World War I: Technology

For Years 9-12

This Pack contains:

6 ARTICLES
11 IMAGES
1 VIDEO

© 2020 Encyclopædia Britannica, Inc.

ARTICLE

trench warfare

warfare in which opposing armed forces attack, counterattack, and defend from relatively permanent systems of trenches dug into the ground. The opposing systems of trenches are usually close to one another. Trench warfare is resorted to when the superior firepower of the defense compels the opposing forces to “dig in” so extensively as to sacrifice their mobility in order to gain protection.



A British soldier inside a trench on the Western Front during World War I, 1914–18.

Hulton Archive/Getty Images

Early developments

A trench system may begin simply as a collection of foxholes hastily dug by troops using their entrenching tools. These holes may subsequently be deepened so that a soldier can safely stand up in one of them, and the individual foxholes may be connected by shallow crawl trenches. From this beginning a system of more permanent field fortifications may be constructed. In making a trench, soil from the excavation is used to create raised parapets running both in front of and behind the trench. Within the trench are firing positions along a raised forward step called a fire step, and duckboards are placed on the often muddy bottom of the trench to provide secure footing.

© 2020 Encyclopædia Britannica, Inc.



Sébastien Le Prestre de Vauban, pastel by Charles Le Brun; in the Bibliothèque de Génie, Paris.

Giraudon—Art Resource/Encyclopædia Britannica, Inc.



Union soldiers in trenches, Fredericksburg, Virginia, 1863.

Library of Congress, Washington, D.C. (LC-DIG-ppmsca-34476)

© 2020 Encyclopædia Britannica, Inc.



Breastworks of the Confederate Fort Mahone (“Fort Damnation”), Petersburg, Virginia, April, 1865.

Library of Congress, Washington, D.C. (LC-B8171-3211 DLC)

The tactical ancestor of modern trench warfare was the system of progressively extended trenches developed by the French military engineer Sébastien Le Prestre de Vauban for the attack of fortresses in the 17th century. Trenches remained merely a part of siegecraft until the increasing firepower of small arms and cannon compelled both sides to make use of trenches in the American Civil War (1861–65). The trench lines of the Petersburg–Richmond theatre of operations in the final months of that war were the foremost example of trench warfare in the 19th century.

Trench warfare in World War I



British troops in a trench on the Western Front during World War I.

Encyclopædia Britannica, Inc.

© 2020 Encyclopædia Britannica, Inc.



French machine-gun position in the trenches on the Western Front during World War I.

Encyclopædia Britannica, Inc.

Trench warfare reached its highest development on the Western Front during World War I (1914–18), when armies of millions of men faced each other in a line of trenches extending from the Belgian coast through northeastern France to Switzerland. These trenches arose within the first few months of the war's outbreak, after the great offensives launched by Germany and France had shattered against the deadly, withering fire of the machine gun and the rapid-firing artillery piece. The sheer quantity of bullets and shells flying through the air in the battle conditions of that war compelled soldiers to burrow into the soil to obtain shelter and survive.



A German machine gun emplacement during World War I.

Prints and Photographs Division/Library of Congress, Washington, D.C. (digital file no. LC-USZ62-136100)

The typical trench system in World War I consisted of a series of two, three, four, or more trench lines running parallel to each other and being at least 1 mile (1.6 km) in depth. Each trench was dug in a type of zigzag so that no enemy, standing at one end, could fire for more than a few yards down its length. Each of the main lines of trenches was connected to each other and to the rear by a series of communications trenches that were dug roughly perpendicular to them. Food, ammunition, fresh troops, mail, and orders were delivered through these trenches. The intricate network of trenches contained command posts, forward supply dumps, first-aid stations, kitchens, and latrines. Most importantly, it had machine-gun emplacements to defend against an assault, and it had dugouts deep enough to shelter large numbers of defending troops during an enemy bombardment.

© 2020 Encyclopædia Britannica, Inc.



Members of the American 132nd Infantry, 33rd Division, in a front line trench. The German line is...

U.S. Signal Corps/The National Archives, Washington, D.C. (photo no. 111-SC-26110)



Two French soldiers in a forward trench not far from German lines during World War I.

Encyclopædia Britannica, Inc.

The first, or front, line of trenches was known as the outpost line and was thinly held by scattered machine gunners distributed behind dense entanglements of barbed wire. The main line of resistance was a parallel series of two, three, or four lines of trenches containing the bulk of the defending troops. The defenders' artillery was posted to the rear of the main line of trenches. Each main line of trenches was fronted by fields of barbed wire intended to slow down and entangle attacking infantry. As World War I progressed, both sides, but particularly the Germans, developed trench systems of progressively greater depth and strength in order to ensure that the enemy could not achieve a breakthrough at any particular point. The Germans evolved an extremely elaborate defense system using pillboxes, i.e., concrete shelters for machine guns. Behind the pillboxes were more lines of barbed wire and more trenches and dugouts reinforced with concrete to withstand artillery bombardment. Behind these defenses were still more lines of trenches that were effectively out of range of the enemy's artillery fire. By 1918 the Germans had constructed some trench systems that had a depth of 14 miles (22 km).

© 2020 Encyclopædia Britannica, Inc.



American soldiers throwing hand grenades toward Austrian trenches during World War I, September...

Sgt. A. Marcioni/U.S. Department of Defense



British Mark I tank with anti-bomb roof and “tail,” 1916.

Courtesy of the Imperial War Museum, London; photograph, Camera Press/Globe Photos

Throughout most of World War I, the opposing armies on the Western Front tried to break through the enemy’s trench system by mounting infantry assaults preceded by intense artillery bombardments of the defending trenches. These attacks usually failed, partly because the preliminary bombardment alerted the defenders to the imminence of an attack, thus allowing them time to bring up reserves for a counterattack, and because the bombardments themselves turned the “no-man’s-land” between the opposing sides into rough, shell-pocked terrain that slowed down the attacking infantry. The crucial elements in attacking a trench system, surprise and overwhelming numbers of infantry, were thus almost impossible to attain. The Allies’ increased use of the tank in 1918 marked the beginning of the end of trench warfare, however, since the tank was invulnerable to the machine gun and rifle fire that were the trenches’ ultimate defense.

© 2020 Encyclopædia Britannica, Inc.

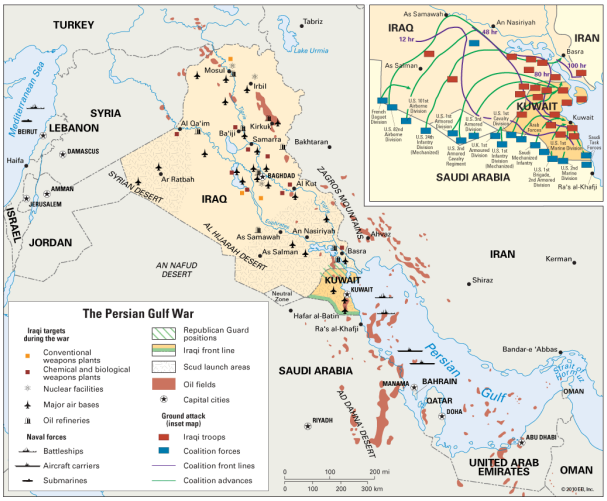
Trench warfare in the modern era



Japanese soldier, flushed from a cave by a smoke grenade, surrendering to U.S. Marines on Okinawa,...

U.S. Department of Defense

Relatively little use was made of trenches in the mobile warfare of World War II in Europe. By contrast, the Japanese in the Pacific theatre, faced with overwhelming American artillery and airpower, heavily fortified many of their islands with chains of deeply dug caves and bunkers. Similar tactics were used by the North Korean and Chinese forces in the Korean War when confronted with American airpower. In the Battle of Dien Bien Phu (March 13–May 8, 1954), which resulted in the French expulsion from Indochina, the communist-led Viet Minh used classic 18th-century siege methods and drove forward an elaborate system of trenches to negate the effects of French artillery and airpower, preparatory to the battle.



Encyclopædia Britannica, Inc.

Classic trench warfare reappeared in the Iran-Iraq War (1980–88), a basically static war in which such mobile weapons as tanks and aircraft were in short supply. In the subsequent Persian Gulf War (1990–91), Iraq built an elaborate system of defensive trenches, ditches, and berms, but it was overwhelmed by airpower, innovative tactics, and the demoralization of its frontline troops. Trench warfare was utilized by opposition forces in the Syrian Civil War (2011–) until Russian airpower, deployed in support of Syrian Pres. Bashar al-Assad, rendered the tactic ineffective. In the conflict in the Donets Basin (2014–), the relatively static contact line between

© 2020 Encyclopædia Britannica, Inc.

Ukrainian government troops and Russian-backed forces led to the establishment of a system of trenches that covered much of the 250-mile (400-km) front. Airpower played a negligible role in that war, as Russian air defenses—such as the missile system that downed Malaysia Airlines flight 17—effectively checked the Ukrainian air force. The Russian air force was not deployed, so as to maintain Moscow's claim that it was not directly involved in the conflict.

EB Editors

Citation (MLA style):

"Trench warfare." *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 23 Sep. 2021. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

ARTICLE

bomb

a container carrying an explosive charge that is fused to detonate under certain conditions (as upon impact) and that is either dropped (as from an airplane) or set into position at a given point. In military science, the term *aerial bomb* or *bomb* denotes a container dropped from an aircraft and designed to cause destruction by the detonation of a high-explosive bursting charge or incendiary or other material. Bombs differ from artillery shells, missiles, and torpedoes in that the latter are all propelled through the air or water by a human-made agency, while bombs travel to their targets through the force of gravity alone. A major distinction must also be made between conventional bombs and atomic and thermonuclear bombs, which have a far greater destructive capacity.



Massive Ordnance Air Blast (MOAB) weapon prepared for testing, U.S. Elgin Air Force Armament Center, ...

Department of Defense (Image Number: 030311-D-9085M-007)

Conventional bomb types

The typical conventional bomb is a streamlined cylinder that consists of five major parts: an outer casing, the inner explosive material, devices such as fins to stabilize the bomb in flight, one or more fuzes to ignite the

© 2020 Encyclopædia Britannica, Inc.

bomb’s main charge, and a mechanism for arming the fuze or preparing it to explode. The outer case is most commonly made of metal and has a point at its tip, or nose. The explosive charge in most conventional bombs usually consists of TNT, RDX, ammonium nitrate, or other high explosives in combination with each other. The fin assembly at the tail end of the bomb enables it to fall through the air nose-first, by the same principle as the feathers on an arrow.

Bombs can be classified according to their use and the explosive material they contain. Among the most common types are blast (demolition), fragmentation, general purpose, antiarmour (armour-piercing), and incendiary (fire) bombs. Demolition bombs rely on the force of the blast to destroy buildings and other structures. They are usually fitted with a time-delay fuze, so that the bomb explodes only after it has smashed through several floors and is deep inside the target building. Fragmentation bombs, by contrast, explode into a mass of small, fast-moving metal fragments that are lethal against personnel. The bomb case consists of wire wound around an explosive charge. General-purpose bombs combine the effects of both blast and fragmentation and hence can be used against a wide variety of targets. They are probably the commonest type of bomb used. Armour-piercing bombs have a thick case and a pointed tip and are used to penetrate armoured or hardened targets such as warships and bunkers. Bombs of the aforementioned types generally range in size from 100 to 3,000 pounds (45 to 1,360 kg). The largest bomb ever regularly used was the British “Grand Slam” type, which weighed 22,000 pounds (10,000 kg) and was used in World War II.

Incendiary bombs are of two main types. The burning material of the intensive type is thermite, a mixture of aluminum powder and iron oxide that burns at a very high temperature. The casing of such a bomb is composed of magnesium, a metal that itself burns at a high temperature when ignited by thermite. Intensive-type incendiaries are designed to set buildings afire by their intense heat. The other type of incendiary bomb is a thin-walled container of napalm, or jellied gasoline, that is used against personnel, vehicles, and flammable installations. The napalm spreads over a wide area, sticks to whatever it falls upon, and burns for a long time. Modern mixtures of napalm consist of gasoline, benzene, and a polystyrene thickener. A Molotov cocktail is a rudimentary version of an incendiary bomb.



A worker checking bomb casings in a factory in Omaha, Nebraska, during World War II.

© Everett Historical/Shutterstock.com

All the aforementioned bomb types were used in World War II. Subsequent types include cluster and fuel-air explosive (FAE) bombs. Cluster bombs consist of an outer casing containing dozens of small bomblets; the casing splits open in midair, releasing a shower of bomblets that explode upon impact. Cluster bombs have both fragmentation and antiarmour capabilities. FAEs are designed to release a cloud of explosive vapour a short distance above the ground; the violent combustion of this fuel creates an overpressure that can detonate buried

© 2020 Encyclopædia Britannica, Inc.

enemy mines, thus clearing the way for a ground advance. Cluster bombs and FAEs have drawn criticism from those who argue that unexploded bomblets present a lethal risk to civilians long after a conflict has ended. Efforts to ban these weapons resulted in the Convention on Cluster Munitions, which prohibits all use, stockpiling, and production of cluster munitions by ratifying countries; it went into force in August 2010.

Guidance and arming

Aiming bombs has always been the most challenging part of aerial bombing, since the bomber must choose a point at which to release the bomb from a moving aircraft so that its trajectory intersects a target on the ground. The paths traversed by the plane and the bomb can be calculated mathematically, but the person who releases the bomb must act within seconds. The use of mechanical and radio targeting devices by a specially trained aircraft crewman called a bombardier solved this problem during World War II.

So-called smart bombs can be guided to their targets with an even higher degree of accuracy. Such bombs are fitted with small wings and adjustable fins that give the bomb some in-flight maneuverability by means of gliding. The bomb’s nose is fitted with a small laser or TV-camera guidance system which provides data on the target’s location to a computer, which then sends signals to actuators that adjust the bomb’s wing and fin surfaces as needed to keep the bomb on track to the target. In the laser system, a beam of laser light is directed at the target from an aircraft, and the bomb’s laser sensors pick up the reflected beam and follow it down to the target. A TV-guidance unit fitted onto a bomb is locked onto the target by an aircraft and then transmits continuous pictures of the target either to a computer in the bomb or to the aircraft crew, either of whom can guide the bomb directly onto its target.

Several types of fuzes are used in bombs. Impact fuzes, historically the most common type, are set in the bomb’s nose and detonate upon impact, setting off the main charge. A time fuze, by contrast, acts after a controlled delay. Another type, the proximity fuze, senses when a target is close enough to be destroyed by the bomb’s explosion. The sensor is typically a small radar set that sends out signals and listens for their reflections from nearby objects. Most bomb fuzes are armed at the moment of the bomb’s release from the aircraft, or just before, so that fuzed bombs cannot explode while being loaded or while being transported to their target. This last-moment arming is achieved by simple mechanical means, most commonly a small pinwheel on the bomb that turns as the air rushes past the falling projectile, and thereby arms the fuze.

Bombs first assumed military importance with the rapid development of zeppelins and aircraft in World War I, but the tonnages dropped in that conflict were insignificant, largely because the carrying capacity of the aircraft was so small. World War II saw the use of larger bombs in much greater numbers; more than 1.5 million tons of bombs were dropped by the Allies on Germany alone. Similar tonnages of bombs were used by the United States in the Korean War and Vietnam War, but by the time of the Persian Gulf War (1990–91), tonnages had dropped owing to the increased use of highly accurate smart bombs.

EB Editors

Citation (MLA style):

"Bomb." *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 20 Jan. 2023. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

ARTICLE

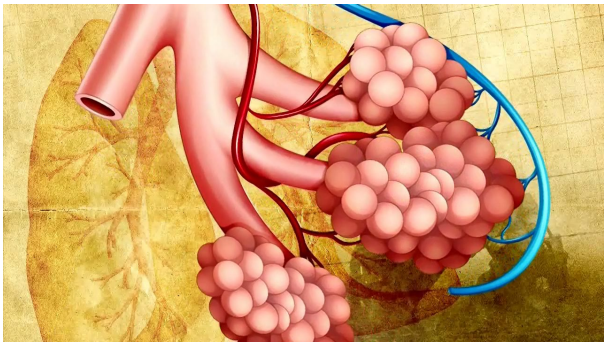
chemical weapon

any of several chemical compounds, usually toxic agents, that are intended to kill, injure, or incapacitate enemy personnel. In modern warfare, chemical weapons were first used in World War I (1914–18), during which gas warfare inflicted more than one million of the casualties suffered by combatants in that conflict and killed an estimated 90,000. In the years since then, chemical arms have been employed numerous times, most notably in the Iran-Iraq War (1980–88) and the Syrian Civil War. The United States and the Soviet Union, during their decades of confrontation in the Cold War (1945–91), built up enormous stockpiles of chemical weapons. The end of the Cold War enabled those former adversaries to agree to ban all chemical weapons of the types that had been developed during World War I (first generation), World War II (second generation), and the Cold War (third generation).



American soldiers participating in a simulated gas attack exercise, World War I.

Encyclopædia Britannica, Inc.



Learn about the development of chemical warfare during World War I.

© American Chemical Society

Like nuclear weapons and biological weapons, chemical weapons are often classified as weapons of mass destruction. Under the Chemical Weapons Convention (CWC) of 1993, the use of chemical weapons in war is prohibited, as is all development, production, acquisition, stockpiling, and transfer of such weapons. Nevertheless, while the aim of the CWC is complete elimination of most types of chemical weapons, not all countries have abandoned their chemical warfare capabilities. In particular, some weaker states have pursued chemical weapons programs as deterrents to being attacked by enemies that have either stronger conventional forces or their own weapons of mass destruction, and some regimes have used chemical weapons to threaten especially vulnerable foes outside and even within their own borders.

Furthermore, some individuals and militant organizations have acquired or have sought to acquire chemical weapons in order to attack their enemies or to secure their own ends through terror. The continued threat from

© 2020 Encyclopædia Britannica, Inc.

chemical weapons has led many states to prepare defenses against them and to exert diplomatic pressure on dissenting or noncompliant states to abide by the CWC.

Types of chemical weapons

Chemical weapons are chemical agents, whether gaseous, liquid, or solid, that are employed because of their direct toxic effects on humans, animals, and plants. They inflict damage when inhaled, absorbed through the skin, or ingested in food or drink. Chemical agents become weapons when they are placed into artillery shells, land mines, aerial bombs, missile warheads, mortar shells, grenades, spray tanks, or any other means of delivering the agents to designated targets.

Not all poisonous substances are considered suitable for weaponization, or use as chemical weapons. Thousands of such chemical compounds exist, but only a few dozen have been used as chemical warfare agents since 1900. The compounds of most utility must be highly toxic but not too difficult to handle. Furthermore, the chemical must be able to withstand the heat developed when delivered in a bursting shell, bomb, mine, or warhead. Finally, it must be resistant to water and oxygen in the atmosphere in order to be effective when dispersed.

Chemical agents

Since World War I, several types of chemical agents have been developed into weapons. These include choking agents, blister agents, blood agents, nerve agents, incapacitants, riot-control agents, and herbicides.

Choking agents



Australian soldiers wearing gas masks during the Second Battle of Ypres, 1915.

Image Asset Managemen/World History Archive/age fotostock

© 2020 Encyclopædia Britannica, Inc.



A German machine gun crew wearing gas masks in World War I.

Encyclopædia Britannica, Inc.

Choking agents were employed first by the German army and later by the Allied forces in World War I. The first massive use of chemical weapons in that conflict came when the Germans released chlorine gas from thousands of cylinders along a 6-km (4-mile) front at Ypres, Belgium, on April 22, 1915, creating a wind-borne chemical cloud that opened a major breach in the lines of the unprepared French and Algerian units. The Germans were not prepared to exploit the opening, which gave the French and Algerians time to rush reinforcements into the line. Eventually both sides mastered the new techniques of using choking agents such as chlorine, phosgene, diphosgene, chloropicrin, ethyldichlorasine, and perfluoroisoboxylene and launched numerous attacks—though without any militarily significant breakthroughs once each side had introduced the first crude gas masks and other protective measures. Phosgene was responsible for roughly 80 percent of all deaths caused by chemical arms in World War I.

© 2020 Encyclopædia Britannica, Inc.



French troops wearing gas masks await attack in a trench on the Western Front during World War I.

© Roger-Viollet

Choking agents are delivered as gas clouds to the target area, where individuals become casualties through inhalation of the vapour. The toxic agent triggers the immune system, causing fluids to build up in the lungs, which can cause death through asphyxiation or oxygen deficiency if the lungs are badly damaged. The effect of the chemical agent, once an individual is exposed to the vapour, may be immediate or can take up to three hours. A good protective gas mask is the best defense against choking agents.

Blister agents



A medical attendant giving water to soldiers injured by mustard gas in Royaumeix, France, in 1918.

Otis Historical Archives, National Museum of Health and Medicine

© 2020 Encyclopædia Britannica, Inc.

Blister agents were also developed and deployed in World War I. The primary form of blister agent used in that conflict was sulfur mustard, popularly known as mustard gas. Casualties were inflicted when personnel were attacked and exposed to blister agents like sulfur mustard or lewisite. Delivered in liquid or vapour form, such weapons burn the skin, eyes, windpipe, and lungs. The physical results, depending on level of exposure, might be immediate or might appear after several hours. Although lethal in high concentrations, blister agents seldom kill. Modern blister agents include sulfur mustard, nitrogen mustard, phosgene oxime, phenyldichlorarsine, and lewisite. Protection against blister agents requires an effective gas mask and protective overgarments.

Blood agents

Blood agents, such as hydrogen cyanide or cyanogen chloride, are designed to be delivered to the targeted area in the form of a vapour. When inhaled, these agents prevent the transfer of oxygen to the cells, causing the body to asphyxiate. Such chemicals block the enzyme that is necessary for aerobic metabolism, thereby denying oxygen to the red blood cells, which has an immediate effect similar to that of carbon monoxide. Cyanogen inhibits the proper utilization of oxygen within the blood cells, thereby “starving” and damaging the heart. The best defense against blood agents is an effective gas mask.

Nerve agents

The most lethal and important chemical weapons contain nerve agents, which affect the transmission of impulses through the nervous system. A single drop on the skin or inhaled into the lungs can cause the brain centres controlling respiration to shut down and muscles, including the heart and diaphragm, to become paralyzed. Poisoning by nerve agents causes intense sweating, filling of the bronchial passages with mucus, dimming of vision, uncontrollable vomiting and defecation, convulsions, and finally paralysis and respiratory failure. Death results from asphyxia, generally within a few minutes of respiratory exposure or within hours if exposure was through a liquid nerve agent on the skin. Defense against nerve agents requires a skintight gas mask and special protective overgarments.

In the mid-1930s chemists working for the German chemical corporation IG Farben developed the first organophosphorus compound with an extremely high toxicity; this became the nerve agent known as tabun (GA). As much as 12,000 tons was produced for the German army in World War II, although it was never used. Another nerve agent, sarin (GB), was first produced in 1938, and a third, soman (GD), was introduced in 1944; both were also invented in Germany. These three German nerve agents, the G-series (for German) in U.S. nomenclature, were all seized in large quantities by the Allies at the end of World War II. After the war the United States, the Soviet Union, and a number of other states also produced these and other nerve agents as weapons.

VX, the most famous of the so-called V-series of persistent nerve agents (and also the deadliest known nerve agent; V is for *venom*), was developed by chemists at a British government facility in 1952. Britain renounced all chemical and biological weapons in 1956 but traded information on the production of VX with the United States in exchange for technical information on the production of thermonuclear bombs. In 1961 the United States began large-scale production of VX. The only other countries believed to have built up VX arsenals were the Soviet Union, France, and Syria. Following the signing of the CWC in 1993, the United States and Russia began the elimination of their chemical weapons stocks, with a goal of finishing the process by 2012; neither country trains its forces with such weapons at present.

Defense against nerve agents requires a skintight mask and effective protective overgarments.

© 2020 Encyclopædia Britannica, Inc.

Incapacitants

A good deal of work has been done on chemicals that can incapacitate, disorient, or paralyze opponents. Experiments have been conducted on a number of hallucinogenic drug compounds—for instance, 3-quinuclidinyl benzilate (BZ), LSD (lysergic acid diethylamide), mescaline, and methaqualone—and at one time the U.S. Army fielded BZ weapons. Those chemical weapons are designed not to kill; however, even incapacitants can cause permanent injury or loss of life if employed in high dosages or if they cause accidents. BZ or LSD may attack the nervous system and derange a victim’s mental processes, causing, for example, hallucinations or psychotic thinking. Other incapacitants might cause victims to sleep or to be slow to respond.

Riot-control agents

Tear gas and vomiting agents have been produced to control riots and unruly crowds. Commonly used tear gases are chloracetophenone (CN), chloropicrin (PS), dibenz(b,f)(1,4)oxazepine (CR), and *o*-chlorobenzylidenemalononitrile (CS). CN, the principal component of the aerosol agent Mace, affects chiefly the eyes. PS and CS are stronger irritants that can burn the skin, eyes, and respiratory tract. Such riot-control agents are banned by the CWC if used as “a method of warfare” but are allowed for domestic police enforcement.

Although the United States signed and ratified the CWC, it has reserved the right to use riot-control agents in certain other situations, including counterterrorist and hostage-rescue operations, noncombatant rescue operations outside war zones, peacekeeping operations where the receiving state has authorized the use of force, and military operations against non-state actors initiating armed conflict.

Herbicides



U.S. helicopter spraying defoliant in dense jungle during the Vietnam War, 1969.

Brian K. Grigsby, Department of Defense/The National Archives

Herbicides are not banned by the CWC unless they are used as “a method of warfare.” However, not all state parties to the CWC consider herbicides to be chemical weapons, and those states therefore do not recognize their use to be banned by the treaty.

States can attach reservations if they do not directly undermine the essential purposes of the treaty. In this case it is less essential to regulate nonlethal herbicides than the more dangerous chemical weapons.

Herbicides can be used to destroy enemy crops and foliage cover. For example, Agent Orange was used extensively by U.S. forces between 1962 and 1971, during the Vietnam War, as a defoliant to deny cover in the jungle to the Viet Cong and to North Vietnamese forces. Other herbicides, such as paraquat, Agent White (picloram and 2,4-D), and Agent Blue (dimethyl arsenic acid), have also been produced to act as chemical weapons.

© 2020 Encyclopædia Britannica, Inc.

Properties of chemical weapons

Chemical weapons can be categorized by their physical characteristics, such as lethality, persistency, mode of action on the human body, and physical state (i.e., gas, liquid, or solid) when being delivered.

Some chemical agents are highly lethal. For example, nerve agents such as sarin, tabun, soman, and VX can kill almost instantly; a few droplets absorbed through the skin can paralyze and cause death in minutes. At the other end of the lethality spectrum are chemical agents such as tear gas that only act as irritants or incapacitants and are unlikely to kill unless used in very large quantities.

Chemical agents also have varied levels of persistency. Some evaporate in minutes or hours and lose their effect rapidly. For example, sarin is a lethal but nonpersistent nerve agent. By contrast, VX can persist for days or weeks in lethal form. This difference in persistency may lead to a different strategic or tactical use of each agent in wartime. A military force may use persistent chemical weapons, such as VX or mustard, to neutralize an air base, seaport, or key staging area for an extended period in order to deny its use to the adversary. On the other hand, nonpersistent chemical weapons, such as sarin, more likely would be employed where only a temporary effect is sought. For example, nonpersistent chemical weapons could be used to breach an enemy line at a point that one’s own forces might want to pass through or occupy after the effects have dissipated.

Some poison gases, such as chlorine and hydrogen cyanide, enter the victim’s lungs during inhalation. On the other hand, nerve agent droplets might enter through the skin into the bloodstream and nervous system. Still other chemicals can be mixed with food in order to poison enemy personnel when they take their meals.

Finally, chemical weapons might be delivered via aerosols, mortars, artillery shells, missile warheads, mines, or aerial bombs. Most of these have all the ingredients premixed, but newer chemical arms may be so-called binary weapons in which the ingredients are mixed in flight while the weapon is being delivered. Binary weapons are safer and easier to store and handle than more-traditional chemical arms.

Defense against chemical weapons

On the battlefield



American soldiers training with anti-gas fans. The fans were intended to disperse poison gas from…

Encyclopædia Britannica, Inc.

Since World War I the military organizations of all the great powers have acquired defensive equipment to cope with emerging offensive chemical weapons. The first and most important line of defense against chemical agents is the individual protection provided by gas masks and protective clothing and the collective protection of combat vehicles and mobile or fixed shelters. Filters for masks and shelters contain specially treated activated

© 2020 Encyclopædia Britannica, Inc.

charcoal, to remove vapours, and paper membranes or other materials, to remove particles. Such filters typically can reduce the concentration of chemical agents by a factor of at least 100,000. Masks can be donned in less than 10 seconds and can be worn for long periods, even in sleep. Modern protective overgarments are made of fabric containing activated charcoal or other adsorptive forms of carbon. A complete suit typically weighs about 2 kg (4.4 pounds). The fabric can breathe and pass water-vapour perspiration. In warm weather, periods of heavy exertion in full protective gear would have to be limited in order to avoid heat stress. Also, removing such gear in a contaminated environment would raise the risk of becoming a casualty or fatality, and so gear must be removed within toxic-free shelters after following decontamination procedures at the shelter entrance.



Essential to survival after exposure to chemical weapons on the battlefield are portable...

© Larry St. Pierre/Shutterstock.com

Chemical detectors have been developed to help identify levels and places of contamination. These include chemically treated litmus paper used to determine the presence of chemical agents. Other sensors may include handheld assays, vehicles equipped with scoops and laboratory analysis tools, and both point and standoff sensors. Automatic field alarm systems are employed by some military forces to alert personnel to the presence of chemical agents.

Well-equipped troops are supplied with hypodermic needles filled with antidotes to be administered in the event of toxic poisoning from nerve agents. For example, atropine shots can be injected to fight the effects of nerve gas exposures, and different medicines are available to treat casualties.

A number of methods have been found useful in decontaminating areas and people covered with chemical agents, including spraying with super tropical bleach (chlorinated lime) or washing contaminated surfaces or garments with warm soapy water. The challenge is finding and using a decontamination solution that is strong enough to neutralize the chemical agent without damaging the equipment or harming the personnel.

In some military forces, modular field hospitals have been developed that are stocked with resuscitation devices for respiratory support and other necessary equipment, decontamination solutions, and staff trained to decontaminate chemical warfare casualties. Collective protective shelters, complete with filters for airflow systems, have been provided to shield personnel in an otherwise contaminated area. Such shelters can provide a toxic-free area for personnel to change clothes, get medical attention, sleep, and take care of bodily functions with less danger of exposure to lethal chemicals.

Chemical agents used against unprotected forces can cause high casualties, fear, and confusion. Thus, personnel facing adversaries equipped with chemical weapons must be trained to don individual protective equipment, seek cover in collective protection shelters, avoid contaminated areas, and rapidly decontaminate personnel and equipment that have been exposed. However, such measures, while necessary to protect against

chemical attacks, may expose protected forces to greater casualties from conventional weapons fire and lead to a loss of conventional combat effectiveness. Indeed, exercises have shown that conventional combat effectiveness can be decreased by 25 percent or more for military forces compelled to operate in masks, protective overgarments, special gloves, and boots. This is especially true if temperatures are high and forces are required to stay sealed in their gear for many hours or days without relief. Prolonged wearing of individual protective equipment can lead to stress, fatigue, disorientation, confusion, frustration, and irritability. Also, heat can build up and lead to dehydration. Thus, there is generally a trade-off between protecting one’s force through chemical-protection gear and maintaining conventional fighting effectiveness.

In civilian defense



Soldiers demonstrating the proper wearing of a gas mask to civilians near the front lines in the...

Encyclopædia Britannica, Inc.

While most military forces have at least some defense against chemical attack, this is not the case for most civilian populations, which typically have no individual protective equipment (masks, overgarments, boots, or gloves) or collective protection shelters. One notable exception is Israel, which has been at war numerous times since its independence in 1948. Israeli citizens are assigned their own gas masks, and new buildings in Israel must contain a reinforced shelter. Israel also conducts civil defense exercises on a regular basis in order to prepare its citizens for attack.

A further problem for almost every country is the presence in most urban centres of storage or manufacturing facilities that contain toxic industrial chemicals and other toxic materials. A conventional attack on such a site would be the functional equivalent of a chemical weapons attack. Most countries do not have adequate security around such areas.

© 2020 Encyclopædia Britannica, Inc.



Woman in a gas mask demonstrating a portable shelter developed by the U.S. Army to protect babies...

U.S. Army photograph

One response to the threat of a chemical weapons attack on civilian society has been the creation of active, well-trained emergency response teams that know how to identify chemical agents, decontaminate areas and people exposed to chemical weapons, and coordinate rescue operations. Cognizant of the growing risk posed by weapons of mass destruction (WMD), the United States in 1998 authorized the creation of 10 National GuardWMD Civil Support Teams (WMD-CST) within its territory; each team was organized, trained, and equipped to handle chemical emergencies in support of local police, firefighters, medical personnel, and other first responders. In subsequent years, dozens of new WMD-CST were authorized, with plans for eventually certifying units for every state and some U.S. protectorates. In addition, the U.S. Centers for Disease Control and Prevention maintains the Strategic National Stockpile, which contains medical supplies and equipment positioned around the country to provide medical help in emergencies, including a chemical weapons attack.

Chemical weapons in history

Antiquity



The crew of a Byzantine dromon, a type of light galley, spraying an enemy ship with Greek fire.

Heritage Image/age fotostock

© 2020 Encyclopædia Britannica, Inc.

The use of chemical weapons dates back to antiquity, when warring forces frequently poisoned the water supplies of their adversaries. For example, the Athenians poisoned the wells of their rivals as early as 600 BCE, and the Spartans, their chief antagonists, in turn hurled burning sulfur pitch over the walls of Athens in 423 BCE. In 673 CE the Byzantines defended Constantinople from the Saracen navy by igniting chemicals (known as Greek fire) floating in the sea. During the Middle Ages, Genghis Khan's Mongolian forces employed chemical warfare when they catapulted burning pitch and sulfur into cities they besieged.

Weapons of mass destruction



The gas mask became a part of modern warfare with the introduction of chemical weapons in World War...

Public Domain



U.S. soldiers using gas equipment and receiving telephone instructions during the Meuse-Argonne...

National Archives, Washington, D.C.

Chemical weapons did not become true weapons of mass destruction (WMD) until they were introduced in their modern form in World War I (1914–18). The German army initiated modern chemical warfare by launching a chlorine attack at Ypres, Belgium, on April 22, 1915, killing 5,000 French and Algerian troops and momentarily breaching their lines of defense. German use of gas and mustard was soon countered by similar tactics from the Allies. By war's end, both sides had used massive quantities of chemical weapons, causing an estimated 1,300,000 casualties, including 91,000 fatalities. The Russian army suffered about 500,000 of these casualties, and the British had 180,000 wounded or killed by chemical arms. One-third of all U.S. casualties in World War I were from mustard and other chemical gases, roughly the ratio for all participants combined. By the war's end, all the great powers involved had developed not only offensive chemical arms but also crude gas masks and protective overgarments to defend themselves against chemical weapon attacks. Altogether, the warring states

© 2020 Encyclopædia Britannica, Inc.

employed more than two dozen different chemical agents during World War I, including mustard gas, which caused perhaps as many as 90 percent of all chemical casualties (though very few of these casualties were fatal) from that conflict.

Other choking gas agents used included chlorine, phosgene, diphosgene, and chloropicrin. The blood agents included hydrogen cyanide, cyanogen, chlorine, and cyanogen bromide. Arsenic-laced sneeze agents were also used, as were tear gases like ethyl bromoacetate, bromoacetone, and bromobenzyl cyanide.

