specifications on the vehicle's carrying capacity, weight, and speed. These purchasing restrictions were attempts to guard against favoritism and avoid the necessity for special industrial tooling for specialized vehicles.[49] The branches who owned and operated vehicles were extremely aware of the advantages of buying vehicles which could be readily obtained on the open market. General Bishop stated that he would rather have a reasonably effective vehicle which was commercially available than an ideal vehicle which was difficult to obtain especially during mobilization.[50] Commercial equipment and the

parts necessary to repair them could literally be obtained on the street. An additional asset of commercial transport was that new troops, by the 1930s, were familiar with the trucks and tractors and therefore the training of drivers took very little time. Commercial motors and the system of purchasing them did pose a problem to those branches responsible for supply and repair.

Economics, and the congressional requirement to buy equipment a year at a time joined to make the logistical support of these vehicles a nightmare. From one year to the next, the lowest bidder was seldom the same company. Consequently, the yearly purchases of motor vehicles resulted in the accumulation of many different makes and models of trucks, cars, and tractors. A study of the Hawaiian Department in 1939 found that the 2,000 vehicles in the command were composed of 32 different makes and models. There were 17 interchangeable parts in 95 per cent of the total number. These parts were things such as points, plugs, starters, and carburetors. Approximately 5 per cent contained 15 components that were so unique that they were not kept in stock and had to be purchased on the local civilian market.[51] In the early thirties, the Quartermaster Corps (the branch responsible for the purchasing of vehicles) attempted to solve the problem of so many different vehicles. It tried to standardize vehicles by buying only major component parts, such as chassis, motors, and transmissions, and then assemblying the total vehicle at the Quartermaster

Depot at Fort Holabird, Maryland. In 1934, automotive manufacturers complained to the Comptroller General that this activity constituted unfair competition. This office not only ordered the Quartermaster Corps to cease assembling their own trucks, but forbade the branch from conducting research in motor transportation. Subsequent appropriations prohibited the use of funds to conduct research and development in motor transport.[52] By 1935, there were over 360 different makes and models of vehicles at the Holabird Depot. These vehicles required the storage of approximately one million spare parts. Even as late as 1939, the Army was forced to purchase equipment which was produced by two or more competing companies.

The problem of standardization compounded an already difficult problem of maintaining the equipment. Although providing for motor transport was cheaper than providing for animals, the former did require a more elaborate support system. The system of maintenance support which dominated the 30s had slowly evolved during the post-war years. After the World War, it was decided that motor transport would be assigned to every branch rather than have it consolidated in a Motor Transport Corps. With the motors, went the responsibility for maintaining them. By the mid-thirties, there was an established system of service and repair. The operator of the vehicle and his sergeant comprised the first echelon of maintenance. The driver was responsible for insuring that the vehicle was properly serviced and inspected

it for possible malfunction. Should the vehicle require minor repair work, it went to the regimental or battalion maintenance section, which was the second echelon. They possessed more tools than the driver and were trained mechanics. The third echelon furnished major repair work that was beyond the capabilities of the regimental mechanics. This was normally the Ordnance company which was assigned to Corps artillery. Major reconstruction and salvage work was done at the fourth echelon, which was normally a fixed Ordnance depot in the rear area. Maintenance was difficult during the thirties because of the lack of funds and trained personnel. This further restricted the progress of motorizing the Army and the Field Artillery.[53]

Conclusion

The post-war Army had comfortably existed on war surplus material for almost a decade. Research and development was not an overriding concern and probably could not have been funded in any event. The exhaustion of war supplies, the realization of the need for new material, and the depression occurred at the same time. The Roosevelt administration chose to attempt to resolve the domestic crisis by economizing in government. The political requirement to reduce spending forced the Army to make a choice of maintaining its manpower with a little research program or devoting funds to re-arm a miniature force. As personnel strength became the highest priority during the 30s, the

condition and effectiveness of the equipment continued to deteriorate. The personnel strength of the Field Artillery prevented its support of the maneuver arms in the fashion of the last war. The obsolete equipment of the branch rendered it ineffective in a future mobile war. Because of both men and equipment, the Field Artillery was unable to support the Army. The Army, due to the same factors was unable to support national policy in the decade of the 30s.

The only bright spot in the economic darkness of the depression was the funds for motorization. The conversion from animal draft to vehicular draft had been a continuous topic of debate between those desiring to retain a system with known limitations and assets and those maintaining that motors were superior and therefore necessary. The purchasing restrictions placed on the Army resulted in some motorization, but at the cost of efficiency in maintenance and logistics. Due to the hodgepodge of makes and models the logistics system for supporting the Army in actual combat might have broken down completely. Motorization, indeed every development which occurred during the thirties, would have a corresponding impact on the tactics of the artillery and the field force. Movement and the gradual development of better guns and ammunition would force the adjustment of the tactical organization and employment of the Field Artillery.

FOOTNOTES

[1]An Act to amend an Act entitled "An Act for making further and more effectual provision for the national defense and for other purposes," Statutes at Large 41, p. 759 (1920). Also known as the National Defense Act.

[2]John Killigrew, "The Impact of the Great Depression on the Army" (Unpub. Ph.D. dissertation, Indiana University, 1960), p. 9.

[3]Robert Miller, "The United States Army During the 1930's" (Unpub. Ph.D. dissertation, Princeton University, 1973), p. 56.

[4]Elmer Harrelson, "Roosevelt and the United States Army: 1937-1940, A Study in Challenge: Response (Unpub. Ph.D. dissertation, University of New Mexico, 1971), p. 6.

[5]Killigrew, p. 189.

[6]War Department, Office of the Chief of Staff (Statistical Branch), Record Group 165, National Archives, Weekly Statistical Report Number 350, June 30, 1940, pp. B-4, B-24.

[7]Office of the Chief of Field Artillery, Annual Report of the Chief of Field Artillery 1930-1934, pp. 2-4. Hereafter cited as Annual Report.

[8]William E. Leuchtenburg, Franklin D. Roosevelt and the New Deal (New York: Harper & Row, 1963), pp. 57, 174.

[9]Killigrew, pp. 297-299.

[10]Ibid.

[11]Riley Sunderland, The History of the Field Artillery School, vol. 1, 1911-1942 (Fort Sill, Oklahoma: Field Artillery School, 1942), p. 122.

[12]Annual Report-1933, p. 10

[13]Sunderland, p. 184.

[14]Letters from 1st, 2nd and 8th Corps Commanders to Chief of Staff, as quoted in Killigrew, p. 25.

[15]Killigrew, p. 29

[16]U.S. Congress, House, Committee on Appropriations, Hearings before a subcommittee of the Committee on Appropriations on HR 11897, 72nd Cong, 1st sess, 1931, p. 531.

[17]U.S. Congress, House, Committee on Appropriations, Hearings before a subcommittee of the Committee on Appropriations on HR 15593, 71st Cong, 2nd sess, 1930, p. 648

[18]U.S. Congress, House, Committee on Appropriations, Hearings before a subcommittee of the Committee on Appropriations on HR 14199, 72nd Cong, 2nd sess, 1932, p. 384.

[19]Ibid., p. 385.

[20]U.S. Congress, House, Committee on Appropriations, Committee Report number 159 on the War Department Appropriations for fiscal year 1936, 74th Cong, 1st Sess, 1935, p. 5.

[21]Harrelson, p. 75.

[22]Killigrew, p. 17.

[23]Constance Green, Harry Thomson and Peter Roots, The Ordnance Department: Planning Munitions for War (Washington: Department of the Army, 1955), p. 45.

[24]Killigrew, p. 406.

