New Weapons of War

Both the Allies and the Central Powers entered the First World War with the strong, perhaps counterintuitive, belief that any war would be won using offensive tactics – in other words, a dashing attack. It became clear early in the war, however, that an offensive charge across no-man's-land to enemy territory was ineffective, though, alarmingly, commanders proved willing to use this tactic even later in the war. In a charge, most soldiers were mowed down by enemy fire long before they reached the other trench. The trench war that developed, however, showed both sides that they needed new tactics – and new technologies – to fit the situation.

Nonetheless, the pace of change was often slow, as, despite the deadlock, many top commanders and political leaders were unwilling to adopt new tactics or technology. While technology eventually contributed greatly to Allied victory, many leaders on both sides believed that the key to victory was to outlast the enemy. This strategy was called *war of attrition*. The idea was that if each side continued the fight, one side would eventually run out of supplies or soldiers, or morale would run low. The strategy did have some merit – in 1917 there were large mutinies in both Germany and France, while the Russian Revolution occurred in that same year. When Russia dropped out of the war and ceded much of its territory to Germany, Allied commanders feared that the Germans would now have enough supplies to last for several more years. However, fighting a war of attrition meant considering manpower as an expendable, renewable resource; it was thought that the next wave could be the one that broke the enemy's lines. The disastrous casualty toll of the First World War can be directly linked to this strategy.

This reading will focus mostly on the western front – the line of trench warfare between the Germans and the Allies that stretched for about 450 miles through northern France and Belgium. As this was a world war, there were several other major theatres. Unlike on the western front, however, these theaters were characterized by movement and large gains of territory. The eastern front, for instance, was approximately 1000 miles long, and both sides regularly gained dozens of miles of territory in a successful advance. On the western front an advance of more than a mile was considered a great victory. It was on the western front, therefore, that the greatest degree of innovation was required and eventually achieved.

In many cases, existing technology was adapted to meet the new conditions. In other cases, new technologies were developed; the best example of this was the tank, which was developed specifically as an armored vehicle to move troops through no-man's-land. Armies sometimes proved slow to abandon old technologies. The bayonet, for instance, was the most widely issued weapon of the war, though soldiers used it mostly as a can opener or for toasting bread (by skewering it and holding it over the fire). It only proved useful in close combat. Armies that adopted new technologies sometimes proved remarkably successful as a result.

It is also important to say a little about how tactics evolved to make better use of technology. As armies on both sides eventually abandoned the headlong charge as a tactic, they established a better one: the creeping barrage. According to this system, the infantry would creep across no-man's-land with protection from artillery, which would

bombard the other side so that they could not fire back. Poison gas was used to incapacitate the enemy, and the resulting period of disorientation was used to storm the trenches. The tank helped to break the deadlock in the war by providing a useful solution to how to get across to the other trench. Finally, though airplanes were not as critical as they were in the Second World War, they could also be used to provide cover for an assault, or to attack enemy planes.

Precursors of the First World War

Because of the defensive trench warfare that characterized the First World War, contemporaries believed that it was an entirely new style of warfare. This was not like the wars of the great stories, in which glorious victory was achieved in a single conclusive battle. While this rose-colored view of the past obscured much of the suffering that had occurred in previous wars, the experience of the First World War shocked many. However, while the trench warfare of the First World War was somewhat new, the way the war was fought and the weapons used to fight it had precursors in a few of the wars of the nineteenth and early twentieth centuries.

Perhaps the most similar precursor to the First World War was the U.S. Civil War. It was the first industrial war, and featured the most advanced military technology – the new Springfield and Enfield rifles, for instance, made the bayonet nearly obsolete (though soldiers still used it for close combat, as mentioned above). While even a well-trained soldier could only fire a few shots a minute, he could kill a man from a quarter mile away. War was becoming much more impersonal. By the end of the war, some instances of trench warfare had even broken out. The earliest machine gun, the Gatling gun, also made its appearance in the U.S. Civil War. The war featured new techniques as well – using railroads to move troops, for instance.