The horrific casualties of World War I helped persuade many world leaders of the need to ban the use of chemical weapons. A number of proposals were made during the 1920s, and at the 1925 Geneva Conference for the Supervision of the International Traffic in Arms (*see* Geneva Conventions) a protocol was approved and signed by most of the world's states. The 1925 Geneva Protocol made it illegal to employ chemical or biological weapons, though the ban extended only to those who signed the treaty. The Geneva Protocol did not ban the production, acquisition, stockpiling, or transfer of such arms, and, critically, it did not contain any verification procedure to ensure compliance.

Despite the popular reaction against this form of warfare and the international agreement banning the use of chemical weapons, chemical arms were used a number of times in the years between the two World Wars. For example, chemical weapons were employed by British forces in the Russian Civil War (1919), Spanish forces in Morocco (1923–26), Italian forces in Libya (1930), Soviet troops in Xinjiang (1934), and Italian forces in Ethiopia (1935–40).

During the Sino-Japanese War (1937–45), Japanese forces employed riot-control agents, phosgene, hydrogen cyanide, lewisite, and mustard agents extensively against Chinese targets. There is no record of chemical warfare among World War II belligerents other than that of the Japanese. The Axis forces in Europe and the Allied forces adopted no-first-use policies, though each side was ready to respond in kind if the other acted first. Indeed, all the major powers developed extensive chemical warfare capabilities as a deterrent to their use.

After World War II, chemical weapons were employed on a number of occasions. Egyptian military forces, participating in Yemen's civil war between royalists and republicans, used chemical weapons, such as nerve and mustard agents, in 1963, 1965, and 1967. During the Soviet intervention into the Afghan War (1978–92), chemical arms, such as mustard and incapacitating agents, were used against the mujahideen rebels. In 1987 Libya used mustard munitions against rebels in Chad.

The most extensive post-World War II use of chemical weapons occurred during the Iran-Iraq War (1980–88), in which Iraq used the nerve agents sarin and tabun, as well as riot-control agents and blister agents like sulfur mustard, resulting in tens of thousands of Iranian casualties. Chemical weapons enabled Iraq to avoid defeat, though not obtain victory, against the more numerous Iranian forces. In response to Iraq's use of chemical weapons, Iran made efforts to develop chemical weapons and may have used them against Iraq, a contention that Iran has denied. Furthermore, Iran claims to have ended its program when it signed (1993) and ratified (1997) the CWC. Iraq also used chemical weapons (thought to be hydrogen cyanide, sarin, or sulfur mustard gas) against Iraqi Kurds who were considered unfriendly to the regime of Saddam Hussein. The most notorious such attack was the killing of 5,000 Kurds, including many civilians, in the city of Halabjah in 1988.

The most notable use of chemical weapons in the 21st century was during the Syrian Civil War. Syrian troops were reported to have used chemical weapons at Homs and Aleppo on several occasions in early 2013. A larger release of chemical agents took place in the suburbs of Damascus on August 21, 2013, killing several hundred people. Over the objections of Russia and Iran, the United States dispatched five guided-missile destroyers to the eastern Mediterranean and threatened to strike military targets in Syria. U.S. Secretary of State John Kerry's

© 2020 Encyclopædia Britannica, Inc.

offhand remark that an attack could be avoided if Syria surrendered all its chemical weapons prompted Russian officials to arrange an agreement calling for Syria to place its chemical weapons stockpile under international control. The United States accepted the Russian initiative, averting military action, and the destruction of weapons began in October. This was by no means the end of chemical weapons use by the regime of Syrian Pres. Bashar al-Assad, however. After a chemical weapons attack was carried out in Khān Shaykhūn in April 2017, the United States barraged the Shayrat air base near Homs with 59 Tomahawkcruise missiles. A year later, after the Syrian government used chemical weapons in Douma, U.S., British, and French forces launched more than 100 strikes targeting chemical weapons facilities near Damascus and Homs.

Banning chemical weapons

During World War I, Germany, France, the United Kingdom, and Russia developed a wide array of chemical arms, including choking, blister, blood, and irritant agents. During World War II, Germany developed nerve agents such as toman, soman, and sarin. After World War II, the British invented VX, a more persistent nerve agent that eventually was deployed by the United States and the Soviet Union.

The World War I chemical agents are referred to as first-generation weapons, the World War II nerve agents are called second-generation weapons, and Cold War chemical agents (such as VX) are known as third-generation weapons. Part of the U.S. arsenal during the Cold War also included CS, a riot-control agent, and BZ, an incapacitant, as well as sarin and VX. The Soviet Union also had a complete chemical weapons arsenal, including “classic” agents from the first, second, and third generation, all of which are now banned by the CWC.

According to some interpretations, the CWC does not cover fourth-generation chemical weapons, so-called nontraditional agents (NTAs), such as some of the binary nerve agents known as “novichoks.” There is evidence that Russia inherited NTAs from the former Soviet arsenals. In March 2018 Sergei Skripal, a former Russian intelligence officer who had acted as a double agent for Britain, and his daughter Yulia were found unconscious in Salisbury, England. British investigators alleged that they had been the target of an assassination attempt by a pair of GRU agents who had applied a novichok to the handle of Skripal’s front door. While the Skripals eventually recovered, a British woman died months later after handling the discarded perfume bottle that was used to transport the novichok.

Negotiations to secure a multilateral chemical disarmament treaty began in the early 1960s at the United Nations. Issues that separated the sides were the kinds of verification procedures for checking on treaty compliance, whether all or part of the weapons stocks should be dismantled, and the sanctions to be levied against violators. Real progress did not take place until the period 1986–91, when relations between the Soviet Union and the United States improved after the rise to power of Soviet leader Mikhail Gorbachev. With the dissolution first of the Warsaw Pact in 1989 and then of the Soviet Union itself in 1991, a real convergence of political and diplomatic views was made possible. In 1990 bilateral reductions and limits were negotiated in which each state agreed to a limit of 5,000 tons of chemical agents in its chemical weapons arsenal. By 1993 the former enemies were finally willing to agree to a robust on-site verification regime featuring challenge inspections of undeclared sites, a total ban on chemical weapons, and a total dismantling of their stockpiles.

The United Nations Conference on Disarmament adopted the Chemical Weapons Convention (CWC) on September 3, 1992, and the treaty was opened to signature by all states on January 13, 1993. The CWC entered into force on April 29, 1997, 180 days after the deposit of the 65th instrument of ratification (such as passage by a national assembly).

At the time that the United States and Russia signed the CWC, Russia declared 40,000 metric tons of chemical weapon agents and the United States 30,000 metric tons—stockpiles that dwarfed the combined arsenals of the

© 2020 Encyclopædia Britannica, Inc.

rest of the world. All were to be destroyed, according to CWC guidelines, by the year 2012. In the early 1990s the U.S. Cooperative Threat Reduction Program was launched to help the states of the former Soviet Union demilitarize their chemical, biological, and nuclear facilities and arsenals and to employ the scientists and technicians from those programs in other, more productive peacetime activities. Despite such efforts, both countries fell behind schedule and announced that they would not be able to meet the 2012 deadline. The United States was on a trajectory to finish the job by 2023, and Russia declared that it had finished its parallel effort in 2017.

All other signatories to the CWC reportedly eliminated their stockpiles, though some states subsequently declared stockpiles that they had previously denied existed. Libya is a case in point. In 2004 Libya decided to part with its chemical and nuclear weapons programs and invited the United States and the United Kingdom to help it dismantle both. Significant progress was made in destroying mustard gas and precursors to other chemical weapons before Libya was paralyzed by civil strife in 2011.



ʿAlī Ḥasan al-Majīd at an investigative hearing held by the Iraqi Special Tribunal, Baghdad, 2004.

U.S. Air Force (041218-F-8946M-008)

United Nations inspection teams entered Iraq after the Persian Gulf War ended in early 1991. Some 40,000 Iraqi chemical weapons were then found and destroyed, and a bunker containing thousands of possibly war-damaged weapons was sealed. After the U.S. invasion of Iraq in 2003, no major stockpile of chemical weapons or dedicated facilities for their manufacture were found in Iraq, contrary to the United States' contention before the invasion. A very few chemical rounds were found among arms storage sites in Iraq, but they were thought to be left over from the Iran-Iraq War. Upon becoming a signatory to the CWC in 2009, Iraq acknowledged its obligation to dispose of its remaining damaged weapons—a complicated and dangerous effort that would take years to complete. ʿAlī Ḥasan al-Majīd, an Iraqi official nicknamed "Chemical Ali" for his role in ordering the chemical attacks on Iraqi Kurds in 1988, was executed for war crimes in 2010.

© 2020 Encyclopædia Britannica, Inc.

Proliferation and detection of chemical weapons programs

Chemical weapons proliferation

The Chemical Weapons Convention has resulted in the elimination of huge stocks of chemical weapons once held by the principal adversaries of the Cold War. Nevertheless, intelligence services of various countries have reported an increase in the number of states with active chemical weapons programs. Some 20 countries were reportedly working on chemical weapons at the beginning of the 21st century, as opposed to only five such states in the 1960s.

Regimes seek to acquire chemical weapons for a number of reasons. First, they may decide that having such lethal weapons will allow them to “level the playing field” against an adversary with a stronger conventional military force. Second, they may wish to deter attacks by rivals, holding them at bay with the threat of a chemical weapons strike in retaliation. Having one type of weapon of mass destruction might deter the use of the same or another type by a rival. Third, chemical weapons, like other mass-casualty weapons such as nuclear and biological arms, may be designed for regime survival in the event that a country is losing a conventional conflict. In this case, possession of chemical warfare capabilities might provide endgame bargaining leverage to establish better terms. For example, in the Iran-Iraq War, Iraq’s use of Scud ballistic missiles (with the potential to deliver chemical warheads) against Iranian cities caused major panic in those metropolitan centres and helped persuade the Iranian government to agree to a cease-fire sought by Iraq. Fourth, chemicals can be used as terror weapons to lower enemy morale and weaken support for the rival’s war effort. Finally, chemical weapons can be used against unprotected rebellious groups inside a country, as Saddam Hussein illustrated in his chemical weapon strikes against the Kurdish city of Halabjah and as Syrian Pres. Bashar al-Assad demonstrated throughout the Syrian Civil War.

Detection of clandestine programs

Although most states have joined the CWC, some member states may still cheat and deploy a clandestine chemical weapons program. Inspectors from the Organisation for the Prohibition of Chemical Weapons (OPCW; the body that administers the CWC) number only in the hundreds, whereas the estimated number of chemical plants that might be inspected exceed many thousands. Therefore, only a small fraction of sites can be inspected every year. Still other states, notably Israel and some of its Arab rivals, refuse to ratify the various nuclear, biological, and chemical nonproliferation pacts until their rivals eliminate their own (undeclared) arsenals and join the respective arms-control treaty regimes.

This leads to the question of how a clandestine chemical weapons program can be detected and measured. Using technical means, human intelligence, and on-site inspections, chemical weapons program signatures can be monitored when searching for a hidden cache of weapons or a production process. These signatures include purchases of unique combinations of chemical precursors and equipment, the presence of equipment for chemical weaponization, and the presence of chemical warfare defensive gear in military units. Other signatures are the discovery of trace amounts of chemical warfare agents or chemical weapons degradation products at a production site or in a plant’s waste products. Finally, signatures may be the presence of storage bunkers, related manufacturing facilities needed for chemical weaponization, or even the presence of a chemical plant with abnormal input-output flows of materials. Nevertheless, detection of clandestine chemical weapons, banned

© 2020 Encyclopædia Britannica, Inc.

by the CWC or otherwise, is a difficult challenge, since chemical weapons production can be embedded in commercial chemical production plants and evidence can be eliminated in a short period prior to permitting inspectors onto a site—if they are allowed on at all.

The Australia Group is a standing diplomatic conference made up of representatives from states dedicated to restraining the proliferation of key materials and technologies that could be used to produce chemical or biological weapons. Since its formation in 1985, members of the organization have exchanged information and cooperated with one another to control such exports to suspect buyers. The Australia Group is a strictly voluntary and informal export control regime with no formal guidelines, charter, or constitution.

Chemical weapons and terrorism



Workers cleaning a train car after members of AUM Shinrikyo released sarin in the Tokyo subway...

© Noboru Hashimoto—Corbis News/Getty Images

Until the 1990s, terrorists had rarely possessed or employed chemical weapons. However, several states that have sponsored terrorism have also possessed chemical weapons—Libya, Iran, and Iraq—and there is a concern that they and groups they sponsor might use chemical weapons in the future.

An example of an organization that learned to produce and use chemical weapons is the AUM Shinrikyo sect in Japan, members of which used sarin nerve agent to kill 12 people and injure more than 1,000 in a March 1995 chemical weapons attack inside the Tokyo subway system. Members of this same group had killed seven and injured more than 300 in a June 1994 attack in Matsumoto, Japan. They also assassinated one opponent using VX nerve agent in Osaka and injured another by the same means in Tokyo in early 1995. Finally, in May and July 1995, members of the AUM Shinrikyo used hydrogen cyanide in two follow-up strikes in the Tokyo subway that injured four persons. Altogether, the several attacks with three different types of chemical weapons killed 20 people, injured some 1,300, and sent more than 5,600 to the hospital for examination. Casualties would likely have been much higher had the Japanese police not intervened when they did.

Al-Qaeda leaders have shown an interest in acquiring and employing chemical weapons, as indicated by experiments testing the use of hydrogen cyanide on animals in al-Qaeda camps in Afghanistan prior to the September 11 attacks on the United States in 2001. In addition to other documents showing ongoing research on chemical weapons, al-Qaeda planned and then aborted a chemical attack on the New York Citysubway system in 2005. Furthermore, al-Qaeda of Mesopotamia (also known as al-Qaeda in Iraq) initiated chlorine attacks in Iraq in 2007. It is believed by some Western analysts that al-Qaeda leaders would not hesitate to use any chemical, biological, radiological, or nuclear weapons that they might acquire. For example, al-Qaeda of Mesopotamia openly issued a public invitation for Muslim chemists, biologists, and physicists to join their cause.

© 2020 Encyclopædia Britannica, Inc.

Unfortunately, a substantial amount of information on how to manufacture chemical weapons already exists in the public domain, particularly on the Internet, which is within reach of individuals and groups worldwide.

Barry R. SchneiderEB Editors

Additional Reading

FREDERICK R. SIDELL, ERNEST T. TAKAFUJI, and DAVID R. FRANZ (eds.), *Medical Aspects of Chemical and Biological Warfare* (1997), is an excellent historical and medical summary of chemical and biological warfare issues, agents, and treatments. ERIC CRODDY, *Chemical and Biological Warfare: A Comprehensive Survey for the Concerned Citizen* (2002), details the properties and evolution of chemical and biological weapons, as well as the historical efforts to impose arms control and disarmament limitations on their development, production, possession, and use. ALBERT MAURONI, *Chemical and Biological Warfare*, 2nd ed. (2007), is an excellent summary of chemical and biological warfare problems and solutions that also contains information on case studies, organizations, and further resources on the subject. JONATHAN TUCKER, *War of Nerves: Chemical Warfare from World War I to Al-Qaeda* (2006), is a unique set of historical case studies of chemical and biological terrorism, including lessons learned and motivational factors. STEPHEN F. BURGESS and HELEN E. PURKITT, *The Rollback of South Africa's Chemical and Biological Warfare Program* (2001), details Project Coast, the South African chemical and biological weapons program that started in 1981 and was finally terminated in 1994. JONATHAN TUCKER, "The Yellow Rain Controversy: Lessons for Arms Control Compliance," *The Nonproliferation Review*, Spring 2001, is a comprehensive discussion of the history of the controversy over whether the Soviet Union and its Vietnamese and Laotian communist allies used mycotoxins against resistance forces in Laos and Cambodia in the 1970s; one lesson learned is that verifying such charges is extremely difficult when evidence is ambiguous, incomplete, and highly classified and when alternative explanations might also fit the data available.

Barry R. Schneider

Citation (MLA style):

"Chemical weapon." *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 28 Feb. 2023. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

ARTICLE

machine gun

automatic weapon of small calibre that is capable of sustained rapid fire. Most machine guns are belt-fed weapons that fire from 500 to 1,000 rounds per minute and will continue to fire as long as the trigger is held back or until the supply of ammunition is exhausted. The machine gun was developed in the late 19th century and has profoundly altered the character of modern warfare.

© 2020 Encyclopædia Britannica, Inc.



A U.S. Marine with an M249 squad automatic weapon during the Persian Gulf War, 1991.

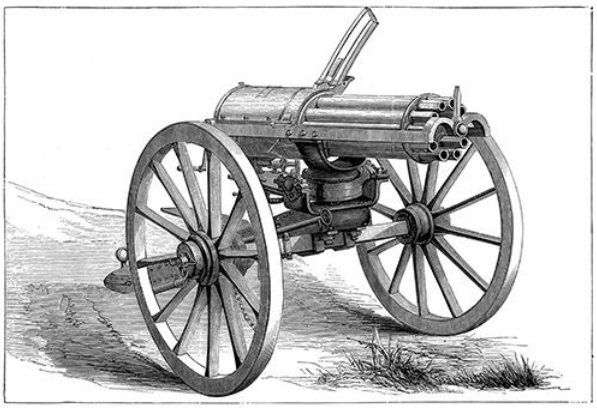
Sgt. Brad Mitzelfelt, USMC/U.S. Department of Defense



Bren machine gun.

Robert DuHamel

Modern machine guns are classified into three groups. The light machine gun, also called the squad automatic weapon, is equipped with a bipod and is operated by one soldier; it usually has a box-type magazine and is chambered for the small-calibre, intermediate-power ammunition fired by the assault rifles of its military unit. The medium machine gun, or general-purpose machine gun, is belt-fed, mounted on a bipod or tripod, and fires full-power rifle ammunition. Through World War II the term “heavy machine gun” designated a water-cooled machine gun that was belt-fed, handled by a special squad of several soldiers, and mounted on a tripod. Since 1945 the term has designated an automatic weapon firing ammunition larger than that used in ordinary combat rifles; the most widely used calibre is .50 inch or 12.7 mm, although a Soviet heavy machine gun fired a 14.5-millimetre round.



An engraving of a Gatling gun.

Photos.com/Thinkstock

© 2020 Encyclopædia Britannica, Inc.

From the introduction of firearms in the late Middle Ages, attempts were made to design a weapon that would fire more than one shot without reloading, typically by a cluster or row of barrels fired in sequence. In 1718 James Puckle in London patented a machine gun that was actually produced; a model of it is in the Tower of London. Its chief feature, a revolving cylinder that fed rounds into the gun's chamber, was a basic step toward the automatic weapon; what prevented its success was the clumsy and undependable flintlock ignition. The introduction of the percussion cap in the 19th century led to the invention of numerous machine guns in the United States, several of which were employed in the American Civil War. In all of these either the cylinder or a cluster of barrels was hand-cranked. The most successful was the Gatling gun, which in its later version incorporated the modern cartridge, containing bullet, propellant, and means of ignition.



Maxim machine gun being used by U.S. Army soldiers during maneuvers in Texas, 1911.

George Grantham Bain Collection/Library of Congress, Washington, D.C. (Digital file no. cph 3a03511)



French soldiers operating a Saint-Étienne machine gun at the Somme, World War I.

Encyclopædia Britannica, Inc.



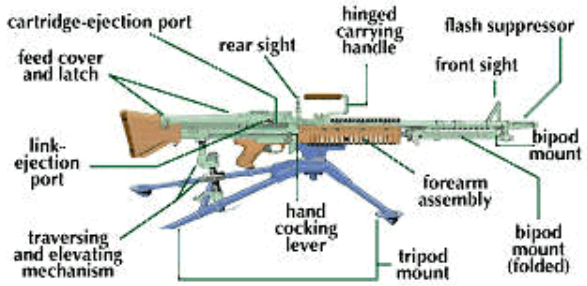
German Maschinenpistole 40 (MP40), a 9-mm submachine gun used by the German Army during World War...

Stefan Kühn

The introduction of smokeless powder in the 1880s made it possible to convert the hand-cranked machine gun into a truly automatic weapon, primarily because smokeless powder's even combustion made it possible to harness the recoil so as to work the bolt, expel the spent cartridge, and reload. Hiram Stevens Maxim of the

© 2020 Encyclopædia Britannica, Inc.

United States was the first inventor to incorporate this effect in a weapon design. The Maxim machine gun (c. 1884) was quickly followed by others—the Hotchkiss, Lewis, Browning, Madsen, Mauser, and other guns. Some of these utilized another property of the even burning of smokeless powder: small amounts of the combustion gas were diverted through a port to drive a piston or lever to open the breech as each round was fired, admitting the next round. As a result, during World War I the battlefield was from the outset dominated by the machine gun, generally belt-fed, water-cooled, and of a calibre matching that of the rifle. Except for synchronizing with aircraft propellers, the machine gun remained little changed throughout World War I and into World War II. Since then, innovations such as sheet-metal bodies and air-cooled, quick-changing barrels have made machine guns lighter and more reliable and quick-firing, but they still operate under the same principles as in the days of Hiram Maxim.



The United States Army M60 machine gun is a lightweight gas-operated weapon chambered for a 7.62…

Encyclopædia Britannica, Inc.

Most machine guns employ the gas generated by the explosion of the cartridge to drive the mechanism that introduces the new round in the chamber. The machine gun thus requires no outside source of power, instead using the energy released by the burning propellant in a cartridge to feed, load, lock, and fire each round and to extract and eject the empty cartridge case. This automatic operation may be accomplished by any of three ways: blowback, recoil, and gas operation.



A German machine gun crew wearing gas masks in World War I.

Encyclopædia Britannica, Inc.

In simple blowback operation, the empty cartridge case is hurled backward by the explosion of the cartridge and thereby pushes back the bolt, or breechblock, which in turn compresses a spring and is returned to the firing

© 2020 Encyclopædia Britannica, Inc.

position upon that spring's recoil. The basic problem involved in blowback is to control the rearward motion of the bolt so that the gun's cycle of operation (i.e., loading, firing, and ejection) takes place correctly. In recoil operation, the bolt is locked to the barrel immediately after a round is fired; both the bolt and barrel recoil, but the barrel is then returned forward by its own spring while the bolt is held to the rear by the locking mechanism until a fresh round has fallen into place in the opened breech.

More common than either of these two methods is gas operation. In this method, the energy required to operate the gun is obtained from the pressure of gas tapped off from the barrel after each cartridge explodes. In a typical gas-operated machine gun, an opening or port is provided in the side of the barrel at a point somewhere between the breech and the muzzle. When the bullet has passed this opening, some of the high-pressure gases behind it are tapped off through the hole and operate a piston or some similar device for converting the pressure of the powder gases to a thrust. This thrust is then used through a suitable mechanism to provide the energy necessary for performing the automatic functions required for sustained fire: loading, firing, and ejection.

EB Editors

Citation (MLA style):

"Machine gun." *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 19 May. 2020. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

ARTICLE

tank

any heavily armed and armoured combat vehicle that moves on two endless metal chains called tracks. Tanks are essentially weapons platforms that make the weapons mounted in them more effective by their cross-country mobility and by the protection they provide for their crews. Weapons mounted in tanks have ranged from single rifle-calibre machine guns to, in recent years, long-barreled guns of 120- or 125-mm (4.72- or 4.92-inch) calibre.



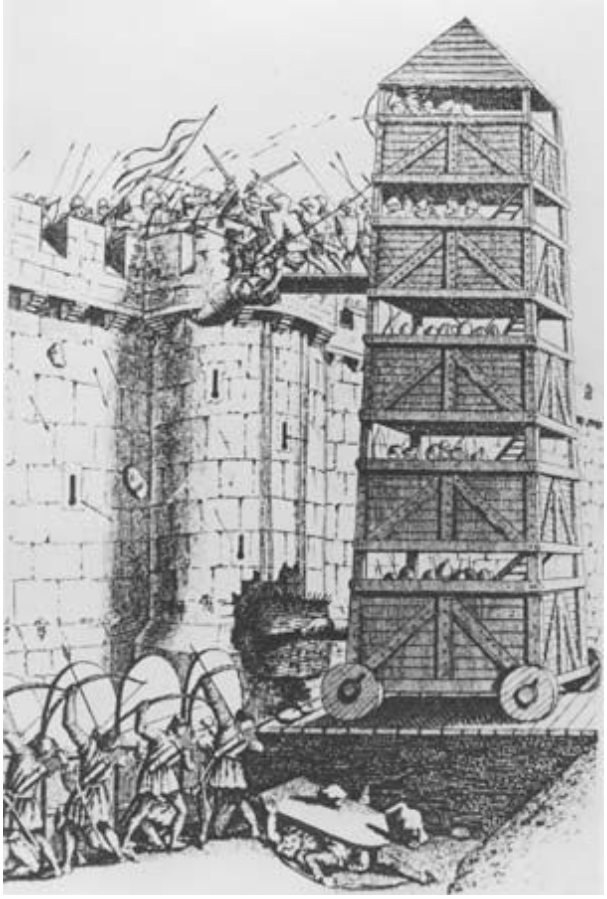
M1A1 Abrams main battle tanks of the U.S. 1st Armored Division moving across the desert in northern...

Ssgt. Robert Reeve/U.S. Department of Defense

© 2020 Encyclopædia Britannica, Inc.

This article discusses the development of tanks from the beginning of the 20th century to the present. For articles on related military platforms, *see* amphibious assault vehicle and armoured vehicle.

Earliest developments



Under cover from archers, a storming party crossing the drawbridge of a medieval siege tower brought …

Ian V. Hogg

The use of vehicles for fighting dates to the 2nd millennium BCE, when horse-drawn war chariots were used in the Middle East by the Egyptians, Hittites, and others as mobile platforms for combat with bows and arrows. The concept of protected vehicles can be traced back through the wheeled siege towers and battering rams of the Middle Ages to similar devices used by the Assyrians in the 9th century BCE. The two ideas began to merge in the battle cars proposed in 1335 by Guido da Vigevano, in 1484 by Leonardo da Vinci, and by others, down to James Cowen, who took out a patent in England in 1855 for an armed, wheeled, armoured vehicle based on the steam tractor.

But it was only at the beginning of the 20th century that armoured fighting vehicles began to take practical form. By then the basis for them had become available with the appearance of the traction engine and the automobile. Thus, the first self-propelled armoured vehicle was built in 1900 in England when John Fowler & Company armoured one of their steam traction engines for hauling supplies in the South African (Boer) War (1899–1902). The first motor vehicle used as a weapon carrier was a powered quadricycle on which F.R. Simms mounted a machine gun in 1899 in England. The inevitable next step was a vehicle that was both armed and armoured. Such a vehicle was constructed to the order of Vickers, Sons and Maxim Ltd. and was exhibited in London in 1902. Two years later a fully armoured car with a turret was built in France by the Société Charron, Girardot et Voigt, and another was built concurrently in Austria by the Austro-Daimler Company.

© 2020 Encyclopædia Britannica, Inc.

To complete the evolution of the basic elements of the modern armoured fighting vehicle, it remained only to adopt tracks as an alternative to wheels. This became inevitable with the appearance of the tracked agricultural tractor, but there was no incentive for this until after the outbreak of World War I. A tracked armoured vehicle was proposed in France as early as 1903 but failed to arouse the interest of military authorities, as did a similar proposal made in England in 1908. Three years later a design for a tracked armoured vehicle was rejected by the Austro-Hungarian and then by the German general staffs, and in 1912 the British War Office turned down yet another design.

World War I



British Mark I tank with anti-bomb roof and “tail,” 1916.

Courtesy of the Imperial War Museum, London; photograph, Camera Press/Globe Photos

The outbreak of World War I in 1914 radically changed the situation. Its opening stage of mobile warfare accelerated the development of armoured cars, numbers of which were quickly improvised in Belgium, France, and Britain. The ensuing trench warfare, which ended the usefulness of armoured cars, brought forth new proposals for tracked armoured vehicles. Most of these resulted from attempts to make armoured cars capable of moving off roads, over broken ground, and through barbed wire. The first tracked armoured vehicle was improvised in July 1915, in Britain, by mounting an armoured car body on a Killen-Strait tractor. The vehicle was constructed by the Armoured Car Division of the Royal Naval Air Service, whose ideas, backed by the First Lord of the Admiralty, Winston S. Churchill, resulted in the formation of an Admiralty Landships Committee. A series of experiments by this committee led in September 1915 to the construction of the first tank, called “Little Willie.” A second model, called “Big Willie,” quickly followed. Designed to cross wide trenches, it was accepted by the British Army, which ordered 100 tanks of this type (called Mark I) in February 1916.



© 2020 Encyclopædia Britannica, Inc.

A British tank at the Western Front, World War I.

Encyclopædia Britannica, Inc.

Simultaneously but independently, tanks were also developed in France. Like the very first British tank, the first French tank (the Schneider) amounted to an armoured box on a tractor chassis; 400 were ordered in February 1916. But French tanks were not used until April 1917, whereas British tanks were first sent into action on September 15, 1916. Only 49 were available and their success was limited, but on November 20, 1917, 474 British tanks were concentrated at the Battle of Cambrai and achieved a spectacular breakthrough. These tanks, however, were too slow and had too short an operating range to exploit the breakthrough. In consequence, demand grew for a lighter, faster type of tank, and in 1918 the 14-ton Medium A appeared with a speed of 8 miles (13 km) per hour and a range of 80 miles (130 km). After 1918, however, the most widely used tank was the French Renault F.T., a light six-ton vehicle designed for close infantry support.



French Renault F.T. light tank, 1918.

Courtesy of the Imperial War Museum, London; photograph, Camera Press/Globe Photos

When World War I ended in 1918, France had produced 3,870 tanks and Britain 2,636. Most French tanks survived into the postwar period; these were the Renault F.T., much more serviceable than their heavier British counterparts. Moreover, the Renault F.T. fitted well with traditional ideas about the primacy of the infantry, and the French army adopted the doctrine that tanks were a mere auxiliary to infantry. France’s lead was followed in most other countries; the United States and Italy both assigned tanks to infantry support and copied the Renault F.T. The U.S. copy was the M1917 light tank, and the Italian was the Fiat 3000. The only other country to produce tanks by the end of the war was Germany, which built about 20.

© 2020 Encyclopædia Britannica, Inc.

Interwar developments



French tanks and soldiers in the streets of Katowice (Kattowitz), Upper Silesia, during one of the…

Encyclopædia Britannica, Inc.

The Renault F.T. remained the most numerous tank in the world into the early 1930s. Aware of the need for more powerful vehicles, if only for leading infantry assaults, the French army took the lead in developing well-armed tanks. The original 1918 French Schneider and Saint-Chamond tanks already had 75-mm guns, while the heavier British tanks were at best armed with 57-mm guns. After the war the French built 10 68-ton 2C tanks with the first turret-mounted 75-mm guns and continued to develop 75-mm-gun tanks, notably the 30-ton Char B of 1936.

In the meantime, Britain took the lead, technically and tactically, in developing the mobility of tanks. Even before World War I had ended, work had started on the Medium D with a maximum speed of 20 miles (32 km) per hour. Between 1923 and 1928 the British Army ordered 160 of the new Vickers Medium tanks. They were virtually the only tanks the British Army had until the early 1930s and the only tanks to be produced in quantity anywhere in the world during the mid-1920s. The Vickers Mediums stimulated the Royal Tank Corps to develop mobile tactics, and various experiments during the 1920s and early ’30s resulted in the general adoption of two categories of tanks. Mobile tanks were intended for the role performed earlier by horse cavalry, while slower but more heavily armoured tanks provided infantry support.

Before this division into mobile and slow tanks had crystallized, several different designs were tried. The British Independent tank of 1925, with five turrets, started a trend toward multi-turreted heavy tanks. Another trendsetter was a small turretless tankette, originated in Britain by Maj. Giffard le Quesne Martel and John Carden in the mid-1920s, and a slightly heavier, turreted, two-man light tank. The number of light tanks grew rapidly after 1929, as several countries started to produce armoured vehicles. The Soviet Union was by far the most important producer; on a much smaller scale Poland, Czechoslovakia, and Japan entered the field in 1930–31. Concurrently, tank production started up again in France and Italy. As tank production grew and spread among nations, the value of light tanks armed only with machine guns decreased, and heavier models armed with 37- to 47-mm guns for fighting other tanks began to displace them. An early example was the Vickers-Armstrong six-ton model of 1930, copied on a large scale in the Soviet Union (as the T-26). The most successful example was the BT, also built in large numbers in the Soviet Union. The fastest tank of its day, the BT was based on designs evolved in the United States by J.W. Christie, who in 1928 built an experimental model capable of 42.5 miles per hour. Christie’s vehicles could run on wheels after the removal of tracks and, far more significant, had road wheels independently suspended. This enabled them to move over broken ground faster than tanks with the earlier types of suspension.

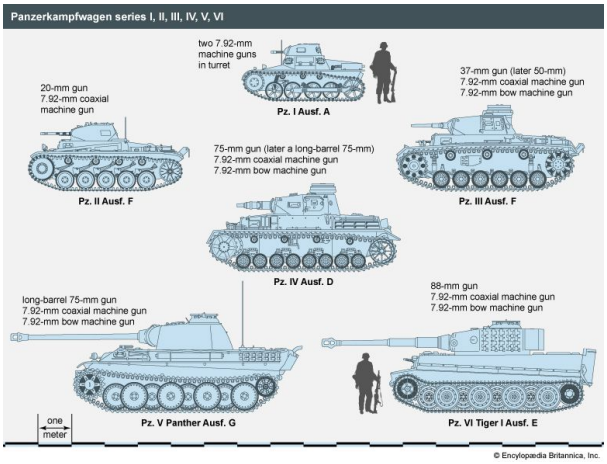
© 2020 Encyclopædia Britannica, Inc.

Although they were relatively well-armed and mobile, tanks of the T-26 and BT type were lightly armoured (plates 10 to 15 mm thick) and were not, therefore, suitable for close infantry support. This was clearly demonstrated in 1937 during the civil war in Spain, where T-26 and BT tanks were used by the Republican forces. Even before this time, it had become clear that tanks that moved at the slow pace of the infantry and were therefore exposed to the full effect of antitank guns had to be thickly armoured. This realization led in the mid-1930s to such infantry tanks as the French R-35 with 40-mm armour and the British A.11 with up to 60-mm armour.

Apart from being lightly armoured, the Soviet BT, the equivalent British cruiser tanks, and the German Pz. III also required support from more heavily armed tanks if they were to engage in fighting of any intensity. The need for tanks with more powerful 75-mm guns was clearly recognized in Germany, leading in 1934 to the design of the Pz. IV. The problem was realized less clearly in the Soviet Union, even though the T-28 and T-35 multi-turret tanks with 76-mm guns were first built there in 1932–33. But the Russians recognized more quickly than others the need for the next step, which was to replace all the light-medium tanks armed with 37- to 47-mm guns by medium tanks armed with 75- or 76-mm guns. Thus, in 1939, while the Germans were still developing the Pz. III from a 37-mm to a 50-mm version, the Russians were already concentrating on the T-34 medium tank with a 76-mm gun.

Other armies were farther behind in producing well-armed tanks on the eve of World War II. All but 80 of the 1,148 tanks that Britain had produced between 1930 and 1939 were still armed only with machine guns. Italy was even worse off, with only 70 M/11 tanks with 37-mm guns while the rest of its total of 1,500 were small, machine-gun-armed tankettes. The United States had only about 300 machine-gun-armed light tanks. Most of the 2,000 tanks produced in Japan were equally lightly armed. By comparison, France had a more powerful tank force—2,677 modern tanks, of which, however, only 172 were the Char B, armed with 75-mm guns. The largest force was the Soviet Union’s, which, as a result of a massive production program started in 1930–31, had about 20,000 tanks by 1939, considerably more than the rest of the world put together.