[25]John P. Lucas, "The 105mm Howitzer," Field Artillery Journal, XXXI (Mar-Apr 1941), p. 66.

[26]Ibid., p. 69.

[27]Annual Report- 1934, p. 12.

[28]S.L. Conner, "The 75mm Gun," Army Ordnance XXX (May-June 1939), p. 347.

[29]Field Artillery Board, Report on the Tests of the Dual-Purpose Gun, Report Number OQ-48-A, July 1934, p. 12.

[30]Thomas Hayes, Elements of Ordnance (New York: John Wiley & Sons, Inc., 1938), p. 359.

[31]Annual Report-1933, p. 12.

[32]Green, pp. 173-175.

[33]Ibid., pp. 40, 206.

[34]Killigrew, p. 40.

[35]Kreidberg and Henry, p. 455.

[36]Mark Watson, Chief of Staff: Pre-War Plans and Preparations (Washington: Department of the Army, 1950), pp. 127-132.

[37]Sunderland, pp. 154-155.

[38]U.S. War Department, Restudy of the Caliber Board Report May 10, 1939. Of the twelve officers responding to a questionnaire from the War Department, ten advocated the 105mm howitzer, and all felt that 360 degrees of traverse was unnecessary.

[39]U.S. Congress, House, Committee on Appropriations, Hearings before a subcommittee of the Committee on Appropriations on HR 15712, 70th Cong., 2nd sess, 1928, p. 782.

[40]U.S. Congress, House, Committee on Appropriations, Hearings before a subcommittee of the Committee on Appropriations on HR 7955, 71st Cong., 2nd sess, 1929, p. 643.

[41]Author unknown, "Sez the Stable Sergeant to the Motor Sergeant," Field Artillery Journal XXV (Jan-Feb 1935), p. 46.

[42]Harry Bishop, Field Artillery: The King of Battle (New York: Houghton Mifflin Company, 1935), p. 67.

[43]Sunderland, p. 167.

[44]U.S. Congress, Hearings on HR 14199, p. 32.

[45]Office of the Chief of Ordnance, Handbook of Ordnance Data (Washington: Government Printing Office, 1919), pp. 357-359.

[46]Annual Report-1933, p. 16.

[47]Committee Report #159, p. 5

[48]Annual Report-1934, p. 13.

[49]Harry Thomson and Lida Mayo, The Ordnance Department: Procurement and Supply (Washington: Department of the Army, 1960), p. 268.

[50]Annual Report-1932, p. 19.

[51]Walter Thee, "Standardization and Simplification of U.S. Army Motor Vehicles," The Quartermaster Review XVIII (May-June 1938), p. 40.

[52]Thomson and Mayo, p. 269.

[53]James Johnson, "The Army System of Field Maintenance of Motor Vehicles," The Quartermaster Review XVIII (May-June 1938), pp. 7-9.

CHAPTER IV

FIELD ARTILLERY TACTICS

The Field Artillery of the 1930s had its strongest bond with the World War in the area of tactics. The war in Europe had been the branch's first exposure to the role of artillery in supporting a national army. Lessons of artillery employment from the war became the foundation of doctrine through the twenties and into the thirties. The artillery was resistant to adopt new tactics, such as the mechanized force, for two reasons. The new concepts had not been subjected to the test of battle. Their merits rested on a particular conception of the battlefield of the future. Secondly, the equipment of the artillery required extensive modification, such as high speed axles, in order to participate in any war which was unlike the World War. The equipment was designed for employment based on the 19th century concept of massed guns. The 30s were a time of transition for equipment and therefore tactics. Founded on the lessons of the World War, artillery tactics had to be modified to adapt to the slowly changing nature of a more mobile army.

Tactical Organization

The Field Artillery, as it was structured for war, was

classified according to the type of weapon used in the unit, the primary means of transport for that weapon, and the level of the field force which it was assigned to. Changes which occurred in armaments, transport, and the nature of the field force, therefore affected the tactical organization of the branch. Ever since the Field Artillery had become a separate branch in 1907, the weapons in its inventory had been classified into three categories. The number of categories and their basic descriptions remained relatively unchanged, but the weapons within the groups did change. The first class of weapons was the light artillery. During the war and throughout the 20s and 30s, the 75mm weapons comprised most of the cannons in this group. There were four different weapons of 75mm; the French 75mm gun Model 1897, the American Model 1916, the British Model 1917 gun, and the American 75mm howitzer Model M1. The medium artillery was comprised almost entirely of the French 155mm howitzer Model 1918. The heavy weapons were either the French 155mm gun Model 1918, the French 240mm howitzer Model 1918, or the Mark VII British 8" howitzer. In each category, there were other calibers but these were the weapons which were normally assigned to active units.[1]

The second manner of classifying artillery organizations was the transportation used to tow the weapons. The first class was the horse-drawn units. These units relied on the six-horse team to pull the light guns and the support wagons. The second type of unit was the horse-artillery.

The only difference between this unit and horse-drawn units was that the cannoneers who served the guns were mounted on horses in the horse-artillery. Armed with only light guns, they were considered to be the most mobile artillery organization. Truck-drawn organizations, armed with medium weapons, comprised the third group. As trucks developed and became more available, some light artillery units were converted from animals to motors. Tractor-drawn units comprised the fourth class and normally towed the heavy guns. The loud and slow tractors were also replaced as the design and capabilities of trucks improved. The fifth class, portee artillery, used trucks to carry their light guns as piggy-back loads. Once settled in a location, light tractors were used to move the guns into their final firing position. Attempts at converting medium and heavy artillery to portee transportation were abandoned because the weight of the guns often exceeded the hauling capacity of the vehicles. There were some attempts to design self-propelled artillery in the 20s and 30s. Most artillerymen were not receptive to motorized carriages due to the belief that if the motorized carriage failed, the gun was out of action. It was felt that towed weapons could always find some transport if the prime mover failed. The last category of artillery units were moved by mule pack. Light howitzers had been designed which could be disassembled and transported on pack mules. Pack artillery units never constituted more than 12 per cent of the active batteries, but their ability

to cover jungle and mountain terrain justified their continued existence through the 30s.[2]

The final classification of Field Artillery organizations was determined by the echelon of the field army which they were assigned to. The division was the lowest tactical field organization which had artillery units assigned to it. Below the division, artillery units supported infantry and cavalry units but were not under their permanent control. Division artillery was normally comprised of light and medium artillery. Corps was the next higher echelon, and possessed medium and heavy cannons. The highest tactical level which field artillery was assigned to was the field army. Artillery at this level was a mixture of heavy weapons, portee,and pack howitzers.[3]

Artillery Units

The basic Field Artillery organization was the Firing Battery, which was comparable to the infantry company. As the cannon was the foundation of the Field Artillery, the firing battery was the primary element in the organizational structure. The battery consisted of six sections, four of which had one weapon each. The 5th section was concerned with ammunition resupply, and the 6th section was the maintenance and supply element. The battery commander and all the personnel required to conduct observation and compute firing data were in the unofficial 7th section. In all, the battery totalled 4 officers, 148 enlisted

men and 138 horses, if it were a horse-drawn unit.[4] It was felt that "the limit has about been reached in the amount of material and personnel one man (the commander) can coordinate and the number of guns whose fire he can efficiently handle."[5]

Although the firing battery was the element which actually conducted the fire missions, the battalion was the echelon where the fires were planned and directed. It was considered the lowest level for tactical planning. The organization of the battalion varied depending on whether the unit was a light, medium, or heavy artillery unit. Light battalions contained three firing batteries, whereas, the medium and heavy units only had two gun batteries. Both types of battalions also contained headquarters batteries for command and combat trains for ammunition resupply. Light battalions normally had 25 officers, 680 enlisted men and 692 animals. The medium and heavy battalions had slightly more men and approximately 90 vehicles instead of animals.[6] As the number of batteries varied depending on the type of weapon, so did the number of battalions within a regiment.

