

The French Artillery in the First World War

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The history of the artillery of the French Army of the First World War is a tale of extremes. Some of the artillery pieces in the French arsenal were powerful, reliable weapons that made good use of new technology. Indeed, a few might fairly be described as the paragons of the particular classes of ordnance to which they belonged. Other cannon in the French service, however, were distinguished by the absence of these virtues, some to the point where they might be considered the very worst of their respective types. This great dichotomy in the field of ordnance, moreover, had its counterpart in the realm of concepts and conventions. At some points during the war, the French artillery establishment seems to be an extraordinarily innovative organization, open to new ideas and capable of rapid adaptation to new circumstances. At the other times, it appears rigid and dogmatic, a classic bureaucracy holding fast to familiar formulae long after they had outlived their usefulness.

The roots of the diversity, both moral and material, of the French artillery of the First World War lie in the last twenty-five years of the 19th century, an era in which the French Army had the extreme good fortune to acquire two successive generations of superb artillery pieces. The first of these consisted of a family of seven guns, howitzers, and mortars that was commonly known as the “*système de Bange*.” Adopted between 1877 and 1881, these pieces quickly gained an excellent reputation for accuracy, durability, reliability, and range.¹ The second generation was dominated by a single piece, the 75^{mm} field gun of 1897. This remarkable weapon was the first quick-firing field gun to be adopted by a major European army and, in the view of the expert opinion of the time, the best weapon of that class to enter serial production before 1914.

In the years leading up to the outbreak of war, the excellence of French ordnance gave French gunners a taste for working with first-class materiel and French weapons designers a high standard of excellence to emulate. At the same time, the combination of a superb field gun with a complete family of

¹ The de Bange system is named after Charles Ragon de Bange (1833–1914), the artillery officer who, in addition to directing the development of its component artillery pieces, also invented the breach mechanism that they used. For a brief biography of de Bange, see E. Hennebert, *L'Artillerie* (Paris: Hachette, 1887), pp. 158–182.

serviceable ordnance of other sorts had the perverse effect of delaying the procurement of a full range of fully modern artillery pieces. Thus, in August

TABLE 3.1 *Artillery pieces of the de bange system*²

Model	Caliber	Type
1878	80 ^{mm}	Mountain Gun
1877	80 ^{mm}	Field Gun (Horse Artillery)
1877	90 ^{mm}	Field Gun
1878	120 ^{mm}	Heavy Gun
1881	155 ^{mm}	Light Siege Howitzer
1877	155 ^{mm}	Heavy Gun
1880	220 ^{mm}	Siege Mortar

TABLE 3.2 *Artillery pieces assigned to french field armies*³; August 1914

Model	Caliber	Type	Batteries	Pieces
1897	75 ^{mm}	Field Gun	960	3,840
1912	75 ^{mm}	Field Gun (Horse Artillery)	30	120
1878	120 ^{mm}	Heavy Gun	20	120
1904	155 ^{mm}	Heavy Field Howitzer	26	104
1907	65 ^{mm}	Mountain Gun	22	88
1890	120 ^{mm}	Light Field Howitzer	21	84

2 For the performance characteristics of the weapons of the de Bange system, see J. Challéat, *Histoire technique de l'artillerie de terre en France* (Paris: Imprimerie Nationale, 1935), Volume 2, p. 16.

3 The figures for 75^{mm} guns (of both types) and mountain guns are taken from the detailed orders of battle of divisions and army corps published in the French official history, *Les armées françaises dans la Grande Guerre* (Paris: Imprimerie Nationale, 1922–1930), Tome x, Volume 1, pp. 609–811 and Volume 2, pp. 1–966. Figures for other pieces come from the copy of the French plan for the concentration of armies (*Plan 17*) found in *Les armées françaises dans la Grande Guerre* (hereafter *AFGG*), Tome 1, 1^{er} Volume, Annexe 8. These figures do not include weapons assigned to territorial divisions, fortresses, siege trains, or units serving overseas. The motorized batteries armed with 120^{mm} guns were six-piece units. All other batteries mobilized for service with field armies at the start of the war had four guns or howitzers apiece.

TABLE 3.3 *Characteristics of older french guns*⁴

Model	Caliber	Family	Weight of piece	Weight of shell	Range
1877	80 ^{mm}	de Bange	928 ^{kg}	5.6 ^{kg}	7,100 ^m
1877	90 ^{mm}	de Bange	1,240 ^{kg}	7.95 ^{kg}	6,900 ^m
1875	95 ^{mm}	Lahitolle	1,956 ^{kg}	10.95 ^{kg}	8,250 ^m
1878	120 ^{mm}	de Bange	2,784 ^{kg}	18.3 ^{kg}	8,950 ^m
1877	155 ^{mm}	de Bange	5,684 ^{kg}	40 ^{kg}	9,000 ^m

of 1914, the French artillery went to war with both the best field gun in the world and also the worst heavy field howitzer in the first line forces of any belligerent.⁵ Similarly, while the pieces that armed mountain and horse artillery batteries were as up-to-date as their counterparts in other armies, the 120^{mm} pieces, whether guns or howitzers, that armed the lion's share of mobile heavy batteries, were of types that had been obsolete for more than a decade.

Older Mobile Heavy Guns

The first few weeks of fighting served up a number of surprises for the French artillery. One of the most ironic of these was the increasingly prominent role played by the oldest piece to serve with French field armies in August 1914, the 120^{mm} de Bange heavy gun of 1878. Upon mobilization, the only mobile units to employ this weapon were the twenty batteries of the 4th Heavy Artillery Regiment (*4^{ème} Régiment d'Artillerie Lourde*), a one-of-a-kind organization that, among other things, had begun to replace its horse-drawn vehicles with gasoline-powered trucks.⁶ However, the first few weeks of the

4 J. Challéat, *Histoire technique*, Volume 2, pp. 16–17. The figures for range assume the use of black powder propellant charges.

5 On paper, the salient deficiencies of the Model 1904 155^{mm} heavy field howitzer were its great weight and its limited range. Also known as the 'Rimailho' (after its inventor, Emile Rimailho) and the '155 CTR' (*court tir rapide*, "short quick-firing"), the 155^{mm} heavy field howitzer weighed in at 3,200 kilograms and had a maximum range of 6,300 meters. Its German counterpart (the 150^{mm} heavy field howitzer of 1902) weighed 2,035 kilograms and could reach out to 7,450 meters. H. Linnenkohl, *Vom Einzelschuss zur Feuerwalze* (Koblenz: Bernhard und Graefe, 1990), pp. 91–92.

6 General Baquet counted 21 batteries of 120^{mm} guns in the *4^{ème} Régiment d'Artillerie Lourde*, 18 six-piece horse-drawn batteries and three four-piece motorized batteries. However, both the history of the motorized portion of the regiment and the war diary of that group identify four

war saw a large number of additional units armed with guns of this type.

Some of the batteries armed with the 120^{mm} gun were formed from men, weapons, equipment, and animals belonging to the garrisons of fortresses located in the areas where field armies were operating. Others were assembled in a more systematic manner at the depots of the five heavy artillery regiments mobilized at the start of the war. A few were units of the aforementioned heavy artillery regiments that needed temporary substitutes for 155^{mm} Rimailho heavy field howitzers, that had been evacuated to repair shops.⁷ These same methods were used to create units armed with a slightly older piece, the 95^{mm} Lahitolle gun of 1875. Though not, strictly speaking, a member of the de Bange family, the robust and accurate Lahitolle was so similar to the 120^{mm} heavy gun that it might well be described as a scaled-down version of it.⁸ However, unlike the 120^{mm} gun, it had found no place in the field armies mobilized at the start of the war.

Notwithstanding their other virtues, neither the Lahitolle nor any member of the de Bange family possessed integrated recoil systems. As a result, they were unable to fire as quickly as state-of-the-art weapons. At the same time, as recoil systems were proving to be the most fragile part of newer heavy pieces, the absence of such mechanisms greatly reduced the incidence of mechanical breakdown. Indeed, the fear of such breakdowns provides a partial explanation for the tendency of heavy artillery units to hold onto the older guns they had acquired as temporary substitutes, long after the successful repair of their Rimailho howitzers.⁹

motorized batteries, each of six pieces. L. Baquet, *Souvenirs d'un directeur d'artillerie* (Paris: Henri Charles-Lavauzelle, 1921), p. 119; Anonymous, *Historique des 4^{ème}, 8^{ème} et 28^{ème} régiments d'Artillerie Lourde à Tracteurs* (Nancy: Berger-Levrault, circa 1918), p. 2 and *Journal des marches et opérations, 1^{ère} Groupe, 4^{ème} Régiment d'Artillerie Lourde*, Archives de Guerre, 26N1079.

7 On 1 September 1914, mechanical difficulties deprived the 2^{ème} Groupe of the 5^{ème} Régiment d'Artillerie Lourde of the use of all twelve of its 155^{mm} Rimailho heavy field howitzers. *Journal des marches et opérations, 2^{ème} Groupe, 5^{ème} Régiment d'Artillerie Lourde*, Archives de Guerre, Carton 26N1080. For other examples of mechanical problems with the Rimailho howitzer, to include the distressing tendency of barrels to separate themselves from cradles in the course of firing at particularly distant targets, see the war diaries (*journaux des marches et opérations*) of the various batteries and groups of the 1^{ère}, 2^{ème}, 3^{ème} and 5^{ème} Régiments d'Artillerie Lourde, Archives de Guerre, 26N1075, 26N1076, 26 N1077, and 26N1080.

8 The 95^{mm} Lahitolle gun was introduced in 1875 and fitted with a new breech mechanism in 1888. It is thus sometimes described as the "Modèle 1875" and sometimes as the "Modèle 1888."

9 For examples of this practice, see the war diaries of component batteries and groups of the 1^{ère}, 2^{ème}, 3^{ème} and 5^{ème} Régiments d'Artillerie Lourde.

The chief motivation for the dispatch of so many older heavy guns to French forces in the field was the desire to respond to the fire of German heavy artillery, particularly the seemingly ubiquitous 150^{mm} heavy field howitzer. When firing shrapnel shells, a French 75^{mm} gun could reach out to 5,500 meters.¹⁰ The use of high explosive shells extended the maximum range to 6,800 meters, though only at the cost of putting excessive strain on the recoil mechanism.¹¹ By way of contrast, the maximum range of the most common of the contemporary German heavy field howitzers was 7,450 meters, and that of the older French heavy guns was well in excess of 8,000 meters.¹²

While the shells shot by the Lahitolle and 120^{mm} de Bange heavy guns could fly further than those fired by the German heavy field howitzers, they were substantially smaller. (The German 150^{mm} shell weighed a little more than 40 kilograms, which made it more than twice as heavy as those fired by the 120^{mm} de Bange heavy guns, and nearly four times as heavy as the shells fired by the 95^{mm} Lahitolle piece.) Thus, once the war of grand maneuvers gave way to the war of position, the heaviest gun of the de Bange family, the 155^{mm} gun of 1877, became an increasingly common sight at the front. This piece, which had been designed for use in siege warfare, could fire a shell comparable to that of the German heavy field howitzer out to a range of 9,000 meters.