World War II



Panzers (German tanks) of World War II.

Encyclopædia Britannica, Inc.

The most effective tank force proved to be the German, composed in 1939 of 3,195 vehicles, including 211 Pz. IVs. What made the German panzers so formidable was that, instead of being divided between various infantry

© 2020 Encyclopædia Britannica, Inc.

and cavalry tank units, they were all concentrated and used in massed formations in the panzer divisions. The successes of the panzer divisions during the first two years of World War II led the major armies to reorganize most of their tanks into similar formations; this resulted in a dramatic increase in production.



German Pz. IV (foreground) and Pz. III (background) tanks, 1942.

U.S. Army photograph

The campaigns of 1939–41, in which armoured forces played an important role, also intensified the technical development of tanks and other armoured vehicles. The German Pz. IV and Soviet T-34 were rearmed in 1942 with longer-barreled, higher-velocity guns; soon afterward these began to be displaced by more powerfully armed tanks. In 1943 the Germans introduced the Panther medium tank with a long 75-mm gun having a muzzle velocity of 936 metres (3,070 feet) per second, compared with 384 metres (1,260 feet) per second for the original Pz. IV and 750 metres (2,460 feet) per second for its 1942 version. The 43-ton Panther weighed almost twice as much as its predecessor and was correspondingly better armoured. Germany also introduced the still more powerful Tiger tank, armed with an 88-mm gun. Its final version (Tiger II), at 68 tons, was to be the heaviest tank used during World War II. To oppose it, the Russians brought out the JS, or Stalin, heavy tank, which appeared in 1944 armed with a 122-mm gun. Its muzzle velocity was lower than that of the German 88-mm guns, however, and it weighed only 46 tons. At about the same time the T-34 was rearmed with an 85-mm gun.



A U.S. M10 Wolverine tank destroyer crossing a stream into German territory during World War II.

Encyclopædia Britannica, Inc.

In contrast to the breakthrough role of the earlier heavy tanks, the Tiger and JS tanks functioned chiefly to support basic medium tanks by destroying enemy tanks at long range. German and Soviet armies also developed other heavy vehicles for this purpose, such as the 128-mm-gun Jagdtiger and the 122-mm-gun ISU, which in effect were turretless tanks. In addition, all armies developed lightly armoured self-propelledantitank guns. The U.S. Army developed a specialized category of tank destroyers that resembled self-propelled guns in being relatively lightly armoured but that, like tanks, had rotating turrets.

© 2020 Encyclopædia Britannica, Inc.

The turretless-tank type of vehicle originated with the Sturmgeschutz, or assault gun, introduced by the German army for infantry support but subsequently transformed into more versatile vehicles particularly suited for destroying enemy tanks. No such vehicles were produced in Britain or the United States. Throughout the war, however, the British Army retained a specialized category of infantry tanks, such as the Churchill, and of cruiser tanks, such as the Crusader and Cromwell. The former were well-armoured and the latter were fast, but none was well-armed compared with German and Soviet tanks. As a result, during 1943 and 1944 British armoured divisions were mostly equipped with U.S.-built M4 Sherman medium tanks.



U.S. M3 General Lee tank on a training exercise during World War II, 1942.

Library of Congress, Washington, D.C.



(Foreground) U.S. Army M26 Pershing tank with a 90-millimetre gun and (background) M4 Sherman tank...

Ullstein Bilderdienst

The M4 was preceded by the mechanically similar M3 General Grant medium tank, which was also armed with a medium-velocity 75-mm gun but had it mounted in the hull instead of the turret, because this could be put into production more quickly when tanks were urgently required in 1940 and 1941. Production of the M4 began in 1942 and eventually 49,234 were built, making it the principal tank of U.S. and other Allied armoured forces. Successful when first introduced, it was by 1944 no longer adequately armed and should have been replaced by a new medium tank. But the U.S. Army, like the British, adhered to the fallacious doctrine that armoured divisions should confine themselves to exploitation of infantry breakthroughs and did not, therefore, need powerfully armed tanks. Only toward the end of the war did the U.S. Army introduce a few M26 Pershing heavy tanks with a 90-mm gun comparable to that of the original German Tiger. Similarly, the British Army introduced the prototypes of the Centurion tank with a 76-mm gun comparable to that of the German Panther. Otherwise, U. S. and British tanks were well behind the German and Soviet tanks in their gun power.

© 2020 Encyclopædia Britannica, Inc.

Postwar tank development



U.S. M26 Pershing tank in the Naktong River area during the Korean War, September 1950.

Sgt. Frank C. Kerr/U.S. Department of Defense

After World War II it was generally recognized that all tanks must be well-armed to fight enemy tanks. This finally ended the division of tanks into under-gunned categories of specialized infantry and cavalry tanks, which the British Army retained longer than any other. Still not fully recognized, however, were the advantages of concentrating tanks in fully mechanized formations, and the British and U.S. armies continued to divide tanks between the armoured divisions and the less mobile infantry divisions. After World War II, tanks also suffered from one of the periodic waves of pessimism about their future. New antitank weapons, such as rocket launchers and recoilless rifles, and the mistaken belief that the value of tanks lay primarily in their armour protection caused this attitude. The Soviet army, however, maintained large armoured forces, and the threat they posed to western Europe as the Cold War became more intense, together with the havoc created by Soviet-built T-34/85 tanks during the North Korean invasion of South Korea in 1950, provided a new impetus to development.

The development of tactical nuclear weapons in the mid-1950s provided further stimulus to the development of tanks and other armoured vehicles. Nuclear weapons encouraged the use of armoured forces because of the latter’s mobility and high combat power in relation to their vulnerable manpower. Moreover, armoured vehicles proved capable of operating in relative proximity to nuclear explosions by virtue of their protection against blasts and radioactivity.

As less emphasis was placed after a time on nuclear weapons and more on conventional forces, tanks retained their importance. This was based on their being recognized, particularly from the early 1970s, as the most effective counter to other armoured forces, which formed the principal threat posed on the ground by potential aggressors.

Armament

In keeping with the importance attached to the ability of tanks to defeat enemy tanks, great emphasis was placed after World War II on their armament. The result was progressive increases in the calibre of tank guns, the development of new types of ammunition with greater armour-piercing capabilities, and the introduction of more sophisticated fire-control systems to improve tank guns’ ability to hit targets.

© 2020 Encyclopædia Britannica, Inc.

Gun calibre



British Centurion tank, developed at the end of World War II and used as a principal main battle…

Encyclopædia Britannica, Inc.

Increases in gun calibre are well illustrated by the British Centurion, which started in 1945 with a 76-mm gun but in 1948 was rearmed with an 83.8-mm gun and in 1959 with an even more powerful 105-mm gun. Moreover, during the 1950s the capabilities of British tank units were augmented by a small number of Conqueror heavy tanks armed with 120-mm guns, and in the early 1970s the Centurions were entirely replaced by Chieftains armed with new and more-effective 120-mm guns.



Soviet T-72 main battle tank, with a 125-millimetre gun. A snorkel is mounted for submerged fording.

Tass/Sovfoto

Similar increases took place in the calibre of Soviet tank guns. After World War II the basic T-34/85 tanks armed with 85-mm guns were replaced by T-54 and T-55 tanks armed with 100-mm guns. They were followed in the 1960s by the T-62, with a 115-mm gun, and in the 1970s and ’80s by the T-64, T-72, and T-80, all with 125-mm smoothbore guns. The JS-3 and T-10 heavy tanks with their less powerful 122-mm guns had by then been withdrawn. This left the Soviet army in the same position as others of having a single type of battle tank as well-armed as contemporary technology would allow.

For a time the U.S. Army also subscribed to a policy of developing heavy as well as medium tanks. But the heavy M103 tank, armed with a 120-mm gun, was only built in small numbers in the early 1950s. As a result, virtually the only battle tanks the U.S. Army had were the M46, M47, and M48 medium tanks, all armed with 90-mm guns. After the mid-1950s the M47 tanks were passed on to the French, Italian, Belgian, West German, Greek, Spanish, and Turkish armies, and during the 1960s the M48 began to be replaced by the M60, which was armed with a U.S.-made version of the 105-mm gun developed for the British Centurion.

© 2020 Encyclopædia Britannica, Inc.



West German Leopard 2 main battle tank, with a 120-millimetre gun. Smoke dischargers are fitted onto ...

Lothar Kucharz/Ullstein

The same 105-mm gun was adopted for the Pz. 61 and Pz. 68 tanks produced in Switzerland, the West German Leopard 1, the Swedish S-tank, the Japanese Type 74, and the Mark 1 and 2 versions of the Israeli Merkava. It was also retained in the original version of the U.S. M1 Abrams tank developed in the 1970s, but the subsequent M1A1 version of the 1980s was rearmed with a 120-mm gun originally developed in West Germany for the Leopard 2 tank. The British Challenger, introduced in the 1980s, was also armed with 120-mm guns, but these were still of the rifle type.

Ammunition

The last years of World War II saw the development of more- effective antitank ammunition with armour-piercing, discarding-sabot (APDS) projectiles. These had a smaller-calibre, hard tungsten carbide core inside a light casing. The casing fell away on leaving the gun barrel, while the core flew on at an extremely high velocity. The APDS, which was adopted for the 83.8-mm gun of the Centurions, was fired with a velocity of 1,430 metres (4,692 feet) per second. By comparison, earlier full-calibre, armour-piercing projectiles had a maximum muzzle velocity of about 900 metres (3,000 feet) per second. With this shell the Centurion’s 83.8-mm gun could penetrate armour twice as thick as could the 88-mm gun of the German Tiger II of World War II.

An alternative type of armour-piercing ammunition developed during the 1950s was the high-explosive antitank (HEAT) shell. This shell used a shaped charge with a conical cavity that concentrated its explosive energy into a very high-velocity jet capable of piercing thick armour. The HEAT round was favoured by the U.S. Army for its 90-mm tank guns and also by the French army for the 105-mm gun of its AMX-30 tank, introduced in the mid-1960s. However, during the 1970s both APDS and HEAT began to be superseded by armour-piercing, fin-stabilized, discarding-sabot (APFSDS) ammunition. These projectiles had long-rod penetrator cores of tungsten alloy or depleted uranium; they could be fired with muzzle velocities of 1,650 metres (5,400 feet) per second or more, making them capable of perforating much thicker armour than all earlier types of ammunition.



U.S. Army M60 Patton tank, armed with a gun/launcher for firing a 152-mm projectile or launching an...

© 2020 Encyclopædia Britannica, Inc.

U.S. Army Photograph

During the 1960s, attempts were made to arm tanks with guided-missile launchers. These were to provide tanks with a combination of the armour-piercing capabilities of large shaped-charge warheads with the high accuracy at long range of guided missiles. The U.S. M60A2 and the U.S.-West German MBT-70 were armed with 152-mm gun/launchers firing standard ammunition as well as launching Shillelagh guided antitank missiles, and the AMX-30 was armed experimentally with the 142-mm ACRA gun/launcher. But the high cost, unreliability, and slow rate of fire of the missiles, together with the appearance of APFSDS ammunition and greatly improved fire-control systems, led to abandonment of gun/launchers in the early 1970s.

Fire control

The first major postwar advance in fire-control systems was the adoption of optical range finders, first on the M47 tank and then on the Leopard 1, the AMX-30, and other tanks. In the 1960s, optical range finders began to be replaced by laser range finders. In combination with electronic ballistic computers, these greatly increased the hit probability of tank guns. They became standard in all new tanks built from the early 1970s and were retrofitted in many of the earlier tanks.

Another major development was that of night sights, which enabled tanks to fight in the dark as well as in daylight. Originally of the active infrared type, they were first adopted on a large scale on Soviet tanks. Other tanks were fitted from the 1960s with image-intensifier sights and from the 1970s with thermal imaging sights. These latter were called passive because, unlike active infrared systems, they did not emit energy and were not detectable.

After World War II an increasing number of tanks were fitted with stabilized gun controls to enable them to fire more accurately on the move (i.e., to keep their gun barrels at a constant angle of elevation even while the tank was riding over bumps or depressions). At first some tanks, such as the T-54, had their guns stabilized only in elevation, but the Centurion already had stabilization in traverse as well as elevation, and this became standard beginning in the 1970s. Afterward tanks were also provided with independently stabilized gunners’, as well as commanders’, sights, the better to engage targets on the move.

Armour

Until the 1960s, tank armour consisted of homogeneous steel plates or castings. The thickness of this armour varied from 8 mm on early tanks to 250 mm at the front of the German Jagdtiger of 1945. After World War II, opinions differed about the value of armour protection. Tanks such as the Leopard 1 and AMX-30 had relatively thin armour for the sake of light weight and greater mobility, which was considered to provide a greater chance of battlefield survival. Other tanks, such as the Chieftain, had heavier armour, up to 120 mm thick at the front, and the Arab-Israeli wars of 1967 and 1973 demonstrated the continued value of heavy armour.

At the same time, new types of armour were developed that were much more effective than homogeneous steel, particularly against shaped-charge warheads. The new types were multilayered and incorporated ceramics or other nonmetallic materials as well as steel. The first was successfully developed in Britain under the name of Chobham armour. Armour of its kind was first adopted in the early 1970s in the M1 and Leopard 2; it then came into general use in place of simple steel armour.

Fighting in Lebanon in 1982 saw the first use, on Israeli tanks, of explosive reactive armour, which consisted of a layer of explosive sandwiched between two relatively thin steel plates. Designed to explode outward and thus neutralize the explosive penetration of a shaped-charge warhead, reactive armour augmented any protection already provided by steel or composite armour.

© 2020 Encyclopædia Britannica, Inc.



A British Challenger tank during the Persian Gulf War of 1990–91.

PHC Holmes/U.S. Army

The increased protection afforded to tanks inevitably increased their weight. Some tanks introduced during the 1950s and ’60s, such as the T-54 and AMX-30, weighed only 36 tons, but the Chieftain already weighed 54 tons. Most tanks introduced during the 1980s, such as the M1 and the Leopard 2, also weighed more than 50 tons, and the Challenger weighed as much as 62 tons.

Mobility

In spite of the progressive increases in weight, tanks’ speed and agility actually increased because they were provided with more powerful engines. After World War II, tank engines had an output of 500 to 800 horsepower, but, starting with the MBT-70, their output increased to 1,500 horsepower. Engines of this power were installed in the M1 and the Leopard 2, giving them power-to-weight ratios of more than 20 horsepower per ton.

Most tank engines of the immediate postwar years had 12 cylinders in a V-configuration and at first were of the spark-ignition gasoline type. But Soviet tanks already had diesel engines, and from the 1960s almost all tanks were diesel-powered. This increased their range of operation because of the greater thermal efficiency of the diesels, and it reduced the risk of catastrophic fires that could erupt if the armour was perforated by enemy weapons.



A U.S. M1A1 tank—essentially an M1 Abrams main battle tank with a 120-mm gun adapted from the West...

Land Systems Division/General Dynamics Corporation

© 2020 Encyclopædia Britannica, Inc.

The development of gas turbines led in the 1960s to the use of one, in combination with a diesel engine, in the Swedish S-tank. After that, a 1,500-horsepower gas turbine was adopted to power by itself the M1 and M1A1. A gas turbine also powered the Soviet T-80, introduced in the 1980s. All other new tanks of the 1980s continued to be powered by diesels because of their greater fuel economy.

Since the speed of tanks over rough ground depended not only on the power of their engines but also on the effectiveness of their suspensions, the latter developed considerably in the postwar era. Almost all tanks adopted independently located road wheels, sprung in most cases by transversely located torsion bars. Exceptions to this were the Centurion and Chieftain and the Merkava, which used coil springs. To improve their ride over rough ground still further, most tanks built during the 1980s were fitted with hydropneumatic instead of metallic spring units.

Configuration

The great majority of postwar tanks continued the traditional configuration of driver’s station at the front of the hull, engine compartment at the rear, and rotating turret at the centre. The turret mounted the main armament and was occupied by the tank’s commander, gunner, and loader. This configuration, introduced by the Vickers-Armstrong A.10 tank designed in 1934, became almost universal after World War II, but after 1960 it was abandoned in some cases in favour of novel configurations. One widely adopted configuration retained the turret but replaced the human loader by an automatic loading mechanism. The first examples of this were on the T-64 and T-72 tanks, whose guns were automatically loaded from a carousel-type magazine below the turret. Another tank with an unconventional configuration was the Merkava, which had its engine compartment at the front and the ammunition at the rear of the hull, where it was least likely to be hit by enemy fire. The Merkava also had a turret with a low frontal area, which reduced the target it presented to enemy weapons.

Richard Marian OgorkiewiczEB Editors

Additional Reading

The tanks and armoured vehicles of both World Wars are discussed in RICHARD M. OGORKIEWICZ, *Armour: A History of Mechanized Forces* (1960, reissued as *Armoured Forces: A History of Armoured Forces and Their Vehicles*, 1970). The history of various types of vehicles from World War I to the end of World War II is presented in books by DUNCAN CROW (ed.), such as *AFVs of World War One* (1970), *British AFVs, 1919–40* (1970), *British and Commonwealth AFVs, 1940–46* (1971), *American AFVs of World War II* (1972), and *Armored Fighting Vehicles of Germany: World War II* (1973). A useful reference source for German tanks, armoured vehicles, and self-propelled guns is PETER CHAMBERLAIN and HILARY L. DOYLE, *Encyclopedia of German Tanks of World War Two*, rev. ed. (1993).

Illustrated histories of Soviet and Russian armour are provided in WOLFGANG FLEISCHER, *Russian Tanks and Armored Fighting Vehicles, 1917–1945* (1999); FRED KOCH, *Russian Tanks and Armored Vehicles, 1946 to the Present* (1999); and ANDREW W. HULL, DAVID R. MARKOV, and STEVEN J. ZALOGA, *Soviet/Russian Armor and Artillery Design Practices: 1945 to Present* (1999).

Popular histories of U.S. armour are offered in books by R.P. HUNNICUT, including *Sherman: A History of the American Medium Tank* (1978), *Abrams: A History of the American Main Battle Tank* (1990), and *Bradley: A History of American Fighting and Support Vehicles* (1999).

Jane’s Armour and Artillery (annual) describes all current tanks.

© 2020 Encyclopædia Britannica, Inc.

Richard Marian OgorkiewiczEB Editors

Citation (MLA style):

"Tank." *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 24 Jun. 2019. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

ARTICLE

World War I

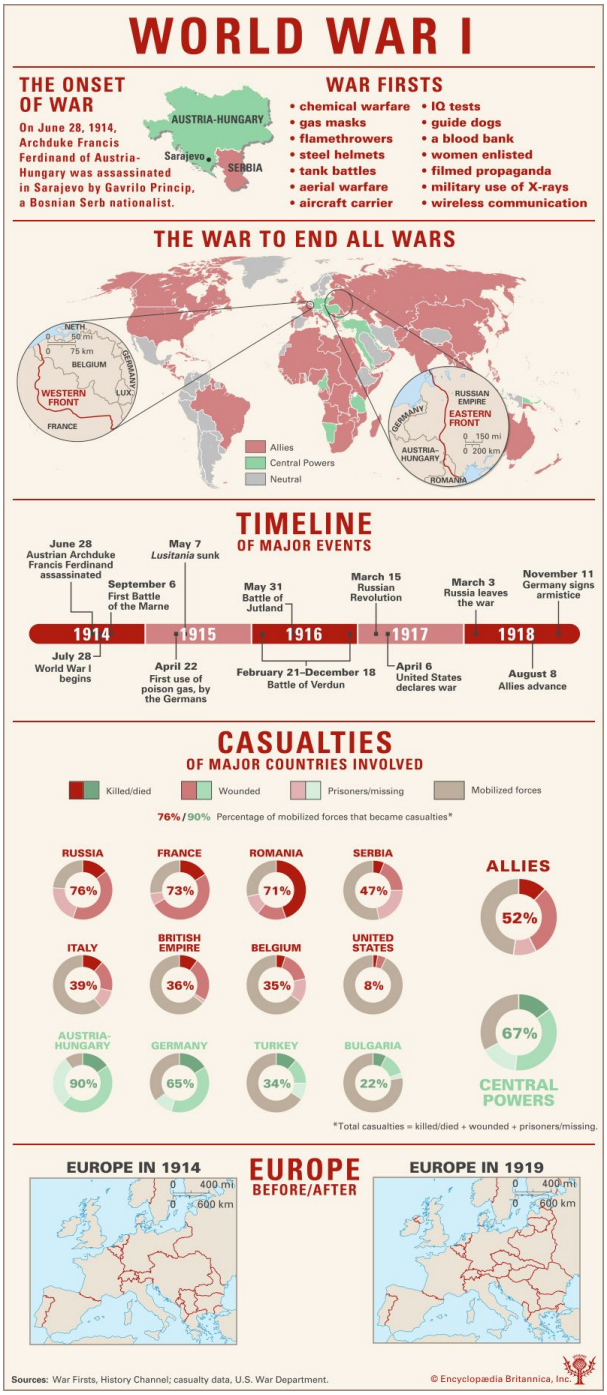
also called First World War or Great War, an international conflict that in 1914–18 embroiled most of the nations of Europe along with Russia, the United States, the Middle East, and other regions. The war pitted the Central Powers—mainly Germany, Austria-Hungary, and Turkey—against the Allies—mainly France, Great Britain, Russia, Italy, Japan, and, from 1917, the United States. It ended with the defeat of the Central Powers. The war was virtually unprecedented in the slaughter, carnage, and destruction it caused.



A British soldier inside a trench on the Western Front during World War I, 1914–18.

Hulton Archive/Getty Images

© 2020 Encyclopædia Britannica, Inc.



A collection of significant facts about World War I.

Encyclopædia Britannica, Inc./Kenny Chmielewski



Three notable women of World War I: Marie Curie, Mabel St. Clair Stobart, and Aileen Cole Stewart.

Encyclopædia Britannica, Inc.

World War I was one of the great watersheds of 20th-century geopolitical history. It led to the fall of four great imperial dynasties (in Germany, Russia, Austria-Hungary, and Turkey), resulted in the Bolshevik Revolution in Russia, and, in its destabilization of European society, laid the groundwork for World War II.

The last surviving veterans of World War I were American serviceman Frank Buckles (died in February 2011), British-born Australian serviceman Claude Choules (died in May 2011), and British servicewoman Florence Green (died in February 2012), the last surviving veteran of the war.

The outbreak of war

With Serbia already much aggrandized by the two Balkan Wars (1912–13, 1913), Serbian nationalists turned their attention back to the idea of “liberating” the South Slavs of Austria-Hungary. Colonel Dragutin Dimitrijević, head of Serbia’s military intelligence, was also, under the alias “Apis,” head of the secret society Union or Death, pledged to the pursuit of this pan-Serbian ambition. Believing that the Serbs’ cause would be served by the death of the Austrian archduke Franz Ferdinand, heir presumptive to the Austrian emperor Franz Joseph, and learning that the Archduke was about to visit Bosnia on a tour of military inspection, Apis plotted his assassination. Nikola Pašić, the Serbian prime minister and an enemy of Apis, heard of the plot and warned the Austrian government of it, but his message was too cautiously worded to be understood.



Austrian Archduke Franz Ferdinand and his wife, Sophie, duchess of Hohenberg, in an open carriage at …

Henry Guttmann Collection—Hulton Archive/Getty Images

At 11:15 AM on June 28, 1914, in the Bosnian capital, Sarajevo, Franz Ferdinand and his morganatic wife, Sophie, duchess of Hohenberg, were shot dead by a Bosnian Serb, Gavrilo Princip. The chief of the Austro-Hungarian general staff, Franz, Graf (count) Conrad von Hötzendorf, and the foreign minister, Leopold, Graf von Berchtold, saw the crime as the occasion for measures to humiliate Serbia and so to enhance Austria-Hungary’s prestige in the Balkans. Conrad had already (October 1913) been assured by William II of Germany’s support if Austria-Hungary should start a preventive war against Serbia. This assurance was confirmed in the week following the assassination, before William, on July 6, set off upon his annual cruise to the North Cape, off Norway.

The Austrians decided to present an unacceptable ultimatum to Serbia and then to declare war, relying on Germany to deter Russia from intervention. Though the terms of the ultimatum were finally approved on July 19, its delivery was postponed to the evening of July 23, since by that time the French president, Raymond Poincaré, and his premier, René Viviani, who had set off on a state visit to Russia on July 15, would be on their way home and therefore unable to concert an immediate reaction with their Russian allies. When the delivery was announced, on July 24, Russia declared that Austria-Hungary must not be allowed to crush Serbia.

Serbia replied to the ultimatum on July 25, accepting most of its demands but protesting against two of them—namely, that Serbian officials (unnamed) should be dismissed at Austria-Hungary’s behest and that Austro-

© 2020 Encyclopædia Britannica, Inc.

Hungarian officials should take part, on Serbian soil, in proceedings against organizations hostile to Austria-Hungary. Though Serbia offered to submit the issue to international arbitration, Austria-Hungary promptly severed diplomatic relations and ordered partial mobilization.

Home from his cruise on July 27, William learned on July 28 how Serbia had replied to the ultimatum. At once he instructed the German Foreign Office to tell Austria-Hungary that there was no longer any justification for war and that it should content itself with a temporary occupation of Belgrade. But, meanwhile, the German Foreign Office had been giving such encouragement to Berchtold that already on July 27 he had persuaded Franz Joseph to authorize war against Serbia. War was in fact declared on July 28, and Austro-Hungarian artillery began to bombard Belgrade the next day. Russia then ordered partial mobilization against Austria-Hungary, and on July 30, when Austria-Hungary was riposting conventionally with an order of mobilization on its Russian frontier, Russia ordered general mobilization. Germany, which since July 28 had still been hoping, in disregard of earlier warning hints from Great Britain, that Austria-Hungary’s war against Serbia could be “localized” to the Balkans, was now disillusioned insofar as eastern Europe was concerned. On July 31 Germany sent a 24-hour ultimatum requiring Russia to halt its mobilization and an 18-hour ultimatum requiring France to promise neutrality in the event of war between Russia and Germany.

Both Russia and France predictably ignored these demands. On August 1 Germany ordered general mobilization and declared war against Russia, and France likewise ordered general mobilization. The next day Germany sent troops into Luxembourg and demanded from Belgium free passage for German troops across its neutral territory. On August 3 Germany declared war against France.

In the night of August 3–4 German forces invaded Belgium. Thereupon, Great Britain, which had no concern with Serbia and no express obligation to fight either for Russia or for France but was expressly committed to defend Belgium, on August 4 declared war against Germany.

Austria-Hungary declared war against Russia on August 5; Serbia against Germany on August 6; Montenegro against Austria-Hungary on August 7 and against Germany on August 12; France and Great Britain against Austria-Hungary on August 10 and on August 12, respectively; Japan against Germany on August 23; Austria-Hungary against Japan on August 25 and against Belgium on August 28.

Romania had renewed its secret anti-Russian alliance of 1883 with the Central Powers on February 26, 1914, but now chose to remain neutral. Italy had confirmed the Triple Alliance on December 7, 1912, but could now propound formal arguments for disregarding it: first, Italy was not obliged to support its allies in a war of aggression; second, the original treaty of 1882 had stated expressly that the alliance was not against England.

On September 5, 1914, Russia, France, and Great Britain concluded the Treaty of London, each promising not to make a separate peace with the Central Powers. Thenceforth, they could be called the Allied, or Entente, powers, or simply the Allies.



Overview of the start of World War I, including details of the June 28, 1914, assassination of...

© 2020 Encyclopædia Britannica, Inc.

Contunico © ZDF Studios GmbH, Mainz; Thumbnail Prints and Photographs Division/Library of Congress, Washington D.C.; Encyclopædia Britannica, Inc.

The outbreak of war in August 1914 was generally greeted with confidence and jubilation by the peoples of Europe, among whom it inspired a wave of patriotic feeling and celebration. Few people imagined how long or how disastrous a war between the great nations of Europe could be, and most believed that their country's side would be victorious within a matter of months. The war was welcomed either patriotically, as a defensive one imposed by national necessity, or idealistically, as one for upholding right against might, the sanctity of treaties, and international morality.

Forces and resources of the combatant nations in 1914

When war broke out, the Allied powers possessed greater overall demographic, industrial, and military resources than the Central Powers and enjoyed easier access to the oceans for trade with neutral countries, particularly with the United States.

Strength of the belligerents, Aug. 4, 1914Table 1 shows the population, steel production, and armed strengths of the two rival coalitions in 1914.

All the initial belligerents in World War I were self-sufficient in food except Great Britain and Germany. Great Britain's industrial establishment was slightly superior to Germany's (17 percent of world trade in 1913 as compared with 12 percent for Germany), but Germany's diversified chemical industry facilitated the production of ersatz, or substitute, materials, which compensated for the worst shortages ensuing from the British wartime blockade. The German chemist Fritz Haber was already developing a process for the fixation of nitrogen from air; this process made Germany self-sufficient in explosives and thus no longer dependent on imports of nitrates from Chile.

Of all the initial belligerent nations, only Great Britain had a volunteer army, and this was quite small at the start of the war. The other nations had much larger conscript armies that required three to four years of service from able-bodied males of military age, to be followed by several years in reserve formations. Military strength on land was counted in terms of divisions composed of 12,000–20,000 officers and men. Two or more divisions made up an army corps, and two or more corps made up an army. An army could thus comprise anywhere from 50,000 to 250,000 men.

Land forces of the belligerents, Aug. 4, 1914The land forces of the belligerent nations at the outbreak of war in August 1914 are shown in Table 2.

The higher state of discipline, training, leadership, and armament of the German army reduced the importance of the initial numerical inferiority of the armies of the Central Powers. Because of the comparative slowness of mobilization, poor higher leadership, and lower scale of armament of the Russian armies, there was an approximate balance of forces between the Central Powers and the Allies in August 1914 that prevented either side from gaining a quick victory.

Germany and Austria also enjoyed the advantage of "interior lines of communication," which enabled them to send their forces to critical points on the battlefronts by the shortest route. According to one estimate, Germany's railway network made it possible to move eight divisions simultaneously from the Western Front to the Eastern Front in four and a half days.

Even greater in importance was the advantage that Germany derived from its strong military traditions and its cadre of highly efficient and disciplined regular officers. Skilled in directing a war of movement and quick to

© 2020 Encyclopædia Britannica, Inc.

exploit the advantages of flank attacks, German senior officers were to prove generally more capable than their Allied counterparts at directing the operations of large troop formations.

Sea power was largely reckoned in terms of capital ships, or dreadnought battleships and battle cruisers having extremely large guns. Despite intensive competition from the Germans, the British had maintained their superiority in numbers, with the result that, in capital ships, the Allies had an almost two-to-one advantage over the Central Powers.

British and German naval strength, August 1914The strength of the two principal rivals at sea, Great Britain and Germany, is compared in Table 3.

The numerical superiority of the British navy, however, was offset by the technological lead of the German navy in many categories, such as range-finding equipment, magazine protection, searchlights, torpedoes, and mines. Great Britain relied on the Royal Navy not only to ensure necessary imports of food and other supplies in wartime but also to sever the Central Powers’ access to the markets of the world. With superior numbers of warships, Great Britain could impose a blockade that gradually weakened Germany by preventing imports from overseas.

Technology of war in 1914



German infantrymen operating a Maxim machine gun during World War I.

Imperial War Museum



French soldiers operating a Saint-Étienne machine gun at the Somme, World War I.

Encyclopædia Britannica, Inc.

© 2020 Encyclopædia Britannica, Inc.



The French 75-mm cannon, the archetypal rapid-firing gun from its introduction in 1897 through World ...

Ian V. Hogg

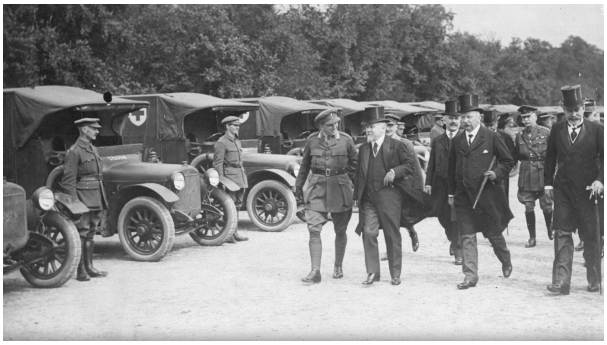
The planning and conduct of war in 1914 were crucially influenced by the invention of new weapons and the improvement of existing types since the Franco-German War of 1870–71. The chief developments of the intervening period had been the machine gun and the rapid-fire field artillery gun. The modern machine gun, which had been developed in the 1880s and ’90s, was a reliable belt-fed gun capable of sustained rates of extremely rapid fire; it could fire 600 bullets per minute with a range of more than 1,000 yards (900 metres). In the realm of field artillery, the period leading up to the war saw the introduction of improved breech-loading mechanisms and brakes. Without a brake or recoil mechanism, a gun lurched out of position during firing and had to be re-aimed after each round. The new improvements were epitomized in the French 75-millimetre field gun; it remained motionless during firing, and it was not necessary to readjust the aim in order to bring sustained fire on a target.



Heavy fighting on what became known as “No Man's Land” spawned the first military use of airplanes,...

Encyclopædia Britannica, Inc.

Machine guns and rapid-firing artillery, when used in combination with trenches and barbed-wire emplacements, gave a decided advantage to the defense, since these weapons’ rapid and sustained firepower could decimate a frontal assault by either infantry or cavalry.



Learn about the medical innovations that came from World War I.

© 2020 Encyclopædia Britannica, Inc.

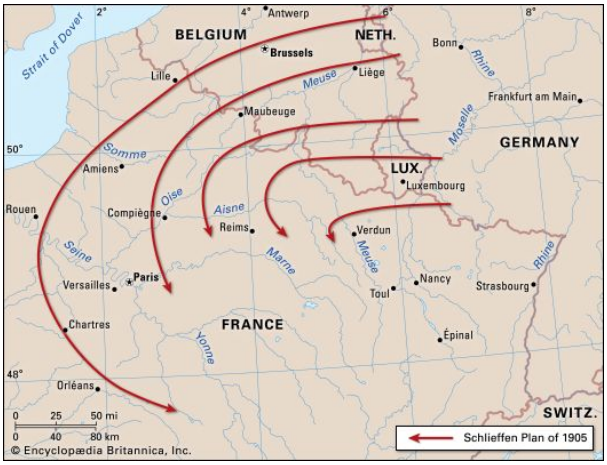
Encyclopædia Britannica, Inc.

There was a considerable disparity in 1914 between the deadly effectiveness of modern armaments and the doctrinal teachings of some armies. The South African War and the Russo-Japanese War had revealed the futility of frontal infantry or cavalry attacks on prepared positions when unaccompanied by surprise, but few military leaders foresaw that the machine gun and the rapid-firing field gun would force armies into trenches in order to survive. Instead, war was looked upon by many leaders in 1914 as a contest of national wills, spirit, and courage. A prime example of this attitude was the French army, which was dominated by the doctrine of the offensive. French military doctrine called for headlong bayonet charges of French infantrymen against the German rifles, machine guns, and artillery. German military thinking, under the influence of Alfred, Graf von Schlieffen, sought, unlike the French, to avoid frontal assaults but rather to achieve an early decision by deep flanking attacks; and at the same time to make use of reserve divisions alongside regular formations from the outset of war. The Germans paid greater attention to training their officers in defensive tactics using machine guns, barbed wire, and fortifications.

The initial stages of the war

Initial strategies

The Schlieffen Plan



Encyclopædia Britannica, Inc.