Another important similarity between the U.S. Civil War and the First World War was that neither side was well prepared in any way for what transpired. Armies in both wars featured large numbers of recruits were who rushed through training so that they could get to the front; this helped contribute to the high casualty totals. So did the obstinacy of commanders who sent their soldiers charging into enemy lines when the enemy's rifles and machine guns were much more powerful. The result was that for most of the Civil War, neither side advanced far or won many victories in the face of ever-stronger defensive technologies. Military planners in Europe failed to take notice of the carnage in the United States, however, and repeated many of the same mistakes as a result.

Instead of learning lessons from the U.S. Civil War, European military planners preferred to believe that a European war would follow the same lines as the Franco-Prussian War of 1870–71. Europeans remembered the war for the German Army's rapid advance through French territory and the French Army's supposedly cowardly defeat. Very few people realized that the German Army's advance had been just slow enough to allow its supply train to keep up with the advancing troops. If the army had moved any faster, it would have outdistanced its supply train, much as the German advance did in the first days of the First World War. (The Germans' quick advance brought them close to Paris, but the French moved troops to the front rapidly and

effectively by rail. With supplies dwindling, the German advance petered out as it met tough resistance, and the trench war began.)

Perhaps Europeans were also lulled into complacency by the colonial conflicts they fought in the second half of the nineteenth century. In these conflicts European forces were almost always victorious, and most victories came with ease. They did not consider what would happen if two armies with similar levels of technology fought one another. Those who did raise the alarm were generally ignored. In 1900, a Polish banker named Ivan Bloch wrote a book called *Is War Now Impossible?*, in which he predicted that a European war would quickly devolve into trench warfare and stalemate. Though we can now see Bloch's prescience, his contemporaries derided his skepticism and tried to write better offensive war plans.

Rifles and Machine Guns

Europeans made a number of improvements to the gun through the course of the nineteenth century. Soldiers no longer used muskets, which were inaccurate and fired slowly. Rather, they used repeating rifles, which fired more quickly and more accurately, and could be used from a kneeling position and in almost any weather. The first machine guns, introduced in the late nineteenth century, represented the pinnacle of these developments.

While the advances in gun technology proved useful to European colonizers in Africa and Asia in the nineteenth and early twentieth centuries, they proved less useful on the western front. The difficult conditions in the trenches, where it was often raining and usually muddy, made dependable weapons particularly important. The new guns were made to work in wet weather but the rain still affected them often, while the mud often jammed them. Some weapons were better than others. Canadian troops sent to the front in 1914 and 1915, for instance, found that their Ross rifles would often jam or fail to work. Many soldiers would throw away their Ross rifles and take the Lee-Enfield rifles of dead British servicemen. This went on until the Canadian government eventually decided to adopt the more robust Lee-Enfield rifle.

Though rifles had shortcomings, and neither side in the war improved upon rifle design during the course of the war, it was nonetheless the soldier's main weapon throughout. Soldiers could carry their rifles when advancing across no-man's-land, something they could not do with a machine gun, for instance. More powerful weapons, such as machine guns and mortars, had drawbacks as well (these will be discussed later in the entry), or could only be used by a small, well-trained contingent.

On both sides, snipers used the rifle as an effective tool of war. Essentially, snipers would fire at anything that moved in the opposing trench. This meant that soldiers had to be careful never to expose themselves to the other side, even for a moment, as snipers were always watching the other side.

While the rifle was the weapon most often used during the First World War, the machine gun was likely the most effective. Nonetheless, at the beginning of the war the machine gun often overheated quickly, which made it effective for sporadic periods only. The guns overheated within the first few minutes of use, and needed to be constantly cooled. At first, this was achieved with water, which was used to fill a water jacket

around the gun. When the water ran out, the machine gun would be inoperable until it cooled again or more water supplies could be brought up. Later in the war, air became the preferred method – new machine guns were designed with vents so that air could circulate through them. Nonetheless, these solutions were not perfect; sometimes operators still had to let the machine gun rest for a while because it was too hot.