The First Shell Shortage

Another great surprise of the first few months of the war was the rate at which batteries armed with the 75^{mm} field gun consumed ammunition. In the years leading up to the outbreak of war, most who commented publically on such matters agreed that existing stocks of both projectiles and propellant were far too low. The most prominent French artillery officer of the first decade of the 20th century, Hippolyte Langlois, had argued that a supply of 3,000 rounds should be set aside for each 75^{mm} field gun. However, the expense of producing

10 J. Schott, "Die gegenwärtige Ausrüstung der Feldartillerie mit Kanonen," *Militär-Wochenblatt*, 1905, p. 3,327.

11 H. Linnenkohl, *Vom Einzelschuß zur Feuerwältze* (Koblenz: Bernard & Graefe Verlag, 1990), p. 66 and Grand Quartier Général, Armées de l'Est, État-Major, 3^{ème} Bureau, No. 6721, 22 septembre 1914,, *AFGG*, Tome II, Annexes, 1^{er} Volume, Annexe 26, pp. 18–19. The relationship between firing at longer ranges and strain on the recoil mechanism may be the reason for the claim that the range of the French 75^{mm} gun "barely exceeded" 4,000 meters. P.M.H. Lucas, *L'Evolution des idées tactiques en France et Allemagne pendant la guerre de 1914–1918* (Paris: Berger-Levrault, 1923), p. 35.

12 H. Linnenkohl, *Vom Einzelschuß zur Feuerwältze*, p. 91.

large amounts of artillery ammunition combined with the problem of long-term storage to prevent the accumulation of a sufficient reserve. Thus, on 2 August 1914, the French Army possessed only 1,390 rounds of ammunition for each 75^{mm} field gun in the inventory.¹³

To further complicate matters, the majority of the 75^{mm} projectiles on hand at mobilization (roughly fifty-eight percent of the total number of such shells on hand) were shrapnel shells.¹⁴ While these proved sufficiently murderous during the first few weeks of the war, the increased range at which engagements were taking place soon deprived them of much of their utility. By the middle of September of 1914, the preference for high explosive had become so marked that the commanders of many artillery units armed with 75^{mm} field guns were refusing to accept shipments of shrapnel shells, lest the presence of too many shrapnel shells in their caissons hinder their ability to obtain, store, or move sufficient numbers of high explosive projectiles.¹⁵

Before the end of the second month of the war, the shortage of ammunition for 75^{mm} guns had become so acute that it prevented the French field armies from completing the pursuit of German forces defeated at the first battle of the Marne. On 27 September 1914, General Joseph Joffre, then commanding all the French armies serving in France and Flanders, put a halt to all offensive actions save those that he himself might order. That same day, he undertook a radical redistribution of the remaining stocks of 75^{mm} ammunition, allowing formations in the field to retain three hundred rounds for each 75^{mm} gun in service, and concentrating all ammunition beyond that ration in depots that were under his direct control.¹⁶

In the long term, the solution to the shortage of ammunition for 75^{mm} guns lay in the realm of industrial mobilization. In the short term, many field batteries made use of 90^{mm} field guns of the de Bange system, weapons for which considerable stocks of ammunition were available. While this was clearly a retrograde development, it was not entirely without its compensations. For one thing, the 90^{mm} field guns, which had no recoil mechanism to damage, were better suited to sustained long distance fire than 75^{mm} guns. For another, while most of the available 90^{mm} projectiles were cast iron shells with thick walls and

13 L. Baquet, *Souvenirs*, p. 68.

14 L. Baquet, *Souvenirs*, p. 68.

15 Grand Quartier Général, Armées de l'Est, État-Major, 3^{ème} Bureau, No. 5205, "Note Pour les Armées", 14 septembre 1914, *AFGG*, Tome II, Annexes, 1^{ère} Volume, Annexe 7, pp. 6–7.

16 Grand Quartier Général, Armées de l'Est, État-Major, 3^{ème} Bureau, No. 7513, "Le Commandant en Chef à Armées", 27 septembre 1914, *AFGG*, Tome II, Annexes, 1^{ère} Volume, Annexe 34, pp. 24–25.

little in the way of payload, a small proportion consisted of high-capacity steel shells comparable to those fired by the 75^{mm} gun.¹⁷

The dispatch of de Bange field guns to the front took place at a time when the war of grand maneuvers was ending and position warfare, what might be called siege warfare on a national scale, was slowly taking its place. This metamorphosis greatly reduced the amount of transportation needed to keep a given number of artillery pieces in action. In particular, the ammunition columns, which had served as ‘rolling magazines’ in mobile warfare, had far less to do in position warfare. At the same time, the horses, wagons, and drivers that had served to keep field batteries either on the march or in constant readiness to move, found themselves underemployed. Thus, French armies in the field possessed the means of forming the newly arrived de Bange field guns into batteries.¹⁸ Some of these were organized as mobile batteries, with a full allotment of drivers, horses, and vehicles. Others were *batteries de position*, substantially smaller units without the organic means of quickly moving their pieces, personnel, and projectiles from one place to another.¹⁹

Howitzers and Siege Mortars

The onset of position warfare led to the dispatch to the front of substantial numbers of the three pieces of the *système de Bange* that had been designed explicitly for siege warfare: the 155^{mm} howitzer, the 220^{mm} mortar, and the 270^{mm} mortar. All three of these were short-barreled weapons that used relatively small charges to send relatively large projectiles along sharply curved

17 L. Baquet, *Souvenirs*, p. 96.

18 The creation an authoritative list of the batteries improvised by the French Army during the first year of the war would be a Herculean task, one complicated by the tendency of documents created by formations in the field to refer to batteries simply by the caliber of their weapons (e.g. “*batterie de 95*”), the name of their commander, or their location. One can, however, get a sense of how, where, and when these units were created by perusing the war diaries (*Journaux des marches et opérations*) and regimental histories of artillery units. Those contemplating the detailed study of such sources may want to begin with the two wonderfully detailed histories of the 47th Field Artillery Regiment: [initial] Masson, *47^{ème} Régiment d’Artillerie en Campagne* (Belfort: Schmitt Frères, no date) and R. Surugue, *Le 47^{ème} Régiment d’Artillerie* (Besançon: Imprimerie Jacques et Demontrond, 1919).

19 For a detailed description of the organization of the mobile batteries improvised by one French field army during the autumn of 1914, see v^{ème} Armée, État-Major, Artillerie, 3^{ème} Bureau, “Organisation de l’Artillerie Mobile autre que 75”, 13 décembre 1914, Annexe 330, *AFGG*, Tome II, Annexes, 1^{ère} Volume, pp. 453–455.

trajectories. As such, they were well suited to the task of dropping large shells on top of German trenches and strong points. This virtue, however, was not sufficiently attractive to cause the French armies in the field to make full use of the stock of these weapons that was at hand. Indeed, while the larger short-barreled weapons were slowly making their way to the battlefield, the twenty-one batteries that had begun the war with 120^{mm} Baquet howitzers were in the process of exchanging those weapons, which lacked the range to fully participate in the struggle against German heavy field howitzers, for older guns of one sort or another.²⁰

One possible contributor to the failure of the French Army to make full use of the short-barreled members of the de Bange family, was the desire to modernize older heavy pieces before sending them to the front. While these improvements all served to increase rate-of-fire, reduce the burdens on gun crews, and eliminate the need to build fixed platforms, some were much more elaborate than others. In particular, the modifications that French arsenals applied to 120^{mm} and 155^{mm} heavy guns consisted largely of the fitting of a belt of rectangular 'shoes' to the wheels of the gun carriage.²¹ This required less in the way of both materials and labor than the modification of the older short-barreled pieces, a task that required the fabrication of a portable platform, a sophisticated steel undercarriage, and a hydraulic recoil system.²²

A more likely cause of the failure of French armies to make full use of the available short-barreled weapons was, paradoxically, the continued challenge posed by the German counterparts to those pieces, which were not only more modern but also far more numerous. Thus, in order to inhibit the Germans

20 General Joffre recommended that the batteries armed with 120^{mm} Baquet howitzers replace them with Lahitolle guns mounted on the *affût omnibus*, a mounting that permitted a higher angle of fire than the normal field carriage. G.H.Q., 1^{ère} Bureau, No. 6784, 22 septembre 1914, *AFGG*, Tome 11, Annexes, 1^{er} Volume, Annexe 25, pp. 16–17. However, several batteries exchanged their 120^{mm} Baquet howitzers for 90^{mm} de Bange guns. See, for examples, the war diaries of the third and fourth groups of the 1^{ère}, 2^{ème}, 3^{ème} and 5^{ème} *Régiments d'Artillerie Lourde*, as well as the war diaries of the component batteries of those groups.

21 When combined with transportable ramps, the "belt for wheels" (*ceinture de roues*) greatly reduced the distance that an older artillery piece moved to the rear each time that it was fired. For an entertaining account of how this device was adopted by the French Army, see R. Alexandre, *Avec Joffre d'Agadir à Verdun* (Paris: Berger-Levrault, 1932), pp. 48–49.

22 "État du Matériel d'Artillerie Lourde" (Fonds Clémentel), p. 9. For a detailed description of both the Model 1881 155^{mm} siege howitzer and the modifications that converted it into the Model 1881–1912, see P. Alvin and F. André, *Les canons en service* (Paris: Charles-Lauvauzelle, 1930), pp. 233–243.

from using their field howitzers and siege mortars to destroy French field fortifications, the French continued to devote the lion's share of the resources needed to create heavy artillery units to the forming of batteries armed with long-barreled weapons.

The French Army's fondness for long-barreled pieces of the de Bange system had its counterpart in the realm of ordnance of a more recent vintage. At the start of the war, the one piece of quick-firing heavy artillery in production for the French Army was the Schneider 105^{mm} heavy gun, which had been adopted for service in 1913. In September of 1914, the first three batteries to be armed with this weapon took the field. That same month, the worst of the production problems that had plagued the 105^{mm} heavy gun, to include the mobilization of all but two of the factory workers who had been building it, had been resolved.²³ Thus, each month of the first year of the war saw the delivery of a dozen or so of the new weapons, and the creation of a group of three four-piece batteries to employ them.

While the 105^{mm} gun enjoyed a high rate of fire and a greater maximum range than the guns of the de Bange system, the newer piece was far less robust than the older ones. While the barrels of the 120^{mm} de Bange gun could easily withstand the firing of 10,000 rounds, those of the 105^{mm} heavy gun were worn out after 2,500 rounds.²⁴ To make matters worse, the shells fired by the 105^{mm} gun, were prone to exploding while still in the barrel. Such explosions were so common that, by the spring of 1915, nearly a quarter of the 105^{mm} heavy guns sent to the front had been damaged beyond repair.²⁵ This fragility led to an army-wide policy of restricting the use of the 105^{mm} heavy gun to situations where no other piece could accomplish the mission at hand.

When, in 1913, the senior leadership of the French Army decided to procure the 105^{mm} heavy gun, it imagined the piece as the companion to a quick-firing field howitzer of a type "to be determined at a later date."²⁶ However, in the

23 A. D'Aubigny, "Rapport sur les armements", *Les archives de la Grande Guerre*, June 1921, p. 495.

24 Grand Quartier Général, 1^{ère} Bureau, "Extension de programme de fabrications", 11 juin 1915, *AFGG*, Tome III, Annexes, 1^{er} Volume, Annexe 554, pp. 726–727.

25 A census conducted in May 1915 found that only 72 of the 98 105^{mm} guns sent to the front were still in service. A second census, conducted in June or July 1915, found that, of 116 105^{mm} heavy guns delivered to the French Army, 84 were at the front, five were with training units, three had been destroyed by enemy fire, and 24 had been damaged beyond repair by premature explosions. L. Baquet, *Souvenirs*, pp. 120, 121, and 125 and "État du matériel d'artillerie lourde" (Fonds Clémentel), p. 12.