Years before 1914, successive chiefs of the German general staff had been foreseeing Germany’s having to fight a war on two fronts at the same time, against Russia in the east and France in the west, whose combined strength was numerically superior to the Central Powers’. The elder Helmuth von Moltke, chief of the German general staff from 1858 to 1888, decided that Germany should stay at first on the defensive in the west and deal a crippling blow to Russia’s advanced forces before turning to counterattack the French advance. His immediate successor, Alfred von Waldersee, also believed in staying on the defensive in the west. Alfred, Graf von Schlieffen, who served as chief of the German general staff from 1891 to 1905, took a contrary view, and it was the plan he developed that was to guide Germany’s initial wartime strategy. Schlieffen realized that on the outbreak of war Russia would need six full weeks to mobilize and assemble its vast armies, given the immense Russian countryside and population, the sparsity of the rail network, and the inefficiency of the government bureaucracy. Taking advantage of this fact, Schlieffen planned to initially adopt a purely defensive posture on the Eastern Front with a minimal number of troops facing Russia’s slowly gathering armies. Germany would instead concentrate almost all of its troops in the west against France and would seek to bypass France’s frontier fortifications by an offensive through neutral Belgium to the north. This offensive would sweep westward and

then southward through the heart of northern France, capturing the capital and knocking that country out of the war within a few weeks. Having gained security in the west, Germany would then shift its troops to the east and destroy the Russian menace with a similar concentration of forces.

By the time of his retirement in 1905, Schlieffen had elaborated a plan for a great wheeling movement of the right (northern) wing of the German armies not only through central Belgium but also, in order to bypass the Belgian fortresses of Liège and Namur in the Meuse valley, through the southernmost part of the Netherlands. With their right wing entering France near Lille, the Germans would continue to wheel westward until they were near the English Channel; they would then turn southward so as to sever the French armies' line of retreat from France's eastern frontier to the south; and the outermost arc of the wheel would sweep southward west of Paris, in order to avoid exposing the German right flank to a counterstroke launched from the city's outskirts. If the Schlieffen Plan succeeded, Germany's armies would simultaneously encircle the French army from the north, overrun all of northeastern France, and capture Paris, thus forcing France into a humiliating surrender. The large wheeling movement that the plan envisaged required correspondingly large forces for its execution, in view of the need to keep up the numerical strength of the long-stretched marching line and the need to leave adequate detachments on guard over the Belgian fortresses that had been bypassed. Accordingly, Schlieffen allocated nearly seven-eighths of Germany's available troop strength to the execution of the wheeling movement by the right and centre wings, leaving only one-eighth to face a possible French offensive on Germany's western frontier. Thus, the maximum of strength was allocated to the wheel's edge—that is, to the right. Schlieffen's plan was observed by the younger Helmuth von Moltke, who became chief of the general staff in 1906. Moltke was still in office when war broke out in 1914.

Eastern Front strategy, 1914

Russian Poland, the westernmost part of the Russian Empire, was a thick tongue of land enclosed to the north by East Prussia, to the west by German Poland (Poznania) and by Silesia, and to the south by Austrian Poland (Galicia). It was thus obviously exposed to a two-pronged invasion by the Central Powers, but the Germans, apart from their grand strategy of crushing France before attempting anything against Russia, took note of the poverty of Russian Poland's transportation network and so were disinclined to overrun that vulnerable area prematurely. Austria-Hungary, however, whose frontier with Russia lay much farther east than Germany's and who was moreover afraid of disaffection among the Slav minorities, urged some immediate action to forestall a Russian offensive. Moltke therefore agreed to the Austrian general staff's suggestion for a northeastward thrust by the Austrian army into Russian Poland—the more readily because it would occupy the Russians during the crisis in France.

The Russians, for their part, would have preferred to concentrate their immediately available forces against Austria and to leave Germany undisturbed until their mobilization should have been completed. The French were anxious to relieve the German pressure against themselves, however, and so they persuaded the Russians to undertake an offensive involving two armies against the Germans in East Prussia simultaneously with one involving four armies against the Austrians in Galicia. The Russian army, whose proverbial slowness and unwieldy organization dictated a cautious strategy, thus undertook an extra offensive against East Prussia that only an army of high mobility and tight organization could have hoped to execute successfully.

The strategy of the Western Allies, 1914

For some 30 years after 1870, considering the likelihood of another German war, the French high command had subscribed to the strategy of an initial defensive to be followed by a counterstroke against the expected invasion: a great system of fortresses was created on the frontier, but gaps were left in order to "canalize" the German attack. France's alliance with Russia and its entente with Great Britain, however, encouraged a reversal

© 2020 Encyclopædia Britannica, Inc.

of plan, and after the turn of the century a new school of military thinkers began to argue for an offensive strategy. The advocates of the offensive *à l'outrance* ("to the utmost") gained control of the French military machine, and in 1911 a spokesman of this school, General J.-J.-C. Joffre, was designated chief of the general staff. He sponsored the notorious Plan XVII, with which France went to war in 1914.

Plan XVII gravely underestimated the strength that the Germans would deploy against France. Accepting the possibility that the Germans might employ their reserve troops along with regular troops at the outset, Plan XVII estimated the strength of the German army in the west at a possible maximum of 68 infantry divisions. The Germans actually deployed the equivalent of 83 $^{1}/_{2}$ divisions, counting *Landwehr* (reserve troops) and *Ersatz* (low-grade substitute troops) divisions, but French military opinion ignored or doubted this possibility; during the war's crucial opening days, when the rival armies were concentrating and moving forward, the French Intelligence counted only Germany's regular divisions in its estimates of the enemy strength. This was a serious miscalculation. Plan XVII also miscalculated the direction and scope of the coming onslaught: though it foresaw an invasion through Belgium, it assumed that the Germans would take the route through the Ardennes, thereby exposing their communications to attack. Basing itself on the idea of an immediate and general offensive, Plan XVII called for a French thrust toward the Saar into Lorraine by the 1st and 2nd armies, while on the French left (the north) the 3rd and 5th armies, facing Metz and the Ardennes, respectively, stood ready either to launch an offensive between Metz and Thionville or to strike from the north at the flank of any German drive through the Ardennes. When war broke out, it was taken for granted that the small British Expeditionary Force (BEF) under Sir John French should be used as an adjunct to France's forces, more or less as the French might see fit. It is clearly evident that the French were oblivious to the gigantic German offensive that was being aimed at their left (northern) wing.

The war in the west, 1914

The German invasion



German sailors marching through the streets of Brussels, 1914.

Encyclopædia Britannica, Inc.

For the smooth working of their plan for the invasion of France, the Germans had preliminarily to reduce the ring fortress of Liège, which commanded the route prescribed for their 1st and 2nd armies and which was the foremost stronghold of the Belgian defenses. German troops crossed the frontier into Belgium on the morning of August 4. Thanks to the resolution of a middle-aged staff officer, Erich Ludendorff, a German brigade occupied the town of Liège itself in the night of August 5–6 and the citadel on August 7, but the surrounding forts held out stubbornly until the Germans brought their heavy howitzers into action against them on August 12. These 420-

© 2020 Encyclopædia Britannica, Inc.

millimetre siege guns proved too formidable for the forts, which one by one succumbed. The vanguard of the German invasion was already pressing the Belgian field army between the Gete River and Brussels, when the last of the Liège forts fell on August 16. The Belgians then withdrew northward to the entrenched camp of Antwerp. On August 20 the German 1st Army entered Brussels while the 2nd Army appeared before Namur, the one remaining fortress barring the Meuse route into France.

The initial clashes between the French and German armies along the Franco-German and Franco-Belgian frontiers are collectively known as the Battle of the Frontiers. This group of engagements, which lasted from August 14 until the beginning of the First Battle of the Marne on September 6, was to be the largest battle of the war and was perhaps the largest battle in human history up to that time, given the fact that a total of more than two million troops were involved.

The planned French thrust into Lorraine, totaling 19 divisions, started on August 14 but was shattered by the German 6th and 7th armies in the Battle of Morhange-Sarrebourg (August 20–22). Yet this abortive French offensive had an indirect effect on the German plan. For when the French attack in Lorraine developed, Moltke was tempted momentarily to postpone the right-wing sweep and instead to seek a victory in Lorraine. This fleeting impulse led him to divert to Lorraine the six newly formed *Ersatz* divisions that had been intended to increase the weight of his right wing. This was the first of several impromptu decisions by Moltke that were to fatally impair the execution of the Schlieffen Plan.

Meanwhile, the German imperial princes who commanded armies on the Germans’ left (southern) wing in Lorraine were proving unwilling to forfeit their opportunity for personal glory. Crown Prince Rupert of Bavaria on August 20 ordered his 6th Army to counterattack instead of continuing to fall back before the French advance as planned, and Crown Prince William of Germany ordered his 5th Army to do the same. The strategic result of these unplanned German offensives was merely to throw the French back onto a fortified barrier that both restored and augmented their power of resistance. Thus, the French were soon afterward enabled to dispatch troops to reinforce their left flank—a redistribution of strength that was to have far-reaching results in the decisive Battle of the Marne.



Europeans were fighting heavily on two fronts before the U.S. entered the war in 1917.

Encyclopædia Britannica, Inc.

While this seesaw campaign in Lorraine was taking place, more decisive events were occurring to the northwest. The German attack on Liège had awakened Joffre to the reality of a German advance through Belgium, but not to its strength or to the wideness of its sweep. In preparing a counterattack against the German advance through Belgium, Joffre envisaged a pincer movement, with the French 3rd and 4th armies on the right and the 5th, supported by the BEF, on the left, to trap the Germans in the Meuse–Ardennes area south of Liège. The fundamental flaw in this new French plan was that the Germans had deployed about 50 percent more troops than the French had estimated, and for a vaster enveloping movement. Consequently, while the right-hand claw of the French pincer (23 divisions) collided with the German 5th and 4th armies (20 divisions) in the Ardennes

© 2020 Encyclopædia Britannica, Inc.

and was thrown back, the left-hand claw (13 French and four British divisions) found itself nearly trapped between the German 1st and 2nd armies, with a total of 30 divisions, on the one hand, and the 3rd, on the other. As the French 5th Army, under General Charles Lanrezac, was checked in its offensive south of the Sambre River by a German attack on August 21, the British, who reached Mons on August 22, at first agreed to stand there to cover Lanrezac's left; but on August 23 news of the fall of Namur and of the German 3rd Army's presence near Dinant induced Lanrezac to wisely order a general retreat; and on August 24 the British began their retreat from Mons, just in time to escape envelopment by the German 1st Army's westward march around their unprotected left flank.

At last Joffre realized the truth and the utter collapse of Plan XVII. Resolution was his greatest asset, and with imperturbable coolness he formed a new plan out of the wreckage. Joffre decided to swing the Allied centre and left back southwestward from the Belgian frontier to a line pivoted on the French fortress of Verdun and at the same time to withdraw some strength from the right wing so as to be able to station a newly created 6th Army on the extreme left, north of Paris. This plan might, in turn, have collapsed if the Germans had not themselves departed from Schlieffen's original plan due to a combination of Moltke's indecisiveness, poor communications between his headquarters and the field army commanders of the German right wing, and Moltke's resulting confusion about the developing tactical situation. In the first place, the German right wing was weakened by the subtraction of 11 divisions; four were detached to watch Antwerp and to invest French fortresses near the Belgian frontier, instead of using reserve and *Ersatz* troops for this as earlier intended, and seven more regular divisions were transferred to check the Russian advance into East Prussia (*see below*). In the second place, Alexander von Kluck, in command of the 1st Army, did in fact wheel inward north of Paris rather than southwest of the city.

Kluck's change of direction meant the inevitable abandonment of the original wide sweep around the far (western) side of Paris. Now the flank of this wheeling German line would pass the near side of Paris and across the face of the Paris defenses into the valley of the Marne River. The premature inward wheel of Kluck's 1st Army before Paris had been reached thus exposed the German extreme right wing to a flank attack and a possible counter-envelopment. On September 4 Moltke decided to abandon the original Schlieffen Plan and substituted a new one: the German 4th and 5th armies should drive southeastward from the Ardennes into French Lorraine west of Verdun and then converge with the southwestward advance of the 6th and 7th armies from Alsace against the Toul–Épinal line of fortifications, so as to envelop the whole French right wing; the 1st and 2nd armies, in the Marne valley, should stand guard, meanwhile, against any French countermove from the vicinity of Paris. But such an Allied countermove had already begun before the new German plan could be put into effect.

The First Battle of the Marne

Already on September 3, General J.-S. Gallieni, the military governor of Paris, had guessed the significance of the German 1st Army's swing inward to the Marne east of Paris. On September 4 Joffre, convinced by Gallieni's arguments, decisively ordered his whole left wing to turn about from their retreat and to begin a general offensive against the Germans' exposed right flank on September 6. The French 6th Army, under M.-J. Maunoury, forewarned by Gallieni, had actually begun attacking on September 5, and its pressure caused Kluck finally to engage the whole 1st Army in support of his right flank when he was still no farther up the Marne valley than Meaux, with nothing but a cavalry screen stretched across the 30 miles between him and Karl von Bülow's 2nd Army (at Montmirail). While the French 5th Army was turning to attack Bülow, the BEF (between the 5th and the 6th armies) was still continuing its retreat for another day, but on September 9 Bülow learned that the British too had turned and were advancing into the gap between him and Kluck. He therefore ordered the 2nd Army to retreat, thus obliging Kluck to do likewise with the 1st. The counterattack of the French 5th and 6th armies and

© 2020 Encyclopædia Britannica, Inc.

the BEF developed into a general counterattack by the entire left and centre of the French army. This counterattack is known as the First Battle of the Marne. By September 11 the German retreat extended to all the German armies.

There were several reasons for this extraordinary turn of events. Chief among them was the utter exhaustion of the German soldiery of the right wing, some of whom had marched more than 150 miles (240 kilometres) under conditions of frequent battle. Their fatigue was ultimately a by-product of the Schlieffen Plan itself, for while the retreating French had been able to move troops by rail to various points within the circle formed by the front, the German troops had found their advance hampered by demolished bridges and destroyed rail lines. Their food and ammunition supply was consequently restricted, and the troops also had to make their advance by foot. Moreover, the Germans had underestimated the resilient spirit of the French troops, who had maintained their courage and morale and their confidence in their commanders. This fact was strikingly evidenced by the comparatively small number of prisoners taken by the Germans in the course of what was undeniably a precipitous French retreat.

Meanwhile, the assault by the German 6th and 7th armies on the defenses of the French eastern frontier had already proved a predictably expensive failure, and the German attempt at a partial envelopment pivoted on Verdun was abandoned. The German right wing withdrew northward from the Marne and made a firm stand along the Lower Aisne River and the Chemin des Dames ridge. Along the Aisne the preponderant power of the defense over the offense was reemphasized as the Germans repelled successive Allied attacks from the shelter of trenches. The First Battle of the Aisne marked the real beginning of trench warfare on the Western Front. Both sides were in the process of discovering that, in lieu of frontal assaults for which neither had the manpower readily available, the only alternative was to try to overlap and envelop the other’s flank, in this case the one on the side pointing toward the North Sea and the English Channel. Thus began the “Race to the Sea,” in which the developing trench networks of both sides were quickly extended northwestward until they reached the Atlantic at a point just inside coastal Belgium, west of Ostend.

The First Battle of the Marne succeeded in pushing the Germans back for a distance of 40 to 50 miles and thus saved the capital city of Paris from capture. In this respect it was a great strategic victory, since it enabled the French to renew their confidence and to continue the war. But the great German offensive, though unsuccessful in its object of knocking France out of the war, had enabled the Germans to capture a large portion of northeastern France. The loss of this heavily industrialized region, which contained much of the country’s coal, iron, and steel production, was a serious blow to the continuation of the French war effort.

The Belgian army, meanwhile, had fallen back to the fortress city of Antwerp, which ended up behind the German lines. The Germans began a heavy bombardment of Antwerp on September 28, and Antwerp surrendered to the Germans on October 10.

After the failure of his first two attempts to turn the Germans’ western flank (one on the Somme, the other near Arras), Joffre obstinately decided to try again yet farther north with the BEF—which in any case was being moved northward from the Aisne. The BEF, accordingly, was deployed between La Bassée and Ypres, while on the left the Belgians—who had wisely declined to participate in the projected attack—continued the front along the Yser down to the Channel. Erich von Falkenhayn, however, who on September 14 had succeeded Moltke as chief of the German general staff, had foreseen what was coming and had prepared a counterplan: one of his armies, transferred from Lorraine, was to check the expected offensive, while another was to sweep down the coast and crush the attackers’ left flank. The British attack was launched from Ypres on October 19, the German thrust the next day. Though the Belgians of the Yser had been under increasing pressure for two days already, both Sir John French and Ferdinand Foch, Joffre’s deputy in the north, were slow to appreciate what was happening to their “offensive,” but in the night of October 29–30 the Belgians had to open the sluices on the Yser River to

© 2020 Encyclopædia Britannica, Inc.

save themselves by flooding the Germans' path down the coast. The Battle of Ypres had its worst crises on October 31 and November 11 and did not die down into trench warfare until November 22.

By the end of 1914 the casualties the French had so far sustained in the war totaled about 380,000 killed and 600,000 wounded; the Germans had lost a slightly smaller number. With the repulse of the German attempt to break through at the Battle of Ypres, the strained and exhausted armies of both sides settled down into trench warfare. The trench barrier was consolidated from the Swiss frontier to the Atlantic; the power of modern defense had triumphed over the attack, and stalemate ensued. The military history of the Western Front during the next three years was to be a story of the Allies' attempts to break this deadlock.

The Eastern and other fronts, 1914

The war in the east, 1914

On the Eastern Front, greater distances and quite considerable differences between the equipment and quality of the opposing armies ensured a fluidity of the front that was lacking in the west. Trench lines might form, but to break them was not difficult, particularly for the German army, and then mobile operations of the old style could be undertaken.

Urged by the French to take offensive action against the Germans, the Russian commander in chief, Grand Duke Nicholas, took it loyally but prematurely, before the cumbrous Russian war machine was ready, by launching a pincer movement against East Prussia. Under the higher control of General Ya.G. Zhilinsky, two armies, the 1st, or Vilna, Army under P.K. Rennenkampf and the 2nd, or Warsaw, Army under A.V. Samsonov, were to converge, with a two-to-one superiority in numbers, on the German 8th Army in East Prussia from the east and the south, respectively. Rennenkampf's left flank would be separated by 50 miles from Samsonov's right flank.

Max von Prittwitz und Gaffron, commander of the 8th Army, with his headquarters at Neidenburg (Nidzica), had seven divisions and one cavalry division on his eastern front but only the three divisions of Friedrich von Scholtz' s XX Corps on his southern. He was therefore dismayed to learn, on August 20, when the bulk of his forces had been repulsed at Gumbinnen (August 19–20) by Rennenkampf's attack from the east, that Samsonov's 13 divisions had crossed the southern frontier of East Prussia and were thus threatening his rear. He initially considered a general retreat, but when his staff objected to this, he approved their counterproposal of an attack on Samsonov's left flank, for which purpose three divisions were to be switched in haste by rail from the Gumbinnen front to reinforce Scholtz (the rest of the Gumbinnen troops could make their retreat by road). The principal exponent of this counterproposal was Lieutenant Colonel Max Hoffmann. Prittwitz, having moved his headquarters northward to Mühlhausen (Młynary), was surprised on August 22 by a telegram announcing that General Paul von Hindenburg, with Ludendorff as his chief of staff, was coming to supersede him in command. Arriving the next day, Ludendorff readily confirmed Hoffmann's dispositions for the blow at Samsonov's left.

Meanwhile, Zhilinsky was not only giving Rennenkampf time to reorganize after Gumbinnen but even instructing him to invest Königsberg instead of pressing on to the west. When the Germans on August 25 learned from an intercepted Russian wireless message (the Russians habitually transmitted combat directives "in clear," not in code) that Rennenkampf was in no hurry to advance, Ludendorff saw a new opportunity. Developing the plan put forward by Hoffmann, Ludendorff concentrated about six divisions against Samsonov's left wing. This force, inferior in strength, could not have been decisive, but Ludendorff then took the calculated risk of withdrawing the rest of the German troops, except for a cavalry screen, from their confrontation with Rennenkampf and rushing them southwestward against Samsonov's right wing. Thus, August von Mackensen's XVII Corps was taken from near Gumbinnen and moved southward to duplicate the planned German attack on Samsonov's left with an attack on his right, thus completely enveloping the Russian 2nd Army. This daring move was made

© 2020 Encyclopædia Britannica, Inc.

possible by the notable absence of communication between the two Russian field commanders, whom Hoffmann knew to personally dislike each other. Under the Germans' converging blows Samsonov's flanks were crushed and his centre surrounded during August 26–31. The outcome of this military masterpiece, called the Battle of Tannenberg, was the destruction or capture of almost the whole of Samsonov's army. The history of imperial Russia's unfortunate participation in World War I is epitomized in the ignominious outcome of the Battle of Tannenberg.

The progress of the battle was as follows. Samsonov, his forces spread out along a front 60 miles long, was gradually pushing Scholtz back toward the Allenstein–Osterode (Olsztyn–Ostróda) line when, on August 26, Ludendorff ordered General Hermann von François, with the I Corps on Scholtz's right, to attack Samsonov's left wing near Usdau (Uzdowo). There, on August 27, German artillery bombardments threw the hungry and weary Russians into precipitate flight. François started to pursue them toward Neidenburg, in the rear of the Russian centre, and then made a momentary diversion southward, to check a Russian counterattack from Soldau (Działdowo). Two of the Russian 2nd Army's six army corps managed to escape southeastward at this point, and François then resumed his pursuit to the east. By nightfall on August 29 his troops were in control of the road leading from Neidenburg eastward to Willenberg (Wielbark). The Russian centre, amounting to three army corps, was now caught in the maze of forest between Allenstein and the frontier of Russian Poland. It had no line of retreat, was surrounded by the Germans, and soon dissolved into mobs of hungry and exhausted men who beat feebly against the encircling German ring and then allowed themselves to be taken prisoner by the thousands. Samsonov shot himself in despair on August 29. By the end of August the Germans had taken 92,000 prisoners and annihilated half of the Russian 2nd Army. Ludendorff's bold recall of the last German forces facing Rennenkampf's army was wholly justified in the event, since Rennenkampf remained utterly passive while Samsonov's army was surrounded.

Having received two fresh army corps (seven divisions) from the Western Front, the Germans now turned on the slowly advancing 1st Army under Rennenkampf. The latter was attacked on a line extending from east of Königsberg to the southern end of the chain of the Masurian Lakes during September 1–15 and was driven from East Prussia. As a result of these East Prussian battles Russia had lost about 250,000 men and, what could be afforded still less, much war matériel. But the invasion of East Prussia had at least helped to make possible the French comeback on the Marne by causing the dispatch of two German army corps from the Western Front.

Having ended the Russian threat to East Prussia, the Germans could afford to switch the bulk of their forces from that area to the Częstochowa–Kraków front in southwestern Poland, where the Austrian offensive, launched on August 20, had been rolled back by Russian counterattacks. A new plan for simultaneous thrusts by the Germans toward Warsaw and by the Austrians toward Przemyśl was brought to nothing by the end of October, as the Russians could now mount counterattacks in overwhelming strength, their mobilization being at last nearly completed. The Russians then mounted a powerful effort to invade Prussian Silesia with a huge phalanx of seven armies. Allied hopes rose high as the much-heralded "Russian steamroller" (as the huge Russian army was called) began its ponderous advance. The Russian armies were advancing toward Silesia when Hindenburg and Ludendorff, in November, exploited the superiority of the German railway network: when the retreating German forces had crossed the frontier back into Prussian Silesia, they were promptly moved northward into Prussian Poland and thence sent southeastward to drive a wedge between the two armies of the Russian right flank. The massive Russian operation against Silesia was disorganized, and within a week four new German army corps had arrived from the Western Front. Ludendorff was able to use them to press the Russians back by mid-December to the Bzura–Rawka (rivers) line in front of Warsaw, and the depletion of their munition supplies compelled the Russians to also fall back in Galicia to trench lines along the Nida and Dunajec rivers.

© 2020 Encyclopædia Britannica, Inc.

The Serbian campaign, 1914

The first Austrian invasion of Serbia was launched with numerical inferiority (part of one of the armies originally destined for the Balkan front having been diverted to the Eastern Front on August 18), and the able Serbian commander, Radomir Putnik, brought the invasion to an early end by his victories on the Cer Mountain (August 15–20) and at Šabac (August 21–24). In early September, however, Putnik's subsequent northward offensive on the Sava River, in the north, had to be broken off when the Austrians began a second offensive, against the Serbs' western front on the Drina River. After some weeks of deadlock, the Austrians began a third offensive, which had some success in the Battle of the Kolubara, and forced the Serbs to evacuate Belgrade on November 30, but by December 15 a Serbian counterattack had retaken Belgrade and forced the Austrians to retreat. Mud and exhaustion kept the Serbs from turning the Austrian retreat into a rout, but the victory sufficed to allow Serbia a long spell of freedom from further Austrian advances.

The Turkish entry

The entry of Turkey (or the Ottoman Empire, as it was then called) into the war as a German ally was the one great success of German wartime diplomacy. Since 1909 Turkey had been under the control of the Young Turks, over whom Germany had skillfully gained a dominating influence. German military instructors permeated the Turkish army, and Enver Paşa, the leader of the Young Turks, saw alliance with Germany as the best way of serving Turkey's interests, in particular for protection against the Russian threat to the straits. He therefore persuaded the grand vizier, Said Halim Paşa, to make a secret treaty (negotiated late in July, signed on August 2) pledging Turkey to the German side if Germany should have to take Austria-Hungary's side against Russia. The unforeseen entry of Great Britain into the war against Germany alarmed the Turks, but the timely arrival of two German warships, the *Goeben* and the *Breslau*, in the Dardanelles on August 10 turned the scales in favour of Enver's policy. The ships were ostensibly sold to Turkey, but they retained their German crews. The Turks began detaining British ships, and more anti-British provocations followed, both in the straits and on the Egyptian frontier. Finally the *Goeben* led the Turkish fleet across the Black Sea to bombard Odessa and other Russian ports (October 29–30). Russia declared war against Turkey on November 1; and the western Allies, after an ineffective bombardment of the outer forts of the Dardanelles on November 3, declared war likewise on November 5. A British force from India occupied Basra, on the Persian Gulf, on November 21. In the winter of 1914–15 Turkish offensives in the Caucasus and in the Sinai Desert, albeit abortive, served German strategy well by tying Russian and British forces down in those peripheral areas.

The war at sea, 1914–15



Assembly of the Royal Navy at Spithead for fleet review, July 1914.

Encyclopædia Britannica, Inc.

© 2020 Encyclopædia Britannica, Inc.



German torpedo boats assembled at port during World War I.

Encyclopædia Britannica, Inc.

In August 1914 Great Britain, with 29 capital ships ready and 13 under construction, and Germany, with 18 and nine, were the two great rival sea powers. Neither of them at first wanted a direct confrontation: the British were chiefly concerned with the protection of their trade routes; the Germans hoped that mines and submarine attacks would gradually destroy Great Britain's numerical superiority, so that confrontation could eventually take place on equal terms.

The first significant encounter between the two navies was that of the Helgoland Bight, on August 28, 1914, when a British force under Admiral Sir David Beatty, having entered German home waters, sank or damaged several German light cruisers and killed or captured 1,000 men at a cost of one British ship damaged and 35 deaths. For the following months the Germans in European or British waters confined themselves to submarine warfare—not without some notable successes: on September 22 a single German submarine, or U-boat, sank three British cruisers within an hour; on October 7 a U-boat made its way into the anchorage of Loch Ewe, on the west coast of Scotland; on October 15 the British cruiser *Hawke* was torpedoed; and on October 27 the British battleship *Audacious* was sunk by a mine.

On December 15 battle cruisers of the German High Seas Fleet set off on a sortie across the North Sea, under the command of Admiral Franz von Hipper: they bombarded several British towns and then made their way home safely. Hipper's next sortie, however, was intercepted on its way out: on January 24, 1915, in the Battle of the Dogger Bank, the German cruiser *Blücher* was sunk and two other cruisers damaged before the Germans could make their escape.

Abroad on the high seas, the Germans' most powerful surface force was the East Asiatic squadron of fast cruisers, including the *Scharnhorst*, the *Gneisenau*, and the *Nürnberg*, under Admiral Graf Maximilian von Spee. For four months this fleet ranged almost unhindered over the Pacific Ocean, while the *Emden*, having joined the squadron in August 1914, was detached for service in the Indian Ocean. The Germans could thus threaten not only merchant shipping on the British trade routes but also troopships on their way to Europe or the Middle East from India, New Zealand, or Australia. The *Emden* sank merchant ships in the Bay of Bengal, bombarded Madras (September 22; now Chennai, India), haunted the approaches to Ceylon (Sri Lanka), and had destroyed 15 Allied ships in all before it was caught and sunk off the Cocos Islands on November 9 by the Australian cruiser *Sydney*.

Meanwhile, Admiral von Spee's main squadron since August had been threading a devious course in the Pacific from the Caroline Islands toward the Chilean coast and had been joined by two more cruisers, the *Leipzig* and the *Dresden*. On November 1, in the Battle of Coronel, it inflicted a sensational defeat on a British force, under Sir Christopher Cradock, which had sailed from the Atlantic to hunt it down: without losing a single ship, it sank Cradock's two major cruisers, Cradock himself being killed. But the fortunes of the war on the high seas were

© 2020 Encyclopædia Britannica, Inc.

reversed when, on December 8, the German squadron attacked the Falkland (Malvinas) Islands in the South Atlantic, probably unaware of the naval strength that the British, since Coronel, had been concentrating there under Admiral Sir Doveton Sturdee: two battle cruisers (the *Invincible* and *Inflexible*, each equipped with eight 12-inch guns) and six other cruisers. The German ships were suffering from wear and tear after their long cruise in the Pacific and were no match for the newer, faster British ships, which soon overtook them. The *Scharnhorst*, with Admiral von Spee aboard, was the first ship to be sunk, then the *Gneisenau*, followed by the *Nürnberg* and the *Leipzig*. The British ships, which had fought at long range so as to render useless the smaller guns of the Germans, sustained only 25 casualties in this engagement. When the German light cruiser *Dresden* was caught and sunk off the Juan Fernández Islands on March 14, 1915, commerce raiding by German surface ships on the high seas was at an end. It was just beginning by German submarines, however.

The belligerent navies were employed as much in interfering with commerce as in fighting each other. Immediately after the outbreak of war, the British had instituted an economic blockade of Germany, with the aim of preventing all supplies reaching that country from the outside world. The two routes by which supplies could reach German ports were: (1) through the English Channel and the Strait of Dover and (2) around the north of Scotland. A minefield laid in the Strait of Dover with a narrow free lane made it fairly easy to intercept and search ships using the Channel. To the north of Scotland, however, there was an area of more than 200,000 square miles (520,000 square kilometres) to be patrolled, and the task was assigned to a squadron of armed merchant cruisers. During the early months of the war, only absolute contraband such as guns and ammunition was restricted, but the list was gradually extended to include almost all material that might be of use to the enemy.

The prevention of the free passage of trading ships led to considerable difficulties among the neutral nations, particularly with the United States, whose trading interests were hampered by British policy. Nevertheless, the British blockade was extremely effective, and during 1915 the British patrols stopped and inspected more than 3,000 vessels, of which 743 were sent into port for examination. Outward-bound trade from Germany was brought to a complete standstill.

The Germans similarly sought to attack Great Britain’s economy with a campaign against its supply lines of merchant shipping. In 1915, however, with their surface commerce raiders eliminated from the conflict, they were forced to rely entirely on the submarine.

The Germans began their submarine campaign against commerce by sinking a British merchant steamship (*Glitra*), after evacuating the crew, on October 20, 1914. A number of other sinkings followed, and the Germans soon became convinced that the submarine would be able to bring the British to an early peace where the commerce raiders on the high seas had failed. On January 30, 1915, Germany carried the campaign a stage further by torpedoing three British steamers (*Tokomaru*, *Ikaria*, and *Oriole*) without warning. They next announced, on February 4, that from February 18 they would treat the waters around the British Isles as a war zone in which all Allied merchant ships were to be destroyed, and in which no ship, whether enemy or not, would be immune.

Yet, whereas the Allied blockade was preventing almost all trade for Germany from reaching that nation’s ports, the German submarine campaign yielded less satisfactory results. During the first week of the campaign seven Allied or Allied-bound ships were sunk out of 11 attacked, but 1,370 others sailed without being harassed by the German submarines. In the whole of March 1915, during which 6,000 sailings were recorded, only 21 ships were sunk, and in April only 23 ships from a similar number. Apart from its lack of positive success, the U-boat arm was continuously harried by Great Britain’s extensive antisubmarine measures, which included nets, specially armed merchant ships, hydrophones for locating the noise of a submarine’s engines, and depth bombs for destroying it underwater.

© 2020 Encyclopædia Britannica, Inc.

For the Germans, a worse result than any of the British countermeasures imposed on them was the long-term growth of hostility on the part of the neutral countries. Certainly the neutrals were far from happy with the British blockade, but the German declaration of the war zone and subsequent events turned them progressively away from their attitude of sympathy for Germany. The hardening of their outlook began in February 1915, when the Norwegian steamship *Belridge*, carrying oil from New Orleans to Amsterdam, was torpedoed and sunk in the English Channel. The Germans continued to sink neutral ships occasionally, and undecided countries soon began to adopt a hostile outlook toward this activity when the safety of their own shipping was threatened.


THE NEW YORK HERALD.

THE LUSITANIA IS SUNK;
1,000 PROBABLY ARE LOST

GERMANS TORPEDO THE GIANT STEAMSHIP AND SHE FOUNDERS EIGHT MILES FROM IRISH COAST

RESCUE VESSELS SPEED TO THE SCENE TO PICK UP SURVIVORS, ONLY 500 ARE ACCOUNTED FOR

George A. Kessler One of Those Saved, Cable Message to Consul Office Says

The New York Herald reporting the sinking of the Lusitania, a British ocean liner, by a German...

Hulton Archive/Getty Images

Much more serious was an action that confirmed the inability of the German command to perceive that a minor tactical success could constitute a strategic blunder of the most extreme magnitude. This was the sinking by a German submarine on May 7, 1915, of the British liner *Lusitania*, which was on its way from New York to Liverpool: though the ship was in fact carrying 173 tons of ammunition, it had nearly 2,000 civilian passengers, and the 1,198 people who were drowned included 128 U.S. citizens. The loss of the liner and so many of its passengers, including the Americans, aroused a wave of indignation in the United States, and it was fully expected that a declaration of war might follow. But the U.S. government clung to its policy of neutrality and contented itself with sending several notes of protest to Germany. Despite this, the Germans persisted in their intention and, on August 17, sank the *Arabic*, which also had U.S. and other neutral passengers. Following a new U.S. protest, the Germans undertook to ensure the safety of passengers before sinking liners henceforth; but only after the torpedoing of yet another liner, the *Hesperia*, did Germany, on September 18, decide to suspend its submarine campaign in the English Channel and west of the British Isles, for fear of provoking the United States further. The German civilian statesmen had temporarily prevailed over the naval high command, which advocated “unrestricted” submarine warfare.

© 2020 Encyclopædia Britannica, Inc.

The loss of the German colonies

Germany’s overseas colonies, virtually without hope of reinforcement from Europe, defended themselves with varying degrees of success against Allied attack.

Togoland was conquered by British forces from the Gold Coast (now Ghana) and by French forces from Dahomey (now Benin) in the first month of the war. In the Cameroons (German: Kamerun), invaded by Allied forces from the south, the east, and the northwest in August 1914 and attacked from the sea in the west, the Germans put up a more effective resistance, and the last German stronghold there, Mora, held out until February 18, 1916.