The regiment was the major tactical element in the Field Artillery. If the regiment were comprised of light weapons, it contained two battalions. In a medium or heavy regiment, there would be three battalions. Both regiments had a total of 24 weapons because of the belief that this was the maximum number that a commander could control and

his supply system could maintain. Along with the battalions, the regiment had a headquarters battery which served the same purpose as its counterpart in the battalion. A service battery was responsible for the supply, maintenance, and ammunition resupply of the regiment. Attached to the service battery, but not under its direct control, was the regimental band. Other attachments within the unit were the medical and chaplin detachments at regimental headquarters. As the regiment was the primary tactical and organizational unit, the Field Artillery brigade at division and corps was simply a combination of regiments and support personnel.[7]

The Field Artillery brigade at the division level had the primary mission of destroying the enemy ground forces. It also had to have a limited capacity to attack hostile artillery weapons. These missions had been delineated by the Caliber Board. For these reasons, as recommended by the board, the division had two gun regiments for use against troops and a medium howitzer regiment for counter-battery work. At corps, counter-battery was the primary mission and the destruction of troops and fortifications was of secondary importance. Again, reflecting the Caliber Board thought, the gun-howitzer ratio at corps was two medium howitzer regiments and one heavy gun regiment. Both echelons had service, support, and headquarters units. Corps artillery also had a Coast Artillery regiment which was responsible for the air defense of the corps area, and

an attached Ordnance company for major repairs on vehicles and weapons. The Sound and Flash battalion, which was responsible for locating hostile artillery positions, was also assigned to corps artillery.[8]

Tactical Operations

A major reason for the continuity of tactical procedures and doctrines into the thirties, was the lack of significant changes in equipment during the twenties. The nature of the equipment dictated the possible courses of action available to the artillery commander. For example, tactical operations were dominated by the consideration of transportation. Because of the reliance on horses, and the nature of the early motor vehicles, the Field Artillery was dependent on road systems. This dependency can be seen clearly in the recommendations of the post-war boards. The Hero Board recommended the adoption of the 120mm howitzer because the weight of the 155mm shells required many trips by the early model trucks to sustain operations. A smaller howitzer and subsequent lighter shell would not require as many trips and would help relieve congestion on the roads. Included in the Caliber Board specifications of new artillery were weight limitations. The weight restrictions on light weapons was to ensure the capability of a six-horse team to move the cannon. Limitations on the medium and heavy weapons were intended to decrease the dependency on hard surface roads.

Because of the reliance on road networks, virtually all of the tactical doctrine on unit movement dealt with road marches. The interval between marching units and the reconnaissance of good routes were as important as what the unit did when it arrived. In fact, the selection of the position itself, was affected by transportation considerations. Although horse-drawn artillery did possess good off-the-road mobility, extremely difficult terrain would exhaust the draft animals quickly. If the need arose for the unit to move out quickly, the horses might not be equal to the task. Tractor-drawn artillery also had good cross-country abilities, but it had to be placed near roads because its ammunition resupply came by truck.[9] Wartime trucks could not move any distance off a hard surface. As a result of the continuation of animal transport and forced retention of old equipment during the 20s and early 30s, the ability of the Field Artillery to move did not change. This resulted in tactical operations conducted at a snail's pace.

As the mobility of the artillery had not changed in the early part of the 1930s, the conduct of artillery fires and the coordination of these fires with the maneuver arms remained much as they had been during the war. Since the days of the smooth-bore Civil War cannon, the artillery commander, who directed the fires of his unit, was always located near the guns. This was necessary in order for him to communicate instructions to his men. The advent of wire

communications did not drastically alter this practice. Because of this communications tie with the unit, firing computations were always predicated on the observer (who also computed firing data)being able to see the battery and the target. Consequently, the necessity of a good observation point influenced the selection of battery positions.[10] The range of the light artillery in the division was about 12,000 yards. The full advantage of this range could never be realized because the observer, located near the battery , could not accurately observe fires greater than 5,000 yards away. Mobility had affected communicaitons which, in turn, had affected fire direction and observation.[11]

This same relationship can be seen in the task of coordinating the artillery fires with the maneuver arms. From the World War to the early 30s, the Field Artillery battalion commander was primarily responsible for liaison between the artillery and the infantry. The tactics manuals of the 30s stressed the need for continuous contact between the artillery and infantry battalion commanders. Where possible, the artillery command post and the infantry command post were located next to each other.[12] Because of the limitations of mobility, the tactical employment of artillery fires continued to resemble the set-piece battle. Detailed plans would be made for the coming battle, which the commanders would observe and control from a chosen vantage point. In an offensive operation, wire communications

were extremely difficult to maintain, therefore, once the attack began, there was little communication with the attacking units, except runner. This meant that the artillery could not respond, in a timely manner, to unforseen circumstances. The existence of liason detachments with the maneuver units did not appreciably increase the flexibility of response.

The last area affected by the mobility-communications relationship was the ability of the battery to survive. For the artillery to remain effective they had to remain undetected. Enemy knowledge of friendly artillery positions would result in attack by hostile artillery or aircraft. Due to the lack of large numbers of automatic weapons, the primary anti-aircraft weapon, the American Field Artillery was extremely vulnerable to enemy aircraft.[13] The reliance on wire communications, forced the firing batteries of the battalion to remain relatively close together. The normal distance between batteries was about 40 yards. This positioning also reflected the philosophy of closly spaced massed artillery. As each battery had a frontage of 100 yards, this gave the battalion a total frontage of 380 yards.[14] A relatively modern aircraft traveling at 150 mph could cover the battalion position in about $5\frac{1}{2}$ seconds. The need to place the battalion in such a small area posed the threat of total destruction even if only one unit was discovered.

From 1933 to 1939, the improvement in motor transport

resulted in the need for the change of the tactical doctrine of the Field Artillery. Vehicles carrying more weight and possessing better traction on difficult ground eliminated the need for the positioning of artillery units near road networks. As the trucks slowly replaced animal-draft, the firing batteries were able to occupy positions which afforded better concealment from observation. When the mobility of the army was increased by mechanization, the battlefield became more fluid and shifted with startling rapidity. Tactics were now dominated by fast moving units, and the traditional reliance on control of operations from a distant vantage point could not be maintained. Mobile units needed artillery observers with them, rather than back with the firing batteries. Wire communications, had to be replaced with radio in an attempt to maintain contact with widely dispersed forces. Unfortunately, for the most part of the decade, the artillery battalion was only authorized four radios.[154] Lightweight , portable radios for liaison, observation, and fire control were not procured for the artillery until the first of 1940.