26 In October 1913, War Minister Eugène Étienne approved a plan for the creation of five heavy artillery regiments (*régiments d'artillerie lourde*). Four of these (known as "metro-

eight months that passed between that decision and the outbreak of war, the War Ministry had done little more than reveal a prejudice in favor of a 120^{mm} piece offered by Schneider, and promise that production of the new weapon would be complete by the end of 1917.²⁷ Thus, the project to acquire a quick-firing field howitzer lacked the bureaucratic momentum needed to survive the crisis atmosphere of the first few months of the war.²⁸ Indeed, during the first year of the war, the level of official interest in this weapon was so low that no use was made of the forty-eight 120^{mm} howitzers of the preferred model that Schneider had on hand.²⁹

Trench Mortars

While field howitzers were the first of the German short-barreled weapons to make an impression on French gunners, they were not the only weapons of that sort to have an effect upon the evolution of French artillery. Soon after the onset of position warfare, short-barreled canon of an entirely new type, devices that the Germans called *Minenwerfer* ('mine throwers') began to appear at the front. These trench mortars, which initially came in two sizes (170^{mm} and 250^{mm}), fired 'mines' (*Minen*) that were much larger than the shells fired by

politan" regiments) were to consist of six batteries of guns and six batteries of howitzers. The remaining regiment, belonging to the *Troupes Coloniales*, was to have only three batteries of guns and three batteries of howitzers. Upon mobilization, each of the four metropolitan regiments was to double itself. Thus, the French armies in the field would be provided with a force of mobile heavy artillery that consisted of 51 batteries of 105^{mm} heavy guns and 51 batteries of the new quick-firing field howitzers. While waiting for these weapons to emerge from the factories, the heavy artillery regiments were to be armed with either the 155^{mm} Rimailho howitzer or the 120^{mm} Baquet howitzer: minutes (*procès-verbaux*) of the meeting of the Conseil Supérieur de la Guerre, 15 October 1913, Carton 1N11, Archives de Guerre

27 "La defense nationale au Sénat", *Le temps*, 15–16 July 1914, p. 3.

28 General Alexandre claims that an order for 120^{mm} howitzers was given (presumably to Schneider) on the very eve of the war. However, as the rather detailed treatment of pre-war heavy artillery in the memoirs of Marshal Joffre makes no mention of this, it is likely that Alexandre confused the War Minister's decision to procure a 120^{mm} howitzer with the placement of an order with a manufacturer. R. Alexandre, *Avec Joffre d'Agadir à Verdun* (Paris: Berger-Levrault, 1932), p. 46 and J. Joffre, *Mémoires de Maréchal Joffre* (Paris: Plon, 1932), Tome I, p. 70.

29 These weapons, which were so new that they had yet to be assembled, had been built for export. "État du matériel d'artillerie lourde" (Fonds Clémentel), p. 44.

contemporary heavy field howitzers.³⁰ Moreover, thanks to the modest propellant charges used to toss them into the air, these shells were able to make do with relatively thin walls and, as a consequence, were able to carry disproportionately large bursting charges.³¹ In other words, while the small propellant charges used in *Minenwerfer* limited their range, they made it possible for these relatively small weapons to ‘punch above their weight’ and, in particular, do a great deal of damage to dugouts, trenches, and obstacles located on the forward edges of French positions.

The response of the French Army to the challenge posed by the *Minenwerfer* had much in common with its program for dealing with the problem of German heavy field howitzers. In both cases, the impetus for the enterprise came from commanders at the front rather than the War Ministry in Paris. In both cases, the personnel for the new units were officers and men made redundant by the onset of position warfare. And, in both cases, the new units were initially armed with weapons built in the day of black powder charges and cast iron projectiles. In one respect, however, the two initiatives were very different. While the French Army’s response to the challenge of the German heavy field howitzer was asymmetric, its solution to the problem posed by *Minenwerfer* was to acquire trench mortars of its own.

In the autumn of 1914, a bewildering array of improvised trench mortars made their appearance on the French side of ‘no-man’s land’. A few of these, like the *lance-mines Gatard*, delivered projectiles comparable to the mines thrown by *Minenwerfer*. The Gatard used the barrel of a de Bange 80^{mm} mountain gun to fire a variety of rod-mounted projectiles, the largest of which weighed about 100 kilos.³² Most of the French trench mortars, however, employed much smaller projectiles. The Cellier and Chaumont mortars, for example, used barrels made from the steel bodies of shrapnel shells that had been fired by field guns. Thus, their projectiles were small enough to fit into the interior of shells with a diameter of 75^{mm} or so.³³

30 Like its French counterpart (*mine*), the German word *Mine* (“mine”) and *Minengranate* (“mine shell”) referred to a projectile that carried a relatively large amount of high explosive. H. Linnenkohl, *Vom Einzelschuß zur Feuerwaffe*, p. 107.

31 The mine for the 170^{mm} *Minenwerfer* weighed 54 kilos and carried an explosive charge weighing 17 kilos. By way of contrast, the shell for the 150^{mm} howitzer weighed 40.5 kilos, but carried a mere 4.5 kilos worth of explosive. H. Linnenkohl, *Vom Einzelschuß zur Feuerwaffe*, pp. 91 and 189.

32 J.-J. Rouquerol, *Les crapouillots* (Paris: Payot, 1935), p. 24 and P. Waline, *Les crapouillots, 1914–1918: naissance, vie, et mort d’une arme* (Paris: Charles-Lavauzelle, 1965), pp. 39–40.

33 J.-J. Rouquerol, *Les crapouillots*, pp. 22–23.

The most popular of the trench mortars serving with French armies during the first season of trench warfare was the *mortier de 15* (the number '15' referred to the caliber of the weapon, as measured in centimeters). Accepted into service during the reign of Louis-Phillipe (1830–1848), this bronze mortar would not have looked out of place in a siege conducted during the 16th century. Nonetheless, it proved capable of delivering sheet-metal cylinders filled with 6.6 kilos worth of high explosive out to ranges of 220 meters and old-fashioned spherical shells as far as 600 meters.³⁴ As was the case with the improvised trench mortars, the barrel of the *mortier de 15* was fixed at a particular angle. Thus, the chief means of adjusting range on these pieces was a change in the size of the propellant charge.³⁵

The first standard trench mortar in French service, the '58T', was as much a product of serendipity as the improvised weapons it replaced. Its barrel was a steel tube with an interior diameter of 58 millimeters that had been taken from the recoil mechanism of the Schneider 105^{mm} heavy gun. These were left over from the failed attempt of the state arsenal at Bourges to build complete copies of the latter weapon.³⁶ The projectile had a diameter of 150 millimeters because cylinders of that size had been built for use with the *mortier de 15*. Nonetheless, the 58^{mm} trench mortar represented a considerable improvement over its predecessors. Thanks to a combination of fins and impact fuzes, its 'aerial torpedoes' flew further than projectiles fired by the improvised trench mortars, were much more likely to hit their intended targets, and detonated with much greater reliability. Thanks to an adjustable barrel, crews could adjust for range and even change targets without having to move the entire piece.³⁷

By the spring of 1915, three different versions of the 58^{mm} trench mortar were serving at the front. The original model ('58 T no. 1') fired a light (16-kilo) 'torpedo' to a maximum range of 250 meters. The improved light model ('58 T no. 1 bis') delivered a similar projectile, but could reach out to 500 meters or so. The improved heavy model ('58 T no. 2') could throw a variety of finned bombs, the largest of which weighed 40 kilos.³⁸ While all three of these models had been initially inspired by a desire to respond in kind to the fire of the much

34 R. Bouchon, *Cours d'artillerie de tranchée* (Bourge: Imprimerie Léon Renaud, 1917), pp. 12–13

35 J.-J. Rouquerol, *Les crapouillots*, p. 25 and P. Waline, *Les crapouillots*, p. 37–38

36 R. Bouchon, *Cours d'artillerie de tranchée*, p. 14.

37 The best account of the genesis of the 58 T is that of its inventor, Colonel Duchêne: "Comment naquit l'artillerie de tranchée française", *Revue militaire française*, January-March 1925, pp. 107–124.

38 R. Bouchon, *Cours d'artillerie de tranchée*, pp. 15–18.

heavier German *Minenwerfer*, much of the official interest in them in the winter, spring, and summer of 1915 seems to have been the ability to help deal with the problem of barbed wire obstacles.

TABLE 3.4 *Aerial torpedoes fired by 58^{mm} trench mortars*³⁹

Model of mortar	Weight of projectile	Weight of explosive	Maximum range
58T no. 1 bis	16 ^{kg}	6.35 ^{kg}	470 meters
58T no. 2	16 ^{kg}	6.35 ^{kg}	650 meters
58T no. 2	18 ^{kg}	5.95 ^{kg}	930 meters
58T no. 2	35 ^{kg}	11 ^{kg}	550 meters
58T no. 2	40 ^{kg}	11.1 ^{kg}	445 meters

During the first season of position warfare, a period that corresponds closely to the autumn of 1914, French soldiers used a variety of means to solve the rapidly evolving problem of barbed wire obstacles. At first, they used the means that had been prepared in the years before the war: small explosive charges placed by sappers and heavy duty scissors inspired by the hand-held wire cutters used by Bulgarian soldiers in the recent Balkan Wars (1912–1913). Later, as the obstacles grew in size, extent, and sophistication, they employed various combinations of canon-fired grappling hooks, Bangalore torpedoes, explosive-filled ‘snakes’, small wheel-mounted shields, acetylene blowtorches, and the concentrated fire of machineguns.⁴⁰ By the onset of winter, however, the Germans had begun to use types of barbed-wire that were much harder to cut than the thin and brittle agricultural wire used in early obstacles. As a result, the older methods, while still useful in places, were increasingly unable to clear suitable paths for attacking infantry. Because of this, French commanders began to devote some of their precious stock of high explosive shells for the 75^{mm} field gun to the work of creating paths in the wide belts of barbed wire obstacles that protected so many German positions. Indeed, by the spring of

39 R. Bouchon, *Cours d'artillerie de tranchée*, p. 18

40 Grand Quartier Général, 1^{ère} Bureau, No. 6327, “Note relative aux divers engins de destruction contre le personnel et le matériel”, 25 décembre 1914, *AFGG*, Tome 11, Annexes, 1^{er} Volume, Annexe No. 460, pp. 653–655

1915, the 75^{mm} high explosive shell had become the preferred means of dealing with the problem of barbed wire obstacles.⁴¹

The use of 75^{mm} field guns to cut wire greatly simplified the organization of bombardments. Using a single set of firing positions, the field gun batteries were able to cut wire before the attack and then, as the infantry moved forward, deliver *tirs de barrage* (curtains of shells that isolated enemy positions). This solution, however, was not without its defects. When fired at the relatively close ranges required for efficient wire cutting, 75^{mm} shells followed a very flat trajectory. This meant that they were unable to reach, let alone destroy, obstacle belts placed in hollows, draws, and depressions. As a result, most programs of wire cutting required high-angle-of-fire weapons to complement the 75^{mm} field gun. In a few cases, the gunners charged with destroying barbed wire obstacles were able to obtain the services of 155^{mm} howitzers. In most, however, they had to make do with 58^{mm} trench mortars.

