**Notes on HIS 410**

**War and Peace since 1914**

**Defining the concept of war and peace**

Ordinarily, the term war connotes conflicts, crisis and violence involving the destruction of lives and properties. The term war is as old as humanity, as the concept exists in virtually all societies of the world. Conflicts and crisis take different forms and occur at various scales and magnitudes in all spheres of lives. For instance, war takes place at limited scale within the family, that is, between husband and wife, parents and children. Beyond the family at the level of the society there are conflicts between one village and another, between one ethnic group and another. Yet at a higher level of the society, war takes place between one kingdom and the other, and between one state or nation and the other etc. However, not all forms of social conflicts and crisis constitute war.

Technically, the professionals will reserve the definition of the concept of war to mean any conflict and crisis that occur between organised states or nations in which the motives, intensions, and reasons for the war are clearly and without ambiguity set out and understood by both parties before the declaration of the war. By implication, this is different from small scale skirmishes, surprise attacks which take different forms like inter and intra ethnic conflicts, terrorism (Al Qaeda, Boko Haram, ISIS), and raiding, etc. In essence, as a rule, war must involve one organised sovereign state and another. But conflict and crisis do take place within the same country as have occurred in the past or even recently in several African countries. Such internal conflicts are referred to as civil wars. Cases of civil wars are numerous like the revolutionary wars that have recently swept across the whole of Northern Africa (Algeria, Libya. Tunisia, Egypt); East Africa (Somalia, Ethiopia, Uganda); Eastern Europe (Chechnya), Syria, Iran, Iraq, South America (Ecuador, Brazil, Bolivia, Chile)etc

The phenomenon of warfare which has dominated and permeated all aspects of humanity has drawn the attention of great statesmen of the world and scholars from virtually every discipline. Each of the discipline has its own explicit definition, around which it has formulated different types of hypothesis and theories to explain not only the meaning but also the significant role of war, its tactics, strategies and weapons in societies. From the vast array of studies, scholars have come up with different types of wars such as primitive, classical, medieval, modern, colonial, guerrilla, liberation, atomic, nuclear, biological and chemical, terrorism etc.

From the vast array of literature on the definitions and theories of the concept of war, one of the best definitions that one may well associate with is that of Carl von Clausewitz. According to him, “war is the continuation of dialogue by other means.” One of the favourite questions in this course is to ask students to comment on Clausewitz view about the definition of the concept of war. Students should be motivated to go into the internet and find as many definition and theories of the concept of war and write these as part of their continuous assessments.

Write a set of class discussion questions and give it to the class.

**The Role of War**

The question is what is the role of war in the society? In response it is worth noting that, if war has no value, then people would not engage in it. Despite the attendant destructions of lives and properties, war is still desirable and valuable to make people always to engage in it, what then is the importance of war? In spites of its horrors, war is mother of invention. It is behind almost all kinds of scientific and technological development. The transformation of societies from the smallest social and political units to largest scale state structures has been possible only through warfare. Rulers and great statesmen normally rise to power and authority through the mobilisation and use of military force. Thus warfare has been an important source of employment into the armed forces which have been divided into several professions. Today the military is perhaps one of largest employer of labour in every society. This is evident in the organisation and division of the military into different professional bodies such as the army, air force, navy, customs, immigration, police and civil defence. Let me give you an idea of what is happening elsewhere. Do you know that the number of police force employed in the city New York only is larger than the number of all the police force recruited in the whole of Nigeria?