Operations by South African forces in huge numerical superiority were launched against German South West Africa (Namibia) in September 1914 but were held up by the pro-German rebellion of certain South African officers who had fought against the British in the South African War of 1899–1902. The rebellion died out in February 1915, but the Germans in South West Africa nevertheless did not capitulate until July 9.

In Jiaozhou (Kiaochow) Bay a small German enclave on the Chinese coast, the port of Qingdao (Tsingtao) was the object of Japanese attack from September 1914. With some help from British troops and from Allied warships, the Japanese captured it on November 7. In October, meanwhile, the Japanese had occupied the Marianas, the Caroline Islands, and the Marshalls in the North Pacific, these islands being defenseless since the departure of Admiral von Spee’s naval squadron.

In the South Pacific, Western Samoa (now Samoa) fell without blood at the end of August 1914 to a New Zealand force supported by Australian, British, and French warships. In September an Australian invasion of Neu-Pommern (New Britain) won the surrender of the whole colony of German New Guinea within a few weeks.

The story of German East Africa (comprising present-day Rwanda, Burundi, and continental Tanzania) was very different, thanks to the quality of the local askaris (European-trained African troops) and to the military genius of the German commander Paul von Lettow-Vorbeck. A landing of troops from India was repelled with ignominy by the Germans in November 1914. A massive invasion from the north, comprising British and colonial troops under the South African J.C. Smuts, was launched in February 1916, to be coordinated with a Belgian invasion from the west and with an independent British one from Nyasaland in the south, but, though Dar es Salaam fell to Smuts and Tabora to the Belgians in September, Lettow-Vorbeck maintained his small force in being. In November 1917 he began to move southward across Portuguese East Africa (Germany had declared war on Portugal in March 1916), and, after crossing back into German East Africa in September 1918, he turned southwestward to invade Northern Rhodesia in October. Having taken Kasama on November 9 (two days before the German armistice in Europe), he finally surrendered on November 25. With some 12,000 men at the outset, he eventually tied down 130,000 or more Allied troops.

The years of stalemate

Rival strategies and the Dardanelles campaign, 1915–16

By late 1914 the state of deadlock on the Western Front had become clear to the governments of the warring countries and even to many members of their general staffs. Each side sought a solution to this deadlock, and the solutions varied in form and manner.

Erich von Falkenhayn had succeeded the dispirited Moltke as chief of the German general staff in September 1914. By the end of 1914 Falkenhayn seems to have concluded that although the final decision would be reached in the West, Germany had no immediate prospect of success there, and that the only practicable

© 2020 Encyclopædia Britannica, Inc.

theatre of operations in the near future was the Eastern Front, however inconclusive those operations might be. Falkenhayn was convinced of the strength of the Allied trench barrier in France, so he took the momentous decision to stand on the defensive in the West.

Falkenhayn saw that a long war was now inevitable and set to work to develop Germany’s resources for such a warfare of attrition. Thus, the technique of field entrenchment was carried to a higher pitch by the Germans than by any other country; Germany’s military railways were expanded for the lateral movement of reserves; and the problem of the supply of munitions and of the raw materials for their manufacture was tackled so energetically and comprehensively that an ample flow was ensured from the spring of 1915 onward—a time when the British were only awakening to the problem. Here were laid the foundations of that economic organization and utilization of resources that was to be the secret of Germany’s power to resist the pressure of the British blockade.

The western Allies were divided into two camps about strategy. Joffre and most of the French general staff, backed by the British field marshal Sir John French, argued for continuing assaults on the Germans’ entrenched line in France, despite the continued attrition of French forces that this strategy entailed. Apart from this, the French high command was singularly lacking in ideas to break the deadlock of trench warfare. While desire to hold on to territorial gains governed the German strategy, the desire to recover lost territory dominated the French.



British Mark I tank with anti-bomb roof and “tail,” 1916.

Courtesy of the Imperial War Museum, London; photograph, Camera Press/Globe Photos

British-inspired solutions to the deadlock crystallized into two main groups, one tactical, the other strategical. The first was to unlock the trench barrier by inventing a machine that would be invulnerable to machine guns and capable of crossing trenches and would thus restore the tactical balance upset by the new preponderance of defensive over offensive power. Such a machine had long been contemplated, and the early years of the 20th century saw the first attempts at a practical armoured fighting vehicle. British efforts were nourished and tended in infancy by Winston Churchill, then first lord of the Admiralty, and ultimately, after months of experiment hampered by official opposition, came to maturity in 1916 in the weapon known as the tank. Some of the British strategists, on the other hand, argued that instead of seeking a breakthrough on the Germans’ impregnable Western Front, the Allies should turn the whole position of the Central Powers either by an offensive through the Balkans or even by a landing on Germany’s Baltic coast. Joffre and his supporters won the argument, and the Balkan projects were relinquished in favour of a concentration of effort on the Western Front. But misgivings were not silenced, and a situation arose that revived the Middle Eastern scheme in a new if attenuated form.

© 2020 Encyclopædia Britannica, Inc.



An overview of the 1915–16 Gallipoli Campaign of World War I, with a focus on ANZAC troops.

© Behind the News



Allied troops lining the shore at "ANZAC Cove" on the Gallipoli Peninsula. The cove was named after…

Hulton Archive/Getty Images

Early in January 1915 the Russians, threatened by the Turks in the Caucasus, appealed to the British for some relieving action against Turkey. The British, after acrimonious argument among themselves, decided in favour of “a naval expedition in February to bombard and take the Gallipoli Peninsula (the western shore of the Dardanelles), with Constantinople as its objective.” Though subsequently it was agreed that army troops might be provided to hold the shores if the fleet forced the Straits, the naval attack began on February 19 without army support. When at last Sir Ian Hamilton’s troops from Egypt began to land on the Turkish shores, on April 25, the Turks and their German commander, Otto Liman von Sanders, had had ample time to prepare adequate fortifications, and the defending armies were now six times as large as when the campaign opened.



A Turkish perspective on the Gallipoli Campaign (1915–16), widely known among Turks as the Battle of …

© Behind the News

Against resolute opposition from the local Turkish commander (Mustafa Kemal, the future Atatürk), Australian and New Zealand troops won a bridgehead at “Anzac Cove,” north of Kaba Tepe, on the Aegean side of the peninsula, with some 20,000 men landing in the first two days. The British, meanwhile, tried to land at five points around Cape Helles but established footholds only at three of them and then asked for reinforcements.

© 2020 Encyclopædia Britannica, Inc.

Thereafter little progress was made, and the Turks took advantage of the British halt to bring into the peninsula as many troops as possible. The standstill of the enterprise led to a political crisis in London between Churchill, the Liberal government’s first lord of the Admiralty, who, after earlier doubts, had made himself the foremost spokesman of the Dardanelles operation, and John, Lord Fisher, the first sea lord, who had always expressed doubts about it. Fisher demanded on May 14 that the operation be discontinued and, when he was overruled, resigned the next day. The Liberal government was replaced by a coalition, but Churchill, though relieved of his former post, remained in the War Council of the Cabinet.



The use of animals during World War I, especially among ANZAC troops.

© Behind the News



British army officers in a trench at “ANZAC Cove” during the Gallipoli Campaign of World War I.

© Mary Evans Picture Library Ltd/age fotostock

In July the British began sending five more divisions to the peninsula, and a new plan was hatched. In the hope of cutting the Turks’ north–south communications down the peninsula by seizing the Sari Bair heights, which commanded the Straits from the west, the British reinforced the bridgehead at “Anzac Cove” and, in the night of August 6–7, landed more troops at Suvla Bay (Anafarta Limanı), farther to the north. Within a few days, both the offensive from “Anzac” and the new landing had proved ineffectual. More argument ensued in the War Council, and only late in the year was it acknowledged that the initially promising but ill-conducted enterprise should be given up. The evacuation of the troops was carried out from Suvla Bay and from “Anzac Cove” under cover of darkness in December 1915, and from the Cape Helles beaches in January 1916. The Dardanelles campaign thus came to a frustrating end. Had it succeeded it might well have ended Turkey’s participation in the war. In failing, it had cost about 214,000 casualties and achieved nothing.

© 2020 Encyclopædia Britannica, Inc.

The Western and Eastern fronts, 1915

The Western Front, 1915

Repeated French attacks in February–March 1915 on the Germans' trench barrier in Champagne won only 500 yards (460 metres) of ground at a cost of 50,000 men. For the British, Sir Douglas Haig's 1st Army, between Armentières and Lens, tried a new experiment at Neuve-Chapelle on March 10, when its artillery opened an intense bombardment on a 2,000-yard front and then, after 35 minutes, lengthened its range, so that the attacking British infantry, behind the second screen of shells, could overrun the trenches ravaged by the first. But the experiment's immediate result was merely loss of life, both because shortage of munitions made the second barrage inadequate and because there was a five-hour delay in launching the infantry assault, against which the Germans, having overcome their initial surprise, had time to rally their resistance. It was clear to the Allies that this small-scale tactical experiment had missed success only by a narrow margin and that there was scope for its development. But the Allied commands missed the true lesson, which was that a surprise attack could be successfully made immediately following a short bombardment that compensated for its brevity by its intensity. Instead, they drew the superficial deduction that mere volume of shellfire was the key to reducing a trench line prior to an assault. Not until 1917 did they revert to the Neuve-Chapelle method. It was left to the Germans to profit from the experiment. In the meantime, a French offensive in April against the Germans' Saint-Mihiel salient, southeast of Verdun, sacrificed 64,000 men to no effect.

The Germans, in accordance with Falkenhayn's strategy, remained generally on the defensive in the West. They did, however, launch an attack on the Allies' Ypres salient (where the French had in November 1914 taken the place of the British). There, on April 22, 1915, they used chlorine gas for the first time on the Western Front, but they made the mistake of discharging it from cylinders (which were dependent on a favourable wind) rather than lobbing it onto the enemy trenches in artillery shells. The gas did throw the agonized defenders into chaotic flight; but the German high command, having been disappointed by the new weapon's performance under adverse conditions in Poland earlier in the year, had failed to provide adequate reserves to exploit its unforeseen success. By the end of a month-long battle, the Allies' front was only slightly retracted.

On May 9, meanwhile, the Allies had launched yet another premature offensive, combining a major French onslaught between Lens and Arras with two thrusts by Haig's 1st Army, from Festubert and from Fromelles, against the Aubers Ridge north of Lens. The French prolonged their effort until June 18, losing 102,000 men without securing any gain; the British, still short of shells against the Germans' mass of machine guns, had suspended their attacks three weeks earlier.

An even worse military failure was the joint offensive launched by the Allies on September 25, 1915. While 27 French divisions with 850 heavy guns attacked on a front 18 miles long in Champagne, north and east of Reims, simultaneous blows were delivered in distant Artois by 14 French divisions with 420 heavy guns on a 12-mile front south of Lens and by six British divisions with only 117 guns at Loos north of Lens. All of these attacks were disappointing failures, partly because they were preceded by prolonged bombardments that gave away any chance of surprise and allowed time for German reserves to be sent forward to close up the gaps that had been opened in the trench defenders' ranks by the artillery bombardment. At Loos the British use of chlorine gas was less effective than Haig had hoped, and his engagement of all his own available forces for his first assault came to nothing when his commander in chief, Sir John French, was too slow in sending up reserves; the French on both their fronts likewise lost, through lack of timely support, most of what they had won by their first attacks. In all, for a little ground, the Allies paid 242,000 men, against the defenders' loss of 141,000.

© 2020 Encyclopædia Britannica, Inc.

Having subsequently complained bitterly about Sir John French’s management of operations, Haig was appointed British commander in chief in his place in December.

The Eastern Front, 1915



Russian troops in the trenches at the East Prussian frontier.

Encyclopædia Britannica, Inc.

The Russians’ plans for 1915 prescribed the strengthening of their flanks in the north and in Galicia before driving westward again toward Silesia. Their preparations for a blow at East Prussia’s southern frontier were forestalled, as Ludendorff, striking suddenly eastward from East Prussia, enveloped four Russian divisions in the Augustów forests, east of the Masurian Lakes, in the second week of February; but in Galicia the winter’s fighting culminated, on March 22, in the fall of Przemyśl to the Russians.



Historical map of the Eastern Front during World War I.

Encyclopædia Britannica, Inc.

For the Central Powers, the Austrian spokesman, Conrad, primarily required some action to relieve the pressure on his Galician front, and Falkenhayn was willing to help him for that purpose without departing from his own general strategy of attrition—which was already coming into conflict with Ludendorff’s desire for a sustained effort toward decisive victory over Russia. The plan finally adopted, with the aim of smashing the Russian centre in the Dunajec River sector of Galicia by an attack on the 18-mile front from Gorlice to Tuchów (south of Tarnów), was conceived with tactical originality: in order to maintain the momentum of advance, no daily objectives were to be set for individual corps or divisions; instead, each should make all possible progress before the Russians could bring their reserves up, on the assumption that the rapid advance of some attacking units

© 2020 Encyclopædia Britannica, Inc.

would contagiously promote the subsequent advance of others that had at first met more resistance. Late in April, 14 divisions, with 1,500 guns, were quietly concentrated for the stroke against the six Russian divisions present. Mackensen was in command, with Hans von Seeckt, sponsor of the new tactic of infiltration, as his chief of staff.

The Gorlice attack was launched on May 2 and achieved success beyond all expectation. Routed on the Dunajec, the Russians tried to stand on the Wisłoka, then fell back again. By May 14, Mackensen’s forces were on the San, 80 miles from their starting point, and at Jarosław they even forced a crossing of that river. Strengthened with more German troops from France, Mackensen then struck again, taking Przemyśl on June 3 and Lemberg (Lvov) on June 22. The Russian front was now bisected, but Falkenhayn and Conrad had foreseen no such result and had made no preparations to exploit it promptly. Their consequent delays enabled the Russian armies to retreat without breaking up entirely.

Falkenhayn then decided to pursue a new offensive. Mackensen was instructed to veer northward, so as to catch the Russian armies in the Warsaw salient between his forces and Hindenburg’s, which were to drive southeastward from East Prussia. Ludendorff disliked the plan as being too much of a frontal assault: the Russians might be squeezed by the closing-in of the two wings, but their retreat to the east would not be cut off. He once more urged his spring scheme for a wide enveloping maneuver through Kovno (Kaunas) on Vilna (Vilnius) and Minsk, in the north. Falkenhayn opposed this plan, fearing that it would mean more troops and a deeper commitment, and on July 2 the German emperor decided in favour of Falkenhayn’s plan.

The results justified Ludendorff’s reservations. The Russians held Mackensen at Brest-Litovsk and Hindenburg on the Narew River long enough to enable the main body of their troops to escape through the unclosed gap to the east. Though by the end of August all of Poland had been occupied and 750,000 Russians had been taken prisoner in four months of fighting, the Central Powers had missed their opportunity to break Russia’s ability to carry on the war.

Too late, Falkenhayn in September allowed Ludendorff to try what he had been urging much earlier, a wider enveloping movement to the north on the Kovno–Dvinsk–Vilna triangle. The German cavalry, in fact, approached the Minsk railway, far beyond Vilna; but the Russians’ power of resistance was too great for Ludendorff’s slender forces, whose supplies moreover began to run out, and by the end of the month his operations were suspended. The crux of this situation was that the Russian armies had been allowed to draw back almost out of the net before the long-delayed Vilna maneuver was attempted. Meanwhile, an Austrian attack eastward from Lutsk (Luck), begun later in September and continued into October, incurred heavy losses for no advantage at all. By October 1915 the Russian retreat, after a nerve-wracking series of escapes from the salients the Germans had systematically created and then sought to cut off, had come to a definite halt along a line running from the Baltic Sea just west of Riga southward to Czernowitz (Chernovtsy) on the Romanian border.

Other fronts, 1915–16

The Caucasus, 1914–16

The Caucasian front between Russia and Turkey comprised two battlegrounds: Armenia in the west, Azerbaijan in the east. While the ultimate strategic objectives for the Turks were to capture the Baku oilfields in Azerbaijan and to penetrate Central Asia and Afghanistan in order to threaten British India, they needed first to capture the Armenian fortress of Kars, which, together with that of Ardahan, had been a Russian possession since 1878.

A Russian advance from Sarıkamış (Sarykamysh, south of Kars) toward Erzurum in Turkish Armenia in November 1914 was countered in December when the Turkish 3rd Army, under Enver himself, launched a three-pronged offensive against the Kars–Ardahan position. This offensive was catastrophically defeated in battles at Sarıkamış

© 2020 Encyclopædia Britannica, Inc.

and at Ardahan in January 1915; but the Turks, ill-clad and ill-supplied in the Caucasian winter, lost many more men through exposure and exhaustion than in fighting (their 3rd Army was reduced in one month from 190,000 to 12,400 men, the battle casualties being 30,000). Turkish forces, which had meanwhile invaded neutral Persia's part of Azerbaijan and taken Tabriz on January 14, were expelled by a Russian counterinvasion in March.

During this campaign the Armenians had created disturbances behind the Turkish lines in support of the Russians and had threatened the already arduous Turkish communications. The Turkish government on June 11, 1915, decided to deport the Armenians. In the process of deportation, the Turkish authorities committed atrocities on a vast scale: most estimates of Armenian deaths have ranged from 600,000 to 1,500,000 for this period.

Grand Duke Nicholas, who had hitherto been commander in chief of all Russia's armies, was superseded by Emperor Nicholas himself in September 1915; the Grand Duke was then sent to command in the Caucasus. He and General N.N. Yudenich, the victor of Sarıkamış, started a major assault on Turkish Armenia in January 1916; Erzurum was taken on February 16, Trabzon on April 18, Erzıncan on August 2; and a long-delayed Turkish counterattack was held at Oğnut. Stabilized to Russia's great advantage in the autumn, the new front in Armenia was thereafter affected less by Russo-Turkish warfare than by the consequences of revolution in Russia.

Mesopotamia, 1914–April 1916

The British occupation of Basra, Turkey's port at the head of the Persian Gulf, in November 1914 had been justifiable strategically because of the need to protect the oil wells of southern Persia and the Abadan refinery. The British advance of 46 miles northward from Basra to al-Qurnah in December and the further advance of 90 miles up the Tigris to al-ʿAmārah in May–June 1915 ought to have been reckoned enough for all practical purposes, but the advance was continued in the direction of the fatally magnetic Baghdad, ancient capital of the Arab caliphs of Islām. Al-Kūt was occupied in September 1915, and the advance was pushed on until the British, under Major General Charles Townshend, were 500 miles away from their base at Basra. They fought a profitless battle at Ctesiphon, only 18 miles from Baghdad, on November 22 but then had to retreat to al-Kūt. There, from December 7, Townshend's 10,000 men were besieged by the Turks; and there, on April 29, 1916, they surrendered themselves into captivity.

The Egyptian frontiers, 1915–July 1917

Even after the evacuation from Gallipoli, the British maintained 250,000 troops in Egypt. A major source of worry to the British was the danger of a Turkish threat from Palestine across the Sinai Desert to the Suez Canal. That danger waned, however, when the initially unpromising rebellion of the Hāshimite amir Ḥusayn ibn ʿAlī against the Turks in the Hejaz was developed by the personal enterprise of an unprofessional soldier of genius, T.E. Lawrence, into a revolt infecting the whole Arabian hinterland of Palestine and Syria and threatening to sever the Turks' vital Hejaz Railway (Damascus–Amman–Maʿān–Medina). Sir Archibald Murray's British troops at last started a massive advance in December 1916 and captured some Turkish outposts on the northeastern edge of the Sinai Desert but made a pusillanimous withdrawal from Gaza in March 1917 at the very moment when the Turks were about to surrender the place to them; the attempt the next month to retrieve the mistake was repulsed with heavy losses. In June the command was transferred from Murray to Sir Edmund Allenby. In striking contrast to Murray's performance was Lawrence's capture of Aqaba (al-ʿAqabah) on July 6, 1917: his handful of Arabs got the better of 1,200 Turks there.

Italy and the Italian front, 1915–16

Great Britain, France, and Russia concluded on April 26, 1915, the secret Treaty of London with Italy, inducing the latter to discard the obligations of the Triple Alliance and to enter the war on the side of the Allies by the

© 2020 Encyclopædia Britannica, Inc.

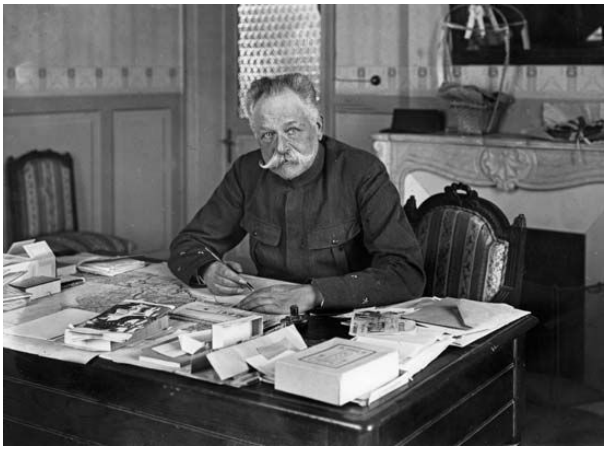
promise of territorial aggrandizement at Austria-Hungary’s expense. Italy was offered not only the Italian-populated Trentino and Trieste but also South Tirol (to consolidate the Alpine frontier), Gorizia, Istria, and northern Dalmatia. On May 23, 1915, Italy accordingly declared war on Austria-Hungary.

The Italian commander, General Luigi Cadorna, decided to concentrate his effort on an offensive eastward from the province of Venetia across the comparatively low ground between the head of the Adriatic and the foothills of the Julian Alps; that is to say, across the lower valley of the Isonzo (Soča) River. Against the risk of an Austrian descent on his rear from the Trentino (which bordered Venetia to the northwest) or on his left flank from the Carnic Alps (to the north), he thought that limited advances would be precaution enough.

The Italians’ initial advance eastward, begun late in May 1915, was soon halted, largely because of the flooding of the Isonzo, and trench warfare set in. Cadorna, however, was determined to make progress and so embarked on a series of persistent renewals of the offensive, known as the Battles of the Isonzo. The first four of these (June 23–July 7; July 18–August 3; October 18–November 4; and November 10–December 2) achieved nothing worth the cost of 280,000 men; and the fifth (March 1916) was equally fruitless. The Austrians had shown on this front a fierce resolution that was often lacking when they faced the Russians. In mid-May 1916 Cadorna’s program was interrupted by an Austrian offensive from the Trentino into the Asiago region of western Venetia. Though the danger of an Austrian breakthrough from the mountainous borderland into the Venetian plain in the rear of the Italians’ Isonzo front was averted, the Italian counteroffensive in mid-June recovered only one-third of the territory overrun by the Austrians north and southwest of Asiago. The Sixth Battle of the Isonzo (August 6–17), however, did win Gorizia for the Italians. On August 28 Italy declared war on Germany. The next three months saw three more Italian offensives on the Isonzo, none of them really profitable. In the course of 1916 the Italians had sustained 500,000 casualties, twice as many as the Austrians, and were still on the Isonzo.

Serbia and the Salonika expedition, 1915–17

Austria’s three attempted invasions of Serbia in 1914 had been brusquely repulsed by Serbian counterattacks. By the summer of 1915 the Central Powers were doubly concerned to close the account with Serbia, both for reasons of prestige and for the sake of establishing secure rail communications with Turkey across the Balkans. In August, Germany sent reinforcements to Austria’s southern front; and, on September 6, 1915, the Central Powers concluded a treaty with Bulgaria, whom they drew to their side by the offer of territory to be taken from Serbia. The Austro-German forces attacked southward from the Danube on October 6; and the Bulgars, undeterred by a Russian ultimatum, struck at eastern Serbia on October 11 and at Serbian Macedonia on October 14.



Maurice Sarrail, World War I.

Encyclopædia Britannica, Inc.

© 2020 Encyclopædia Britannica, Inc.

The western Allies, surprised in September by the prospect of a Bulgarian attack on Serbia, hastily decided to send help through neutral Greece’s Macedonian port of Salonika, relying on the collusion of Greece’s pro-Entente prime minister, Eleuthérios Venizélos. Troops from Gallipoli, under the French general Maurice Sarrail, reached Salonika on October 5, but on that day Venizélos fell from power.



Mabel St. Clair Stobart (left), founder of the Women's Sick and Wounded Convoy Corps and the Women's ...

George Grantham Bain Collection/Library of Congress, Washington, D.C. (reproduction no. LC-DIG-ggbain-07836)



Learn more about the life of Mabel St. Clair Stobart.

Encyclopædia Britannica, Inc.

The Allies advanced northward up the Vardar into Serbian Macedonia but found themselves prevented from junction with the Serbs by the westward thrust of the Bulgars. Driven back over the Greek frontier, the Allies were merely occupying the Salonika region by mid-December. The Serbian Army, meanwhile, to avoid double envelopment, had begun an arduous winter retreat westward over the Albanian mountains to refuge on the island of Corfu. English relief worker Mabel St. Clair Stobart, who had been commissioned a major in the Serbian army, led the First Serbian-English Field Hospital (Front) during the retreat. Stobart achieved some renown for the feat, as her unit was one of the few to reach the Albanian coast without suffering any losses or desertions.

© 2020 Encyclopædia Britannica, Inc.

In the spring of 1916 the Allies at Salonika were reinforced by the revived Serbs from Corfu as well as by French, British, and some Russian troops, and the bridgehead was expanded westward to Vodena (Edessa) and eastward to Kilkis; but the Bulgars, who in May obtained Fort Rupel (Klidhi, on the Struma) from the Greeks, in mid-August not only overran Greek Macedonia east of the Struma but also, from Monastir (Bitola), invaded the Florina region of Greek Macedonia, to the west of the Allies' Vodena wing. The Allied counteroffensive took Monastir from the Bulgars in November 1916, but more ambitious operations, from March to May 1917, proved abortive. The Salonika front was tying down some 500,000 Allied troops without troubling the Central Powers in any significant way.

Major developments in 1916

The Western Front, 1916

In 1914 the centre of gravity of World War I had been on the Western Front, in 1915 it shifted to the Eastern, and in 1916 it once more moved back to France. Though the western Allies had dissipated some of their strength in the Dardanelles, Salonika, and Mesopotamia, the rising tide of Britain's new armies and of its increased munition supplies promised the means for an offensive far larger in scale than any before to break the trench deadlock. Britain's armies in France had grown to 36 divisions by the end of 1915. By that time voluntary enlistments, though massive, had nevertheless proved to be inadequate to meet Britain's needs, so in January 1916, by the Military Service Act, voluntary service was replaced by conscription.

In December 1915 a conference of the leaders of the French, British, Belgian, and Italian armies, with representatives present from the Russian and Japanese armies, was held at Joffre's headquarters. They adopted the principle of a simultaneous general offensive in 1916 by France, Great Britain, Russia, and Italy. But military action by Germany was to dislocate this scheme, and only the British offensive came fully into operation.



Overview of the Battle of Verdun, 1916.

Contunico © ZDF Studios GmbH, Mainz; Thumbnail © Awcnz62/Dreamstime.com

By the winter of 1915–16, Falkenhayn regarded Russia as paralyzed and Italy as inconsiderable. He considered the time at last ripe for positive action against France, after whose collapse Great Britain would have no effective military ally on the European continent and would be brought to terms rather by submarine warfare than by land operations. For his offensive in the West, however, Falkenhayn clung always to his method of attrition. He believed that a mass breakthrough was unnecessary and that instead the Germans should aim to bleed France of its manpower by choosing a point of attack "for the retention of which the French Command would be compelled to throw in every man they have." The town of Verdun and its surrounding complex of forts was chosen, because it was a menace to the main German lines of communications, because it was within a French salient and thus cramped the defenders, and because of the certainty that the French would sacrifice any number of men to defend Verdun for reasons of patriotism associated with the town itself.

© 2020 Encyclopædia Britannica, Inc.

The keynote of Falkenhayn's tactical plan was to place a dense semicircle of German heavy and medium artillery to the north and east of Verdun and its outlying fortresses and then to stage a continuous series of limited infantry advances upon the forts. These advances would draw the French infantry into defending or trying to retake the forts, in the process of which they would be pulverized by German artillery fire. In addition, each German infantry advance would have its way smoothed by a brief but extremely intense artillery bombardment that would clear the targeted ground of defenders.



French troops passing though the ruins of Verdun, France, 1916.

Hulton Archive/Getty Images

Although French Intelligence had given early warnings of the Germans' offensive preparations, the French high command was so preoccupied with its own projected offensive scheme that the warning fell on deaf ears. At 7:15 AM on February 21, 1916, the heaviest German artillery bombardment yet seen in the war began on a front of eight miles around Verdun, and the French trenches and barbed wire fields there were flattened out or upheaved in a chaos of tumbled earth. At 4:45 PM the German infantry advanced—although for the first day only on a front of two and a half miles. From then until February 24 the French defenders' lines east of the Meuse River crumbled away. Fort-Douaumont, one of the most important fortresses, was occupied by the Germans on February 25. By March 6, when the Germans began to attack on the west bank of the Meuse as well as on the east bank, the French had come to see that something more than a feint was intended. To relieve the pressure on France, the Russians made a sacrificial attack on the Eastern Front at Lake Naroch (see below The Eastern Front, 1916); the Italians began their fifth offensive on the Isonzo (see above Italy and the Italian front, 1915–16); and the British took over the Arras sector of the Western Front, thus becoming responsible for the whole line from the Yser southward to the Somme. Meanwhile, General Philippe Pétain was entrusted with commanding the defense of Verdun. He organized repeated counterattacks that slowed the German advance, and, more importantly, he worked to keep open the one road leading into Verdun that had not been closed by German shelling. This was the Bar-le-Duc road, which became known as La Voie Sacrée (the "Sacred Way") because vital supplies and reinforcements continued to be sent to the Verdun front along it despite constant harassment from the German artillery.

Slowly but steadily the Germans moved forward on Verdun: they took Fort-Vaux, southeast of Fort-Douaumont, on June 7 and almost reached the Belleville heights, the last stronghold before Verdun itself, on June 23. Pétain was preparing to evacuate the east bank of the Meuse when the Allies' offensive on the Somme River was at last launched. Thereafter, the Germans assigned no more divisions to the Verdun attack.

Preceded by a week's bombardment, which gave ample warning of its advent, the Somme offensive was begun on July 1, 1916, by the 11 British divisions of Rawlinson's new 4th Army on a 15-mile front between Serre, north of the Ancre, and Curlu, north of the Somme, while five French divisions attacked at the same time on an eight-

© 2020 Encyclopædia Britannica, Inc.

mile front mainly south of the Somme, between Curlu and Péronne. With incredibly misplaced optimism, Haig had convinced himself that the British infantry would be able to walk forward irresistibly over ground cleared of defenders by the artillery. But the unconcealed preparations for the assault and the long preliminary bombardment had given away any chance of surprise, and the German defenders were well prepared for what was to come. In the event, the 60,000 attacking British infantrymen moving forward in symmetrical alignment at a snail's pace enforced by each man's 66 pounds (30 kilograms) of cumbrous equipment were mowed down in masses by the German machine guns, and the day's casualties were the heaviest ever sustained by a British army. The French participants in the attack had twice as many guns as the British and did better against a weaker system of defenses, but almost nothing could be done to exploit this comparative success.

Resigning himself now to limited advances, Haig concentrated his next effort on the southern sector of his Somme front. The Germans' second position there (Longueval, Bazentin, and Ovillers) fell on July 14, but again the opportunity of exploitation was missed. Thenceforward, at great cost in lives, a methodical advance was continued, gaining little ground but straining the German resistance. The first tanks to be used in the war, though in numbers far too small to be effective, were thrown into the battle by the British on September 15. In mid-November early rains halted operations. The four-month Battle of the Somme was a miserable failure except that it diverted German resources from the attack on Verdun. It cost the British 420,000 casualties, the French 195,000, and the Germans 650,000.

At Verdun, the summer slackening of German pressure enabled the French to organize counterattacks. Surprise attacks directed by General Robert-Georges Nivelle and launched by General Charles Mangin's army corps recovered Fort-Douaumont on October 24, Fort-Vaux on November 2, and places north of Douaumont in mid-December. Pétain's adroit defense of Verdun and these counterattacks had deprived Falkenhayn's offensive of its strategic fulfillment; but France had been so much weakened in the first half of 1916 that it could scarcely satisfy the Allies' expectations in the second. Verdun was one of the longest, bloodiest, and most ferocious battles of the war; French casualties amounted to about 400,000, German ones to about 350,000.

The Battle of Jutland

The summer of 1916 saw the long-deferred confrontation of Germany's High Seas Fleet and Great Britain's Grand Fleet in the Battle of Jutland—history's biggest naval battle, which both sides claimed as a victory.

Admiral Reinhard Scheer, who became commander in chief of the High Seas Fleet in January 1916, planned to contrive an encounter on the open sea between his fleet and some part of the British fleet in separation from the whole, so that the Germans could exploit their momentary superiority in numbers to achieve victory. Scheer's plan was to ensnare Admiral Beatty's squadron of battle cruisers at Rosyth, midway up Britain's eastern coast, by stratagem and destroy it before any reinforcements from the Grand Fleet's main base at Scapa Flow could reach it.

To set the trap, five battle cruisers of the German High Seas Fleet, together with four light cruisers, were to sail northward, under Hipper's command, from Wilhelmshaven, Ger., to a point off the southwestern coast of Norway. Scheer himself, with the battle squadrons of the High Seas Fleet, was to follow, 50 miles behind, to catch Beatty's forces in the gap once they had been lured eastward across the North Sea in pursuit of Hipper. But the signal for the German operation to begin, made in the afternoon of May 30, was intercepted and partially decoded by the British; and before midnight the whole British Grand Fleet was on its way to a rendezvous off Norway's southwestern coast and roughly across the planned route of the German fleet.

At 2:20 PM on May 31, when Admiral John Jellicoe's Grand Fleet squadrons from Scapa Flow were still 65 miles away to the north, Beatty's advance guard of light cruisers—five miles ahead of his heavier ships—and Hipper's

© 2020 Encyclopædia Britannica, Inc.

scouting group learned quite accidentally of one another's proximity. An hour later the two lines were drawn up for battle, and in the next 50 minutes the British suffered severely, and the *Indefatigable* was sunk. When Beatty's battle cruisers came up, however, the German cruisers, in their turn, sustained such damage that Hipper sent a protective screen of German destroyers in to launch a torpedo attack. The British had lost another battle cruiser, the *Queen Mary*, before the German High Seas Fleet was sighted by a British patrol to the south, at 4:35 PM. On this report Beatty ordered his ships northward, to lure the Germans toward the Grand Fleet under Jellicoe's command.

Not until 6:14 PM, after Jellicoe's squadrons and Beatty's had been within sight of one another for nearly a quarter of an hour, was the German fleet precisely located—only just in time for Jellicoe to deploy his ships to the best advantage. Jellicoe arrayed the Grand Fleet end-to-end in a line so that their combined broadsides could be brought to bear on the approaching German ships, who could in turn reply only with the forward guns of their leading ships. The British ships in effect formed the horizontal stroke and the German ships the vertical stroke of the letter "T," with the British having deployed into line at a right angle to the German ships' forward progress. This maneuver was in fact known as "crossing the enemy's T" and was the ideal situation dreamed of by the tacticians of both navies, since by "crossing the T" one's forces temporarily gained an overwhelming superiority of firepower.