The units that served 58^{mm} trench mortars were formed in much the same way as those created to employ heavy pieces. In the autumn of 1914 and the winter of 1915, units and formations at the front used their own resources to create provisional organizations, each of which was equipped with whatever resources happened to be at hand. On 16 February 1915, General Joffre authorized the formation of sections of *artilleurs-bombardiers*, each of which consisted of eighteen gunners, and two trench mortars. While they waited for sufficient numbers of 58^{mm} trench mortars to emerge from the factories, many of the sections were armed with *mortiers de 15*. On 9 May 1915, Joffre announced that the War Ministry had directed that these sections be affiliated with the depots of particular field artillery regiments that, in turn, provided them with the officers and men they needed to expand into half batteries (*demi-batteries*) of six trench mortars and full batteries armed with twelve such weapons. In contrast to the sections of *artilleurs-bombardiers*, which consisted entirely of gun crews, the batteries and half-batteries were fully mobile units, with enough transport to move their trench mortars, organizational equipment, and a stock of ammunition from one sector of the front to another.⁴²

General Joffre's plan for the distribution of units armed with 58^{mm} trench mortars, called for two complete batteries to be assigned to each field army. In addition to this, each two-division army corps was to get a battery, each autonomous division was to get a half-battery, and each triangular (three-division)

41 According to General Roquerol, the first use of 75^{mm} field guns to clear barbed wire obstacles took place on 21 December 1914 in the course of an attack carried out near the city of Reims. R. Roquerol, *Les crapouillots*, p. 33.

42 P. Waline, *Les crapouillots*, pp. 56–57 and 61

army corps was to get one full battery and one half-battery.⁴³ By the end of June 1915, the depots of artillery regiments had formed, equipped, and dispatched a sufficient number of such units to fulfill this plan. Better yet, there were sufficient officers, men, and trench mortars left over to create a general reserve of trench mortar units for assignment to armies that were about to undertake offensive operations.⁴⁴

In July 1915, the War Ministry began to form a second series of trench mortar batteries, each of which was to be armed with six 240^{mm} trench mortars.⁴⁵ Substantially larger than the 58^{mm} trench mortar, the *mortier de 240T* fired a projectile comparable in weight and payload to the shell of the heavy *Minenwerfer*. While these units were being formed, the War Ministry pursued additional trench mortar projects, which ranged from a 340^{mm} piece that fired a finned projectile of nearly 200 kilos, to a much smaller trench mortar that fired 75^{mm} shells originally built for use in field guns.⁴⁶

TABLE 3.5 *Distribution of 58^{mm} trench mortars to formations in the field*⁴⁷; 29 June 1915

Formation	No. 2	No. 1 bis	No. 1	Total
XXXVI Army Corps	12	24	9	45
<i>Détachement d'Armée de Lorraine</i>	12	36	10	58
First Army	24	78	12	114
Second Army	36	90	10	136
Third Army	36	54	6	96
Fourth Army	36	48	0	84
Fifth Army	24	48	12	84

43 P. Waline, *Les crapouillots*, pp. 61–62

44 For an example of how batteries and half-batteries were distributed within a single field army, see X^{ème} Armée, État-Major, *Le général de division d'Urbal, commandant la X^{ème} Armée, à Monsieur le général commandant le groupe des Armées du Nord, 30 juin 1915*, Annexe No. 809, AFGG, Tome III, Annexes, 1^{er} Volume, pp. 1049–1053

45 Ministère de la guerre, inspection des études et expériences techniques d'artillerie, No 4800, *Le General Dumezil, inspecteur des études et expériences techniques d'artillerie, à monsieur le ministre de la guerre (3e direction, 2e bureau, 1ère section bis)*, 8 juillet 1915, AFGG, Tome III, Annexes, 2^{ème} Volume, Annexe No. 868, p. 93

46 Ministère de la guerre, 3^{ème} direction, artillerie et équipages militaires, le sous-secrétaire de la guerre (artillerie) à monsieur le général commandant en chef, Annexe No. 1217, AFGG, Tome III, Annexes, 2^{ème} Volume, pp. 648–649

47 *Situation des batteries de 58*, Annexe 812, AFGG, Tome III, Annexes, 1^{er} Volume, p. 1657.

Formation	No. 2	No. 1 bis	No. 1	Total
Sixth Army	24	30	7	63
Seventh Army	24	30	2	56
Tenth Army	48	126	2	176
Total	276	564	70	912

TABLE 3.6 *French trench mortars developed in 1915*⁴⁸

Model of mortar	Weight of projectile	Weight of explosive	Maximum range
340T	195 ^{kg}	93 ^{kg}	2,300 meters
240T	87 ^{kg}	45 ^{kg}	1,025 meters
75T	5.315 ^{kg}	0.825 ^{kg}	1,700 meters

TABLE 3.7 *Older artillery pieces serving with french field armies*⁴⁹

Model	Caliber	Type	August 1914	December 1914	May 1915
1877	90 ^{mm}	Field Gun	–	672	834
1875	95 ^{mm}	Heavy Gun	–	266	398
1878	120 ^{mm}	Heavy Gun	120	295	370
1877	155 ^{mm}	Heavy Gun	–	132	172
1881	155 ^{mm}	Siege Howitzer	–	96	120
1880	220 ^{mm}	Siege Mortar	–	–	48
1885	270 ^{mm}	Siege Mortar	–	–	32

48 R. Bouchon, *Cours d'artillerie de tranchée*, p. 18.

49 These figures do not include 80^{mm} de Bange pieces (whether field guns or mountain guns) or pieces transferred directly from fortresses near to the front to armies in the field. L. Baquet, *Souvenirs*, pp. 122–123. For slightly different counts of older pieces serving at the front at various times in 1914 and 1915, see A. D'Aubigny, "Rapport sur les armements", *Les archives de la Grande Guerre*, June 1921, p. 501 and J. Joffre, *Mémoires*, Tome 11, p. 13.

Older Field Guns

In the spring of 1915, the arrival of large numbers of 58^{mm} trench mortars at the front coincided with three other important developments. The most spectacular of these was the epidemic of premature explosions that greatly reduced the number of 75^{mm} field guns in service. The most ironic was a shortage of ammunition for the 90^{mm} field guns. The most significant was a growing appreciation, among general officers as well as gunners, for the ability of short-barreled heavy pieces to deal with some of the perennial problems of position warfare.

Between 20 December 1914 and 2 May 1915, high explosive shells that exploded while still in the barrels of 75^{mm} field guns destroyed 487 of those weapons.⁵⁰ Investigators would eventually discover that the cause of nearly all of the premature detonations was faulty ammunition, and, in particular, some of the shortcuts in the production process taken by firms that had just begun to make artillery ammunition.⁵¹ In the mean time, General Joffre issued an order forbidding the use of sustained rapid fire, thereby depriving the 75^{mm} field gun of the very capability that had made it famous.⁵²

As before, the most readily available substitute for the 75^{mm} field guns that had been destroyed was the 90^{mm} field gun. This older weapon, however, was experiencing a shell crisis of its own. On 16 February 1915, Joffre's chief logistician noticed that commanders at the front found it so difficult to provide ammunition to *batteries de position* armed with 90^{mm} guns that they had begun to withdraw such units to the rear.⁵³ Four days later, this same officer sent him a note warning that, given current rates of production and consumption of 90^{mm} shells, the stock of such projectiles would be exhausted within six weeks. He therefore advised Joffre to place in storage a substantial portion (65%) of the 90^{mm} guns then serving at the front.⁵⁴

Joffre declined to take this advice. Nonetheless, the winter and spring of 1915 saw a considerable decrease in the number of 90^{mm} field guns sent forward to serve with armies in the field. Between August 1914 and December of that year, a total of 672 such weapons were delivered to formations at the front. Between December 1914 and May 1915, only 162 of them made the same journey. Thus,

50 AFGG, Tome II, pp. 391–392.

51 L. Baquet, *Souvenirs*, pp. 77–79.

52 AFGG, Tome II, p. 393.

53 Grand Quartier Général, État-Major, 1^{er} Bureau, "Note pour les armées", Annexe 888, AFGG, Tome II, Annexes, 2^{ème} Volume, pp. 196–197.

54 Grand Quartier Général, État-Major, 1^{er} Bureau, "Note relative à la situation en matériel d'artillerie de champagne", 20 février 1915, Annexe 942, AFGG, Tome II, Annexes, 2^{ème} Volume, pp. 276–277.

the average rate of deliveries of 90^{mm} field guns dropped from 134 a month to 32.⁵⁵ In this same period, the role played by the 90^{mm} field gun seems to have changed somewhat. During the first five or six months of the war, the 90^{mm} field gun was employed as a temporary substitute for the 75^{mm} gun. Starting in the first half of 1915, it became a more permanent complement to the 75^{mm} gun, a means of freeing the newer, more powerful weapon for those missions that required a higher rate of fire. In other words, the 90^{mm} field gun performed the routine tasks of position warfare in order to make the 75^{mm} field gun available for actions on a larger scale.

TABLE 3.8 *Monthly rate of delivery to the front of older artillery pieces*⁵⁶

Model	Caliber	Type	August through December 1914	January through May 1915
1877	90 ^{mm}	Field Gun	134	32
1875	95 ^{mm}	Heavy Gun	53	26
1878	120 ^{mm}	Heavy Gun	59	39
1877	155 ^{mm}	Heavy Gun	26	8
1881	155 ^{mm}	Siege Howitzer	19	5
1880	220 ^{mm}	Siege Mortar	–	10
1885	270 ^{mm}	Siege Mortar	–	6

The reduction in the rate of delivery for the 90^{mm} field gun was part of a general slowdown in the migration of older guns to the front. In the first five months of 1915, the average monthly rate of delivery of the 95^{mm} Lahitolle gun was less than half of that of the last five months of 1914, while that of the 120^{mm} gun had dropped by a third and that of 155^{mm} gun plummeted by two-thirds. The 155^{mm} siege howitzer suffered an even worse fate, with a reduction in average monthly rate of delivery that rivaled that of the 90^{mm} field gun. At the same time, the other two short-barreled weapons of the de Bange family, the 220^{mm} and 270^{mm} siege mortars, were beginning to appear at the front.

Siege mortars of both types had been available to French forces at the front from the very start of the war. However, no weapons of those types took part in the great migration of older heavy pieces to the front in the late summer of 1914. On 22 September 1914, Joffre sent a message to the generals commanding

55 L. Baquet, *Souvenirs*, pp. 122–123.

56 L. Baquet, *Souvenirs*, pp. 122–123.

armies in the field to encourage them to make use of 220^{mm} siege mortars.⁵⁷ That same day, he asked the War Ministry to prepare batteries armed with that weapon for service at the front. In the weeks that followed, he continued to remind his army commanders of both the availability and the capabilities of the 220^{mm} mortar.⁵⁸ However, 220^{mm} mortars do not appear in the orders of battle of formations at the front until the very end of November of 1914. When they do appear, moreover, they are only present in very small numbers.⁵⁹

One explanation for the changes in the pattern of migration of older artillery pieces lies in the realm of ammunition. By the early spring of 1915, it looked as if the dearth of 90^{mm} projectiles would soon be followed by a shortage of shells for 95^{mm}, 120^{mm} and 155^{mm} pieces. Both of the 155^{mm} pieces of the de Bange family fired the same projectiles. Thus, a shortage of shells for 155^{mm} guns was also a shortage of shells for 155^{mm} howitzers. At the same time, the stocks of ammunition for 220^{mm} and 270^{mm} siege mortars that been accumulating since the 1880s were largely untouched. This meant that those senior commanders who would have preferred to receive weapons of other sorts would find it difficult to refuse delivery of siege mortars.