In conclusion the significance of war can be summed up as follows:

* War has been one of the most powerful engines of human development. The ability of mankind to successfully conquer and harness the resources of nature for the improvement of life has been through constant struggles. Putting it differently, war is regarded as a powerful weapon of change.
* In very many cases, war between two or more nations may invoke the spirit of nationalism and suppress any internal divisions within the states thereby serving as a rally point against a common enemy. Such unity may last for a short or long time.
* War has been behind most scientific discoveries, inventions and the production of tools and weapons. While tools are useful in the production of food, domestication and breeding of animals, weapons are indispensable implements for defence, conquest and the formation of large centralize states. In essence, war is intrinsically tied to the manufacture of tools and weapons and ultimately inevitable in the process of state formation.
* It is within these positive perspectives of looking at conflicts and crisis that one of the great philosophers on the theories of war, Carl von Clausewitz (1780-1831) has defined war as “the continuation of dialogue by other means.” As a matter of fact, almost without exception, it can be said that all kinds of wars are fought in the pursuit of peace. This leads us to the definition of peace.

**Peace**

What is peace? Someone has defined peace as the absence of war. But peace means much more than that. It is a process and condition in which all organized communities or states can expect to achieve a sufficient proportion of their aims non-violently, so that a resort to physical force by any one of them would be regarded as unnecessary, irrational and totally illegitimate. By contrast, while war on the one hand, uses physical force as a means of resolving political differences, peace on the other hand, seeks for broad basis of agreement, consensus, and compromise through mutual discussions. There is one common denominator underlining both war and peace, that is, they all pursue their ends through international cooperation.

But there are contradictions in the meaning of peace. This is particularly with respect to how large state organisation attained their level of social, political and economic development. The process was achieved through warfare. In other words the process of the formation of statehood and the management and maintenance of peace within it was through coercion, that is, by the instrument of force. So that what those in power and authority will call peace will never be same for the subject people. By implication, peace to the subjected people means domination, the denial of freedom, suppression of opposition, etc. For example, during the ancient times, when the Romans conquered the then known world and imposed law and order throughout their empire, they proclaimed that there was universal peace in the whole world. This was known as *Pax Romagna*. Similarly when the British conquered most parts of the world in the 20th century, she was proud to claim that she had imposed universal peace, popularly called Pax Britannica.

The next question is what is the significance or the role of peace? At whatever level one may wish to answer this question, just as no one cannot deny the contribution of war in the transformation of society, so also is the desirability of peace for all aspects of human development. It is in recognition of the important role of peace that different organisations have been constituted and formed at the local, national and international levels for the maintenance and preservation of peace in which social, political, technological, economic and scientific development can take place. Besides the formation of temporary or ad hoc arbitration to negotiate peaceful resolution of conflicts and crisis between communities, there are individual and private initiatives that exist with the sole objective of promoting peaceful coexistence at the local, national and international levels, such as Human Right Watchdog. The largest international body concerned with the management, maintenance and preservation of peace in the world is the UNO.

* Students should search for more details about the definition and theory of peace, the different organisations for peace at local, national and international levels, their objectives and avenues they use in attaining their goals

**The Weapons of War**

The manufacture and production of weapons of war is perhaps one of the most lucrative and flourishing business in the world. At the most primitive and elementary levels, weapons of warfare consisted of crude implements such as flints, clubs, bows and arrows etc. The sources for the manufacture and production of these implements were available at every locality. Societies that did not produce weapons of war obtained them from their immediate and distance neighbours. While the knowledge and technology was universal some societies had better advantage than others and so produced more advanced and sophisticated weapons than their neighbours. In the course of many generations the science and technology of the production of weapons have developed and past from the use of crude implements (which are now absolute) to more sophisticated use of guns and pistols, rockets and grenades, explosives and mines, atomic bombs, biological and chemical warheads. Today, computer science and technology that now dominate and rule the whole world has its origin is rooted in war. In other word, the computer was invented first as an instrument of war.

**The Development of Warfare Technology**

The development of warfare technology has gone a long way from the manufacture of crude implements to highly sophisticated dangerous and destructive modern weapons. Even the guns and pistols, atomic bombs biological and chemical warheads have all been replaced by guided scud missiles, self- propelled air jets, et cetera

**Strategies and Tactics of Warfare**

Students should find appropriate definitions for these military terms. The application of science and technology in warfare have revolutionised the strategies and tactics of wars. Since battles are no longer fought on the grounds or at seas but largely in the air, soldiers are no longer deployed to war fronts to confront their opponents. Guided scud missiles and self-propelled air jets are usually dispatch against enemy camps.