Just as transportation and communications had an effect on the tactics of the arm, the characteristics of the guns also influenced the operations conducted by artillery units. Most of the artillery used during the 20s and 30s was designed before or during the World War. The French 75mm gun was perfected in 1897. At the time these weapons were built, artillery units massed their fires by lining the

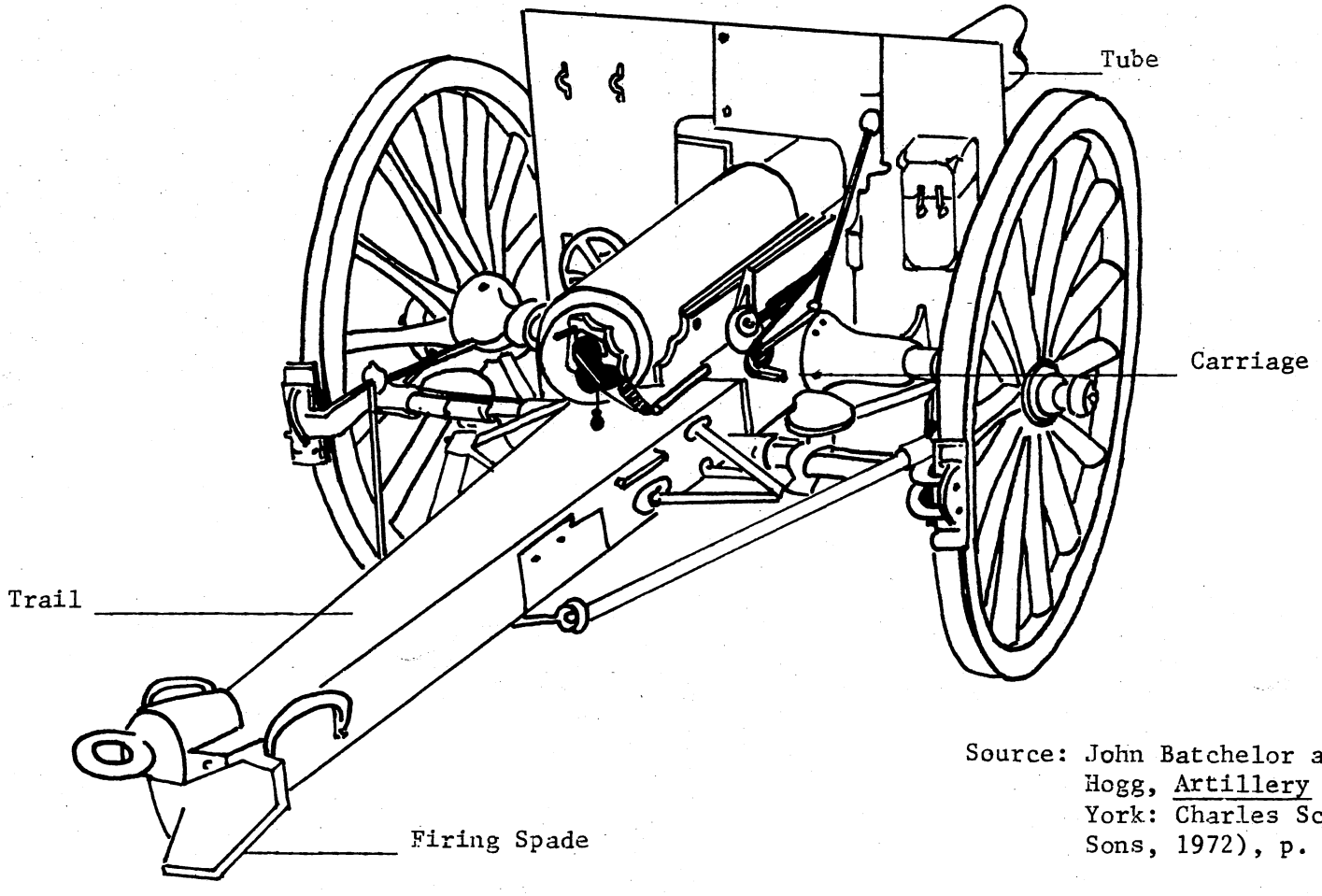
weapons up wheel to wheel. With this method of fire, it was not necessary for the gun to possess a great deal of traverse and elevation. The French 75mm gun and 155mm howitzer could only traverse three degrees left or right of center.[16] The light French gun could only elevate its tube 19 degrees. Limited elevations were also characteristic of medium and heavy weapons. These firing limitations made certain tactical adjustments necessary.

It has been observed that guns had to be positioned on firm ground, which limited the number of acceptable firing positions. The limited elevation of the French 75mm gun further restricted possible positions. The battery could not be located behind high ground because the trajectory of the shell could not clear this type of obstacle. Firing positions that were free from forward obstructions were open to the view of enemy observation posts for the same reason.[17] As artillery carriages had been designed for either horse or tractor draft, they now had to be modified to withstand the strain of high speeds. Without modification, these weapons would limit unit movement to twenty miles a day. Because of this one factor, more money was spent, during the 30s, on modification for high speeds than on new carriages and guns.

The firing properties of these weapons also influenced their employment in a tactical situation. The time required for a gun or howitzer to respond to a request for support was severely affected by the carriage design. Every weapon

had a device, called a spade, which, when dug into the ground prevented the gun from moving backward when the shell was fired (See figure 1, p. 77). If the French 75mm gun or 155mm howitzer was forced to fire on a target that was more than three degrees left or right of its center of traverse, the entire carriage had to be moved and the firing spade dug into the ground. In addition, the French light gun could only achieve its maximum possible range by digging a hole and lowering the trail, which permitted an elevation of about 42 degrees. If a fire request dictated a shift of the carriage, precious minutes were spent lifting and shifting the trail. The trails of the French 155mm gun could not be lowered, therefore the weapon could not be elevated to an angle which would achieve the maximum possible range. The significance of these limitations can be seen in the tactical dispositions in which they were found. Because of the time required to shift the weapons, tactical operations were planned with sufficient supporting artillery, that any possible target was within the traverse and elevation limits of at least one battery.

The tactical restrictions of the wartime ordnance were the chief reasons why the Army continued to search for better weapons. The specifications of the Caliber Board had been recognized as standards by which new weapons were measured. The restudy of the Caliber Board recommendations, in 1939, made only minor modifications in the total developmental criteria advocated in 1919. Artillery commanders



Source: John Batchelor and Ian Hogg, Artillery (New York: Charles Scribner's Sons, 1972), p. 23.

Figure 1, French 75mm gun Model 1897

did augment their consideration of the Caliber Board findings with information the 1919 board did not possess. It had been shown that the angle of impact of a shell fired from a field gun was approximately 10 to 12 degrees. At this angle, the majority of the blast's effect and fragmentation went into the ground or in the air. A shell that impacted at a greater angle had a better effect over a wider area (See figure 2, p. 79). Also, the flat trajectory of the field gun prevented it from firing on positions or troops on the reverse slopes of hills. A howitzer, capable of a higher trajectory, could fire on reverse slopes and had a better angle of impact. The howitzer could also be be positioned behind high ground, thus protecting it from direct observation and fire (See figure 3, p. 79). The limitations of wartime materiel, the early recognition of better firing properties, and subsequent experimentation led to a new group of artillery weapons.

Replacing the 75mm gun as the main support weapon at division level was the 105mm howitzer. It could traverse 45 degrees and attain 65 degrees of elevation. It could achieve a range of 12,000 yards with a 33 pound projectile. The French 155mm howitzer was replaced in late 1940 with a new weapon capable of 53 degrees traverse and 65 degrees elevation. It could fire a 95 pound projectile 16,000 yards. The French 155mm gun and British 8" howitzer were replaced by guns of the same caliber which could be mounted on the same type carriage. This carriage allowed 60 degrees of