Another explanation for the transfer of so many siege mortars to the front in the spring of 1915 is a change in the climate of opinion. Sometime in the first few months of 1915, the same French commanders who had previously declined to make use of siege mortars began to appreciate their potential. In particular, they began to see them as an antidote to the concrete shelters that the Germans had begun to build in their positions. This epiphany, in turn, seems to have been part of a larger change of heart where short-barreled pieces were concerned, a new way of thinking that had much to do with the way that the Germans had been using such weapons.

In the course of the winter of 1915, the Germans had conducted a large number of 'attacks with limited objectives' against French, British, and Belgian positions in France and Flanders. Aimed at the seizure of pieces of relatively small pieces of ground, these minor operations made extensive use of both heavy field howitzers and *Minenwerfer*. Indeed, while the details of these

57 Grand Quartier Général, État-Major, 1^{er} Bureau, télégramme chiffré, guerre, 3^{ème} direction, 22 septembre 1914, annexe 24, *AFGG*, Tome 11, annexes, 1^{er} Volume, p. 16 and Grand Quartier Général, État-Major, 1^{er} Bureau, Guerre, 3^{ème} direction, 22 septembre 1914, Annexe 25, *AFGG*, Tome 11, Annexes, 1^{er} Volume, pp. 16–17.

58 See, among others, Grand Quartier Général, État-Major, 3^{ème} Bureau, "Note pour les armées", 27 septembre 1914, Annexe 36, *AFGG*, Tome 11, Annexes, 1^{er} Volume, pp. 25–26.

59 VIII^{ème} Armée, État-Major, 3^{ème} Bureau, 29 novembre 1914, Annexe 228, *AFGG*, Tome 11, Annexes, 1^{er} Volume, pp. 297–298 and I^{er} Armée, 31^{ème} Corps d'Armée, État-Major, 3^{ème} Bureau, "Ordre général d'opérations ...", 3 décembre 1914, *AFGG*, Tome 11, Annexes, 1^{er} Volume, pp. 328–329.

attacks varied greatly, the essential feature of nearly all of them was the use of short-barreled weapons to bombard the trenches and strong points located on or near the piece of ground to be taken.⁶⁰ Between these attacks, the Germans used their *Minenwerfer* as a tool of routine trench warfare, a means of harassment and demoralization that was particularly effective because many French formations lacked the means of responding in kind.⁶¹

Whatever the reason, the summer of 1915 found the senior leadership of the French forces at the front in agreement with Joffre's longstanding belief in the value of short-barreled artillery pieces. Indeed, the desire for these weapons at the front was such that when, on 11 June 1915, Joffre informed the War Ministry that the shortage of ammunition for older artillery pieces had been satisfactorily resolved, he also predicted an increase in demand for shells for 155^{mm} howitzers, 220^{mm} siege mortars, and 270^{mm} siege mortars.⁶²

Industrial Mobilization

The formation of a new consensus on the value of short-barreled weapons coincided with a great increase in the production of both artillery pieces and artillery ammunition. In the winter of 1915, French factories produced a grand total of 180 75^{mm} field guns. Of these, all but five were assembled from components recovered from damaged pieces. In the summer of that year, the number of 75^{mm} field guns produced rose to 850, 250 of which were entirely new. In the January of 1915, French industry produced 1,110,000 shells of types fired by 75^{mm} field guns. In August of that year, that figure had all but doubled, to a monthly rate of 2,210,000. In January 1915, 155^{mm} guns and howitzers of the de Bange system made exclusive use of shells produced before the war. In August 1915, 145,000 new shells of types fired by those weapons were manufactured.⁶³

60 B.I. Gudmundsson, *On Artillery* (Westport: Praeger, 1993), pp. 77–78.

61 See, for examples, V^{ème} Armée, État-Major, Artillerie, "Note au sujet de tir de l'artillerie", 27 janvier 1915, Annexe 741, *AFGG*, Tome II, Annexes, 1^{er} Volume, pp. 1097–1098 and the reports of General Dubail of 24 January 1914 and 31 January 1914, Annexes 722 and 741, *AFGG*, Tome II, Annexes, 1^{er} Volume, pp. 1066–1067 and 1097–1098.

62 On 11 June 1915, Joffre informed the War Ministry that, while he anticipated increased demand for shells for 155^{mm} howitzers, 220^{mm} siege mortars, and 270^{mm} siege mortars, the rate of production for ammunition for older artillery pieces was satisfactory. Quartier Général, État-Major, 1^{er} Bureau, 11 juin 1915, Annexe 554, *AFGG*, Tome III, Annexes, 1^{er} Volume, pp. 726–729.

63 F. Reboul, *Mobilisation industrielle, Tome I: des fabrications de guerre en France de 1914 à 1918* (Paris: Berger-Levrault, 1925), pp. 28, 39, and 55

While the figures for the summer of 1915 would be dwarfed by the achievements of later periods, they mark the transition from one era to another. Prior to the summer of 1915, the chief source for most of the material resources used by the French artillery, whether weapons or ammunition, was the stock of such items laid down in the thirty or so years leading up to the outbreak of war. After the summer of 1915, an item issued to a battery at the front stood a much greater chance of being a product of wartime manufacture.

The great exception to this general rule was provided by artillery pieces of the heavier sort. In the course of the first year of the war, the only heavy pieces to emerge from French factories were the 105^{mm} heavy guns that had been ordered in April 1913. Weapons of two other types, a 155^{mm} heavy gun and a 280^{mm} siege mortar, had been ordered from Schneider just before the war. However, both of these projects had been suspended in order to devote resources to the production of 105^{mm} heavy guns.⁶⁴

One of the more paradoxical effects of the revolution in manufacturing that began in earnest in the summer of 1915, was a resumption of the great migration of older pieces from fortresses and other locations in the interior of France to formations at the front. In the course of the second half of 1915, the number of older pieces serving with armies in the field increased by a third. What was true of older pieces in general, moreover, was also true of most types of older guns and howitzers. The one exception to this general rule was the 220^{mm} siege mortar. Between 1 July 1915 and 1 January 1916, the number of such weapons at the front more than doubled.⁶⁵

TABLE 3.9 *Orders for modern heavy pieces in place during the first year of the war*⁶⁶

Date of order	Model	Caliber	Type	Number ordered
April 1913	1913	105 ^{mm}	Heavy Gun	110
November 1913	1913	280 ^{mm}	Siege Mortar	18
June 1914	1914	155 ^{mm}	Heavy Gun	120
December 1914	1913	105 ^{mm}	Heavy Gun	110
April 1915	1913	105 ^{mm}	Heavy Gun	110

64 L. Baquet, *Souvenirs*, pp. 37 and 125–127

65 J. Joffre, *Mémoires*, Tome II, p. 13

66 L. Baquet, *Souvenirs*, pp. 37 and 125–127

TABLE 3.10 *Number of older artillery pieces serving with french armies in the field*⁶⁷

Caliber	Type	January 1915	April 1915	July 1915	October 1915	January 1916
90 ^{mm}	Field Gun	600	700	750	940	1,230
95 ^{mm}	Heavy Gun	270	440	480	600	650
120 ^{mm}	Heavy Gun	300	550	600	900	900
155 ^{mm}	Heavy Gun	190	300	320	460	470
155 ^{mm}	Siege Howitzer	110	160	190	350	320
220 ^{mm}	Siege Mortar	17	50	80	180	180
Total		1,487	2,200	2,420	3,430	3,750

TABLE 3.11 *Production of modern heavy artillery pieces in 1915*⁶⁸

Model	Caliber	Type	Firm	First half	Second half
1913	105 ^{mm}	Heavy Gun	Schneider	50	70
1913	280 ^{mm}	Siege Mortar	Schneider	–	15
1915	120 ^{mm}	Field Howitzer	Schneider	–	15
1915	155 ^{mm}	Field Howitzer	St. Chamond	–	40
Total				50	140

The second half of 1915 also saw an effort, on the part of both Joffre and a number of prominent politicians, to convince the War Ministry to place (and, in some instances, revive) orders with private arms makers for modern heavy pieces other than the 105^{mm} heavy gun. In doing this, Joffre made clear his preference for short-barreled weapons. In particular, he asked the War Ministry to contract with Schneider to complete the series of 120^{mm} howitzers that that firm had been building for export at the start of the war, resume work on a pre-war order for 280^{mm} siege mortars and 155^{mm} heavy guns (that had been suspended for the sake of the production of 75^{mm} guns), and commence work on the production of large numbers of 155^{mm} field howitzers and 220^{mm} siege mortars. Joffre also advocated the acquisition of 155^{mm} field howitzers, of a

67 J. Joffre, *Mémoires*, Tome 11, p. 13

68 F. Reboul, *Mobilisation industrielle*, p. 50

type that the somewhat smaller firm of St. Chamond had offered to the government at the start of the war.⁶⁹

Because of these orders, the production of new heavy pieces in the second half of 1915 was nearly three times greater than it had been in the first half of that year. Between the start of 1915 and the middle of that year, French factories finished 50 modern heavy pieces. Between the middle of 1915 and the end of that year, those factories completed 140 modern heavy pieces. Moreover, while all of the modern heavy pieces built in the first half of 1915 were of one type, those manufactured in the second half of the year were of four very different models.⁷⁰

All of the modern heavy pieces produced in the second half of 1915, were products of orders placed either by the French Army or foreign powers, well before the start of the war. Moreover, some work on many of these pieces had taken place during the first year of the war. Thus, many of the pieces delivered to the French Army in the summer and autumn of 1915 contained a substantial number of components that had been built in 1914 or even 1913. Nonetheless, the achievement was considerable, and did much to undermine the arguments of those who, like the war minister Alexandre Millerand, thought that French industry would be unable to support the production of a large number of new heavy pieces.⁷¹

Motorization

While waiting for the quick-firing heavy pieces to be built, Joffre undertook three additional reforms. The first of these was a great expansion of the fleet of motor vehicles, whether trucks or tractors, used by the French artillery. The

69 Joffre was aware that the simultaneous mobilization of two different models of 155^{mm} field howitzers was less than ideal. However, he made it clear on several occasions that he preferred the earlier delivery of many howitzers of two different kinds to the later delivery of a smaller number of weapons of a standard type. Frédéric-Georges Herr, *L'Artillerie, ce qu'elle a été, ce qu'elle est, et ce quelle doit être* (Paris: Berger-Levrault, 1924), p. 41.

70 F. Reboul, *Mobilisation Industrielle*, p. 50.

71 Alexandre Millerand (1859–1943) was minister of war from 28 August 1914 until 29 October 1915. For his opinion on the ability of French industry to support the production of new heavy artillery pieces, see his letter to Joffre of 26 June 1915: Ministère de la Guerre, Cabinet du Ministre, 26 juin 1915, Annexe 760, Annexes, 1^{er} Volume, pp. 984–985. For more on the strained relationship between Joffre and Millerand, see B.I. Gudmundsson, *Learning from the Front: Tactical Innovation in France and Flanders, 1914–1915* (Doctoral Thesis, Oxford University, 2007), pp. 94–96 and 301.

second was a considerable increase in the use of artillery pieces that had been originally built for the purpose of shooting at ships. The third was a reorganization of the units that served the heavier pieces in the French artillery park.