**Class Presentation and Discussion Questions**

1. In groups of three to four write answer to one of the following questions for presentation in class
2. Individually answer any question other than the one done by your group
3. Provide definitions and theories for the concept of war and peace.
4. What is the distinction between war and other forms of social conflicts?
5. Comment on the view that “war is the continuation of dialogue by other means.”
6. Attempt a comparative analysis of the main ideas and theories of Carl Von Clausewitz and Sun Tsu
7. Write short notes on the following:-

a). Total War

b). Absolute War

c). Guerrilla Warfare

d). Cold War

e). Terrorist War

1. How do you define the concept of peace?
2. Examine the relationship between warfare and technological development.
3. What do you understand by strategy and tactics in warfare?
4. Examine the threat to world security by the proliferation of warfare technology in the hands of access of evil
5. Analyse the problems of arms and nuclear control by the international community
6. To what extent was economic rivalries and imperialism the main cause of the World War I?
7. Assess the role of women in the World War I
8. Discuss the main factors that led to the collapse of the League of Nations.
9. Examine the organisation of Liberation wars against the imperialist powers by any colonised country of your choice
10. What are the implications of using chemical and biological weapons in warfare?
11. What do you understand by guided scud missiles in warfare?
12. Examine the history of computer as a weapon of warfare
13. Evaluate the advantages and disadvantages of self-controlled air planes in modern warfare
14. Account for the absence of peace among the advanced as well as the developing nations of the world.
15. How has warfare affected the development of science and technology during the 20th and 21st centuries?
16. Analyse the new strategies and tactics of modern warfare.
17. Discuss the problems of small arms control in the national security of developing nations in the 20th and 21st centuries.
18. Define the concept of nation and the significance of nationalism in the preservation of peace and security in the modern world.
19. Examine the reasons for and against the conscription of women in the military by some developing countries of the world
20. Evaluate the role of the air force and navy in modern warfare.
21. Why is the production of arms and ammunition one of the most lucrative and flourishing industries in the contemporary world?
22. What are the methods employed by the international community in the attempt to promote and preserve international peace in the 20th and 21st centuries?
23. Analyse the significance of peace and security in the contemporary world?
24. Assess the role of the African Union as an international organ for the maintenance of peace and security in the African continent.

INDUSTRIAL REVOLUTION. The term Industrial Revolutionis normally reserved for a set of events that took place in Britain roughly from 1760 to 1830. The historical events in question consisted of a set of technological, economic, and social changes that in the long run revolutionized not just the British economy but that of the rest of western Europe, North America, and eventually much of the rest of the world. The Industrial Revolution brought about a “modern” economy in which technological progress did not just happen from time to time in isolated sectors but became a sustained and continuous process, resulting eventually in unprecedented economic growth and increases in living standards in much of the world. Its effects led to a complete reorganization of production, consumption, locational patterns, international relations, demographic behavior, and almost every aspect of the human condition. Yet unlike the American and French revolutions that were contemporaneous with it, the Industrial Revolution brought economic changes that were neither dramatic nor very abrupt. There are no industrial equivalents to the Battle of Lexington or the conquest of the Bastille. Yet in the economic history of humankind, the Industrial Revolution marks a watershed. Although some other events are sometimes designed as “industrial revolutions,” to say nothing of “agricultural,” “demographic,” and other assorted revolutions, none of them equals the Industrial Revolution in importance. The Industrial Revolution was not the beginning of “industrialization”; much manufacturing had already been taking place in European cities and in the countryside by the middle of the eighteenth century. Nor did the Industrial Revolution increase by much the number of human hours spent on manufacturing processes; industrial output expanded greatly, but in the long run productivity increased so much that labor could be siphoned off into services. Nor was the Industrial Revolution the beginning of innovation as a force for change in the human condition; early medieval and renaissance Europe had witnessed a series of inventions that revolutionized agriculture, textiles, power use, shipping, iron making, communications, and warfare. Nor was the Industrial Revolution the absolute beginning of economic growth as such; the British economy in 1700 was clearly much richer than it had been at any point in its past, as Adam Smith had already noted. The Industrial Revolution was in some sense a change in the degree of change—but in economic history degree and amount are everything. It should be emphasized nonetheless that the classic Industrial Revolution was a localized affair, one that most Britons were only dimly growing aware of. Napoleon famously referred to Britain as a nation of “shopkeepers,” not “cotton spinners.” Many of the most interesting developments took place in two or three loci; a number of counties