Despite these difficulties, the machine gun became an extremely effective weapon early in the war, and its effectiveness helped to define the war on the western front. It is estimated that one machine gun was the equivalent of as many as 100 rifles; several machine guns, therefore, could wreak havoc on an enemy charge. Early in the war, therefore, it became more expedient for troops to remain safely in their trenches instead of charging into their enemy's machine guns, even though it took a long time for commanders to accept the notion that the charge was not the best method of attack.

The Germans, who quickly recognized the effectiveness of the machine gun, created separate companies in the army for machine-gun operators. The British, who at the beginning of the war did not believe the machine gun to be valuable, equipped each battalion with only two guns each. The British also took a long time to change their tactics; by the time of the Somme Offensive of 1916, two years into the war, the British high command still used the infantry charge as a major tactic. It was to their detriment, as British casualties from this battle in particular were enormously high.

Machine guns were therefore an excellent defensive weapon, but their offensive capabilities were limited. For most of the war, the only useful machine guns were very heavy; the Maxim gun, which the German army used, weighed about 135 pounds. Later versions cut the weight in half, but this was still too much to be used by infantry, and it didn't include the supplies and equipment necessary to make the machine gun function. As a result, machine guns were mostly used as stationary weapons. A crew of four to six men would operate the weapon, which was placed on top of a tripod.

Both sides did, however, try to make smaller and lighter machine guns that infantry could use. The U.S. Army developed a 25-pound version, which they deemed too heavy for a single infantryman to carry while moving quickly. They experimented with loading carts or pack animals with several of the lighter machine guns. The idea was that the guns would be carried until the infantry needed them, but the infantry generally moved faster than either the carts or the animals, so the idea was discarded. By 1918 both sides had developed one-man machine guns weighing from 20 to 30 pounds, but it was still difficult to maintain a steady stream of supplies for the user.

While the light machine gun proved of little use to the infantry during the war, other sectors of each side integrated it into their operations. When German engineers discovered how to fire a light machine gun from behind an airplane's propeller without hitting the blades, they began to equip planes with machine guns. The Allies soon followed suit. Both sides also employed light machine guns on navy ships, while the French and the Italians mounted them on tripods and placed them on vehicles as anti-aircraft weapons.

Grenades

The primary offensive weapon for the regular infantry was the grenade. Once again, this was the result of the tactics that each side adopted as part of trench warfare. In the event of an infantry attack, as the soldiers got close to the opposing trench, they would start to throw grenades. Once they reached the opposing trench, moreover, it was the job of the grenadiers to ensure that there were no enemy combatants hiding in any of the linked trenches. They achieved this by throwing a grenade down each passageway – a tactic that undoubtedly killed many soldiers attempting to surrender.

Both sides used grenades increasingly as the war developed. Of course, in order to use a grenade one had to be within throwing distance of the enemy, which involved the dangerous exercise of advancing across no-man's-land. While undoubtedly this was difficult in the early years of the war, grenadiers received better protection when part of a creeping barrage.

Two types of grenades existed at the beginning of the war: percussive and timed. In the first case, the grenade exploded when it came into contact with something with a certain degree of force. The idea was that the grenade could be thrown and then explode once it hit its target, whether another soldier, some equipment, or the ground. In practice, however, the danger always existed that if one knocked against a percussive grenade too hard by accident, it would explode in one's own trench. This was a real danger in the packed trenches, and led the percussive grenade to be abandoned.

Soldiers on both sides preferred the timed grenade, which became the predominant model by the end of the war. Some early models were timed by lighting a fuse, much like with fireworks or dynamite. The predominant model, however, began the timing sequence when a soldier pulled a pin from it. While early models were unreliable, by the middle of the war both sides were producing hundreds of thousands of mostly reliable grenades.

Engineers on both sides attempted to find ways to make grenades fly further. One idea was to shoot the grenade from a rifle. The grenade was attached to the end of a long rod, which was pushed down the barrel of the gun. Once the soldier had released both safety spoons on the grenade, he had to fire quickly or the grenade would explode at the end of the gun. While this method never proved accurate, and also tended to ruin the rifle after repeated use, the French developed it so that it could fire a grenade up to 400 yards. For the most part, both sides persisted with handheld grenades for the course of the war.