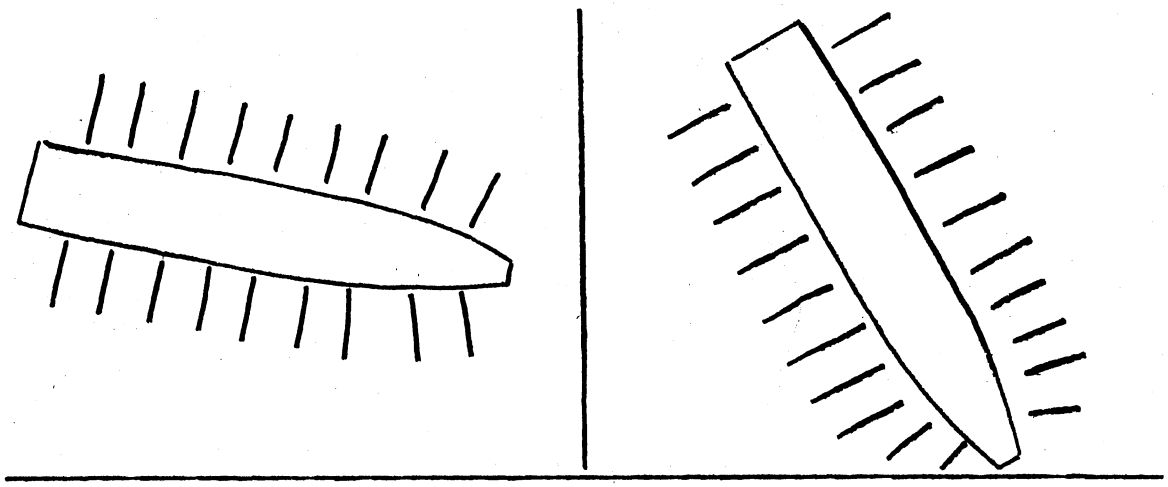


Figure 2, Angle of impact from a gun(left)
and a howitzer(right)

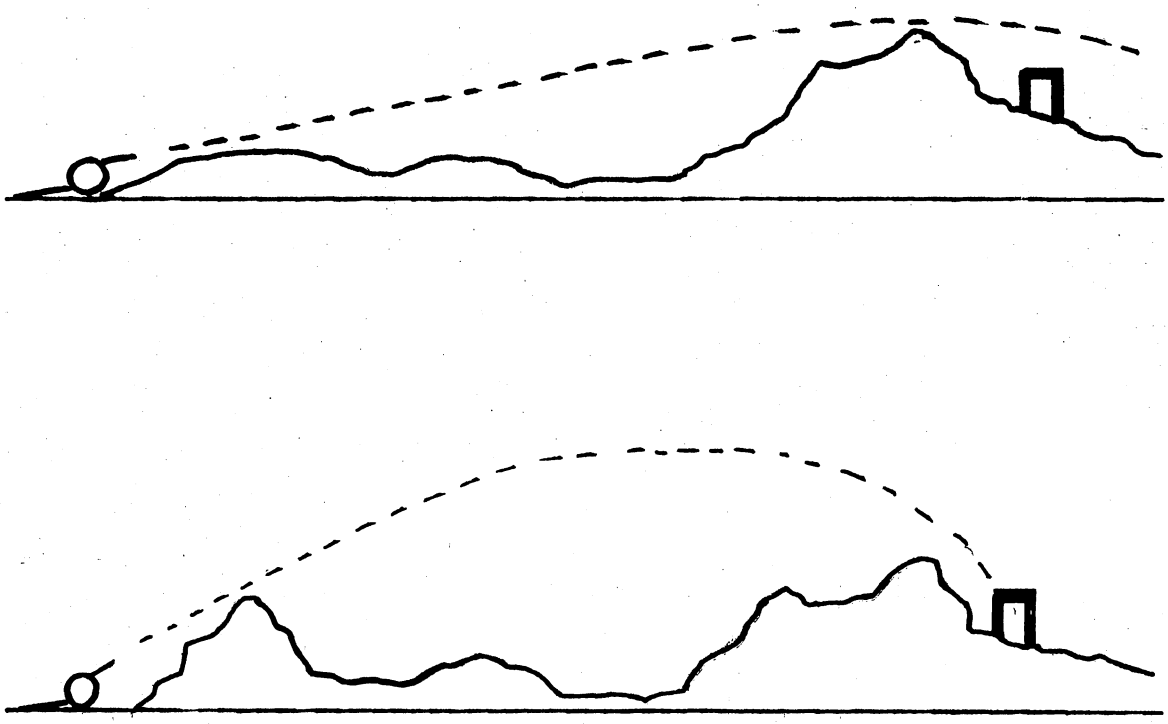


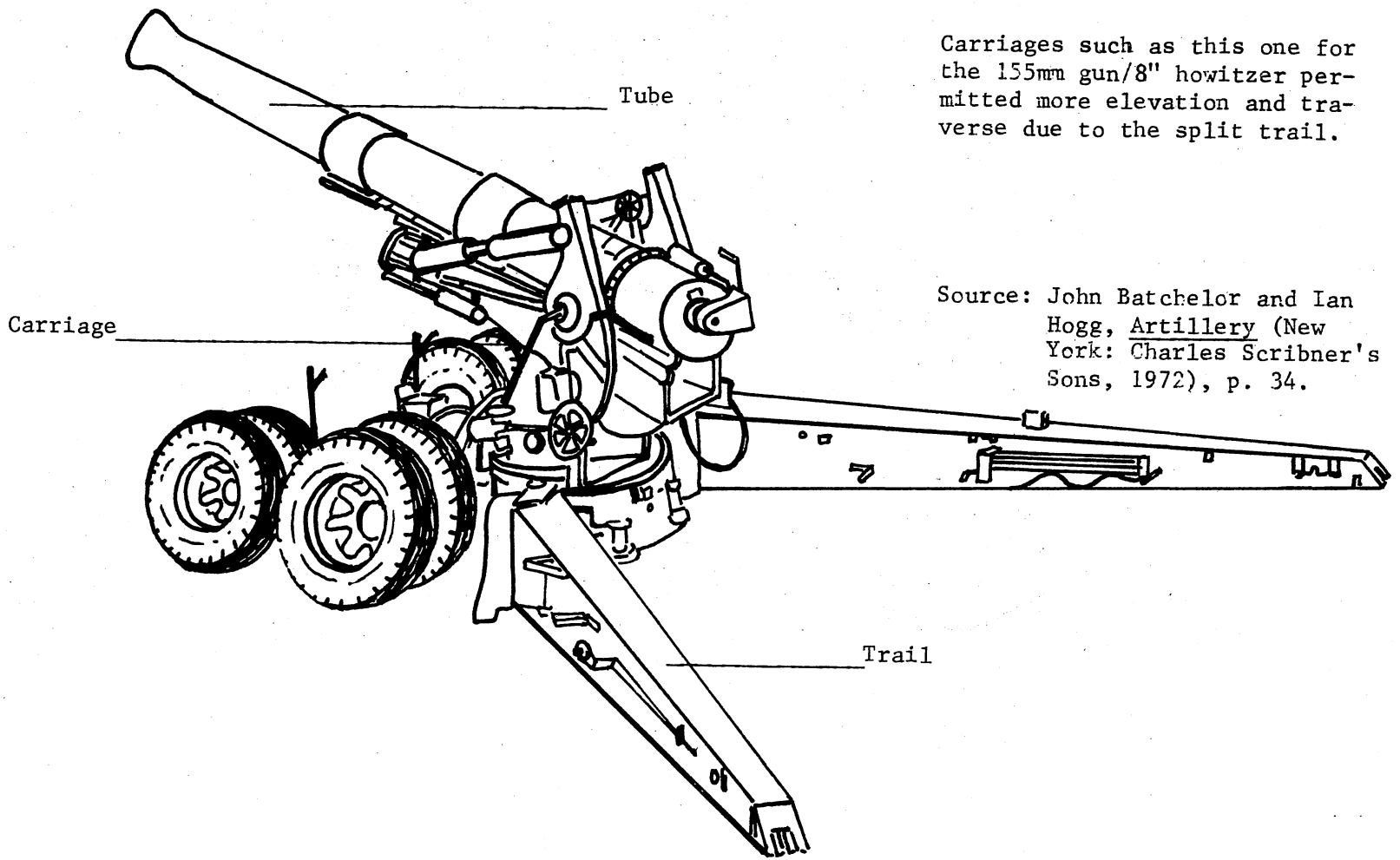
Figure 3, The trajectories of a gun(top)
and a howitzer(bottom)

traverse and 65 degrees elevation regardless of the type of gun (Figure 4, p. 81). These weapons were finally developed and procured in sufficient numbers to be employed in the first days of the Second World War.[18]

Artillery Fires

Although new weapons with improved capabilities would be developed for the coming conflict, the classification of artillery fires and the planning of these fires, during the 30s, was still based on ordnance from the World War. In examining the classification and planning of tactical fires, the influences of limited mobility, wire communications, and wartime weapons can once again be seen. The fires which the Field Artillery could deliver to support the maneuver arms were predominantly pre-arranged. The communications system, dominated by wire, did not allow timely response to a changing battlefield situation. To be able to fire on a multitude of possible targets with weapons of limited abilities, the assigned batteries had to be supplemented with additional units.