For the Germans this was a moment of unparalleled risk. Three factors helped prevent the destruction of the German ships in this trap: their own excellent construction, the steadiness and discipline of their crews, and the poor quality of the British shells. The *Lützow*, the *Derfflinger*, and the battleship *König* led the line and were under broadside fire from some 10 British battleships, yet their main guns remained undamaged and they fought back to such effect that one of their salvoes fell full on the *Invincible* and blew it up. This success, however, did little to relieve the intense bombardment from the other British ships, and the German fleet was still pressing forward into the steel trap of the Grand Fleet.

Relying on the magnificent seamanship of the German crews, Scheer extricated his fleet from the appalling danger into which it had run by a simple but, in practice, extremely difficult maneuver. At 6:30 PM he ordered a turn of 180° for all his ships at once; it was executed without collision; and the German battleships reversed course in unison and steamed out of the jaws of the trap, while German destroyers spread a smoke screen across their rear. The smoke and worsening visibility left Jellicoe in doubt about what had happened, and the British had lost contact with the Germans by 6:45 PM.

Yet the British Grand Fleet had maneuvered in such a way that it ended up between the German High Seas Fleet and the German ports, and this was the situation Scheer most dreaded, so at 6:55 PM Scheer ordered another reverse turn, perhaps hoping to pass around the rear of the British fleet. But the result for him was a worse position than that from which he had just escaped: his battle line had become compressed, and his leading ships found themselves again under intense bombardment from the broadside array of the British ships. Jellicoe had succeeded in crossing the Germans' "T" again. The *Lützow* now received irreparable damage, and many other German ships were damaged at this point. At 7:15 PM, therefore, to cause a diversion and win time, Scheer ordered his battle cruisers and destroyers ahead to virtually immolate themselves in a massed charge against the British ships.

This was the crisis of the Battle of Jutland. As the German battle cruisers and destroyers steamed forward, the German battleships astern became confused and disorganized in trying to execute their reverse turn. Had Jellicoe ordered the Grand Fleet forward through the screen of charging German battle cruisers at that moment, the fate of the German High Seas Fleet would likely have been sealed. As it was, fearing and overestimating the danger of torpedo attacks from the approaching destroyers, he ordered his fleet to turn away, and the two lines

© 2020 Encyclopædia Britannica, Inc.

of battleships steamed apart at a speed of more than 20 knots. They did not meet again, and when darkness fell, Jellicoe could not be sure of the route of the German retreat. By 3:00 AM on June 1 the Germans had safely eluded their pursuers.

The British had sustained greater losses than the Germans in both ships and men. In all, the British lost three battle cruisers, three cruisers, eight destroyers, and 6,274 officers and men in the Battle of Jutland. The Germans lost one battleship, one battle cruiser, four light cruisers, five destroyers, and 2,545 officers and men. The losses inflicted on the British, however, were not enough to affect the numerical superiority of their fleet over the German in the North Sea, where their domination remained practically unchallengeable during the course of the war. Henceforth, the German High Seas Fleet chose not to venture out from the safety of its home ports.

The Eastern Front, 1916

In the hope of diverting German strength from the attack at Verdun on the Western Front, the Russians gallantly but prematurely opened an offensive north and south of Lake Naroch (Narocz, east of Vilna) on March 18, 1916, and continued it until March 27, though they won very little ground at great cost and only for a short time. They then reverted to preparations for a major offensive in July. The main blow, it was planned, should be delivered by A.E. Evert’s central group of armies, assisted by an inward movement of A.N. Kuropatkin’s army in the northern sector of the front. But at the same time, A.A. Brusilov’s southwestern army group was authorized to make a supposedly diversionary attack in its own sectors. In the event, Brusilov’s attack became by far the more important operation of the offensive.

Surprised by the Austrians’ Asiago offensive in May, Italy promptly appealed to the Russians for action to draw the enemy’s reserves away from the Italian fronts, and the Russians responded by advancing their timetable again. Brusilov undertook to start his attack on June 4, on the understanding that Evert’s should be launched 10 days later.

Thus began an offensive on the Eastern Front that was to be imperial Russia’s last really effective military effort. Popularly known as Brusilov’s offensive, it had such an astonishing initial success as to revive Allied dreams about the irresistible Russian “steamroller.” Instead, its ultimate achievement was to sound the death knell of the Russian monarchy. Brusilov’s four armies were distributed along a very wide front, with Lutsk at the northern end, Tarnopol and Buchach (Buczacz) in the central sector, and Czernowitz at the southern end. Having struck first in the Tarnopol and Czernowitz sectors on June 4, Brusilov on June 5 took the Austrians wholly by surprise when he launched A.M. Kaledin’s army toward Lutsk: the defenses crumbled at once, and the attackers pushed their way between two Austrian armies. As the offensive was developed, the Russians were equally successful in the Buchach sector and in their thrust into Bukovina, which culminated in the capture of Czernowitz. By June 20, Brusilov’s forces had captured 200,000 prisoners.

Evert and Kuropatkin, however, instead of striking in accordance with the agreed plan, found excuses for procrastination. The Russian chief of general staff, M.V. Alekseyev, therefore tried to transfer this inert couple’s reserves to Brusilov, but the Russians’ lateral communications were so poor that the Germans had time to reinforce the Austrians before Brusilov was strong enough to make the most of his victory. Though his forces in Bukovina advanced as far as the Carpathian Mountains, a counterstroke by Alexander von Linsingen’s Germans in the Lutsk sector checked Russian progress at the decisive point. Further Russian drives from the centre of Brusilov’s front were launched in July; but by early September the opportunity of exploiting the summer’s victory was lost. Brusilov had driven the Austrians from Bukovina and from much of eastern Galicia and had inflicted huge losses of men and equipment on them, but he had depleted Russia’s armies by about 1,000,000 men in doing so. (A large portion of this number consisted of deserters or prisoners.) This loss seriously undermined both the morale and the material strength of Russia. Brusilov’s offensive also had indirect results of great

© 2020 Encyclopædia Britannica, Inc.

consequence. First, it had compelled the Germans to withdraw at least seven divisions from the Western Front, where they could ill be spared from the Verdun and Somme battles. Second, it hastened Romania’s unfortunate entry into the war.

Disregarding Romania’s military backwardness, the Romanian government of Ionel Brătianu declared war against Austria-Hungary on August 27, 1916. In entering the war, Romania succumbed to the Allies’ offers of Austro-Hungarian territory and to the belief that the Central Powers would be too much preoccupied with other fronts to mount any serious riposte against a Romanian offensive. Some 12 of Romania’s 23 divisions, in three columns, thus began on August 28 a slow westward advance across Transylvania, where at first there were only five Austro-Hungarian divisions to oppose them.

The riposte of the Central Powers was swifter than the progress of the invasion: Germany, Turkey, and Bulgaria declared war against Romania on August 28, August 30, and September 1, respectively; and Falkenhayn had plans already prepared. Though the miscarriage of his overall program for the year led to his being replaced by Hindenburg as chief of the German general staff on August 29, Falkenhayn’s recommendation that Mackensen should direct a Bulgarian attack on southern Romania was approved; and Falkenhayn himself went to command on the Transylvanian front, for which five German as well as two more Austrian divisions were found available as reinforcements.

Mackensen’s forces from Bulgaria stormed the Turtucaia (Tutrakan) bridgehead on the Danube southeast of Bucharest on September 5. His subsequent advance eastward into the Dobruja caused the Romanians to switch their reserves to that quarter instead of reinforcing their Transylvanian enterprise, which thereupon came to a halt. Falkenhayn soon attacked: first at the southern end of the 200-mile front, where he threw one of the Romanian columns back into the Roter Turm (Turnu Roşu) Pass, then in the centre, where by October 9 he had defeated another at Kronstadt (Braşov). For a month, however, the Romanians withstood Falkenhayn’s attempts to drive them out of the Vulcan and Szurduk (Surduc) passes into Walachia. But just before winter snows blocked the way, the Germans took the two passes and advanced southward to Tîrgu Jiu, where they won another victory. Then Mackensen, having turned westward from the Dobruja, crossed the Danube near Bucharest, on which his and Falkenhayn’s armies converged. Bucharest fell on December 6, and the Romanian Army, a crippled force, could only fall back northeastward into Moldavia, where it had the belated support of Russian troops. The Central Powers had access to Romania’s wheat fields and oil wells, and the Russians had 300 more miles of front to defend.

German strategy and the submarine war, 1916–January 1917

Both Admiral Scheer and General Falkenhayn doubted whether the German submarines could do any decisive damage to Great Britain so long as their warfare was restricted in deference to the protests of the United States; and, after a tentative reopening of the submarine campaign on February 4, 1916, the German naval authorities in March gave the U-boats permission to sink without warning all ships except passenger vessels. The German civilian statesmen, however, who paid due attention to their diplomats’ warnings about U.S. opinion, were soon able to prevail over the generals and the admirals: on May 4 the scope of the submarine campaign was again severely restricted.

The controversy between the statesmen and the advocates of unrestricted warfare was not dead yet. Hindenburg, chief of the general staff from August 29, had Ludendorff as his quartermaster general, and Ludendorff was quickly won over to supporting the chief of the Admiralty staff, Henning von Holtzendorff, in his arguments against the German chancellor, Theobald von Bethmann Hollweg, and the foreign minister, Gottlieb von Jagow. Whereas Bethmann and some other statesmen were hoping for a negotiated peace (see below), Hindenburg and Ludendorff were committed to a military victory. The British naval blockade, however,

© 2020 Encyclopædia Britannica, Inc.

threatened to starve Germany into collapse before a military victory could be achieved, and soon Hindenburg and Ludendorff got their way: it was decided that, from February 1, 1917, submarine warfare should be unrestricted and overtly so.

Peace moves and U.S. policy to February 1917



See why the United States abandoned its policy of neutrality and decided to enter World War I.

Encyclopædia Britannica, Inc.

There were few efforts by any of the Central or Allied Powers to achieve a negotiated peace in the first two years of the war. By 1916 the most promising signs for peace seemed to exist only in the intentions of two statesmen in power—the German chancellor Bethmann and the U.S. president Woodrow Wilson. Wilson, having proclaimed the neutrality of the United States in August 1914, strove for the next two years to maintain it. (*See* the video.) Early in 1916 he sent his confidant, Colonel Edward M. House, to sound London and Paris about the possibility of U.S. mediation between the belligerents. House's conversations with the British foreign secretary, Sir Edward Grey, resulted in the House–Grey Memorandum (February 22, 1916), declaring that the United States might enter the war if Germany rejected Wilson's mediation but that Great Britain reserved the right to initiate U.S. mediatory action. By mid-1916, the imminent approach of the presidential election in the United States caused Wilson to suspend his moves for peace.

In Germany, meanwhile, Bethmann had succeeded, with difficulty, in postponing the declaration of unrestricted submarine warfare. Wilson, though he was reelected president on November 7, 1916, let another month pass without doing anything for peace, and during that period the German victory over Romania was taking place. Thus, while Bethmann lost patience with waiting for Wilson to act, the German military leaders came momentarily to think that Germany, from a position of strength, might now propose a peace acceptable to themselves. Having been constrained to agree with the militarists that, if his proposals were rejected by the Allies, unrestricted submarine warfare should be resumed, Bethmann was allowed to announce, on December 12, the terms of a German offer of peace—terms, however, that were militarily so far-reaching as to preclude the Allies' acceptance of them. The main stumbling block was Germany's insistence upon its annexation of Belgium and of the occupied portion of northeastern France.

On December 18, 1916, Wilson invited both belligerent camps to state their "war aims." The Allies were secretly encouraged by the U.S. secretary of state to offer terms too sweeping for German acceptance; and the Germans, suspecting collusion between Wilson and the Allies, agreed in principle to the opening of negotiations but left their statement of December 12 practically unchanged and privately decided that Wilson should not actually take part in any negotiation that he might bring about. By mid-January 1917 the December overtures had ended.

Strangely enough, Wilson's next appeal, a speech of January 22, 1917, preaching international conciliation and a "peace without victory," elicited a confidential response from the British expressing readiness to accept his mediation. In the opposite camp, Austria-Hungary would likewise have listened readily to peace proposals, but Germany had already decided, on January 9, to declare unrestricted submarine warfare. Bethmann's message

© 2020 Encyclopædia Britannica, Inc.

restating Germany’s peace terms and inviting Wilson to persevere in his efforts was delivered on January 31 but was paradoxically accompanied by the announcement that unrestricted submarine warfare would begin the next day.

Wilson severed diplomatic relations between the United States and Germany on February 3, 1917, and asked Congress, on February 26, for power to arm merchantmen and to take all other measures to protect U.S. commerce. But American opinion was still not ready for war, and the Germans wisely abstained from attacks on U.S. shipping. What changed the tenor of public feeling was the publication of the Zimmermann Telegram.

Arthur Zimmermann had succeeded Jagow as Germany’s secretary of state for foreign affairs in November 1916; and in that same month the Mexican president, Venustiano Carranza, whose country’s relations with the United States had been critical since March, had virtually offered bases on the Mexican coast to the Germans for their submarines. Zimmermann on January 16, 1917, sent a coded telegram to his ambassador in Mexico instructing him to propose to the Mexican government that, if the United States should enter the war against Germany, Mexico should become Germany’s ally with a view to recovering Texas, New Mexico, and Arizona from the United States. Intercepted and decoded by the British Admiralty Intelligence, this message was communicated to Wilson on February 24. It was published in the U.S. press on March 1, and it immediately set off a nationwide demand for war against Germany.

Developments in 1917

The Western Front, January–May 1917

The western Allies had good reason to be profoundly dissatisfied with the poor results of their enterprises of 1916, and this dissatisfaction was signalized by two major changes made at the end of the year. In Great Britain, the government of H.H. Asquith, already turned into a coalition in May 1915, was replaced in December 1916 by a coalition under David Lloyd George; and that same month in France the post of commander in chief of the army was transferred from Joffre to General R.-G. Nivelle.

As for the military situation, the fighting strength of the British Army on the Western Front had grown to about 1,200,000 men and was still growing. That of the French Army had been increased by the incorporation of colonial troops to some 2,600,000, so that, including the Belgians, the Allies disposed an estimated 3,900,000 men against 2,500,000 Germans. To the Allies, these figures suggested an offensive on their part.

Nivelle, who owed his appointment to the contrast between the brilliant success of his recent counterattacks at Verdun and the meagre results of Joffre’s strategy of attrition, was deeply imbued with the optimism of which experience was by now curing Joffre. He also had ideas of national glory and, accordingly, modified plans made by Joffre in such a way as to assign to the French Army the determinant role in the offensive that, it was calculated, must decide the issue on the Western Front in 1917. Nivelle’s plan in its final stage was that the British should make preparatory attacks not only north of the wilderness of the old Somme battlefields but also south of them (in the sector previously held by French troops); that these preparatory attacks should attract the German reserves; and, finally, that the French should launch the major offensive in Champagne (their forces in that sector having been strengthened both by new troops from the overseas colonies and by those transferred from the Somme). The tactics Nivelle planned to use were based on those he had employed so successfully at Verdun. But he placed an optimistic overreliance on his theory of combining “great violence with great mass,” which basically consisted of intense artillery bombardments followed by massive frontal attacks.

Meanwhile, Ludendorff had foreseen a renewal of the Allied offensive on the Somme, and he used his time to frustrate Nivelle’s plans and to strengthen the German front in two different ways. First, the hitherto rather shallow defenses in Champagne were by mid-February reinforced with a third line, out of range of the French

© 2020 Encyclopædia Britannica, Inc.

artillery. Second, Ludendorff decided to anticipate the attack by falling back to a new and immensely strong line of defense. This new line, called the Siegfriedstellung, or “Hindenburg Line,” was rapidly constructed across the base of the great salient formed by the German lines between Arras and Reims. From the German position east of Arras, the line ran southeastward and southward, passing west of Cambrai and Saint-Quentin to rejoin the old German line at Anizy (between Soissons and Laon). After a preliminary step backward on February 23, a massive withdrawal of all German troops from the westernmost bulges of the great salient to the new and shorter line was smoothly and quickly made on March 16. The major towns within the areas evacuated by the Germans (i.e., Bapaume, Péronne, Roye, Noyon, Chauny, and Coucy) were abandoned to the Allies, but the area was left as a desert, with roads mined, trees cut down, wells fouled, and houses demolished, the ruins being strewn with explosive booby traps.

This baffling and unexpected German withdrawal dislocated Nivelle’s plan, but, unperturbed by warnings from all quarters about the changed situation, Nivelle insisted on carrying it out. The Battle of Arras, with which the British started the offensive on April 9, 1917, began well enough for the attackers, thanks to much-improved artillery methods and to a new poison gas shell that paralyzed the hostile artillery. Vimy Ridge, at the northern end of the 15-mile battlefront, fell to the Canadian Corps, but the exploitation of this success was frustrated by the congestion of traffic in the British rear, and though the attack was continued until May 5, stiffer German resistance prevented exploitation of the advances made in the first five days.

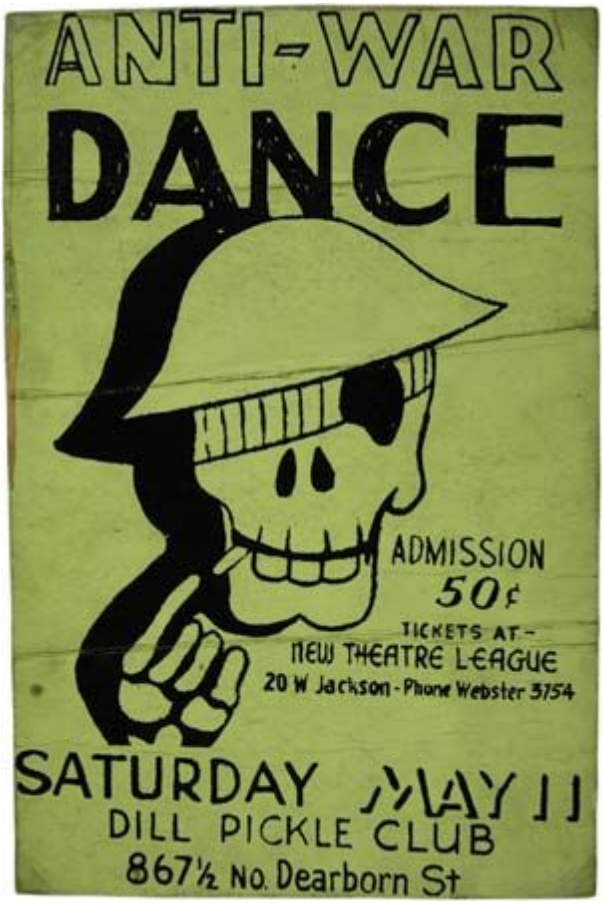
Nivelle’s own offensive in Champagne, launched on April 16 on the Aisne front from Vailly eastward toward Craonne and Reims, proved to be a fiasco. The attacking troops were trapped in a web of machine-gun fire, and by nightfall the French had advanced about 600 yards instead of the six miles anticipated in Nivelle’s program. Only on the wings was any appreciable progress achieved. The results compared favourably with Joffre’s offensives, as some 28,000 German prisoners were taken at a cost to the French of just under 120,000 casualties. But the effect on French morale was worse, because Nivelle’s fantastic predictions of the offensive’s success were more widely known than Joffre’s had ever been. With the collapse of Nivelle’s plan, his fortunes were buried in the ruins, and after some face-saving delay he was superseded as commander in chief by Pétain on May 15, 1917.

This change was made too late to avert a more harmful sequel, for in late April a mutiny broke out among the French infantry and spread until 16 French army corps were affected. The authorities chose to ascribe it to seditious propaganda, but the mutinous outbreaks always occurred when exhausted troops were ordered back into the line, and they signaled their grievances by such significant cries as: “We’ll defend the trenches, but we won’t attack.” Pétain restored tranquillity by meeting the just grievances of the troops; his reputation for sober judgment restored the troops’ confidence in their leaders, and he made it clear that he would avoid future reckless attacks on the German lines. But the military strength of France could never be fully restored during the war.

Pétain insisted that the only rational strategy was to keep to the defensive until new factors had changed the conditions sufficiently to justify taking the offensive with a reasonable hope of success. His constant advice was: “We must wait for the Americans and the tanks.” Tanks were now being belatedly built in large numbers, and this emphasis on them showed a dawning recognition that machine warfare had superseded mass infantry warfare.

© 2020 Encyclopædia Britannica, Inc.

The U.S. entry into the war



Poster advertising an antiwar dance (1918) sponsored by the Dill Pickle Club in Chicago.

The Newberry Library, Dill Pickle Club Records

After the rupture of diplomatic relations with Germany on February 3, 1917, events pushed the United States inexorably along the road to war. Using his authority as commander in chief, Wilson on March 9 ordered the arming of American merchant ships so that they could defend themselves against U-boat attacks. German submarines sank three U.S. merchant ships during March 16–18 with heavy loss of life. Supported by his Cabinet, by most newspapers, and by a large segment of public opinion, Wilson made the decision on March 20 for the United States to declare war on Germany, and on March 21 he called Congress to meet in special session on April 2. He delivered a ringing war message to that body, and the war resolution was approved by the Senate on April 3 and by the House of Representatives on April 6. The presidential declaration of war followed immediately.

© 2020 Encyclopædia Britannica, Inc.



Army recruiting poster featuring Uncle Sam, designed by James Montgomery Flagg, 1917.

James Montgomery Flagg— Leslie-Judge Co., N.Y./Library of Congress, Washington, D.C. (LC-USZC4-3859)

The entry of the United States was the turning point of the war, because it made the eventual defeat of Germany possible. It had been foreseen in 1916 that if the United States went to war, the Allies' military effort against Germany would be upheld by U.S. supplies and by enormous extensions of credit. These expectations were amply and decisively fulfilled. The United States' production of armaments was to meet not only its own needs but also France's and Great Britain's. In this sense, the American economic contribution alone was decisive. By April 1, 1917, the Allies had exhausted their means of paying for essential supplies from the United States, and it is difficult to see how they could have maintained the war effort if the United States had remained neutral. American loans to the Allies worth $7,000,000,000 between 1917 and the end of the war maintained the flow of U.S. arms and food across the Atlantic.



U.S. Army recruits at Camp Pike, Arkansas, in 1918, following the United States' entry into World…

Library of Congress, Washington, D.C.

© 2020 Encyclopædia Britannica, Inc.

The American military contribution was as important as the economic one. A system of conscription was introduced by the Selective Service Act of May 18, 1917, but many months were required for the raising, training, and dispatch to Europe of an expeditionary force. There were still only 85,000 U.S. troops in France when the Germans launched their last great offensive in March 1918; but there were 1,200,000 there by the following September. The U.S. commander in Europe was General John J. Pershing.



Woman working in an American airplane factory during World War I, 1917.

Encyclopædia Britannica, Inc.

The U.S. Navy was the second largest in the world when America entered the war in 1917. The Navy soon abandoned its plans for the construction of battleships and instead concentrated on building the destroyers and submarine chasers so desperately needed to protect Allied shipping from the U-boats. By July 1917 there were already 35 U.S. destroyers stationed at Queenstown (Cobh) on the coast of Ireland—enough to supplement British destroyers for a really effective transatlantic convoy system. By the end of the war there were more than 380 U.S. craft stationed overseas.

The U.S. declaration of war also set an example to other states in the Western Hemisphere. Cuba, Panama, Haiti, Brazil, Guatemala, Nicaragua, Costa Rica, and Honduras were all at war with Germany by the end of July 1918, while the Dominican Republic, Peru, Uruguay, and Ecuador contented themselves with the severance of relations.

The Russian revolutions and the Eastern Front, March 1917–March 1918



Demonstrators gathering before the Winter Palace in Petrograd (St. Petersburg) in January 1917,...

Hulton Archive/Getty Images

© 2020 Encyclopædia Britannica, Inc.

The Russian Revolution of March (February, old style) 1917 put an end to the autocratic monarchy of imperial Russia and replaced it with a provisional government. But the latter's authority was at once contested by soviets, or "councils of workers' and soldiers' deputies," who claimed to represent the masses of the people and so to be the rightful conductors of the revolution. The March Revolution was an event of tremendous magnitude. Militarily it appeared to the western Allies as a disaster and to the Central Powers as a golden opportunity. The Russian Army remained in the field against the Central Powers, but its spirit was broken, and the Russian people were utterly tired of a war that the imperial regime for its own reasons had undertaken without being morally or materially prepared for it. The Russian Army had been poorly armed, poorly supplied, poorly trained, and poorly commanded and had suffered a long series of defeats. The soviets' propaganda—including the notorious Order No. 1 of the Petrograd Soviet (March 14, 1917), which called for committees of soldiers and sailors to take control of their units' arms and to ignore any opposition from their officers—served to subvert the remnants of discipline in troops who were already deeply demoralized.

But the leaders of the provisional government foresaw that a German victory in the war would bode ill for Russia in the future, and they were also conscious of their nation's obligations toward the western Allies. A.F. Kerensky, minister of war from May 1917, thought that a victorious offensive would enhance the new government's authority, besides relieving pressure on the Western Front. The offensive, however, which General L.G. Kornilov launched against the Austrians in eastern Galicia on July 1, 1917, was brought to a sudden halt by German reinforcements after 10 days of spectacular advances, and it turned into a catastrophic rout in the next three weeks. By October the advancing Germans had won control of most of Latvia and of the approaches to the Gulf of Finland.

Meanwhile, anarchy was spreading over Russia. The numerous non-Russian peoples of the former empire were one after another claiming autonomy or independence from Russia—whether spontaneously or at the prompting of the Germans in occupation of their countries. Finns, Estonians, Latvians, Lithuanians, and Poles were, by the end of 1917, all in various stages of the dissidence from which the independent states of the postwar period were to emerge; and, at the same time, Ukrainians, Georgians, Armenians, and Azerbaijanis were no less active in their own nationalist movements.

The provisional government's authority and influence were rapidly fading away in Russia proper during the late summer and autumn of 1917. The Bolshevik Revolution of November (October, O.S.) 1917 overthrew the provisional government and brought to power the Marxist Bolsheviks under the leadership of Vladimir I. Lenin. The Bolshevik Revolution spelled the end of Russia's participation in the war. Lenin's decree on land, of November 8, undermined the Eastern Front by provoking a homeward rush of soldiers anxious to profit from the expropriation of their former landlords. On November 8, likewise, Lenin issued his decree on peace, which offered negotiations to all belligerents but precluded annexations and indemnities and stipulated a right of self-determination for all peoples concerned. Finally, on November 26, the new Bolshevik government unilaterally ordered a cessation of hostilities both against the Central Powers and against the Turks.

An armistice between Lenin's Russia and the Central Powers was signed at Brest-Litovsk on December 15, 1917. The ensuing peace negotiations were complicated: on the one hand, Germany wanted peace in the east in order to be free to transfer troops thence to the Western Front, but Germany was at the same time concerned to exploit the principle of national self-determination in order to transfer as much territory as possible into its own safe orbit from that of revolutionary Russia. On the other hand, the Bolsheviks wanted peace in order to be free to consolidate their regime in the east with a view to being able to extend it westward as soon as the time should be ripe. When the Germans, despite the armistice, invaded Ukraine to cooperate with the Ukrainian nationalists against the Bolsheviks there and furthermore resumed their advance in the Baltic countries and in Belorussia, Lenin rejected his colleague Leon Trotsky's stopgap policy ("neither peace nor war") and accepted

© 2020 Encyclopædia Britannica, Inc.

Germany’s terms in order to save the Bolshevik Revolution. By the Treaty of Brest-Litovsk (March 3, 1918), Soviet Russia recognized Finland and Ukraine as independent; renounced control over Estonia, Latvia, Lithuania, Poland, and most of Belorussia; and ceded Kars, Ardahan, and Batumi to Turkey.

Greek affairs

Greece’s attitude toward the war was long uncertain: whereas King Constantine I and the general staff stood for neutrality, Eleuthérios Venizélos, leader of the Liberal Party, favoured the Allied cause. As prime minister from 1910, Venizélos wanted Greece to participate in the Allies’ Dardanelles enterprise against Turkey in 1915, but his arguments were overruled by the general staff. The Allies occupied Lemnos and Lesbos regardless of Greece’s neutrality. Constantine dismissed Venizélos from office twice in 1915, but Venizélos still commanded a majority in Parliament. The Bulgarians’ occupation of Greek Macedonia in summer 1916 provoked another political crisis. Venizélos left Athens for Crete late in September, set up a government of his own there, and transferred it early in October to Salonika. On November 27 it declared war on Germany and Bulgaria. Finally, the Allies, on June 11, 1917, deposed King Constantine. Venizélos then returned to Athens to head a reunified Greek government, which on June 27 declared war on the Central Powers.

Caporetto

On the Italian front, Cadorna’s 10th Battle of the Isonzo in May–June 1917 won very little ground; but his 11th, from August 17 to September 12, during which General Luigi Capello’s 2nd Army captured much of the Bainsizza Plateau (Banjška Planota), north of Gorizia, strained Austrian resistance very severely. To avert an Austrian collapse, Ludendorff decided that the Austrians must take the offensive against Italy and that he could, with difficulty, lend them six German divisions for that purpose.

The offensive was boldly planned, very ably organized, and well executed. While two Austrian armies, under General Svetozar Borojević von Bojna, attacked the eastern end of the Italians’ Venetian salient on the Bainsizza Plateau and on the low ground near the Adriatic shore, the German 14th Army, comprising the six German divisions and nine Austrian ones under Otto von Below, with Konrad Krafft von Dellmensingen as his chief of staff, on October 24, 1917, began to force its way over the barrier of the Julian Alps at the northeastern corner of the Venetian salient, with Caporetto approximately opposite the middle point of the line. The Italians, completely surprised by this thrust, which threatened their forces both to the north and to the south, fell back in confusion: Below’s van reached Udine, the former site of the Italian general headquarters, by October 28 and was on the Tagliamento River by October 31. Below’s success had far exceeded the hopes of the planners of the offensive, and the Germans could not exploit their speedy advance as effectively as they wished. Cadorna, with his centre shattered, managed by precipitate retreat to save the wings of his army and was able, by November 9, to rally his remaining 300,000 troops behind the Piave River, north of Venice. The Italians had sustained about 500,000 casualties, and 250,000 more had been taken prisoner. General Armando Diaz was then appointed commander in chief in Cadorna’s place. The Italians managed to hold the Piave front against direct assaults and against attempts to turn its left flank by an advance from the Trentino. The Italians’ defense was helped by British and French reinforcements that had been rushed to Italy when the collapse began. A conference of the military and political leaders of the Allies was held at Rapallo in November, and out of this conference there sprang the joint Supreme War Council at Versailles, and ultimately a unified military command.

Mesopotamia, summer 1916–winter 1917

The British forces in Mesopotamia, neglected hitherto and discouraged by the disaster at al-Kūt (see above Mesopotamia, 1914–April 1916), received better attention from London in the second half of 1916; and Sir Frederick Stanley Maude, who became commander in chief in August, did so much to restore their morale that by December he was ready to undertake the recapture of al-Kūt as a first step toward capturing Baghdad.

© 2020 Encyclopædia Britannica, Inc.

By a series of outflanking movements, the British made their way gradually and methodically up the Tigris, compelling the Turks to extend their defenses upstream. When the final blow at al-Kūt was delivered by a frontal attack on February 22, 1917, British forces were already crossing the river from the west bank behind the town; but though al-Kūt fell two days later most of the Turkish garrison extricated itself from the threatened encirclement. Unable to hold a new line on the Diyālā River, the Turkish commander, Kâzim Karabekir, evacuated Baghdad, which the British entered on March 11. In September the British position in Baghdad was definitively secured by the capture of ar-Ramādī, on the Euphrates about 60 miles to the west; and early in November the main Turkish force in Mesopotamia was driven from Tikrīt, on the Tigris midway between Baghdad and Mosul.

Maude, having within a year changed the Mesopotamian scene from one of despair to one of victory, died of cholera on November 18, 1917. His successor in command was Sir William Marshall.

Palestine, autumn 1917

Having assumed command in Egypt (see above The Egyptian frontiers, 1915–July 1917), Allenby transferred his headquarters from Cairo to the Palestinian front and devoted the summer of 1917 to preparing a serious offensive against the Turks. On the Turkish side, Falkenhayn, now in command at Aleppo, was at this time himself planning a drive into the Sinai Peninsula for the autumn, but the British were able to strike first.

The Turkish front in southern Palestine extended from Gaza, on the coast, southeastward to Abu Hureira (Tel Haror) and thence to the stronghold of Beersheba. To disguise his real intention of achieving a breakthrough at Abu Hureira, for which, however, the capture of Beersheba was obviously prerequisite, Allenby began his operation with a heavy bombardment of Gaza from October 20 onward. When Beersheba had been seized by converging movements on October 31, a feint attack on Gaza was launched next day to draw the Turkish reserves thither. Then, the main attack, delivered on November 6, broke through the weakened defenses at Abu Hureira and into the plain of Philistia. Falkenhayn had attempted a counterstroke at Beersheba, but the collapse of the Turkish centre necessitated a general retreat. By November 14 the Turkish forces were split in two divergent groups, the port of Jaffa was taken, and Allenby wheeled his main force to the right for an advance inland on Jerusalem. On December 9 the British occupied Jerusalem.

The Western Front, June–December 1917

Pétain’s decision to remain temporarily on the defensive after Nivelle’s failure gave Haig the opportunity to fulfill his desire for a British offensive in Flanders. He took the first step on June 7, 1917, with a long-prepared attack on the Messines Ridge, north of Armentières, on the southern flank of his Ypres salient. This attack by General Sir Herbert Plumer’s 2nd Army proved an almost complete success; it owed much to the surprise effect of 19 huge mines simultaneously fired after having been placed at the end of long tunnels under the German front lines. The capture of the ridge inflated Haig’s confidence; and, though General Sir Hubert Gough, in command of the 5th Army, advocated a step-by-step method for the offensive, Haig committed himself to Plumer’s view that they “go all out” for an early breakthrough. Haig disregarded the well-founded forecast that, from the beginning of August, rain would be turning the Flanders countryside into an almost impassable swamp. The Germans, meanwhile, were well aware that an offensive was coming from the Ypres salient: the flatness of the plain prevented any concealment of Haig’s preparations, and a fortnight’s intensive bombardment (4,500,000 shells from 3,000 guns) served to underline the obvious—without, however, destroying the German machine gunners’ concrete pillboxes.

Thus, when the Third Battle of Ypres was begun, on July 31, only the left wing’s objectives were achieved: on the crucial right wing the attack was a failure. Four days later, the ground was already swampy. When the attack

© 2020 Encyclopædia Britannica, Inc.

was resumed on August 16, very little more was won, but Haig was still determined to persist in his offensive. Between September 20 and October 4, thanks to an improvement in the weather, the infantry was able to advance into positions cleared by bombardment, but no farther. Haig launched another futile attack on October 12, followed by three more attacks, scarcely more successful, in the last 10 days of October. At last, on November 6, when his troops advanced a very short distance and occupied the ruins of Passchendaele (Passendale), barely five miles beyond the starting point of his offensive, Haig felt that enough had been done. Having prophesied a decisive success without “heavy losses,” he had lost 325,000 men and inflicted no comparable damage on the Germans.

Pétain, less pretentious and merely testing what might be done with his rehabilitated French Army, had at least as much to show for himself as Haig. In August the French 2nd Army under General M.-L.-A. Guillaumat fought the last battle of Verdun, winning back all the remainder of what had been lost to the Germans in 1916. In October General P.-A.-M. Maistre’s 10th Army, in the Battle of Malmaison, took the ridge of the Chemin des Dames, north of the Aisne to the east of Soissons, where the front in Champagne joined the front in Picardy south of the Somme.