At the start of the war, the only fully motorized units in the French artillery were the four truck-drawn heavy batteries of the 4th Heavy Artillery Regiment, all of which were armed with 120^{mm} de Bange heavy guns. Over the course of the first year of the war, the number of batteries of this type grew by a factor of five. Towards the end of the same year, the French Army motorized heavy batteries armed with other heavy pieces from the de Bange system, heavy batteries armed with 100^{mm} naval guns, and field batteries armed with 75^{mm} field guns. It also motorized a large number of ammunition columns. As a truck could carry much more ammunition than a horse-drawn wagon, each automobile column that was formed made possible the dissolution of several horse-drawn ammunition columns, thereby freeing personnel, horses, and vehicles for service with batteries.⁷²

TABLE 3.12 *Number of motorized batteries*⁷³; August 1914 to September 1915

Armament of Battery	August 1914	December 1914	September 1915
120 ^{mm} de Bange Heavy Gun	4	16	22
100 ^{mm} Naval Gun	–	–	6
155 ^{mm} de Bange Light Siege Howitzer	–	–	2
155 ^{mm} de Bange Heavy Gun	–	–	2
220 ^{mm} de Bange Siege Mortars	–	–	2
75 ^{mm} Field Gun	–	–	3
Total	4	16	35

Naval Pieces

The shipboard and coast defense pieces pressed into service in the course of 1915 fell into three basic categories. The first consisted of guns with calibers between 100^{mm} and 145^{mm} that were mounted on carriages of the sort used by

⁷² F. Herr, *L'Artillerie*, p. 41 and *AFGG*, Tome IV, 1^{er} Volume, pp. 70–72.

⁷³ The batteries armed with 120^{mm} guns consisted of six pieces. Those armed with other weapons were all four-piece units. F. Herr, *L'Artillerie*, p. 41 and *AFGG*, Tome IV, 1^{er} Volume, pp. 70–72.

mobile heavy guns. The second consisted of guns of the same (or similar) types that were installed aboard riverine gunboats (*canonnières*) and canal barges (*péniches*.) The third was composed of pieces, whether guns or mortars, that were normally moved by rail.⁷⁴

The great virtue of the anti-ship guns was their ability to fire at ranges well beyond those achieved by de Bange guns of similar calibers. This advantage, however, could only be obtained at the price of rapid barrel wear. Happily, the shipboard and coast defense weapons were overbuilt, and so could be safely re-bored to create a similar weapon of slightly higher caliber. Thus, worn out 100^{mm} guns were re-bored to create 105^{mm} guns and worn-out 138^{mm} guns of the newer, longer sort (Model 1910) were converted into 145^{mm} guns.⁷⁵

The 100^{mm} gun was mounted on the field carriage of the de Bange 155^{mm} heavy gun. The 14^{cm} guns, however, had custom-tailored mountings with metal platforms, sophisticated recoil mechanisms, and the ability to change the direction of fire without moving the platform. As might be imagined, mountings that offered such advantages were extremely heavy. Thus, while batteries armed with the 100^{mm} gun could be either of the horse-drawn or motorized variety, batteries armed with 14^{cm} guns relied entirely upon motor vehicles.⁷⁶

Most of the shipboard and coast defense guns in use at the start of the war were far too heavy to be converted into mobile heavy pieces. In a few cases, such as that of the coast-defense version of the 95^{mm} Lahitolle gun, the extra weight was a function of the way that the piece was mounted. In sharp contrast to the primitive field carriages used with the versions of the Lahitolle gun that served with field and mobile heavy batteries, the pedestal mount of the coast-defense version of that weapon had a sophisticated recoil mechanism and the ability to swing through a complete circle in a matter of seconds.⁷⁷ In most cases, however, the weapons themselves were extraordinarily large. Indeed, anti-ship guns of the middling sort were far larger than the heaviest of weapons designed to serve as siege guns.

Some of the shipboard pieces were transferred to fixed platforms before firing. Others were fired from the flatbed wagons that carried them. The former mode of employment had the advantage of simplicity. The latter, however, was

74 F. Herr, *L'Artillerie*, p. 65

75 R. Leroy, *Cours d'artillerie, historique et organisation de l'artillerie : l'artillerie française depuis le 2 août 1914* (Fontainebleu: École Militaire de l'Artillerie, 1922), pp. 101–107

76 R. Leroy, *Artillerie française depuis le 2 août 1914*, pp. 101–107

77 P. Farsac, *Cours d'artillerie: affûts* (Fontainebleau: Lithographie de l'École Militaire d'Artillerie, 1913), pp. 76–78

more flexible, particularly when special tracks, whether spur lines or complete small-gauge networks, were built to accommodate the wagon-mounted ordnance.

TABLE 3.13 *Shipboard and coast defense guns employed as mobile heavy guns*⁷⁸

Model year	Caliber	Common designation	Length	Muzzle velocity	Maximum range	Weight of shell
1897	100 ^{mm}	100 T.R.	50	760 ^{m/s}	14,500 ^m	14 ^{kg}
1914	105 ^{mm}	105 T.R.	48	740 ^{m/s}	15,800 ^m	15 ^{kg}
1891	138.6 ^{mm}	14cm	45	760 ^{m/s}	15,800 ^m	30 ^{kg}
1910	138.6 ^{mm}	14cm	55	825 ^{m/s}	17,400 ^m	30 ^{kg}
1914	145 ^{mm}	145 ^{mm}	53	800 ^{m/s}	17,600 ^m	36 ^{kg}

TABLE 3.14 *Shipboard and coast defense guns moved by rail*⁷⁹

Model year	Caliber	Common designation	Length	Muzzle velocity	Maximum range	Weight of shell
1888	95 ^{mm}	95 ^{mm} de côte	26	443 ^{m/s}	8,500 ^m	11 ^{kg}
1893–1896	164.7 ^{mm}	16cm	45	775 ^{m/s}	17,500 ^m	50 ^{kg}
1893–1896	194.4 ^{mm}	19cm	30	640 ^{m/s}	18,300 ^m	85 ^{kg}
1884	240 ^{mm}	24cm	26	575 ^{m/s}	16,800 ^m	160 ^{kg}
1893–1896	240 ^{mm}	24cm	31	840 ^{m/s}	22,700 ^m	160 ^{kg}
1893–1896	305 ^{mm}	30cm	40	795 ^{m/s}	27,000 ^m	350 ^{kg}
1893–1896	320 ^{mm}	32cm	38	690 ^{m/s}	27,000 ^m	400 ^{kg}
1912	340 ^{mm}	34cm	45	867 ^{m/s}	38,000 ^m	540 ^{kg}

⁷⁸ R. Leroy, *Artillerie française depuis le 2 août 1914*, pp. 101–107

⁷⁹ M. Goldschmidt, *Cours d'artillerie Navale* (Paris: École d'Application de la Génie Navale, 1914), pp. 25–26 and R. Leroy, *Artillerie française depuis le 2 août 1914*, pp. 145–149 and 158–165

TABLE 3.15 *Coast defense mortars employed as siege mortars*⁸⁰

Model year	Caliber	Common designation	Length	Muzzle velocity	Maximum range	Weight of shell
1889	270 ^{mm}	270 ^{mm} de côte	12	297 ^{m/s}	11,500 ^m	147 ^{kg}
1913	293 ^{mm}	293 ^{mm} Schneider	16	466 ^{m/s}	12,500 ^m	225 ^{kg}
1914	370 ^{mm}	370 ^{mm} Filloux	12	375 ^{m/s}	10,500 ^m	540 ^{kg}

Reorganization of the Mobile Heavy Artillery

On the eve of war, the organization of the French Artillery had been a model of uniformity. With few exceptions, each battery, group, or regiment was true to its type. The places of duty of batteries and groups, moreover, were rarely far from the headquarters of their parent regiments. Mobilization dealt a hard blow to neat arrangement. Groups of horse artillery were detached from their regiments for service with cavalry divisions. Heavy artillery regiments swapped groups in order to provide each field army with a custom-tailored mix of mobile heavy pieces. Reserve batteries from as many as six different regiments were formed into the divisional artilleries of reserve divisions.⁸¹ The effects of this highly disruptive event, however, were nothing compared with the administrative cacophony that followed.

During the first year of the war, old batteries were destroyed. New batteries were formed. Existing batteries were rearmed. Ammunition columns were converted into batteries, and units of fortress and coastal artillery were dispatched to the front. Thus, by the autumn of 1915, there was no necessary connection between the parent regiment of a battery and the weapons with which it was armed or the means of mobility that it possessed. Because of this, many authors of orders and reports adopted the custom of referring to artillery units by the pieces that they served and their locations (e.g. “*groupe de 155C de Saint Médard*”) rather than by their tactically irrelevant official designations.

80 R. Leroy, *Artillerie française depuis le 2 août 1914*, pp. 144–149 and 154 and J. Challéat, *Histoire technique*, Volume 2, pp. 16–17. A catalogue published by Schneider in 1914 gives somewhat different figures for the 293^{mm} mortar: a muzzle velocity of 375^{m/s} and a weight of shell of 300^{kg}. *Les établissements Schneider: matériels d'artillerie et bateaux de guerre* (Paris: Lahure, 1914), p. 103.

81 The field batteries of the 69th Infantry Division came from six different field artillery regiments. Those of the 72nd and 73rd Infantry Divisions each came from five different regiments. *AFGG*, Tome x, Volume 1, pp. 529, 537, 551, and 559

On 5 August 1915, General Joffre took a major step towards the restoration of administrative rationality. On that day, he promulgated a scheme to organize the mobile heavy artillery into twenty-five new regiments. Twenty of these regiments, known as “horse-drawn heavy artillery regiments” (*régiments d'artillerie lourde hippomobile*), would provide administrative homes for those mobile heavy batteries that relied upon quadrupeds to pull their guns. The five remaining regiments, which would bear the title of “motorized heavy artillery regiments” (*régiments d'artillerie lourde à tracteurs*), would provide the same service for units equipped with motor vehicles.⁸²

The new heavy artillery regiments were comparatively large organizations. With twenty component batteries, the horse-drawn regiments would be much larger than the standard (twelve-battery) heavy artillery regiments mobilized in August 1914. With twenty-four batteries, the motorized regiments would be larger than the 4th Heavy Artillery Regiment, which, at twenty batteries, had been the largest mobile artillery regiment to be mobilized at the start of the war. As might be imagined, regiments this large were administrative rather than tactical organizations. That is, the design of these units presumed that the largest element to be employed at a single time and place would be the ‘group’ (*groupement*).⁸³

Each of the new horse-drawn regiments consisted of three groups. One of these, consisting of ten batteries, was designed to serve as part of the heavy artillery of an army in the field (*artillerie lourde d'armée*) or as part of the general reserve of heavy artillery, to be assigned to particular armies for particular operations. Four of the batteries of this first type of group were to be equipped with 155^{mm} guns, and the other six were to be armed with 155^{mm} howitzers. The other two groups of each horse-drawn regiment, with five batteries apiece, were each intended for service as the organic heavy artillery of an army corps (*artillerie lourde de corps d'armée*.) Ideally, each of the batteries assigned to the army corps heavy artillery were to be armed with 105^{mm} quick-firing heavy guns. However, as 105^{mm} heavy guns were in short supply, most of the batteries would have to make do with such substitutes as the 120^{mm} de Bange heavy gun and the 100^{mm} naval gun.⁸⁴

82 F. Herr, *L'Artillerie*, pp. 41–42

83 Prior to the creation of the new heavy artillery regiments, the term “*groupement*” had been reserved for temporary organizations, collections of groups and batteries brought together for the duration of a particular operation. The *groupements* of the new horse-drawn heavy artillery regiments, however, were as permanent as their parent regiments.