The fires which the Field Artillery delivered were categorized according to the desired effect and the tactical purpose. Fires, typed according to effect,were either destruction, neutralization, or nuisance.[19] Destruction fire sought to eliminate a target completely. They were normally used against fortifications and fixed structures such as bridges. Medium and heavy guns usually were given this



Carriages such as this one for the 155mm gun/8" howitzer permitted more elevation and traverse due to the split trail.

Source: John Batchelor and Ian Hogg, Artillery (New York: Charles Scribner's Sons, 1972), p. 34.

Figure 4, 155mm gun/8" howitzer

mission because the number of light artillery shells required to destroy any target was normally too great to justify the use of the weapon. Neutralization missions sought to reduce the combat effectiveness of the enemy temporarily. Typical missions might have been to disrupt the enemy's attack formations, or cause his artillery units to displace. All artillery units fired neutralization missions.[20] Nuisance missions sought to harass the enemy by preventing his troops from resting or by interfering with the use of roads or bridges.

The tactical application of these fires was again predominantly by pre-arrangement. Preparation missions were destruction and neutralization fires designed to soften up enemy resistance prior to an offensive operation. Counter-preparations were intended to disrupt the enemy's preparations for an attack by destroying his supplies and neutralizing his attack formations. Concentrations were fires of great magnitude which were placed on suspected points of enemy resistance during an attack. They were also fired on likely avenues of approach by an advancing enemy force. Barrages were linear fires which attempted to place a curtain of exploding shells on the enemy. A rolling barrage was a moving wall of fire behind which the friendly infantry would advance. A defensive barrage would be a line of explosions in front of friendly positions which would prevent the enemy penetration. Very little discussion in the tactics manuals dealt with fires which were not planned

in advance. In order to deliver these fires effectively with weapons of limited abilities, it was necessary to saturate the rear areas with artillery units.

In planning the artillery requirements for an operation, the Field Artillery relied on a device call the French Experience Table. It standardized the lessons of the World War for offensive operations.

TABLE V

FRENCH EXPERIENCE TABLE[21]

Requirement	Batteries per 1000 meters	
	light	medium or heavy
Maximum	18	18
Normal	14	13
Minimum	10	10

In an offensive operation, a maximum number of batteries would be needed if the enemy positions were well fortified, and the element of surprise was lost. The normal number of batteries would be sufficient if the enemy had only moderate fortifications, partial surprise was expected, and hostile resistance would probably be overcome. The minimum requirement was forseen for circumstances where the enemy was not fortified, would be completely surprised and would offer no opposition. The minimum number was also used for holding the flank of an attack.

To illustrate the use of this table and the influence

of the World War, the requirements for a corps attack will be illustrated. The corps is attacking with two divisions and holding the flank with a third. The enemy is moderately fortified and is expected to resist before yielding ground. The two attacking divisions will operate on a front of 6,000 meters. The division assigned to hold, has a front of 4,000 meters.[22]

Light artillery required

Attacking force- (Normal requirement- 14 batteries per 1000 meters)
6 X 14= 84 batteries

Holding force- (Minimum requirement- 10 batteries per 1000 meters)
4 X 10= 40 batteries

Light batteries assigned to 3 divisions= 36

Required an additional 88 batteries of light artillery

Medium or Heavy artillery required

Attacking force- (Normal requirement- 13 batteries per 1000 meters)
6 X 13= 78

Holding force- (Minimum requirements- 10 batteries per 1000 meters)
4 X 10= 40

Medium or heavy batteries assigned to the division or corps= 36

Required an additional 82 medium or heavy batteries

Translated into regimental organizations, approximately 15 light regiments and 14 medium or heavy regiments were necessary to support this attack in addition to the organic division and corps units. The magnitude of this required augmentation can best be seen in the numbers of officers and

enlisted men needed. Each light regiment contained 66 officers and 1570 enlisted men. In a medium or heavy regiment, there was an average of 77 officers and 1,730 men. To support an attack by a corps would require 1,914 officers and 49,500 enlisted men. These numbers can be appreciated when it is known that as late as 1940, the total strength of the Field Artillery (Regular Army) was 1,700 officers and 30,146 enlisted men.[23]

The tactics manuals of the 30s maintained that for an offensive operation, four battalion per night could be moved into positions to support the attack.[24] At this rate of movement, it would have taken 18 nights for the supporting artillery to move into firing positions. This is predicated on the supposition that adequate positions could be found for the 72 supporting battalions. At no time during the decade of the 1930s could the Field Artillery have supported an attack by only two divisions, using the guidelines and procedures from the World War.

Fire Direction

The development of motor transport affected the design of artillery weapons and the mobility of artillery forces. The mechanization of the maneuver units forced the artillery to furnish observers to the infantry battalion which in turn affected the manner in which firing data was prepared. To understand the importance of this change, the method of computing data during the 20s and 30s must be understood.

The battery commander, who was the primary observer, used trigonometry to compute the necessary data for the guns (See figure 5, p. 87). Using a compass and a device which measured distances, he measured the direction to the target (angle a) and to the battery (angle b). The range finder determined the distance to both points. Determining the value of the angle formed from the target to the observer to the guns (angle c), and knowing the distances to the battery and the target, he was able to compute the distance from the guns to the target. This information was sent to the battery where the gun crews raised the gun tubes to an elevation which would achieve this range.

Aiming the gun at the target was more complicated, because the gun crews normally could not see it. The observer had to select a point which he felt the battery could see and use as an aiming reference. After measuring the direction (angle d) and the distance to this aiming point, he then determined the value of the angle made from the guns to the observer to the aiming point. With this angle known, he could determine both the distance from the guns to the aiming point and the angle formed between these two points and the observer (angle e). This angle, when added to the already determined observer-gun-target angle (angle g) formed the reference angle (angle f). On the gun, the sight which measured direction was built much like a periscope. It could independently traverse a full 360 degrees. The direction in which the lense was pointed was called the line