The British, at least, closed the year’s campaign with an operation of some significance for the future. When the offensive from Ypres died out in the Flanders mud, they looked again at their tanks, of which they now had a considerable force but which they could hardly use profitably in the swamps. A Tank Corps officer, Colonel J.F.C. Fuller, had already suggested a large-scale raid on the front southwest of Cambrai, where a swarm of tanks, unannounced by any preparatory bombardment, could be released across the rolling downland against the German trenches. This comparatively modest scheme might have been wholly successful if left unchanged, but the British command transformed it: Sir Julian Byng’s 3rd Army was to actually try to capture Cambrai and to push on toward Valenciennes. On November 20, therefore, the attack was launched, with 324 tanks leading Byng’s six divisions. The first massed assault of tanks in history took the Germans wholly by surprise, and the British achieved a far deeper penetration and at less cost than in any of their past offensives. Unfortunately, however, all of Byng’s troops and tanks had been thrown into the first blow, and, as he was not reinforced in time, the advance came to a halt several miles short of Cambrai. A German counterstroke, on November 30, broke through on the southern flank of the new British salient and threatened Byng’s whole army with disaster before being checked by a further British counterattack. In the end, three-quarters of the ground that the British had won was reoccupied by the Germans. Even so, the Battle of Cambrai had proved that surprise and the tank in combination could unlock the trench barrier.

The Far East

China’s entry into the war in 1917 on the side of the Allies was motivated not by any grievance against the Central Powers but by the Peking government’s fear lest Japan, a belligerent since 1914, should monopolize the sympathies of the Allies and of the United States when Far Eastern affairs came up for settlement after the war. Accordingly, in March 1917 the Peking government severed its relations with Germany; and on August 14 China declared war not only on Germany but also on the western Allies’ other enemy, Austria-Hungary. China’s contribution to the Allied war effort was to prove negligible in practical effects, however.

Naval operations, 1917–18

Since Germany’s previous restrictions of its submarine warfare had been motivated by fear of provoking the United States into war, the U.S. declaration of war in April 1917 removed any reason for the Germans to retreat from their already declared policy of unrestricted warfare. Consequently, the U-boats, having sunk 181 ships in January, 259 in February, and 325 in March, sank 430 in April. The April sinkings represented 852,000 gross tons, to be compared both with the 600,000 postulated by the German strategists as their monthly target and with

© 2020 Encyclopædia Britannica, Inc.

the 700,000 that the British in March had pessimistically foretold for June. The Germans had calculated that if the world's merchant shipping could be sunk at the monthly rate of 600,000 tons, the Allies, being unable to build new merchant ships fast enough to replace those lost, could not carry on the war for more than five months. At the same time, the Germans, who had 111 U-boats operational when the unrestricted campaign began, had embarked on an extensive building program that, when weighed against their current losses of one or two U-boats per month, promised a substantial net increase in the U-boats' numbers. During April, one in every four of the merchant ships that sailed from British ports was destined to be sunk, and by the end of May the quantity of shipping available to carry the vital foodstuffs and munitions to Great Britain had been reduced to only 6,000,000 tons.

The April total, however, proved to be a peak figure—primarily because the Allies at last adopted the convoy system for the protection of merchant ships. Previously, a ship bound for one of the Allies' ports had set sail by itself as soon as it was loaded. The sea was thus dotted with single and unprotected merchant ships, and a scouting U-boat could rely on several targets coming into its range in the course of a cruise. The convoy system remedied this by having groups of merchant ships sail within a protective ring of destroyers and other naval escorts. It was logistically possible and economically worthwhile to provide this kind of escort for a group of ships. Furthermore, the combination of convoy and escort would force the U-boat to risk the possibility of a counterattack in order to sink the merchant ships, thus giving the Allies a prospect of reducing the U-boats' numbers. Despite the manifest and seemingly overwhelming benefits of the convoy system, the idea was novel and, like any untried system, met with powerful opposition from within the military. It was only in the face of extreme necessity and under great pressure from Lloyd George that the system was tried, more or less as a last resort.

The first convoy sailed from Gibraltar to Great Britain on May 10, 1917; the first from the United States sailed later in May; ships using the South Atlantic sailed in convoy from July 22. During the later months of 1917 the use of convoys caused an abrupt fall in the sinkings by U-boats: 500,500 tons in May, 300,200 in September, and only about 200,600 in November. The convoy system was so quickly vindicated that in August it was extended to shipping outward-bound from Great Britain. The Germans themselves soon observed that the British had grasped the principles of antisubmarine warfare, and that sailing ships in convoys considerably reduced the opportunities for attack.

Apart from the convoys, the Allies improved their antisubmarine technology (hydrophones, depth charges, etc.) and extended their minefields. In 1918, moreover, Admiral Sir Roger Keyes, in command at Dover, set up a system whereby the English Channel was patrolled by surface craft with searchlights, so that U-boats passing through it had to submerge themselves to depths at which they were liable to strike the mines that had been laid for them. Subsequently, most of the U-boats renounced the Channel as a way into the Atlantic and instead took the passage north of Great Britain, thus losing precious fuel and time before reaching the heavily traveled sea lanes of the western approaches to Great Britain. In the summer of 1918, U.S. minelayers laid more than 60,000 mines (13,000 of them British) in a wide belt across 180 miles of the North Sea between Scotland and Norway, so as to obstruct the U-boats' only access from Germany to the Atlantic other than the closely guarded Channel.

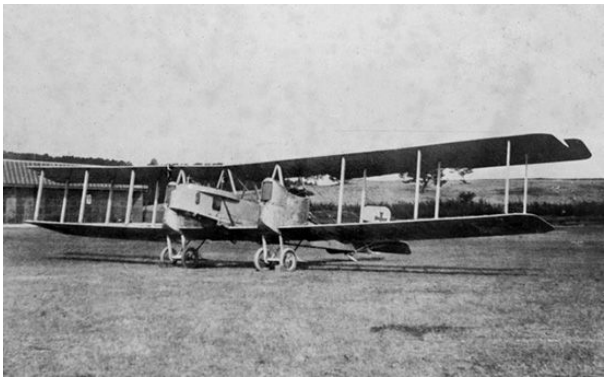
The cumulative effect of all these measures was the gradual containment and ultimately the defeat of the U-boat campaign, which never again achieved the success of April 1917. While sinkings by submarines, after that month, steadily fell, the losses of U-boats showed a slow but steady rise, and more than 40 were destroyed in the first six months of 1918. At the same time the replacement of merchant vessels in the building program improved steadily, until it eventually far outstripped losses. In October 1918, for example, 511,000 tons of new Allied merchant ships were launched, while only 118,559 tons were lost.

© 2020 Encyclopædia Britannica, Inc.

Air warfare

At the start of the war the land and sea forces used the aircraft put at their disposal primarily for reconnaissance, and air fighting began as the exchange of shots from small arms between enemy airmen meeting one another in the course of reconnoitering. Fighter aircraft armed with machine guns, however, made their appearance in 1915. Tactical bombing and the bombing of enemy air bases were also gradually introduced at this time. Contact patrolling, with aircraft giving immediate support to infantry, was developed in 1916.

Strategic bombing, on the other hand, was initiated early enough: British aircraft from Dunkirk bombed Cologne, Düsseldorf, and Friedrichshafen in the autumn of 1914, their main objective being the sheds of the German dirigible airships, or Zeppelins; and raids by German airplanes or seaplanes on English towns in December 1914 heralded a great Zeppelin offensive sustained with increasing intensity from January 1915 to September 1916 (London was first bombed in the night of May 31–June 1, 1915). In October 1916 the British, in turn, began a more systematic offensive, from eastern France, against industrial targets in southwestern Germany.



German Gotha G.III long-range twin-engine bomber airplane, c. 1917.

Courtesy Australian War Memorial

While the British directed much of their new bombing strength to attacks on the bases of the U-boats, the Germans used theirs largely to continue the offensive against the towns of southeastern England. On June 13, 1917, in daylight, 14 German bombers dropped 118 high explosive bombs on London and returned home safely. This lesson and that of subsequent raids by the German Gotha bombers made the British think more seriously about strategic bombing and about the need for an air force independent of the other fighting services. The Royal Air Force (RAF), the world’s first separate air service, was brought into active existence by a series of measures taken between October 1917 and June 1918.

Peace moves, March 1917–September 1918

Until the end of 1916, the pursuit of peace was confined to individuals and to small groups. In the following months it began to acquire a broad popular backing. Semi-starvation in towns, mutinies in the armies, and casualty lists that seemed to have no end made more and more people question the need and the wisdom of continuing the war.

Francis Joseph, Austria’s venerable old emperor, died on November 21, 1916. The new emperor, Charles I, and his foreign minister, Graf Ottokar Czernin, initiated peace moves in the spring of 1917 but unfortunately did not concert their diplomatic efforts, and the channels of negotiation they opened between Austria-Hungary and the Allies had dried up by that summer.

In Germany, Matthias Erzberger, a Roman Catholic member of the Reichstag, had, on July 6, 1917, proposed that territorial annexations be renounced in order to facilitate a negotiated peace. During the ensuing debates Bethmann Hollweg resigned the office of chancellor, and the emperor William II appointed the next chancellor,

© 2020 Encyclopædia Britannica, Inc.

Ludendorff's nominee Georg Michaelis, without consulting the Reichstag. The Reichstag, offended, proceeded to pass its *Friedensresolution*, or "peace resolution," of July 19 by 212 votes. The peace resolution was a string of innocuous phrases expressing Germany's desire for peace but without a clear renunciation of annexations or indemnities. The Allies took almost no notice of it.

Erzberger's proposal of July 6 had been intended to pave the way for Pope Benedict XV's forthcoming note to the belligerents of both camps. Dated August 1, 1917, this note advocated a German withdrawal from Belgium and from France, the Allies' withdrawal from the German colonies, and the restoration not only of Serbia, Montenegro, and Romania but also of Poland to independence. France and Great Britain declined to give an express reply pending Germany's statement of its attitude about Belgium, on which Germany avoided committing itself.

An unofficial peace move was made in London: on November 29, 1917, the *Daily Telegraph* published a letter from Lord Lansdowne suggesting negotiations on the basis of the status quo antebellum. Lloyd George rejected Lansdowne's theses on December 14.

The U.S. president Woodrow Wilson made himself the chief formulator and spokesman of the war aims of the Allies and the United States. The first nine months of 1918 saw Wilson's famous series of pronouncements on his war aims: the Fourteen Points (January 8), the "Four Principles" (February 11), the "Four Ends" (July 4), and the "Five Particulars" (September 27). Most important, not least because of Germany's deluded reliance on them in its eventual suing for peace, were the Fourteen Points: (1) open covenants of peace and the renunciation of secret diplomacy, (2) freedom of navigation on the high seas in wartime as well as peace, (3) the maximum possible freedom of trade, (4) a guaranteed reduction of armaments, (5) an impartial colonial settlement accommodating not only the colonialist powers but also the peoples of the colonies, (6) the evacuation of all Russian territory and respect for Russia's right of self-determination, (7) the complete restoration of Belgium, (8) a complete German withdrawal from France and satisfaction for France about Alsace-Lorraine, (9) a readjustment of Italy's frontiers on an ethnic basis, (10) an open prospect of autonomy for the peoples of Austria-Hungary, (11) the restoration of Romania, Serbia, and Montenegro, with free access to the sea for Serbia and international guarantees of the Balkan states' independence and integrity, (12) the prospect of autonomy for non-Turkish peoples of the Ottoman Empire and the unrestricted opening of the Straits, but secure sovereignty for the Turks in their own areas, (13) an independent Poland with access to the sea and under international guarantee, and (14) "a general association of nations," to guarantee the independence and integrity of all states, great and small. The three subsequent groups of pronouncements mainly consisted of idealistic expansions of themes implicit in the Fourteen Points, with increasing emphasis on the wishes of subject populations; but the first of the "Four Ends" was that every arbitrary power capable by itself of disturbing world peace should be rendered innocuous.

© 2020 Encyclopædia Britannica, Inc.



Crowds on Wall Street celebrating the end of World War I, New York City, 1918.

Library of Congress, Washington, D.C. (digital file no. 09634)

Wilson’s peace campaign was a significant factor in the collapse of the will to fight of the German people and the decision of the German government to sue for peace in October 1918. Indeed, the Germans conducted their preliminary peace talks exclusively with Wilson. And the Armistice, when it came on November 11, 1918, was formally based upon the Fourteen Points and additional Wilsonian pronouncements, with two reservations by the British and French relating to freedom of the seas and reparations.

The last offensives and the Allies’ victory

The Western Front, March–September 1918

As the German strength on the Western Front was being steadily increased by the transfer of divisions from the Eastern Front (where they were no longer needed since Russia had withdrawn from the war), the Allies’ main problem was how to withstand an imminent German offensive pending the arrival of massive reinforcements from the United States. Eventually Pétain persuaded the reluctant Haig that the British with 60 divisions should extend their sector of the front from 100 to 125 miles as compared with the 325 miles to be held by the French with approximately 100 divisions. Haig thus devoted 46 of his divisions to the front from the Channel to Gouzeaucourt (southwest of German-held Cambrai) and 14 to the remaining third of the front from Gouzeaucourt past German-held Saint-Quentin to the Oise River.

On the German side, between November 1, 1917, and March 21, 1918, the German divisions on the Western Front were increased from 146 to 192, the troops being drawn from Russia, Galicia, and Italy. By these means the German armies in the west were reinforced by a total of about 570,000 men. Ludendorff’s interest was to strike from his temporary position of strength—before the arrival of the major U.S. contingents—and at the same time to ensure that his German offensive should not fail for the same reasons as the Allies’ offensives of the past three years. Accordingly he formed an offensive strategy based on taking the tactical line of least resistance. The main German attacks would begin with brief but extremely intense artillery bombardments using a high

© 2020 Encyclopædia Britannica, Inc.

proportion of poison gas and smoke shells. These would incapacitate the Allies' forward trenches and machine-gun emplacements and would obscure their observation posts. Then a second and lighter artillery barrage would begin to creep forward over the Allied trenches at a walking pace (in order to keep the enemy under fire), with the masses of German assault infantry advancing as closely as possible behind it. The key to the new tactics was that the assault infantry would bypass machine-gun nests and other points of strong resistance instead of waiting, as had been the previous practice on both sides, for reinforcements to mop up the obstructions before continuing the advance. The Germans would instead continue to advance in the direction of the least enemy resistance. The mobility of the German advance would thus be assured, and its deep infiltration would result in large amounts of territory being taken.

Such tactics demanded exceptionally fit and disciplined troops and a high level of training. Ludendorff accordingly drew the best troops from all the Western Front forces at his disposal and formed them into elite shock divisions. The troops were systematically trained in the new tactics, and every effort was also made to conceal the actual areas at which the German main attacks would be made.

Ludendorff's main attack was to be on the weakest sector of the Allies' front, the 47 miles between Arras and La Fère (on the Oise). Two German armies, the 17th and the 2nd, were to break through the front between Arras and Saint-Quentin, north of the Somme, and then wheel right so as to force most of the British back toward the Channel, while the 18th Army, between the Somme and the Oise, protected the left flank of the advance against counterattack from the south. Code-named "Michael," this offensive was to be supplemented by three other attacks: "St. George I" against the British on the Lys River south of Armentières; "St. George II" against the British again between Armentières and Ypres; and "Blücher" against the French in Champagne. It was finally decided to use 62 divisions in the main attack, "Michael."

Preceded by an artillery bombardment using 6,000 guns, "Michael" was launched on March 21, 1918, and was helped by an early morning fog that hid the German advance from the Allied observation posts. The attack, which is known as the Second Battle of the Somme or the Battle of Saint-Quentin, took the British altogether by surprise, but it did not develop as Ludendorff had foreseen. While the 18th Army under von Hutier achieved a complete breakthrough south of the Somme, the major attack to the north was held up, mainly by the British concentration of strength at Arras. For a whole week Ludendorff, in violation of his new tactical emphasis, vainly persisted in trying to carry out his original plan instead of exploiting the unexpected success of the 18th Army, though the latter had advanced more than 40 miles westward and had reached Montdidier by March 27. At last, however, the main effort of the Germans was converted into a drive toward Amiens, which began in force on March 30. By that time the Allies had recovered from their initial dismay, and French reserves were coming up to the British line. The German drive was halted east of Amiens and so too was a renewed attack on April 4. Ludendorff then suspended his Somme offensive. This offensive had yielded the largest territorial gains of any operation on the Western Front since the First Battle of the Marne in September 1914.

The Allies' cause at least derived one overdue benefit from the collapse of one-third of the British front: at Haig's own suggestion, Foch was on March 26 appointed to coordinate the Allies' military operations; and on April 14 he was named commander in chief of the Allied armies. Previously, Haig had resisted the idea of a generalissimo.

On April 9 the Germans began "St. George I" with an attack on the extreme northern front between Armentières and the canal of La Bassée, their aim being to advance across the Lys River toward Hazebrouck. Such was the initial success of this attack that "St. George II" was launched the next day, with the capture of Kemmel Hill (Kemmelberg), southwest of Ypres, as its first objective. Armentières fell, and Ludendorff came to think for a time that this Battle of the Lys might be turned into a major effort. The British, however, after being driven back

© 2020 Encyclopædia Britannica, Inc.

10 miles, halted the Germans short of Hazebrouck. French reinforcements began to come up; and, when the Germans had taken Kemmel Hill (April 25), Ludendorff decided to suspend exploitation of the advance, for fear of a counterstroke against his front's new bulge.



The course of the war quickly changed once the American First Army began fighting in France.

Encyclopædia Britannica, Inc.

Thus far Ludendorff had fallen short of strategic results, but he could claim huge tactical successes—the British casualties alone amounted to more than 300,000. Ten British divisions had to be broken up temporarily, while the German strength mounted to 208 divisions, of which 80 were still in reserve. A restoration of the balance, however, was now in sight. A dozen U.S. divisions had arrived in France, and great efforts were being made to swell the stream. Furthermore, Pershing, the U.S. commander, had placed his troops at Foch's disposal for use wherever required.

Ludendorff finally launched "Blücher" on May 27, on a front extending from Coucy, north of Soissons, eastward toward Reims. The Germans, with 15 divisions, suddenly attacked the seven French and British divisions opposing them, swarmed over the ridge of the Chemin des Dames and across the Aisne River, and, by May 30, were on the Marne, between Château-Thierry and Dormans. Once again the attack's initial success went far beyond Ludendorff's expectation or intention; and, when the Germans tried to push westward against the right flank of the Allies' Compiègne salient, which was sandwiched between the Germans' Amiens and Champagne bulges, they were checked by counterattacks, which included one sustained for a fortnight from June 6 by U.S. divisions at Belleau Wood (Bois de Belleau). An attack from Noyon, against the left flank of the Compiègne salient, came too late (June 9).

Overtaken by the inordinate fruition of his own offensives, Ludendorff paused for a month's recuperation. The tactical success of his own blows had been his undoing; yielding to their influence, he had pressed each too far and too long, using up his own reserves and causing an undue interval between blows. He had driven three great wedges into the Allied lines, but none had penetrated far enough to sever a vital rail artery, and this strategic failure left the Germans with a front whose several bulges invited flanking counterstrokes. Moreover, Ludendorff had used up many of his shock troops in the attacks, and the remaining troops, though strong in numbers, were relatively lower in quality. The Germans were to end up sustaining a total of 800,000 casualties in their great 1918 offensives. Meanwhile, the Allies were now receiving U.S. troops at the rate of 300,000 men per month.

© 2020 Encyclopædia Britannica, Inc.



Engineers of the U.S. 3rd Infantry Division preparing to cross the Marne River near Mézy, France,...

National Archives, Washington, D.C.

The next German offensive, which opened the Second Battle of the Marne, was launched in Champagne on July 15. It came to nothing: a German thrust from the front east of Reims toward Châlons-sur-Marne was frustrated by the “elastic defense” that Pétain had recently been prescribing but that the local commanders had failed to practice against the offensive of May 27. A drive from Dormans, on the left flank of the Germans’ huge Soissons–Reims bulge, across the Marne toward Épernay simply made the Germans’ situation more precarious when Foch’s long-prepared counterstroke was launched on July 18. In this great counterstroke one of Foch’s armies assailed the Germans’ Champagne bulge from the west, another from the southwest, one more from the south, and a fourth from the vicinity of Reims. Masses of light tanks—a weapon on which Ludendorff had placed little reliance, preferring gas instead in his plans for the year—played a vital part in forcing the Germans into a hasty retreat. By August 2 the French had pushed the Champagne front back to a line following the Vesle River from Reims and then along the Aisne to a point west of Soissons.

Having recovered the initiative, the Allies were determined not to lose it, and for their next blow they chose again the front north and south of the Somme. The British 4th Army, including Australian and Canadian forces, with 450 tanks, struck the Germans with maximum surprise on August 8, 1918. Overwhelming the German forward divisions, who had failed to entrench themselves adequately since their recent occupation of the “Michael” bulge, the 4th Army advanced steadily for four days, taking 21,000 prisoners and inflicting as many or more casualties at the cost of only about 20,000 casualties to itself, and halting only when it reached the desolation of the old battlefields of 1916. Several German divisions simply collapsed in the face of the offensive, their troops either fleeing or surrendering. The Battle of Amiens was thus a striking material and moral success for the Allies. Ludendorff put it differently: “August 8 was the black day of the German Army in the history of the war.…It put the decline of our fighting power beyond all doubt.…The war must be ended.” He informed Emperor William II and Germany’s political chiefs that peace negotiations should be opened before the situation became worse, as it must. The conclusions reached at a German Crown Council held at Spa were that “We can no longer hope to break the war-will of our enemies by military operations,” and “the objects of our strategy must be to paralyse the enemy’s war-will gradually by a strategic defensive.” In other words, the German high command had abandoned hope of victory or even of holding their gains and hoped only to avoid surrender.

Meanwhile, the French had retaken Montdidier and were thrusting toward Lassigny (between Roye and Noyon); and on August 17 they began a new drive from the Compiègne salient south of Noyon. Then, in the fourth week of August, two more British armies went into action on the Arras–Albert sector of the front, the one advancing directly eastward on Bapaume, the other operating farther to the north. From then on Foch delivered a series of hammer blows along the length of the German front, launching a series of rapid attacks at different points, each broken off as soon as its initial impetus waned, and all close enough in time to attract German reserves, which consequently were unavailable to defend against the next Allied attack along a different part of the front. By the

© 2020 Encyclopædia Britannica, Inc.

early days of September the Germans were back where they had been before March 1918—behind the Hindenburg Line.

The Allies' recovery was consummated by the first feat executed by Pershing's U.S. forces as an independent army (hitherto the U.S. divisions in France had fought only in support of the major French or British units): the U. S. 1st Army on September 12 erased the triangular Saint-Mihiel salient that the Germans had been occupying since 1914 (between Verdun and Nancy).

The clear evidence of the Germans' decline decided Foch to seek victory in the coming autumn of 1918 instead of postponing the attempt until 1919. All the Allied armies in the west were to combine in a simultaneous offensive.

Other developments in 1918

Czechs, Yugoslavs, and Poles

Something must now be said about the growth of the national movements, which, under the eventual protection of the Allies, were to result in the foundation of new states or the resurrection of long-defunct ones at the end of the war. There were three such movements: that of the Czechs, with the more backward Slovaks in tow; that of the South Slavs, or Yugoslavs (Serbs, Croats, and Slovenes); and that of the Poles. The Czech country, namely Bohemia and Moravia, belonged in 1914 to the Austrian half of the Habsburg monarchy, the Slovak to the Hungarian half. The Yugoslavs had already been represented in 1914 by two independent kingdoms, Serbia and Montenegro, but they were also predominantly numerous in territories still under Habsburg rule: Serbs in Bosnia and Hercegovina (an Austro-Hungarian condominium) and in Dalmatia (an Austrian possession); Croats in Croatia (Hungarian), in Istria (Austrian), and in Dalmatia; Slovenes in Istria and in Illyria (Austrian likewise). Poland was divided into three parts: Germany had the north and the west as provinces of the Kingdom of Prussia; Austria had Galicia (including an ethnically Ukrainian extension to the east); Russia had the rest.

The Czechs had long been restless under the Austrian regime, and one of their leading intellectual spokesmen, Tomáš Masaryk (in fact a Slovak), had already envisaged the carving of Czechoslovak and Yugoslav states out of Austria-Hungary in December 1914. In 1916 he and a fellow émigré, Edvard Beneš, based respectively in London and in Paris, organized a Czechoslovak National Council. The western Allies committed themselves to the Czechoslovak idea from 1917 onward, when Russia's imminent defection from the war made them ready to exploit any means at hand for the disabling of Austria-Hungary; and Wilson's sympathy was implicit in his successive peace pronouncements of 1918.

For the South Slavs of Austria-Hungary the Yugoslav Committee, with representatives in Paris and in London, was founded in April 1915. On July 20, 1917, this committee and the Serbian government in exile made the joint Corfu Declaration forecasting a South Slav state to comprise Serbs, Croats, and Slovenes.

The Polish nationalist leaders in the first years of the war were uncertain whether to rely on the Central Powers or on the Allies for a restoration of Poland's independence. So long as the western Allies hesitated to encourage Polish nationalism for fear of offending imperial Russia, the Central Powers seemed to be the most likely sponsors; and Austria at least allowed Józef Piłsudski, from 1914, to organize his volunteer Polish legions to serve with Austrian forces against the Russians. Austria's benevolence, however, was not reflected by Germany; and when the Two Emperors' Manifesto of November 5, 1916, provided for the constitution of an independent Polish kingdom, it was clear that this kingdom would consist only of Polish territory conquered from Russia, not of any German or Austrian territory. When, after the March Revolution of 1917, the Russian provisional government had recognized Poland's right to independence, Roman Dmowski's Polish National Committee, which from 1914 had been functioning in a limited way under Russian protection, could at last count seriously on the sympathy of the

© 2020 Encyclopædia Britannica, Inc.

western Allies. While Piłsudski declined to raise a Polish army to fight on against the new Russia, a Polish army was formed in France, as well as two army corps in Belorussia and in Ukraine, to fight against the Central Powers. The Bolshevik Revolution and Wilson’s Fourteen Points together consummated the alignment of the Poles on the side of the western powers.

Eastern Europe and the Russian periphery, March–November 1918



Delegates at negotiations for the treaties of Brest-Litovsk, 1918.

George Grantham Bain Collection/Library of Congress, Washington, D.C. (digital file no. 26094)

The Treaty of Brest-Litovsk (March 3, 1918) gave Germany a free hand to do what it liked with Russia’s former possessions in eastern Europe. While they pursued their plan of 1916 for a kingdom of Poland, the Germans took new measures for the other countries. Lithuania, recognized as independent, was to be a kingdom under some German prince. Latvia and Estonia were to be merged into a grand duchy of the Baltikum under the hereditary rule of Prussia. An expeditionary force of 12,000 men, under General Graf Rüdiger von der Goltz, was sent to Finland to uphold the Finnish general C.G.E. Mannerheim’s nationalist forces against the Red Guards, whom the Bolsheviks, despite their recognition of Finland’s independence, were now promoting there. And finally, the Ukrainian nationalist government, which had already been challenged by a Communist one before its separate peace with the Central Powers (Brest-Litovsk, February 9), was promptly displaced by a new regime after the advance of German and Austro-Hungarian troops into its territory.

The Romanian armistice of December 1917 was converted into the Treaty of Bucharest on May 7, 1918. Under this treaty’s terms, southern Dobruja was ceded to Bulgaria; northern Dobruja was put under the joint administration of the Central Powers; and the latter obtained virtual control of Romania’s oil fields and communications. Romania, on the other hand, had some consolation from Bessarabia, whose nationalists, after receiving Romanian assistance against the Bolsheviks, had voted in March 1918 for their country’s conditional union with Romania.

Even Transcaucasia began to slide into the German camp. The short-lived federal republic was dissolved by its three members’ individual declarations of independence—Georgia’s on May 26, Armenia’s and Azerbaijan’s on May 28. Treaties of friendship were promptly signed between Georgia and Germany and between Armenia and Turkey, and Turkish troops advanced into Azerbaijan, where they occupied Baku on September 15. The western Allies, meanwhile, were hoping that some new semblance of an Eastern Front could be conjured up if they supported the various and growing forces in Russia that were opposed to the peacemaking Bolsheviks. Since the Black Sea and the Baltic were closed to them, the Allies could land troops only on Russia’s Arctic and Pacific shores. Thus, the Allied “intervention” in Russia on the side of the anti-Bolshevik (“White”) forces, long to be execrated by Soviet historians, began with an Anglo-French landing at Murmansk, in the far north, on March 9, 1918. The subsequent reinforcement of Murmansk made possible the occupation of the Murmansk railway as far south as Soroka (now Belomorsk); and a further landing at Arkhangelsk in the summer raised the total Allied strength in northern Russia to some 48,000 (including 20,000 Russian “Whites”). By this time, moreover, there were some 85,000 interventionist troops in Siberia, where a strong Japanese landing at Vladivostok in April had

© 2020 Encyclopædia Britannica, Inc.

been followed by British, French, Italian, and U.S. contingents. A “White” provisional government of Russia was set up at Omsk, with Admiral A.V. Kolchak as its dominant personality. The “White” resistance in the south of European Russia, which had been growing since November 1917, was put under the supreme command of General A.I. Denikin in April 1918.

The Balkan front, 1918

At Salonika the Allies’ politically ambitious but militarily ineffective commander in chief, General Sarrail, was replaced at the end of 1917 by General Guillaumat, who was in turn succeeded in July 1918 by General L.-F.-F. Franchet d’Esperey, who launched a major offensive in September with six Serbian and two French divisions against a seven-mile front held by only one Bulgarian division.

The initial assault, preceded by heavy bombardment at night, began in the morning of September 15, 1918, and a five-mile penetration was achieved by nightfall on September 16. The next day the Serbs advanced 20 miles forward, while French and Greek forces on their flanks widened the breach to 25 miles. A British attack, launched on September 18 on the front between the Vardar and Lake Doiran, prevented the Bulgars from transferring troops westward against the right flank of the penetration; and by September 19 the Serbian cavalry had reached Kavadarci, at the apex of the Crna–Vardar triangle. Two days later the whole Bulgarian front west of the Vardar had collapsed.

While Italian forces in the extreme west advanced on Prilep, the elated Serbs, with the French beside them, pressed on up the Vardar Valley. The British in the east now made such headway as to take Strumica, across the old Bulgarian frontier, on September 26. The Bulgars then sued for an armistice; and on September 29, when a bold French cavalry thrust up the Vardar from Veles (Titov Veles) took Skopje, key to the whole system of communications for the Balkan front, Bulgarian delegates signed the Armistice of Salonika, accepting the Allies’ terms unreservedly.

The Turkish fronts, 1918

The British–Turkish front in Palestine in the summer of 1918 ran from the Jordan River westward north of Jericho and Lydda to the Mediterranean just north of Jaffa. North of this front there were three Turkish “armies” (in fact, barely stronger than divisions): one to the east of the Jordan, two to the west. These armies depended for their supplies on the Hejaz Railway, the main line of which ran from Damascus southward, east of the Jordan, and which was joined at Déraa (Darʿā) by a branch line serving Palestine.

Liman von Sanders, Falkenhayn’s successor as commander of the Turkish forces in Syria–Palestine, was convinced that the British would make their main effort east of the Jordan. Allenby, however, was really interested in taking a straight northerly direction, reckoning that the Palestine branch rail line at ʿAfula and Beisān, some 60 miles behind the Turkish front, could be reached by a strategic “bound” of his cavalry and that their fall would isolate the two Turkish armies in the west.

Having by ruse and diversion induced the Turks to reduce their strength in the west, Allenby struck there on September 19, 1918, with a numerical superiority of 10 to one. In this Battle of Megiddo, a British infantry attack swept the astonished defenders aside and opened the way for the cavalry, which rode 30 miles north up the coastal corridor before swinging inland to cut the Turks’ northward lines of retreat. ʿAfula, Beisān, and even Nazareth, farther north, were in British hands the next day.

When the Turks east of the Jordan River began to retreat on September 22, the Arabs had already severed the railway line and were lying in wait for them; and a British cavalry division from Beisān was also about to push eastward to intercept their withdrawal. Simultaneously, two more British divisions and another force of Arabs

© 2020 Encyclopædia Britannica, Inc.

were racing on toward Damascus, which fell on October 1. The campaign ended with the capture of Aleppo and the junction of the Baghdad Railway. In 38 days Allenby's forces had advanced 350 miles and taken 75,000 prisoners at a cost of less than 5,000 casualties.

In Mesopotamia, meanwhile, the British had taken Kifrī, north of the Diyālā left-bank tributary of the Tigris, in January 1918, and Khān al-Baghdāḏī, up the Euphrates, in March. Pressing northward from Kifrī, they took Kirkūk in May but soon evacuated it.

The British centre in Mesopotamia, advancing up the Tigris in October, was about to capture Mosul when the hostilities were suspended. The Ottoman government, seeing eastern Turkey defenseless and fearing an Allied advance against Istanbul from the west now that Bulgaria had collapsed, decided to capitulate. On October 30 the Armistice of Mudros was signed, on a British cruiser off Lemnos. The Turks, by its terms, were to open the Straits to the Allies; demobilize their forces; allow the Allies to occupy any strategic point that they might require and to use all Turkey's ports and railways; and order the surrender of their remaining garrisons in Arabia, Syria, and Mesopotamia. The centuries-old Ottoman Empire had come to an end.

Vittorio Veneto

After the stabilization of the Italian front on the Piave River at the end of 1917, the Austrians made no further move until the following June. They then tried not only to force the Tonale Pass and enter northeastern Lombardy but also to make two converging thrusts into central Venetia, the one southeastward from the Trentino, the other southwestward across the lower Piave. The whole offensive came to worse than nothing, the attackers losing 100,000 men.

Diaz, the Italian commander in chief, was meanwhile deliberately abstaining from positive action until Italy should be ready to strike with success assured. In the offensive he planned, three of the five armies lining the front from the Monte Grappa sector to the Adriatic end of the Piave were to drive across the river toward Vittorio Veneto, so as to cut communications between the two Austrian armies opposing them.

When Germany, in October 1918, was at last asking for an armistice (see below The end of the German war), Italy's time had obviously come. On October 24, the anniversary of Caporetto, the offensive opened. An attack in the Monte Grappa sector was repulsed with heavy loss, though it served to attract the Austrian reserves, and the flooding of the Piave prevented two of the three central armies from advancing simultaneously with the third; but the latter, comprising one Italian and one British corps, having under cover of darkness and fog occupied Papadopoli Island farther downstream, won a foothold on the left bank of the river on October 27. The Italian reserves were then brought up to exploit this bridgehead.

Mutiny was already breaking out in the Austrian forces, and on October 28 the Austrian high command ordered a general retreat. Vittorio Veneto was occupied the next day by the Italians, who were also pushing on already toward the Tagliamento. On November 3 the Austrians obtained an armistice (see below).

The collapse of Austria-Hungary

The duality of the Habsburg monarchy had been underlined from the very beginning of the war. Whereas the Austrian parliament, or Reichsrat, had been suspended in March 1914 and was not reconvened for three years, the Hungarian parliament in Budapest continued its sessions, and the Hungarian government proved itself constantly less amenable to dictation from the military than had the Austrian. The Slav minorities, however, showed little sign of anti-Habsburg feeling before Russia's March Revolution of 1917. In May 1917, however, the Reichsrat was reconvened, and just before the opening session the Czech intelligentsia sent a manifesto to its deputies calling for "a democratic Europe…of autonomous states." The Bolshevik Revolution of November 1917

© 2020 Encyclopædia Britannica, Inc.

and the Wilsonian peace pronouncements from January 1918 onward encouraged socialism, on the one hand, and nationalism, on the other, or alternatively a combination of both tendencies, among all peoples of the Habsburg monarchy.