Different, more deadly, types of grenades were developed throughout the war. The basic structure of the Mills bomb, which William Mills developed for the British army in 1915, is still used today. Mills designed grenades with serrations in them, so that when they exploded they would break into fragments. They also had two types of timers. First, the soldier pulled the pin while depressing a lever underneath it. When the soldier threw the grenade, the lever released. The Mills bomb proved the most popular, as the Allies used tens of millions of Mills bombs over the course of the war.

Artillery

One of the crucial weapon groups of the trench war was the artillery. Artilleries were much like large rifles firing much larger shells. They were divided into light and heavy artillery, depending on the weight of the shells they fired. Various types of artillery were used to carry out different kinds of attacks. Usually, they could fire shells for at least a mile. By the end of the war, some types of heavy artillery could launch shells more than 10 miles.

Many soldiers who developed *shell shock*, or posttraumatic stress disorder, feared artillery the most because it came from the sky and could create enormous explosions. Despite the psychological effect it had on enemy soldiers, however, artillery was not used to any great effect after the first months of the war. The Germans used their heavy artillery guns, nicknamed Big Berthas, to reduce several of the Belgian towns they besieged in August 1914. The Germans only produced four Big Berthas over the course of the war, and they went out of service in 1916 once the Allies had built more powerful guns.

While both sides succeeding in building ever more powerful artillery with longer range, the use of artillery barely changed until late in the war. In 1914, commanders on both sides, but especially French commanders, believed that the best way to start an advance was with an artillery bombardment. The idea was that the bombardment would exhaust or demoralize the other side, and victory would soon follow as a result. The reality was rather different; even when the British bombarded the Germans for eight days at the beginning of the Battle of the Somme in mid-1916, it did not help them break through. Enemy troops knew that they needed to wait until the end of the bombardment, and then they could pick off the infantrymen as they charged.

This tactic was used so frequently that it soon served to alert opposing commanders to the beginning of an offensive. The artillery bombardment also had other negative aspects. Some commanders came to believe that powerful artillery could destroy the barbed wire in no-man's-land, thus making it easier for infantry to attack. Not only was this not the case, but also the craters that the bombardment left in its wake made advance harder. Unexploded shells in no-man's-land were another danger of this approach.

As mentioned above, however, the development of the creeping barrage provided for a different use for many weapons. In this method of attack, the artillery was designed to explode shells just in front of the line of advancing soldiers. This involved excellent planning and timing, as well as supreme skill from the artillery commanders.

The British first attempted the creeping barrage in August 1916, as the Battle of the Somme wore on (though Bulgarian troops had experimented with similar tactics in 1913). It proved quickly successful, but the successes were modest; a creeping barrage could yield a small gain of territory, but never a major breakthrough. It was by nature a conservative offensive designed to shield the attacking infantry from the enemy's overwhelming defensive power.

Poison Gas

While artillery was mostly used to fire shells, both sides also used it for the dispersal of poison gas. Both sides viewed gases such as tear gas, chlorine gas, and mustard gas as possible ways to disorient the opposition long enough to make a major breakthrough in the lines. Though the dispersal of gas often did succeed in disorienting the opposition, neither side managed any major breakthroughs as a result of using poison gas.

While the Germans are usually accused of being the first country to use poison gas in the First World War, the French first experimented with it in 1914. The Hague Conventions of 1900 had forbidden the use of poison gas. Since the Germans did not want to be accused of committing war crimes, they feared being the first country to use poison gas, but they also wanted to exploit its potential to break the stalemate on the western front. When the French fired tear gas at the Germans in August 1914, it gave the Germans the excuse they needed to employ gas as well.