84 F. Herr, *L'Artillerie*, pp. 41–42

The motorized regiments, all of which were earmarked for assignment to army groups or the general reserve of heavy artillery, made no use of permanent groups. Rather, each regiment consisted of twelve groups, each of two truck-drawn batteries. These motorized units were at the head of the queue for quick-firing siege pieces, particularly the 155^{mm} guns, 220^{mm} mortars, and 280^{mm} mortars, then on order from Schneider. Until these emerged from the factory, the motorized artillery would make do with older weapons, chief of which was the ubiquitous 120^{mm} de Bange heavy gun.

The formation of the new heavy artillery regiments began in October 1915. On 1 November 1915, Joffre modified the program by adding five additional motorized regiments to the list of units to be created. On 30 May 1916, he promulgated a second program of reform. The chief feature of this second program was the addition of six batteries of 155^{mm} howitzers to each of the groups designed to serve as army corps heavy artillery. In addition to this, the program of 30 May 1916 added four new batteries of mobile heavy guns to each of the horse-drawn regiments: two of 105^{mm} guns, and two of 155^{mm} guns. Thus, the establishment of each of the horse-drawn regiments was increased by a total of sixteen batteries.⁸⁵

The reorganization schemes of 5 August 1915 and 30 May 1916 were also programs of expansion. That is, while a substantial portion of each regiment would consist of batteries that existed before its creation, the realization of each program would require the creation of a large number of batteries that were entirely new. At the end of July 1915, a census of the mobile heavy batteries of the French Army showed that 272 such units were serving with armies in the field. Thus, the realization of the program of 5 August 1915, which called for a force of 520 mobile heavy batteries, required the creation of 248 new batteries. The much more ambitious program of 30 May 1916, which envisioned a grand total of 960 mobile heavy batteries, committed the French Army to the creation of 440 new units of that type.⁸⁶

Production of Modern Guns, Howitzers, and Mortars

It proved far easier to form the new heavy artillery regiments than to provide them with quick-firing artillery pieces. By the end of May 1916, most of the new horse-drawn batteries called for in the program of 5 August 1915 were serving at the front, but only a handful of the mobile heavy batteries, whether newly minted or pre-existing, had been armed with new weapons. The most

85 F. Herr, *L'Artillerie*, pp. 41–43 and 54–55

86 F. Herr, *L'Artillerie*, pp. 41–43 and 54–55

numerous of the new heavy pieces, the Schneider 105^{mm} gun, armed only 36 of the 240 batteries formed to employ it.⁸⁷ Quickfiring heavy pieces of other types were even harder to find in the orders of battle of French armies in the field. On 16 May 1916, only two batteries of quick-firing 155^{mm} guns were serving at the front.⁸⁸

Notwithstanding the ambitious nature of the program of 30 May 1916, the text of the letter promulgating it traced the outlines of a further expansion of the mobile heavy artillery, one that would provide artillery formations in the field with a “definitive organization” (*organisation définitive*). The chief feature of this scheme was the transfer of all 155^{mm} howitzers to infantry divisions, the concentration of all horse-drawn heavy guns (both 105^{mm} and 155^{mm}) into the army corps heavy artillery, and an exclusive reliance upon motorized batteries to provide armies and army groups with the mobile heavy artillery that they needed for particular operations. In particular, each infantry division was to get six batteries of 155^{mm} howitzers, and each army corps was to get twelve batteries of mobile heavy guns (six of 105^{mm} guns and six of 155^{mm} guns).⁸⁹

The realization of the “definitive organization” would allow the mobile heavy artillery of each echelon to focus on a particular set of tasks. The heavy field howitzers of divisions would bombard the trenches that sheltered the German infantry. The heavy guns of army corps would suppress the German artillery. The motorized heavy mortar batteries assigned to armies, formed into “groups of obliteration” (*groupements d'écrasement*), would deal with defended villages and other strong points. At the same time, the motorized heavy gun batteries assigned to armies would reinforce the counter-battery fires of the army corps.⁹⁰

87 Grand Quartier Général, État-Major, 1^{er} et 3^{ème} Bureaux, 19 avril 1916, “Réponse aux questions ...”, Annexe 2105, *AFGG*, Tome IV, 1^{er} Volume, Annexes, 3^{ème} Volume, p. 561.

88 Grand Quartier Général, État-Major, 3^{ème} Bureau, 20 mai 1916, “A.L. à affecter au G.A.N. ...”, Annexe 396, *AFGG*, Tome IV, 2^{ème} Volume, Annexes, 1^{er} Volume, pp. 607–609

89 Grand Quartier Général, État-Major, 1^{er} Bureau, “Organisation d'artillerie lourde et programme de fabrications”, 30 mai 1916, Annexe 696, Tome IV, 2^{er} Volume, Annexes, 1^{ème} Volume, pp. 980–983 (hereafter “Organisation d'artillerie lourde et programme de fabrications”, 30 mai 1916)

90 A *groupement d'écrasement* consisted of all those batteries of a motorized heavy artillery regiment that were armed with short-barreled weapons. Thus, each *groupement d'écrasement* was made up of eight batteries of 220^{mm} mortars and four of 280^{mm} mortars. “Organisation d'artillerie lourde et programme de fabrications”, 30 mai 1916, pp. 982–983.

TABLE 3.16 *Ideal army corps heavy artillery*⁹¹

Type	Program of August 1915		Program of May 1916		Definitive organization	
	Batteries	Pieces	Batteries	Pieces	Batteries	Pieces
105 ^{mm} Gun	5	20	6	24	6	24
155 ^{mm} Howitzer	–	–	6	24	–	–
155 ^{mm} Gun	–	–	–	–	6	24
Total	5	20	12	48	12	48

TABLE 3.17 *Ideal army heavy artillery*

Type	Program of August 1915		Program of May 1916		Definitive organization	
	Batteries	Pieces	Batteries	Pieces	Batteries	Pieces
155 ^{mm} Howitzer	4	16	6	24	–	–
155 ^{mm} Gun	6	24	6	24	–	–
Total	10	40	12	48	–	–

TABLE 3.18 *Ideal regiment of motorized artillery*

Type	Program of August 1915		Program of May 1916		Definitive organization	
	Batteries	Pieces	Batteries	Pieces	Batteries	Pieces
155 ^{mm} Gun	12	48	12	48	12	48
220 ^{mm} Mortar	8	32	8	32	8	32
280 ^{mm} Mortar	4	8	4	8	4	8
Total	24	88	24	88	24	88

91 F. Herr, *L'Artillerie*, pp. 41–55 and “Organisation d'artillerie lourde et programme de fabrications”, 30 mai 1916, pp. 980–98.

TABLE 3.19 *Number of mobile heavy batteries called for by various programs; August 1915 to May 1916*

Type	August 1915	November 1915	May 1916	Definitive organization
105 ^{mm} Gun (Horse-Drawn)	200	200	240	240
155 ^{mm} Howitzer (Horse-Drawn)	120	120	360	540
155 ^{mm} Gun (Horse-Drawn)	80	80	120	360
155 ^{mm} Gun (Motorized)	60	120	120	120
220 ^{mm} Mortar (Motorized)	40	80	80	80
280 ^{mm} Mortar (Motorized)	20	40	40	40

TABLE 3.20 *Orders for modern heavy pieces⁹²; program of 30 May 1916*

Caliber	Type	Model	Batteries	Pieces
105 ^{mm}	Gun	1913	240	960
155 ^{mm}	Howitzer	Various	540	2,160
155 ^{mm}	Gun	Various	360	1,440
220 ^{mm}	Mortar	1916	80	320
280 ^{mm}	Mortar	1914	40	80

TABLE 3.21 *Production of modern heavy guns⁹³*

Caliber	Model	1915	1916	1917	1918	Total
105 ^{mm}	1913	180	195	505	460	1,340
145/155 ^{mm}	1916	–	–	185	30	215
155 ^{mm}	1917	–	–	130	280	410
155 ^{mm}	GPF	–	–	415	300	715
220 ^{mm}	1917	–	–	–	25	25

92 F. Reboul, *Mobilisation industrielle*, p. 46

93 The figure for 105^{mm} guns produced in 1915 includes 60 produced in 1914 and 120 produced in 1915. F. Reboul, *Mobilisation industrielle*, p. 50

TABLE 3.22 *Production of modern howitzers and siege mortars*⁹⁴

Caliber	Model	1915	1916	1917	1918	Total
155 ^{mm}	Saint-Chamond	40	90	260	–	390
155 ^{mm}	Schneider	–	230	1,210	1,580	3,020
220 ^{mm}	Schneider	–	10	105	270	385
280 ^{mm}	Schneider	15	30	55	55	155

TABLE 3.23 *Characteristics of French 155^{mm} Guns*⁹⁵

Model	Common designation	Weight of piece	Length of barrel	Muzzle velocity	Range
1877	de Bange	6,500 ^{kg}	25cal	515 ^{m/s}	11,000 ^m
1877–1914	Schneider	5,775 ^{kg}	25cal	561 ^{m/s}	13,600 ^m
1917	Schneider	7,500 ^{kg}	29.8cal	655 ^{m/s}	15,300 ^m
1917	GPF	11,000 ^{kg}	36.9cal	735 ^{m/s}	15,700 ^m
1916	145/155	12,500 ^{kg}	48.5cal	797 ^{m/s}	17,900 ^m

The adoption of the program of 30 May 1916 was quickly followed by the placement of orders with manufacturers. In four out of five cases – those of 105^{mm} guns, 155^{mm} howitzers, 220^{mm} mortars, and 280^{mm} mortars – the quantities ordered matched those needed to achieve the “definitive organization”. In the remaining case, that of 155^{mm} guns, the quantity ordered would have sufficed to modernize all 360 of the horse-drawn 155^{mm} gun batteries called for by Joffre’s “definitive organization”. Once that was done, however, there would have been no modern 155^{mm} guns left over for any of the 120 motorized batteries that were supposed to have been armed with that weapon.⁹⁶

94 F. Reboul, *Mobilisation industrielle*, p. 50

95 *Renseignements sur les matériels d'artillerie de tous calibres en service sur les champs de bataille des armées françaises* (Paris : Imprimerie Nationale, 1918), pp. 117–136. The figures for the Model 1877 (*de Bange*) 155^{mm} gun presume improved carriages and the use of smokeless propellants. The figures for the 145/155 gun are for the 145^{mm} version of the weapon.

96 F. Herr, *L'Artillerie*, pp. 55–56. In his wonderfully detailed study of the French armaments industry, Frédéric Reboul gives identical figures for all pieces save the 220^{mm} mortar. He records that only 160 of these weapons, enough to equip half of the 80 batteries that were

The discrepancy between the “definitive organization” and the orders for 155^{mm} guns, seems to have been a function of the impending appearance of two new heavy guns with particularly long barrels: the Model 1916 145/155^{mm} gun and the Model 1917 155^{mm} *Grand Puissance Filloux*. As these pieces could reach targets beyond the reach of other mobile heavy guns, and were far too heavy to be pulled by horses, they were well suited for service with the heavy gun batteries of the motorized heavy artillery regiments. The design of the former piece included explicit provision for the eventual re-boring of its barrel. Thus, the practice that had begun as an expedient for extending the life of naval guns pressed into service on land, became a design feature of a state-of-the-art mobile heavy gun.⁹⁷

While modern pieces were being built, the barrels of the de Bange pieces serving at the front were beginning to wear out. The French government thus instituted a program to produce a modest number of replacement barrels for the older weapons that had served as the workhorses of the French heavy artillery for the first three years of the war. Between 1 May 1916 and 1 November of that year, the state arsenals produced 50 barrels for the Model 1881 155^{mm} howitzer, 89 barrels for the Model 1877 155^{mm} gun, and 286 for the ubiquitous Model 1878 120^{mm} gun. In the same period, the state arsenals increased the rate at which they modified the carriages of older pieces, making all more resistant to the rigors of service in the field, and some better suited to the particular demands of service in motorized units. Between the start of the war and 1 May 1916, the arsenals had modified a total of 2,284 carriages. In the six months that followed, they modified 940 carriages. Thus, the average monthly rate of modification rose from 115 to 155.⁹⁸

The orders for modern heavy pieces placed in the spring of 1916 found the French armaments industry busy with the manufacture of 75^{mm} field guns. In the first three months of 1916, French factories produced 1,500 weapons of that type, about as many as they had produced in all of 1915. Unfortunately, this great increase in production coincided with a comparable increase in the number of 75^{mm} field guns lost at the front. Indeed, it was not until the very end of 1916 that the number of new 75^{mm} field guns sent forward to armies in the field exceeded the number of such weapons destroyed by enemy action,

to be armed with it, were ordered in the spring of 1916. F. Reboul, *Mobilisation Industrielle*, p. 46.