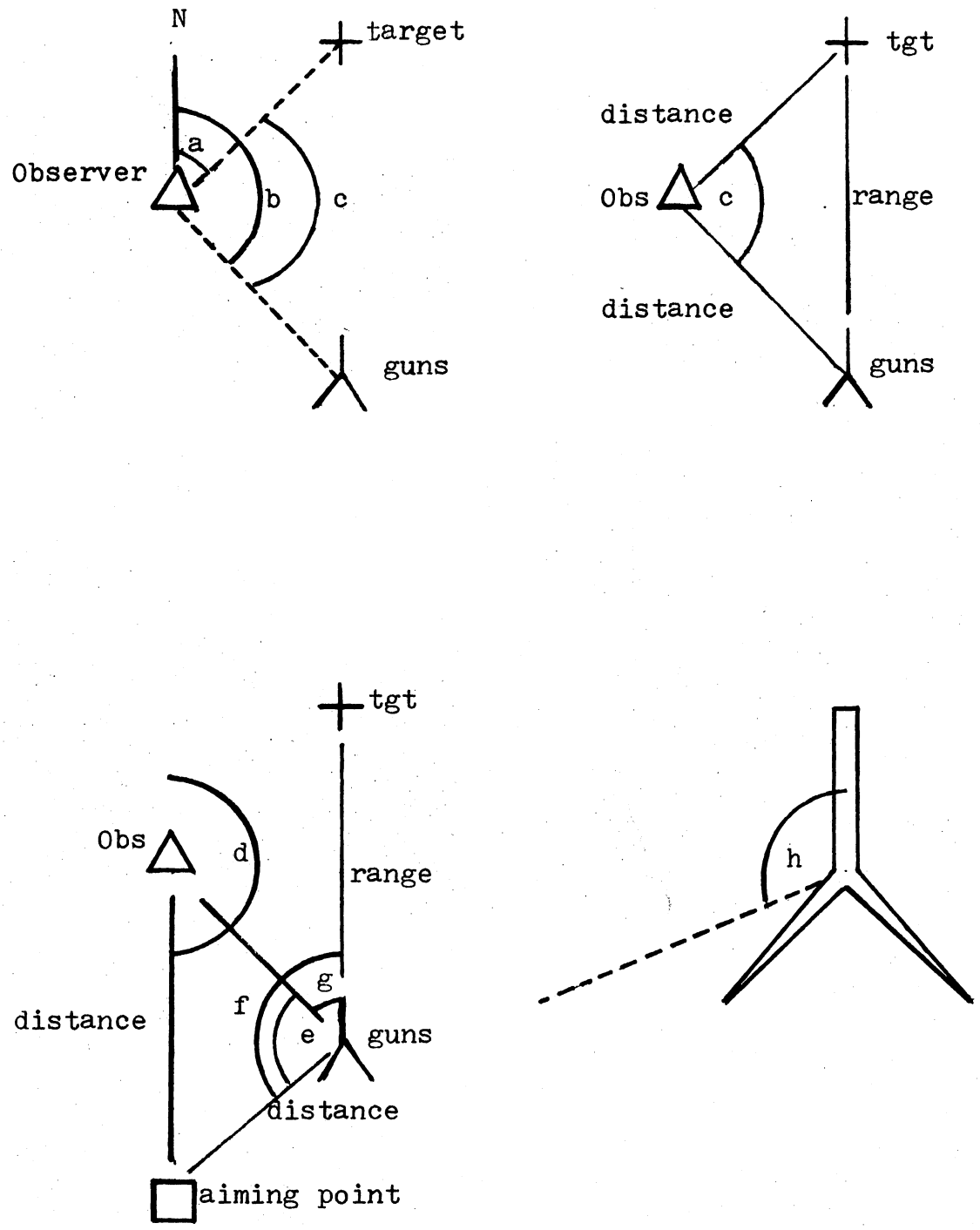


Figure 5, Fire Direction Angles

of sight. This line and the direction in which the tube was pointed formed an angle (angle h) of varying value depending on where the sight was directed. The reference angle (angle f) was applied to the gun (thus making angle f and angle h equal). When the carriage was moved to enable the aiming point to become visible in the sight, the tube was consequently pointed at the target. When the observer began to accompany the infantry, inter-visibility with the battery and the target were destroyed and the accepted method of computing data had to be replaced.[25]

To retain the ability to support the infantry, the observer was relieved of the responsibility of computing data. A section was established at battalion headquarters whose purpose was to convert the observer's information into firing data for the guns. This group, known as the Fire Direction Center, computed all the firing data for the gun batteries. The firing batteries did have a limited capacity to process a fire request. The new system was centered around a firing chart, which was a map with a system of grid lines superimposed on it. Each horizontal or vertical line had a numerical value with the bottom and left lines having the lowest values. The subsequent squares could be subdivided into equal parts. When an observer desired to fire on a target, he located it on his map and determined the grid in which it was located. This "grid location" was converted into the appropriate corresponding numbers and sent to the Fire Direction Center (FDC), where the target

was plotted on the map. As the firing batteries were also plotted on the map, the distance from the batteries to the target (range) could be ascertained. Using a device very similiar to a protractor, the direction from the battery to the target could also be determined. This information was then sent to the gun crews who applied the data to the guns. This method of computing firing data was much faster and more accurate, due to the fewer computations, than the old system. The Field Artillery could then respond to a fire request in a more timely manner.[26]

Although the projectile was fired from a known location to another known location, it would not always hit the target, regardless of the accuracy of the computations. Until the latter part of the 30s, the Field Artillery did not adequately allow for the ballistic factors involved in firing data. Ballistics had been divided into interior ballistics, those things which happened inside the gun, and exterior ballistics, the elements which affect the shell after it left the tube. The effects of conditions outside the tube had been known and appreciated by artillerymen during and after the World War. The pressure and density of the air restricted the passage of the projectile to varying extents. The direction and velocity of the wind obviously affected the shell. The temperature of the powder altered the chamber pressure which propelled the shell out of the tube thereby affecting the range. Most of the factors which could affect the projectile once it left the cannon were

identified. The interior factors, however, were not fully appreciated. Interior ballistics were considered "a subject with which the Field Artilleryman is not practically concerned except to know its effect on muzzle velocity."[27] During the 30s, the study of interior and exterior ballistics was intensified and this resulted in significant changes in the way the artillery would function in fire direction.

The only way to compensate for factors which were subject to change was to establish standards. By using certain arbitrarily determined standards, the effects of deviations from these standards could more easily be compensated for. For the purposes of fire direction, there was no wind, the temperature was 70 degrees F., the earth was not rotating, and pressure was equated to standard sea level. The tube of the gun was considered to be new. These standards were then applied mathematically to the trajectory of the shell. A head or tail wind, the true density of the air, and the temperature of the powder would affect the range which could be achieved at a given elevation. The direction was affected by cross winds, the rotation of the earth and the spin of the projectile. This spin forced the shell to drift to the right of the direction in which it was fired. The longer the shell was in the air, the more it drifted.

During the 30s there were sufficient test firings of artillery weapons that the effects of drift and weather

could be accurately gauged. These firings also helped to identify the conditions inside the weapon which affected its performance. It was learned that as more and more shells were fired, the weapon's chamber pressure decreased. This phenomenon was called erosion. Because of the explosion of the powder and the heat generated by it, the diameter of the powder chamber was gradually increased. This allowed the propelling gasses to escape around the shell thus reducing the velocity of the projectile. A device called a chronograph was perfected which could measure the muzzle velocity of a shell. The amount that this reduced muzzle velocity differed from the standard, could be applied to correct for the reduced range.[28] Exterior and interior ballistics, once appreciated and applied by the Field Artillery, increased the accuracy of artillery fires.