While the French had carried out their assault with tear gas, the Germans turned to chlorine gas, which is much more poisonous. At the Second Battle of Ypres in April 1915, the Germans fired chlorine gas canisters towards French and Algerian troops. The chlorine gas caused mass panic, and the French and Algerians fled. When the Germans attempted to advance through the hole in the Allied line, however, Canadian and British troops stepped into the breach and repulsed the advance.

The Hague Conventions had forbidden the use of poison gases for good reason. Chlorine gas and mustard gas, which is even more dangerous, affect the human body terribly. Soldiers who wore no protection against chlorine gas would choke in seconds, while those who were exposed to phosgene gas (a colorless gas that smelled to some soldiers like moldy hay) often felt the effects 48 hours afterward. Mustard gas exposure resulted in blisters to both the respiratory system and the outside of the body. All the gases could be fatal.

After months of experimentation, the Allies found a way to defend soldiers against gas attacks: gas masks. (In the meantime, they carried out attacks of their own on the Germans.) As each mask was equipped to handle a particular type of poison, however, an attack with a new type of gas could still incapacitate soldiers. In an emergency, soldiers were advised that soaking a cloth with urine and putting it over one's face could protect against some exposure.

Airplanes

Airplane technology made great leaps forwards during the First World War. The Wright brothers had made the first flight only eleven years before the beginning of the war; by war's end, aircraft were being used for all the major operations for which they would be used in the twentieth century: reconnaissance, tactical bombing, naval warfare, and plane-to-plane combat.

The airplane's history as a military tool predated the war by only three years. In 1911, the Italians launched grenades from airplanes in their invasion of Libya. Nonetheless, at the beginning of the war, none of the major belligerents had a large air

force. France, which had the largest air force at the end of the war and produced 68,000 aircraft overall, began the war with fewer than 140 planes.

The First World War also witnessed tremendous improvements in aircraft technology. At the beginning of the war, the typical British airplane had a top speed of just over 70 mph and could stay in the air for just over three hours. Most airplanes were built with the propeller at the back, which was supposed to push the aircraft through the air. By the end of the war, however, planes could fly twice as fast and could stay aloft for eight hours. Instead of making general-use aircraft only, the belligerents produced planes for specific tasks such as bombing or reconnaissance. These planes also had greater capabilities than earlier models; British bombers, for instance, could carry 2000 pounds of bombs.

Airplane design also changed greatly as the war developed. At the beginning of the war, the main concern was keeping a plane in the air; after all, they had only been around for eleven years. Moreover, the first air force pilots had very little experience – sometimes only a few hours of training. It was important, then, that aircraft be stable in the air above all other considerations. The early planes were therefore not very maneuverable.

As the war progressed, however, the factors affecting plane design changed. As each side used airplanes more regularly for many types of operations, it became increasingly important to have planes that were more maneuverable. Pilots were better trained, moreover, so it was deemed acceptable to build planes that were harder to fly but could perform more effectively.

While the airplane did not have as large an impact in the First World War as it did in the Second World War, both sides used airplanes frequently on the battlefield. The aircraft dogfights of the First World War have become legendary in the history of warfare. Several “aces,” as pilots with many victories were called, became heroes of the war. Manfred von Richthofen, a German pilot nicknamed the Red Baron, downed 80 enemy aircraft before being shot down in April 1918.

Aircraft were often used to support the advance of troops, or just for general bombings. While aircraft attacks were seldom accurate, they had a strong psychological effect on opposing troops; only artillery attacks, with the characteristic shriek of an oncoming shell, were more feared. While soldiers could take shelter in the ground from opposing shells and machine gun fire, the aircraft that could cross no-man’s-land at will was a terrifying force, especially considering that the soldiers in the war had generally never experienced aviation before.

Tanks

All of the above technologies existed in some form or another before the outbreak of the First World War. The tank, however, was invented as a result of the difficulties of the war, and its implementation helped to bring the war to its conclusion. Since then, it has become an indispensable part of war materiel. The story of its adoption, however, is as much a story of shortsightedness as of technological advancement.