97 P. Fain, “Notre artillerie lourde de campagne pendant la récente guerre”, *Revue d’artillerie*, August 1922, pp. 252–256.

98 *Journal officiel de la République Française. Débats parlementaires. Chambre des députés. Comité secrète de 28 novembre 1916*, p. 210.

worn out by excessive use, or irreparably damaged by a second wave of premature detonations. This second epidemic of premature detonations was, like its predecessor, caused by faulty ammunition. Thus, once the offending model of shell was identified, the problem was solved. Because of this, most of the older field guns that had found their way to the front in 1914 and 1915 remained in use throughout 1916.⁹⁹

The Retirement of Older Field Guns

The situation with regard to 75^{mm} field guns changed dramatically in the first few months of 1917. An increase in production, combined with a decrease in the number of pieces lost to premature detonation, caused a substantial increase in the stock of such weapons. This made possible the issue of 75^{mm} field guns to all field batteries that had been armed with weapons of the de Bange era.¹⁰⁰ Older field pieces would continue to serve in position batteries until the end of the war. However, these belonged to position batteries, sedentary units that were served either by men of the *artillerie à pied* or detachments provided by field batteries located in their vicinity.¹⁰¹

In the course of 1917, the French Army managed to accumulate a substantial reserve of 75^{mm} guns. This led to a program, begun in November 1917, to provide three additional batteries to each of the field artillery regiments assigned directly to army corps. At the start of the war, each army corps had possessed a twelve-battery field artillery regiment. In the summer of 1915, these regiments were split in two, with six batteries going to recently formed formations and six remaining with their parent regiment.¹⁰²

The augmentation of the field artillery regiment of an army corps usually coincided with the motorization of that unit. Indeed, the economies in manpower that resulted from the replacement of horse-drawn vehicles with a much smaller number of trucks, were an essential prerequisite to the creation of the new batteries. This motorization, however, had the secondary effect of making the new army corps field artillery regiments far more mobile than their predecessors. This quickly led to the practice of temporarily detaching such

99 AFGG, Tome v, 1^{er} Volume, pp. 38–39.

100 F. Reboul, *Mobilisation industrielle*, p. 46.

101 R. Leroy, *Artillerie française depuis le 2 août 1914*, pp. 11–12.

102 For details of the comings and goings of these batteries, see the detailed orders of battle for army corps provided in AFGG, Tome x, 1^{er} Volume, beginning on page 610.

units from their parent army corps in order to reinforce or relieve a divisional artillery regiment in a different sector.¹⁰³

TABLE 3.24 *Number of 75^{mm} field guns built and rebuilt*¹⁰⁴

Quarter	New	Rebuilt	Total
1914/3	–	20	20
1914/4	–	75	75
1915/1	5	170	175
1915/2	55	395	450
1915/3	250	600	850
1915/4	700	500	1,200
1916/1	1,000	500	1,500
1916/2	1,150	550	1,700
1916/3	1,100	800	1,900
1916/4	1,100	1,300	2,400
1917/1	950	1,650	2,600
1917/2	1,350	1,350	2,700
1917/3	1,400	1,300	2,700
1917/4	1,700	1,100	2,800
1918/1	1,800	1,100	2,900
1918/2	2,000	1,000	3,000
1918/3	2,000	1,200	3,200
1918/4	550	650	1,200
Total	17,110	14,260	31,370

TABLE 3.25 *75^{mm} field guns at the front*¹⁰⁵

Date	Pieces
20 February 1916	3,888
1 November 1916	3,850
1 January 1917	4,418
1 April 1918	5,152

103 F. Herr, *L'Artillerie*, p. 102.

104 F. Reboul, *Mobilisation industrielle*, p. 39.

105 F. Reboul, *Mobilisation industrielle*, pp. 37–39.

Reorganization of the Corps and Division Artillery

On 28 May 1918, the general headquarters of the French Armies in the field recognized this change with an order that transferred the recently motorized field artillery regiments to the *Réserve Générale d'Artillerie* (Artillery General Reserve), thereby separating them completely from the army corps to which they had previously been assigned.¹⁰⁶ Founded on 26 January 1918, the *Réserve Générale d'Artillerie* was also the organizational home for a wide variety of other types of artillery units: batteries armed with super-heavy artillery pieces (to include those mounted on railway cars), gunboats, the regiments of *artillerie à pied*, and those units of mobile heavy artillery and trench artillery that had not been assigned to particular formations. Thus, the *Réserve Générale d'Artillerie* contained both the heaviest artillery pieces in the inventory of the French Army and the lightest, both the most mobile units and the units that were most difficult to displace.¹⁰⁷

The diversity of the *Réserve Générale d'Artillerie* contrasted sharply with the growing standardization of the artillery parks of infantry divisions and army corps. For most of 1917, nearly all infantry divisions in the French Army were provided with nine-batteries (three groups) of 75^{mm} guns and two batteries of trench artillery. By 1 April 1918, all of these infantry divisions had lost their organic trench mortar batteries, but half of them (49 out of 103) had acquired three batteries (one group) of modern 155^{mm} howitzers. In the course of the five months that followed, the remaining infantry divisions received their modern 155^{mm} howitzers. Thus, by 10 August 1918, all French infantry divisions possessed the artillery establishments that they would maintain until the end of the war.¹⁰⁸

The allotment of modern 155^{mm} howitzers to infantry divisions in the course of the last year of the war, fell short of the objective set by the “definitive organization” of May 1916. One reason for this was the disappointing rate of production of the new 155^{mm} howitzers. Another was the desire to provide weapons of that sort to the American Expeditionary Force.¹⁰⁹

The assignment of units armed with heavy guns to army corps in the course of the last year of the war also fell short of the numbers called for in the “definitive organization”. In May 1916, Joffre had called for the assignment of twelve heavy batteries, six of 105^{mm} guns and six of 155^{mm} guns, to each army corps. In

¹⁰⁶ R. Leroy, *Artillerie française depuis le 2 août 1914*, pp. 5–8.

¹⁰⁷ F. Herr, *L'Artillerie*, pp. 99–100 and 122–123.

¹⁰⁸ *AFGG*, Tome VI, 1^{er} Volume, p. 169.

¹⁰⁹ *AFGG*, Tome V, 2^{ème} Volume, pp. 1209–1210.

November 1917, his successor, General Philippe Pétain, reduced the ideal allocation of batteries armed with 155^{mm} guns to three.¹¹⁰ Several months later, Pétain ordered a further reduction in the organic heavy artillery of half of the army corps then in the field. While larger army corps (those with four infantry divisions) were able to retain six batteries of 105^{mm} guns, smaller army corps were obliged to transfer half of their 105^{mm} gun batteries to the *Réserve Générale d'Artillerie*.¹¹¹

The rate of production for the heavy guns destined for service with army corps proved as disappointing as that of 155^{mm} howitzers. Thus, on 1 April 1918, a third (57 out of 180) of army corps heavy batteries that were supposed to be armed with 105^{mm} guns were still using 120^{mm} de Bange guns, and a majority (51 out of 90) of those that should have been armed with modern 155^{mm} guns were making do with de Bange pieces of that caliber.¹¹²

Between 1 April 1918 and 10 August 1918, 21 batteries of army corps heavy artillery traded their old 120^{mm} guns for new 105^{mm} guns. However, the rate at which the 105^{mm} guns wore out was such that the war would end before the last 36 batteries of 120^{mm} guns could be re-armed. In this same period, all of the army corps heavy batteries that had, for a time, been armed with modern 155^{mm} guns, exchanged those weapons for older 155^{mm} guns. The reason for this retrogression was the desire of General Pétain to give the newer 155^{mm} guns to the heavy gun batteries of the *Réserve Générale d'Artillerie*.¹¹³

The armistice of 11 November 1918 found the artillery of the French Army on an organizational plateau. The “definitive organization” set down by Joffre and modified by Pétain had, for the most part, been achieved. With the notable exception of units still armed with older 155^{mm} and 120^{mm} guns, all mobile batteries were equipped with weapons that were new enough to possess an on-carriage recoil mechanism. The older field guns that had been so much in evidence in 1915 and 1916 (the 80^{mm} and 90^{mm} de Bange pieces and the 95^{mm} Lahitolle gun) had been relegated to sedentary units, most of which had been left behind as the French armies advanced. The same was true of the short-barreled members of the de Bange family, weapons that, as recently as the autumn of 1917, had been the mainstay of the “groups of obliteration” of the *Réserve Générale d'Artillerie*.

The French artillery of 1918 had little in common with that of 1914. At the start of the First World War, the French Army had gone to war with an artillery

110 AFGG, Tome VI, 1^{er} Volume, p. 169.

111 F. Herr, *L'Artillerie*, pp. 125.

112 AFGG, Tome VI, 1^{er} Volume, p. 169.

113 F. Herr, *L'Artillerie*, pp. 99–100.

establishment made up almost entirely of light field guns. At the end of that conflict, a mobile battery picked at random from the French order of battle was as likely to be armed with heavy pieces of some sort as a light field gun. In August 1914, all but a handful of the artillery pieces serving with armies in the field were guns. In November 1918, batteries armed with short-barreled pieces constituted a respectable minority of the artillery units serving at the front: a quarter of the batteries assigned directly to infantry divisions and half of the motorized heavy batteries of the *Réserve Générale d'Artillerie*. These differences, however, pale in comparison to the great revolution that took place in the realm of transportation. In 1914, all but four of the mobile batteries of the French Army, less than one half of one percent of the total, were motorized. In 1918, over sixty percent of the mobile batteries relied on motor transport to pull their pieces, and nearly all made use of trucks to carry a substantial portion of their ammunition.

TABLE 3.26 *Types of artillery regiments*¹¹⁴

Type of regiment	August 1914	November 1918
Régiment d'Artillerie de Campagne (divisionnaire)	64	112
Régiment d'Artillerie de Campagne (de corps d'armée)	21	—
Régiment d'Artillerie de Campagne (portée)	—	37
Régiment d'Artillerie Lourde	5	50
Régiment d'Artillerie Lourde à Tracteurs	—	20
Régiment d'Artillerie à Pied	11	13
Régiment d'Artillerie de Montagne	2	3

¹¹⁴ The figures for August 1914 are derived from *AFGG*, Tome 1, 1^{er} Volume, Appendices, pp. 519–520. The figures for November 1918 are taken from F. Herr, *L'Artillerie*, pp. 140–141.