Conclusion

The equipment designed before and during the World War was retained in the Army's arsenal until the mid-thirties. Lack of funds limited its replacement by more sophisticated and advanced equipment. This wartime equipment significantly affected the way the Field Artillery was organized and how it planned to support the ground-gaining arms. In the early part of the thirties, the increased numbers of improved motor vehicles brought mobility to the artillery and the maneuver arms. This new mobility make the wartime procedures inadequate, and new procedures and equipment had

to be developed in order to insure continued support of the Army. Artillery weapons had to be converted and modified in order to allow them to be towed at high speeds. Communications equipment, such as the radio, had to replace the reliance on wire, which could not keep pace with fast moving forces. A continued demand for better weapons to support the new forces resulted in the adoption of modern weapons in the last years of the 1930s and the first years of the 1940s. The advancement in new methods of fire direction allowed a more timely response to the needs of the maneuver arms. Improved technology contributed to the increasing accuracy of artillery weapons by resolving the mysteries of interior and exterior ballistics. The interaction of equipment and tactical doctrine was recognized by artillerymen of the period. It was not appreciated by the civilian leaders of a nation concerned with domestic problems. Antiquated equipment and the tactical doctrine possible with such equipment would have rendered the Army ineffective had the threat to the Western Hemisphere materialized.

FOOTNOTES

[1]U.S. War Department, Organization of the Field Artillery, 1935 ed. (Fort Sill, Okla: Field Artillery School, 1935), p. 4.

[2]U.S. Congress, Hearings on HR 14199, p. 392.

[3]Bishop, p. 28.

[4]Ibid., p. 39.

[5]Ibid., p. 40.

[6]Organization of the Field Artillery 1935, Appendix.

[7]Bishop, p. 43.

[8]U.S. War Department, Tactical Employment of Field Artillery, 1936 ed. (Fort Leavenworth, Kan: Command and General Staff School, 1936), p. 178.

[9]Caliber Board, p. 10.

[10]U.S. War Department, Tactical Employment of Field Artillery, 1938 ed. (Fort Sill, Okla: Field Artillery School, 1938), p. 36.

[11]Conrad Boyle, "Has the Close Support Problem Been Solved Yet?" Field Artillery Journal XXIX (Sept-Oct 1939), p. 386.

[12]U.S. War Department, Tactical Employment of Field Artillery, 1931 ed. (Fort Sill, Okla: Field Artillery School, 1931), p. 51.

[13]Tactical Employment of Field Artillery, 1938, p. 4.

[14]Bishop, p. 57.

[15]Tactical Employment of Field Artillery, 1936, p. 48.

[16]Hayes, p. 337.

[17]Because of the restrictions placed on firing positions for light guns, they were given priority in the selection of firing positions in the division area.

[18]G.M. Barnes, Weapons of World War II (New York: D Van Nostrand Company, Inc., 1947), pp. 114-138.

[19]Harassment and Interdiction fires do not adequately fit into either category. Therefore this classification is the author's.

[20]Bishop, p. 145.

[21]Tactical Employment of Field Artillery 1936, p. 538.

[22]Ibid., p. 540. This was considered the actual distance that a division could control under these conditions.

[23]Weekly Statistical Report #350, pp. B-4, B-24.

[24]Tactical Employment of Field Artillery 1938, p. 378.

[25]Bishop, pp. 87-90.

[26]Sunderland, p. 210.

[27]Bishop, p. 79.

[28]Hayes, pp. 85-90.

CHAPTER V

SUMMARY AND CONCLUSION

Prior to the World War, the Army of the United States and its artillery, had been relegated to a frontier existence and had obtained a frontier perspective. The last major conflict that it had been involved in was the Civil War. Because of this frontier outlook, the Army had scant basis for understanding the military and industrial requirements for a modern war. Prior to the nation's entry into war in April, 1917, the armed forces were woefully lacking in men, materiel, and an understanding of 20th century warfare. As a result, the World War became important to the future of the Army. It provided a source of experience for the commanders and a testing ground for theories that had existed only on the blackboard. At the end of the war, the Army and its Field Artillery had attempted to refine the many experiences of the war into a few basic concepts and theorems. Over time, the lessons of this war became transformed into doctrine for all wars. For the Field Artillery, the recommendations of the boards and the general principles of employment during the war, came to carry the weight of divine guidance. The tactical doctrine of the war became more inflexible and resistant to change as the

memories of battle became more vague and obscure.

With this attitude, the Field Artillery and the Army sought to remain viable in the inter-war period. This viability was sought in the face of normal peacetime constraints compounded by the economic chaos of the depression. In the 30s, Congress and the President, fighting the depression by economizing in government, reduced the military budget to subsistence levels. This had serious ramifications for the Army's Field Artillery. The depression came at a time when the vast surpluses of war materials had all but vanished. The lack of funds protracted the normal length of time for the research and development of new weapons systems. This not only prevented the equipment from reflecting the advances in technology but allowed impractical concepts, such as the dual-purpose gun. The scarcity of appropriations forced the branch to concentrate their meager resources on upgrading weapons that had been recognized as outdated at the end of the war. In many respects the modernization of the guns was simply modification to allow for high speed towing behind the growing numbers of motor vehicles. The growing mobility of the field army, required the change of organization, the modification or replacement of certain equipment , and the development of tactics and techniques that could support the ground army.

The tactical application of Field Artillery was the area most resistant to change. Innovation and new techniques

were slowly accepted as they could never be substantiated by battlefield experience. The retention of wartime weapons tended to reinforce wartime doctrine. Improved mobility and an increasing demand for new capabilities in armaments may not have altered the classification of artillery fires, but they did change the application of these fires. The Field Artillery, continuing to support the maneuver arms, had to change its tactics and fire direction methods to maintain its effectiveness. For the Field Artillery, the 30s were a time when the forces of consistency collided with the forces of change. The financial force of the depression restricted the proficiency of the old ways and impeded the adoption of the new.

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APPENDIX

GLOSSARY*

Ballistics: The science dealing with projectiles in motion, normally divided into interior and exterior. Interior ballistics relate to the forces at work while the shell is still in the gun. Exterior ballistics concern those factors which affect the projectile during flight.

Caisson: A horse-drawn wagon designed for the transport of artillery ammunition.

Caliber: The diameter of the bore of a cannon. The term can also be used to express the tube length. A cannon of 10 calibers, has a length equal to ten times the diameter of the bore.

Cannon: The general name for all tube artillery. Comprised of guns, howitzers, and mortars.

Carriage: The support for the firing parts of a cannon. In mobile artillery the carriage usually includes the wheels, suspension system, and traverse and elevation mechanism.

Direction: The position of the line of fire of a cannon in the horizontal plane, which is always measured in a clockwise motion starting from north.

Elevation: The angle between the axis of the cannon tube and the horizontal plane.

Fuze: A device which detonates the main charge of the projectile. Fuzes may function upon impact with the ground, at a pre-determined point in the trajectory of the shell, or a fraction of a second after impact. An alternate spelling is fuse.

Gun: An artillery piece with a long tube, high muzzle velocity and generally flat trajectory. The term is frequently applied to all cannon and small arms.

Howitzer: An artillery piece with a trajectory between those of a gun and the mortar. Its chief advantage

is the ability to deliver flat and high trajectory fire.

Mortar: An artillery piece (now employed only in infantry units) designed to fire at extremely high angles in order for the angle of impact to exceed 80 degrees. It normally has limited range and is designed to fire on weapons on the reverse side of high ground or weapons and personnel in pits or trenches.

Organic: Personnel or material which is permanently assigned to a unit, facility, or activity.

Range: The horizontal distance from the artillery weapon to the target. Maximum effective range is the limit of effective use of the weapon. Maximum range is the most distant point the weapon can achieve.

Shell: A bullet-shaped missile fitted with a fuze to cause detonation on impact. May be high explosive (containing material such as TNT), shrapnel (containing steel balls and an expelling charge) or chemical (containing gasses, either toxic or non-toxic, smoke material or chemical illuminates).

Trajectory: The curved path taken by a projectile (shell) beginning with the departure at the tube and ending upon impact.

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