Early in September 1918 the Austro-Hungarian government proposed in a circular note to the other powers that a conference be held on neutral territory for a general peace. This proposal was quashed by the United States on the ground that the U.S. position had already been enunciated by the Wilsonian pronouncements (the Fourteen Points, etc.). But when Austria-Hungary, after the collapse of Bulgaria, appealed on October 4 for an armistice based on those very pronouncements, the answer on October 18 was that the U.S. government was now committed to the Czechoslovaks and to the Yugoslavs, who might not be satisfied with the “autonomy” postulated heretofore. The emperor Charles had, in fact, granted autonomy to the peoples of the Austrian Empire (as distinct from the Hungarian Kingdom) on October 16, but this concession was ignored internationally and served only to facilitate the process of disruption within the monarchy: Czechoslovaks in Prague and South Slavs in Zagreb had already set up organs ready to take power.

The last scenes of Austria-Hungary’s dissolution were performed very rapidly. On October 24 (when the Italians launched their very timely offensive), a Hungarian National Council prescribing peace and severance from Austria was set up in Budapest. On October 27 a note accepting the U.S. note of October 18 was sent from Vienna to Washington—to remain unacknowledged. On October 28 the Czechoslovak committee in Prague passed a “law” for an independent state, while a similar Polish committee was formed in Kraków for the incorporation of Galicia and Austrian Silesia into a unified Poland. On October 29, while the Austrian high command was asking the Italians for an armistice, the Croats in Zagreb declared Slavonia, Croatia, and Dalmatia to be independent, pending the formation of a national state of Slovenes, Croats, and Serbs. On October 30 the German members of the Reichsrat in Vienna proclaimed an independent state of German Austria.

The solicited armistice between the Allies and Austria-Hungary was signed at the Villa Giusti, near Padua, on November 3, 1918, to become effective on November 4. Under its provisions, Austria-Hungary’s forces were required to evacuate not only all territory occupied since August 1914 but also South Tirol, Tarvisio, the Isonzo Valley, Gorizia, Trieste, Istria, western Carniola, and Dalmatia. All German forces should be expelled from Austria-Hungary within 15 days or interned, and the Allies were to have free use of Austria-Hungary’s internal communications and to take possession of most of its warships.

Count Mihály Károlyi, chairman of the Budapest National Council, had been appointed prime minister of Hungary by his king, the Austrian emperor Charles, on October 31 but had promptly started to dissociate his country from Austria—partly in the vain hope of obtaining a separate Hungarian armistice. Charles, the last Habsburg to rule in Austria-Hungary, renounced the right to participate in Austrian affairs of government on November 11, in Hungarian affairs on November 13.

The final offensive on the Western Front

It was eventually agreed among the Allied commanders that Pershing’s American troops should advance across the difficult terrain of the Argonne Forest, so that the combined Allied offensive would consist of converging attacks against the whole German position west of a line drawn from Ypres to Verdun. Thus, the Americans from the front northwest of Verdun and the French from eastern Champagne, the former on the west bank of the Meuse, the latter west of the Argonne Forest, were to launch attacks on September 26, with Mézières as their objective, in order to threaten not only the Germans’ supply line along the Mézières–Sedan–Montmédy railway and the natural line of retreat across Lorraine but also the hinge of the Antwerp–Meuse defensive line that the Germans were now preparing. The British were to attack the Hindenburg Line between Cambrai and Saint-Quentin on September 27 and to try to reach the key rail junction of Maubeuge, so as to threaten the Germans’

© 2020 Encyclopædia Britannica, Inc.

line of retreat through the Liège gap. The Belgians, with Allied support, were to begin a drive from Ypres toward Ghent on September 28.



British troops passing through the ruins of Ypres, West Flanders, Belgium, September 29, 1918.

Encyclopædia Britannica, Inc.



British soldiers of the North Lancashire Regiment passing through liberated Cambrai, France, October ...

Encyclopædia Britannica, Inc.

The Americans took Vauquois and Montfaucon in the first two days of their offensive but were soon slowed down, and on October 14, when their attack was suspended, they had only reached Grandpré, less than halfway to Mézières. The French advance meanwhile was halted on the Aisne. The British, though they had broken through the German defenses by October 5 and thenceforward had open country in front of them, could not pursue the Germans fast enough to endanger their withdrawal. Nevertheless, the piercing of the Hindenburg Line unnerved the German supreme command. The Belgians were in possession of all the heights around Ypres by September 30.

The end of the German war

Georg von Hertling, who had taken the place of Michaelis as Germany’s chancellor in November 1917 but had proved no more capable than he of restraining Ludendorff and Hindenburg, tendered his resignation on September 29, 1918, the day of the Bulgarian armistice and of the major development of the British attack on the Western Front. Pending the appointment of a new chancellor, Ludendorff and Hindenburg obtained the Emperor’s consent to an immediate peace move. On October 1 they even disclosed their despondency to a meeting of the leaders of all the national political parties, thus undermining the German home front by a sudden revelation of facts long hidden from the public and its civilian leaders. This new and bleak honesty about

© 2020 Encyclopædia Britannica, Inc.

Germany’s deteriorating military situation gave an immense impetus to the native German forces of pacifism and internal discord. On October 3 the new chancellor was appointed: he was Prince Maximilian of Baden, internationally known for his moderation and honorability. Though Max demanded a few days’ interval lest Germany’s overture for peace should appear too obviously an admission of imminent collapse, the military leaders insisted on an immediate move. A German note to Wilson, requesting an armistice and negotiations on the basis of Wilson’s own pronouncements, was sent off in the night of October 3–4.

The U.S. answer of October 8 required Germany’s preliminary assent (1) to negotiations on the sole question of the means of putting Wilson’s principles into practice and (2) to the withdrawal of German forces from Allied soil. The German government’s note of October 12 accepted these requirements and suggested a mixed commission to arrange the postulated evacuation. On October 14, however, the U.S. government sent a second note, which coupled allusions to Germany’s “illegal and inhuman” methods of warfare with demands that the conditions of the armistice and of the evacuation be determined unilaterally by its own and the Allies’ military advisers and that the “arbitrary power” of the German regime be removed in order that the forthcoming negotiations could be conducted with a government representative of the German people.

By this time the German supreme command had become more cheerful, even optimistic, as it saw that the piercing of the Hindenburg Line had not been followed by an actual Allied breakthrough. More encouragement came from reports of a slackening in the force of the Allies’ attacks, largely because they had advanced too far ahead of their supply lines. Ludendorff still wanted an armistice, but only to give his troops a rest as a prelude to further resistance and to ensure a secure withdrawal to a shortened defensive line on the frontier. By October 17 he even felt that his troops could do without a rest. It was less that the situation had changed than that his impression of it had been revised; it had never been quite so bad as he had pictured it on September 29. But his dismal first impression had now spread throughout German political circles and the public. Though they had endured increasing privations and were half-starved due to the Allied blockade by mid-1918, the German people had retained their morale surprisingly well as long as they believed Germany had a prospect of achieving victory on the Western Front. When this hope collapsed in October 1918, many, and perhaps even most, Germans wished only that the war would end, though it might mean their nation would have to accept unfavourable peace terms. German public opinion, having been more suddenly disillusioned, was now far more radically defeatist than the supreme command.

A third German note to the United States, sent on October 20, agreed to the unilateral settlement of conditions for the armistice and for the evacuation, in the express belief that Wilson would allow no affront to Germany’s honour. The answering U.S. note of October 23 conceded Wilson’s readiness to propose an armistice to the Allies but added that the terms must be such as to make Germany incapable of renewing hostilities. Ludendorff saw this, militarily, as a demand for unconditional surrender and would therefore have continued resistance. But the situation had passed beyond his control, and on October 26 he was made to resign by the Emperor, on Prince Max’s advice. On October 27 Germany acknowledged the U.S. note.

Wilson now began to persuade the Allies to agree to an armistice and negotiations according to the U.S.–German correspondence. They agreed, with two reservations: they would not subscribe to the second of the Fourteen Points (on the freedom of the seas); and they wanted “compensation…for damage done to the civilian population…and their property by the aggression of Germany.” Wilson’s note of November 5 apprised the Germans of these reservations and stated that Foch would communicate armistice terms to Germany’s accredited representatives. On November 8 a German delegation, led by Matthias Erzberger, arrived at Rethondes, in the Forest of Compiègne, where the Germans met face to face with Foch and his party and were informed of the Allies’ peace terms.

© 2020 Encyclopædia Britannica, Inc.



Civil unrest and revolution breaking out in the face of Germany's imminent defeat in World War I and …

Contunico © ZDF Studios GmbH, Mainz; Thumbnail German Federal Archives (Bundesarchiv), Bild 183-18483-0001; Prints and Photographs Division/Library of Congress, Washington D.C.

Meanwhile, revolution was shaking Germany. It began with a sailors’ mutiny at Kiel on October 29 in reaction to the naval command’s order for the High Seas Fleet to go out into the North Sea for a conclusive battle. Though the U-boat crews remained loyal, the mutiny of the surface-ship crews spread to other units of the fleet, developed into armed insurrection on November 3, and progressed to open revolution the next day. There were disturbances in Hamburg and in Bremen; “councils of soldiers and workers,” like the Russian soviets, were formed in inland industrial centres; and in the night of November 7–8 a “democratic and socialist Republic of Bavaria” was proclaimed. The Social Democrats of the Reichstag withdrew their support from Prince Max’s government in order to be free to contend against the Communists for the leadership of the revolution. While William II, at Spa, was still wondering whether he could abdicate his imperial German title but remain king of Prussia, Prince Max, in Berlin on November 9, on his own initiative, announced William’s abdication of both titles. The Hohenzollern monarchy thus came to an end, joining those of the Habsburgs and the Romanovs. Prince Max handed his powers as chancellor over to Friedrich Ebert, a Majority Social Democrat, who formed a provisional government. A member of this government, Philipp Scheidemann, hastily proclaimed a republic. On November 10 William II took refuge in the neutral Netherlands, where on November 28 he signed his own abdication of his sovereign rights.

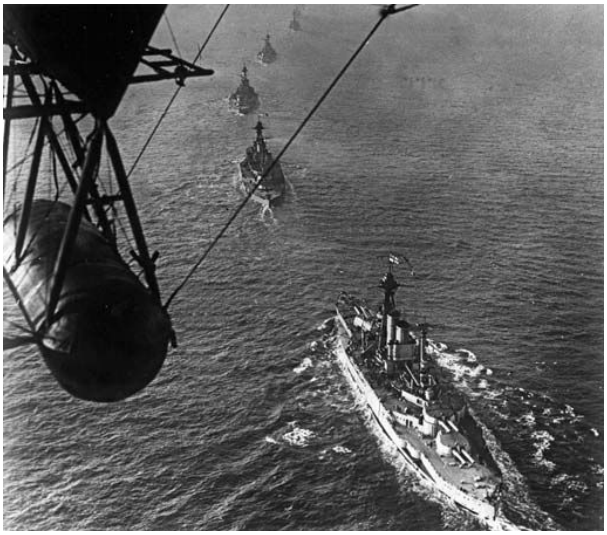
The Armistice



Parisians celebrating the end of World War I, November 11, 1918.

U.S. Signal Corps, Library of Congress, Washington, D.C. (reproduction no. LC-DIG-anrc-00498)

© 2020 Encyclopædia Britannica, Inc.



The British battleship Queen Elizabeth leading the surrendering German fleet, November 21, 1918.

Encyclopædia Britannica, Inc.

The Allies' armistice terms presented in the railway carriage at Rethondes were stiff. Germany was required to evacuate not only Belgium, France, and Alsace-Lorraine but also all the rest of the left (west) bank of the Rhine, and it had to neutralize that river's right bank between the Netherlands and Switzerland. The German troops in East Africa were to surrender; the German armies in eastern Europe were to withdraw to the prewar German frontier; the treaties of Brest-Litovsk and Bucharest were to be annulled; and the Germans were to repatriate all prisoners of war and hand over to the Allies a large quantity of war materials, including 5,000 pieces of artillery, 25,000 machine guns, 1,700 aircraft, 5,000 locomotives, and 150,000 railroad cars. And meanwhile, the Allies' blockade of Germany was to continue.

Pleading the danger of Bolshevism in a nation on the verge of collapse, the German delegation obtained some mitigation of these terms: a suggestion that the blockade might be relaxed, a reduction in the quantity of armaments to be handed over, and permission for the German forces in eastern Europe to stay put for the time being. The Germans might have held out longer for further concessions if the fact of revolution on their home front had not been coupled with the imminence of a new blow from the west.



U.S. troops in French tanks in northeastern France, October 10, 1918.

New York World-Telegram and the Sun Newspaper Photograph Collection/Library of Congress, Washington, D.C. (digital file no. LC-USZC2-6141)

Though the Allied advance was continuing and seemed in some sectors even to be accelerating, the main German forces had managed to retreat ahead of it. The Germans' destruction of roads and railways along the routes of their evacuation made it impossible for supplies to keep pace with the advancing Allied troops; a pause

© 2020 Encyclopædia Britannica, Inc.

in the advance would occur while Allied communications were being repaired, and that would give the Germans a breathing space in which to rally their resistance. By November 11 the Allied advance on the northern sectors of the front had come more or less to a standstill on a line running from Pont-à-Mousson through Sedan, Mézières, and Mons to Ghent. Foch, however, now had a Franco-U.S. force of 28 divisions and 600 tanks in the south ready to strike through Metz into northeastern Lorraine. Since Foch's general offensive had absorbed the Germans' reserves, this new offensive would fall on their bared left flank and held the promise of outflanking their whole new line of defense (from Antwerp to the line of the Meuse) and of intercepting any German retreat. By this time the number of U.S. divisions in France had risen to 42. In addition, the British were about to bomb Berlin on a scale hitherto unattempted in air warfare.



Allied and German officials at the signing of the armistice that ended the fighting in World War I,...

Encyclopædia Britannica, Inc.

Whether the Allies' projected final offensive, intended for November 14, would have achieved a breakthrough can never be known. At 5:00 AM on November 11, 1918, the Armistice document was signed in Foch's railway carriage at Rethondes. At 11:00 AM on the same day, World War I came to an end.

The fact that Matthias Erzberger, who was a civilian politician rather than a soldier, headed the German armistice delegation became an integral part of the legend of the "stab in the back" (*Dolchstoss im Rücken*). This legend's theme was that the German Army was "undefeated in the field" (*unbesiegt im Felde*) and had been "stabbed in the back"—*i.e.,* had been denied support at the crucial moment by a weary and defeatist civilian population and their leaders. This theme was adopted soon after the war's end by Ludendorff himself and by other German generals who were unwilling to admit the hopelessness of Germany's military situation in November 1918 and who wanted to vindicate the honour of German arms. The "stab in the back" legend soon found its way into German historiography and was picked up by German right-wing political agitators who claimed that Allied propaganda in Germany in the last stages of the war had undermined civilian morale and that traitors among the politicians had been at hand ready to do the Allies' bidding by signing the Armistice. Adolf Hitler eventually became the foremost of these political agitators, branding Erzberger and the leaders of the Social Democrats as the "November criminals" and advocating militaristic and expansionist policies by which Germany could redeem its defeat in the war, gain vengeance upon its enemies, and become the preeminent power in Europe.

Killed, wounded, and missing

The casualties suffered by the participants in World War I dwarfed those of previous wars: some 8,500,000 soldiers died as a result of wounds and/or disease. The greatest number of casualties and wounds were inflicted by artillery, followed by small arms, and then by poison gas. The bayonet, which was relied on by the prewar French Army as the decisive weapon, actually produced few casualties. War was increasingly mechanized from 1914 and produced casualties even when nothing important was happening. On even a quiet day on the

© 2020 Encyclopædia Britannica, Inc.

Western Front, many hundreds of Allied and German soldiers died. The heaviest loss of life for a single day occurred on July 1, 1916, during the Battle of the Somme, when the British Army suffered 57,470 casualties.

Sir Winston Churchill once described the battles of the Somme and Verdun, which were typical of trench warfare in their futile and indiscriminate slaughter, as being waged between double or triple walls of cannons fed by mountains of shells. In an open space surrounded by masses of these guns large numbers of infantry divisions collided. They fought in this dangerous position until battered into a state of uselessness. Then they were replaced by other divisions. So many men were lost in the process and shattered beyond recognition that there is a French monument at Verdun to the 150,000 unlocated dead who are assumed to be buried in the vicinity.

This kind of war made it difficult to prepare accurate casualty lists. There were revolutions in four of the warring countries in 1918, and the attention of the new governments was shifted away from the grim problem of war losses. A completely accurate table of losses may never be compiled. The best available estimates of World War I military casualties are assembled in Table 4.

Similar uncertainties exist about the number of civilian deaths attributable to the war. There were no agencies established to keep records of these fatalities, but it is clear that the displacement of peoples through the movement of the war in Europe and in Asia Minor, accompanied as it was in 1918 by the most destructive outbreak of influenza in history, led to the deaths of large numbers. It has been estimated that the number of civilian deaths attributable to the war was higher than the military casualties, or around 13,000,000. These civilian deaths were largely caused by starvation, exposure, disease, military encounters, and massacres.

John Graham Royde-SmithEB Editors

Additional Reading

JOHN KEEGAN, *The First World War* (1999), is a good dramatic overview. Comprehensive general accounts include GERARD J. DEGROOT, *The First World War* (2000); and SPENCER C. TUCKER, *The Great War 1914–1918* (1998). The contributions to HEW STRACHAN (ed.), *The Oxford Illustrated History of the First World War* (1998), an anthology, combine for a first-rate survey.

The best analysis of the war's origins is in HEW STRACHAN, *The First World War: To Arms* (2001), the first of a projected three volumes. HEW STRACHAN, *The First World War*, 1 vol. (2003), is a companion book of a video documentary also titled *The First World War* (2003), produced and narrated by JONATHAN LEWIS for the United Kingdom's Channel 4 television. The classic documentary, featuring interviews with veterans still living at the time and made with the cooperation of the Imperial War Museum, is *The Great War* (1964), produced by TONY ESSEX and GORDON WATKINS for the British Broadcasting Corporation and narrated principally by Sir Michael Redgrave.

NIALL FERGUSON, *The Pity of War* (1999), is best read as an extended interpretive essay. A more-detailed account is provided in LUIGI ALBERTINI, *The Origins of the War of 1914*, 3 vol. (1952–57, reissued 2005; originally published in Italian, 1942–43). *Facing Armageddon: The First World War Experience* (1996, reissued 2003), ed. by HUGH CECIL and PETER H. LIDDLE, includes a large number of excellent specialized essays covering the entire war. *Passchendaele in Perspective: The Third Battle of Ypres* (1997), ed. by PETER H. LIDDLE; and *At the Eleventh Hour: Reflections, Hopes and Anxieties at the Closing of the Great War, 1918* (1998), ed. by HUGH CECIL and PETER H. LIDDLE, focus on the later years. ROGER CHICKERING and STIG FÖRSTER (eds.), *Great War, Total War: Combat and Mobilization on the Western Front, 1914–1918* (2000, reissued 2006), addresses the war as a total experience.

© 2020 Encyclopædia Britannica, Inc.

JAY WINTER and RICHARD WALL (eds.), *The Upheaval of War: Family, Work and Welfare in Europe, 1914–1918* (1988, reissued 2005), an anthology, provides a comparison of home fronts. The contributions to JOHN HORNE (ed.), *State, Society, and Mobilization in Europe During the First World War* (1997, reissued 2002), offer case studies of responses to specific stresses. GERD HARDACH, *The First World War, 1914–1918* (1987), is strong on economics and is accessible to nonspecialists.

Among works on specific participants, HOLGER H. HERWIG, *The First World War: Germany and Austria-Hungary, 1914–1918* (1997), tells the story of the Central Powers' war with flair and insight. NORMAN STONE, *The Eastern Front, 1914–1917* (1975, reissued 1998), covers tsarist Russia's efforts. France's war is the focus of JEAN-JACQUES BECKER, *The Great War and the French People* (1985); and STÉPHANE AUDOIN-ROUZEAU, *Men at War, 1914–1918: National Sentiment and Trench Journalism in France During the First World War* (1991). GERARD J. DEGROOT, *Blighty: British Society in the Era of the Great War* (1996), challenges conventional wisdom. DAVID M. KENNEDY, *Over Here: The First World War and American Society* (1980, reissued 2004), analyzes the American experience.

On particular campaigns and theatres, MARTIN MIDDLEBROOK, *The First Day on the Somme* (1971, reissued 2006); and ALISTAIR HORNE, *The Price of Victory: Verdun 1916* (1962, reissued 1993), are general-audience works. ROBIN PRIOR and TREVOR WILSON, *Passchendaele: The Untold Story* (1996, reissued 2002), is an academic analysis; and JOHN R. SCHINDLER, *Isonzo: The Forgotten Sacrifice of the Great War* (2001), takes a similar approach to the Italian front. BARBARA W. TUCHMAN, *The Guns of August* (1962, reissued 2005), is a classic; it is best read in conjunction with SEWELL TYNG, *The Campaign of the Marne* (1935, reissued 2007), still a standard.

The routines of the Western Front are the subject of TONY ASHWORTH, *Trench Warfare 1914–1918: The Live and Let Live System* (1980, reissued 2004); and JOHN ELLIS, *Eye-Deep in Hell: Trench Warfare in World War I* (1976, reissued 2002). BRUCE I. GUDMUNDSSON, *Stormtroop Tactics: Innovation in the German Army, 1914–1918* (1989, reissued 1995), discusses the German attempt to find a tactical solution. TIM TRAVERS, *The Killing Ground* (1987, reissued 2009), and *How the War Was Won* (1992, reissued 2005), present the British approach; while BILL RAWLING, *Surviving Trench Warfare* (1992), is a Canadian counterpoint. G.D. SHEFFIELD, *Leadership in the Trenches* (2000), covers officer-man relations in the British army; and PETER SIMKINS, *Kitchener's Army* (1988, reissued 2007), analyzes the last great volunteer force. DOUGLAS PORCH, *The March to the Marne: The French Army 1871–1914* (1981, reissued 2003), is excellent on the French army within its prewar context. LEONARD V. SMITH, *Between Mutiny and Obedience* (1994), interprets the mentality of the French wartime force by focusing on one of its divisions. EDWARD M. COFFMAN, *The War to End All Wars* (1968, reissued 1998); and JAMES H. HALLAS (ed.), *Doughboy War* (2000), combine to present the American Expeditionary Force experience. EDWARD J. ERICKSON, *Ordered to Die* (2000), surveys the Ottoman army.

On the war at sea, ARTHUR J. MARDER, *From the Dreadnought to Scapa Flow*, 2nd ed., rev. and enlarged, 5 vol. (1978–), is a detailed presentation from a British perspective. PAUL G. HALPERN, *A Naval History of World War I* (1994), is more comprehensive and less forbidding. ROBERT K. MASSIE, *Dreadnought: Britain, Germany, and the Coming of the Great War* (1991), a detailed and anecdotal treatment of the naval arms race leading up to the war, focuses on the personal rivalry between the opposing monarchs. ROBERT K. MASSIE, *Castles of Steel: Britain, Germany, and the Winning of the Great War at Sea* (2003), is an equally exhaustive sequel that carries the rivalry through the great naval battles of the war.

JOHN H. MORROW, *The Great War in the Air* (1993, reissued 2009); and LEE KENNETT, *The First Air War, 1914–1918* (1991), cover the new "third element" of conflict.

© 2020 Encyclopædia Britannica, Inc.

The war's mentalities are discussed in MODRIS EKSTEINS, *Rites of Spring: The Great War and the Birth of the Modern Age* (1989, reissued 2000); and in PAUL FUSSELL, *The Great War and Modern Memory* (1975, reissued 2009), a classic. JOHN HORNE and ALAN KRAMER, *German Atrocities, 1914: A History of Denial* (2001), analyzes the psychology of atrocities. JAY WINTER, *Sites of Memory, Sites of Mourning: The Great War in European Cultural History* (1995), deals with emotional legacies.

On the peace, contributions to MANFRED F. BOEMEKE, GERALD D. FELDMAN, and ELISABETH GLASER (eds.), *The Treaty of Versailles: A Reassessment After 75 Years* (1998, reissued 2006), combine to make a case that the Versailles treaties offered at least reasonable possibilities for reconstruction and reconciliation. ARNO J. MAYER, *The Politics and Diplomacy of Peacemaking: Containment and Counterrevolution at Versailles* (1967), stresses Western fear of radicalism in determining the peace processes.

Dennis E. ShowalterEB Editors

Citation (MLA style):

"World War I." *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 28 Jul. 2023. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

IMAGE

Curie, Marie; mobile radiological unit



Marie Curie driving a car converted into a mobile radiological unit used to treat wounded soldiers during World War I, 1914.

© 2020 Encyclopædia Britannica, Inc.

Photos.com/Getty Images

Citation (MLA style):

Curie, Marie; mobile radiological unit. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

IMAGE

World War I: gas masks



British soldiers wear gas masks while undergoing firearms training during World War I. Poisonous gas was first used on the Western Front in April 1915, in a German attack with chlorine. Afterward, troops had to be prepared to work and fight while wearing gas masks to protect them from chemical warfare.

Encyclopædia Britannica, Inc.

Citation (MLA style):

World War I: gas masks. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

World War I: phosphorus bomb



A white phosphorus bomb explodes while Allied troops conduct a night attack at Gondrecourt, France, in 1918, during World War I.

U.S. Signal Corps/Library of Congress, Washington, D.C. (photo no. 32460/25123)

Citation (MLA style):

World War I: phosphorus bomb. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

British troops in World War I



British troops in a trench on the Western Front during World War I.

Encyclopædia Britannica, Inc.

Citation (MLA style):

British troops in World War I. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

trench warfare



American soldiers throwing hand grenades toward Austrian trenches during World War I, September 1918.

Sgt. A. Marcioni/U.S. Department of Defense

Citation (MLA style):

Trench warfare. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

Meuse-Argonne offensive



U.S. soldiers use gas equipment as they receive telephone instructions during the Meuse-Argonne offensive in France in 1918.

National Archives, Washington, D.C.

Citation (MLA style):

Meuse-Argonne offensive. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

Maxim machine gun



German infantrymen operating a Maxim machine gun during World War I.

Imperial War Museum

Citation (MLA style):

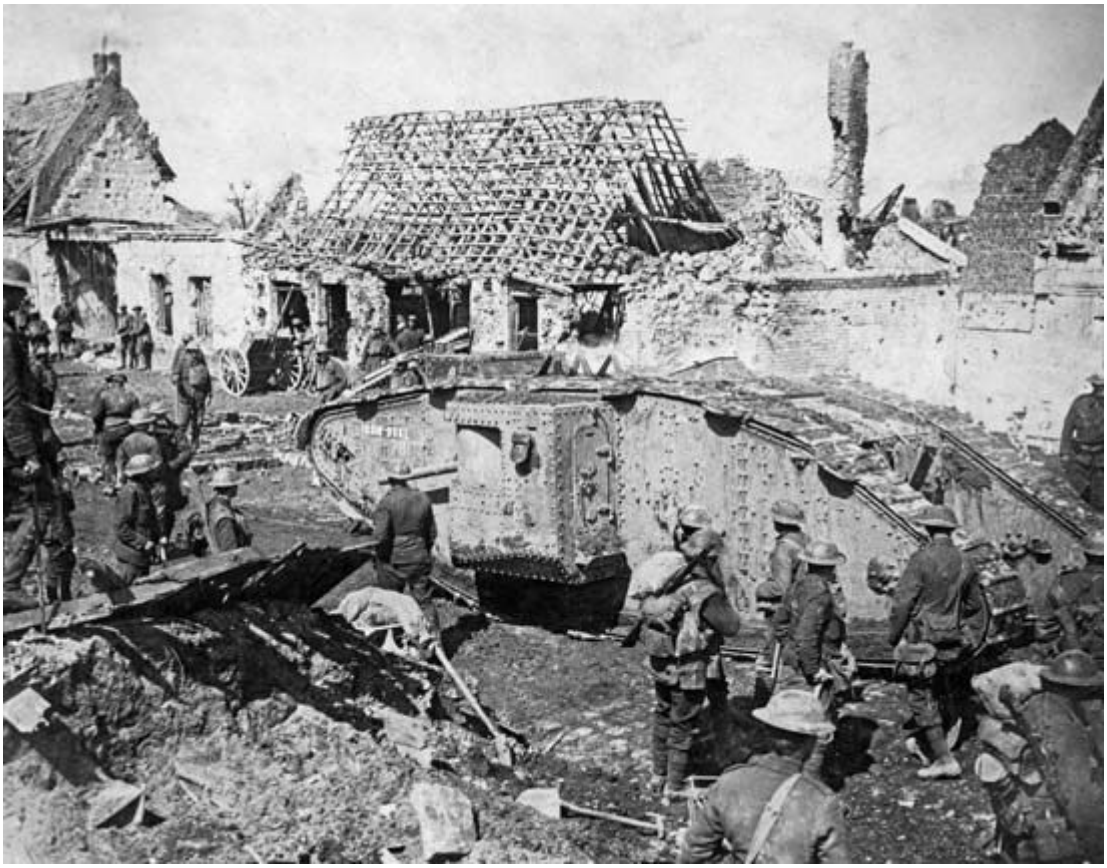
Maxim machine gun. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

British tank in World War I



A British tank at the Western Front, World War I.

Encyclopædia Britannica, Inc.

Citation (MLA style):

British tank in World War I. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

World War I: gas masks



German soldiers operate a machine gun while they wear gas masks. Soldiers in World War I had to wear gas masks as protection from chemical weapons.

Encyclopædia Britannica, Inc.

Citation (MLA style):

World War I: gas masks. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

Somme; machine gun



French soldiers operating a Saint-Étienne machine gun at the Somme, World War I.

Encyclopædia Britannica, Inc.

Citation (MLA style):

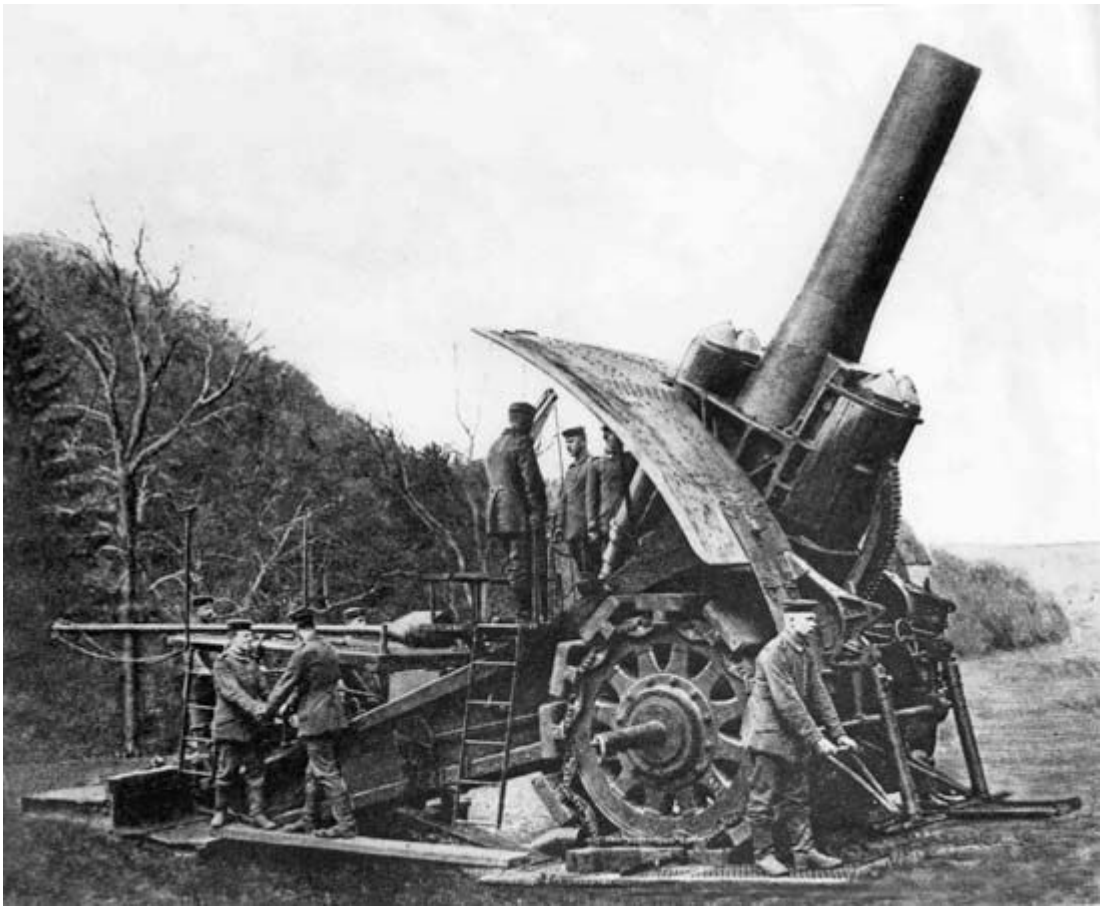
Somme; machine gun. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

IMAGE

German howitzer



The Germans developed Big Bertha howitzer guns that smashed the Belgian and French forts in 1914.

Marc Romanych

Citation (MLA style):

German howitzer. Image. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.

© 2020 Encyclopædia Britannica, Inc.

VIDEO

Brutal truths of the Battle of Verdun

Video Transcript

NARRATOR: 1916 – it’s been over a year since the beginning of war. The German attack is bogged down in France, a static warfare of heavy losses. Carnage is routine, death is everywhere. The new chief of staff Erich von Falkenhayn advises the Emperor to put the front in motion again. His pursuit is the decisive battle in the West. The Emperor grants the general’s wishes. The German troops have advanced up to 120 kilometers into

© 2020 Encyclopædia Britannica, Inc.

French territory. But the strong defenses on the Meuse block the path to Paris. To the west of Metz, in the vicinity of Verdun, German troops are poised to penetrate French fortifications. On the first of February, 1916 the battle begins with a barrage. In preparation for attack, thousands of artillery guns of all calibers bombard the French bulwarks. The key bastion of Fort Douaumont, with its cannons, machine guns and concealed armored turrets, is considered impregnable. But it is inadequately manned. After five days and immense losses, the Germans conquer the Fort. MAURICE BOURGEOIS: "Our defenses were completely destroyed as a result. Thousands of shells fell on the battlefield." NARRATOR: It is up to General Henri-Philippe Pétain to save France. He is an experienced strategist and a cunning propagandist. BOURGEOIS: "'Courage, courage! We'll get them!' We knew what this meant: To save Verdun at any price. 'Courage! We'll stop them. They won't get through!'" NARRATOR: It is a bitter fight for every meter. Attacks. Counterattacks. There are no victors, only losers. GUSTAV-ADOLPH GRAF VON HALEM: "Looking at all these victims, you couldn't feel enthusiastic, only obedient, and that's what we were." NARRATOR: Verdun is now known as the bone mill. Soldiers become mere materials for a war of attrition. The use of flame throwers and poison gas grenades brings only more suffering and no new breakthroughs. But the mass slaughter continues until December 1916. The fronts are unchanged. And hundreds of thousands of dead remain in the soil of Verdun.

Overview of the Battle of Verdun, 1916.

Contunico © ZDF Studios GmbH, Mainz; Thumbnail © Awcnz62/Dreamstime.com

---

Citation (MLA style):

Brutal truths of the Battle of Verdun. Video. *Britannica LaunchPacks: World War I: Technology*, Encyclopædia Britannica, 1 Mar. 2024. packs-learn.eb.com.au. Accessed 27 Aug. 2024.

While every effort has been made to follow citation style rules, there may be some discrepancies. Please refer to the appropriate style manual or other sources if you have any questions.