Although the tank was first produced for warfare in the First World War, its origins lie more than a century before the war's outbreak. Moreover, the tank came very close to being a vehicle for warfare long before 1914, but military authorities never quite saw its potential. The first tractors that operated on a caterpillar track were developed in 1770 by Richard Edgeworth of Great Britain. Some steam-powered caterpillar tractors were even used on muddy battlefields in the Crimean War in the 1850s. In 1901, Alvin Lombard of Maine had developed the first tractor on caterpillar tracks with a combustion engine; in other words, a vehicle with all of the aspects of a tank. While the technology slowly improved, military leaders were unwilling to believe entrepreneurs who told them that their inventions could be useful in a war.

The British army eventually came to adopt the tank because a few officers *had* been impressed with its use. Their single-mindedness eventually convinced some senior British politicians to witness a demonstration in mid-1915. Among those in attendance were David Lloyd-George, who became Prime Minister in 1916, and Winston Churchill, who was First Lord of the Admiralty. Both men were impressed by the tank, and Churchill ordered further investigations into its potential uses.

It is important to mention, however, that in 1915 the tank had not yet progressed to the point where it could be useful on the battlefield. However, the secret British committee tasked with improving the tank set about to make it reach the potential that Churchill and others saw in it. The first model, however, weighed fourteen tons, travelled at a speed of two miles an hour, and could not cross a trench.

The British nonetheless began to manufacture tanks in early 1916, though they came too late for the disastrous 1916 Somme Offensive mentioned above. The French military also belatedly began to produce their own models, which were ready by April 1917. The Germans were surprised when the British first deployed tanks on the battlefield in September 1916, but many tanks became stuck in the muddy trenches and had to be abandoned. The interior of the tank also tended to get extremely hot and fill up with dangerous fumes. When the French deployed their own tanks in 1917, they experienced the same difficulties. Thus, though the Allies held the edge in tank technology over the Germans, they were unable at first to gain any advantage as a result.

The British and French both used tanks successfully in the autumn of 1917, taking a few miles of territory from the Germans. However, neither Ally had the manpower to continue the invasion, and they had to abandon their gains when the Germans counterattacked in other regions. The victories convinced the Germans that they, too, needed tanks, and also encouraged the Americans, who had recently entered the war, to manufacture their own. The Germans deployed their first tanks in April 1918, but the British tanks drove off the German offensive.

Eventually, however, an Australian commander, General John Monash, experimented with a new tank strategy that allowed the Allies to begin their final push to victory. Instead of having the infantry as the focus as an offensive, he organized a solid core of tanks, artillery, and aircraft to clear the Germans out of the way and prepare a path for the infantry. In his first battle, at Le Hamel, Monash took the town in just over an hour and a half – an incredible victory by the standards of the war. The Allies used this tactic increasingly over the last months of the war and pushed the German army back

quickly. While the Allies had produced several thousand tanks by the end of the war, the Germans had produced only twenty.

Summary

- While most of the categories listed above – guns, grenades, artillery, and airplanes – experienced technological developments throughout the course of the war, their uses also varied as commanders on each side adjusted their tactics.
- Guns of various types were the main infantry weapons of the war. The rifle was the predominant weapon for infantry, while the machine gun acted as the war's supreme defensive weapon.
- Grenades were also commonly used by infantry. The first grenades were notoriously unreliable and could easily explode prematurely. Later models were more successful, and raiding parties on both sides used them frequently.
- Artillery bombardments were also a main feature of the war. Early tactics called for a bombardment to disorient the enemy before a charge, but as commanders eventually realized that this did not work, they adopted the creeping barrage, according to which artillery shells exploded just in front of advancing infantry, forming a protective curtain.
- Poison gas had the potential to incapacitate soldiers, but though both sides used it extensively in the war, it never produced the hoped-for breakthrough.
- Airplanes, a relatively new technology in 1914, became a main part of each country's military by the end of the war. Technological advances were crucial, as the slow, easy-to-fly planes of 1914 were replaced by faster, more maneuverable planes at the end of the war.
- The invention of the tank, an armored vehicle that could drive through trenches, helped to end the stalemate on the western front and bring about the end of the war.