around Lancashire and the town of Manchester, the Scottish Lowlands, and some smaller regions in the midlands and Wales saw almost all of the action. In the eastern parts of the country and the area south of London, there was little evidence of rapid economic change before 1830. After 1830, the structural change in the economy accelerated rather than wound down, thanks to the railroads, the telegraph, and the spreading of technological changes to new industries. The foundations of a new economy in which change was the normal condition were laid from 1760 to 1830.

Technology was at the core of everything. An anonymous schoolboy, immortalized in a classic 1948 book by T. S. Ashton, called the Industrial Revolution “a wave of gadgets” that swept Britain. Yet these inventions did not rain upon Britain like manna from heaven. Technology may have been an engine that propelled the economy forward, but it took its fuel from a society and an economy that were exceptional, not just relative to non-European nations but even in comparison to its close European competitors and enemies such as France and the United Provinces. Eighteenth-century Britain was what we may call a technologically competent society. It was teeming with engineers, mechanics, millwrights, and dexterous and imaginative tinkerers who spent their time and energy designing better pumps, pulleys, and pendulums. Even wealthy landowners and merchants displayed a fascination with technical matters. Men such as John Smeaton, often called the first modern engineer, Joseph Bramah, thought of as the originator of hydraulic power, and the prodigiously gifted engineer Richard Roberts could turn to almost any technical question and resolve it as well as could be done. Britain had an unusual number of such people. One famous quote from a Swiss visitor in Britain in 1766 declared that for a thing to be perfect it had to be invented in France and worked out in England. As it turned out, some of the great inventions of the Industrial Revolution were produced in Britain, whereas others came from the Continent. Yet in the kind of society that Britain was in these years the question of “where it came from” was not important. “Does it work?” and “Can it make money?” were what mattered. The main technological breakthroughs of the Industrial Revolution were the famous ones listed in high school history textbooks; yet these “heroic” inventions were only the tip of the iceberg. Right below them lay a large number of important breakthroughs that solved major bottlenecks and opened the door to further improvements. A third layer contained an even larger number of small improvements, adjustments, new applications, and minor technical insights that never made it to the patent office, much less to the history of technology books; yet they, maybe more than the textbook inventions, consolidated the achievements of ingenuity and imagination in terms of productivity gains. The most famous invention of the Industrial Revolution was the steam engine. Strictly speaking, the steam engine was the result of work carried out, mostly on the Continent, in the last third of the seventeenth century. The first steam engine prototype was built by a Frenchman named Denis Papin, but there is no question that the first useful atmospheric steam engine was built in 1712 by a Cornish mechanic named Thomas Newcomen. For half a century Britain used Newcomen engines, which, though noisy and voracious in their fuel use, served mostly as pumps. The conversion of the steam engine into a source of industrial power was the handiwork of Scottish inventor James Watt, who introduced a number of famous improvements to the steam engine, such as a separate condenser, the principle of double-acting expansion, improved gears, and regulators. Watt turned steam power from an atmospheric pump to a true steam engine. When his patent expired in 1800 after thirtyone years, a new principle in steam power, the high-pressure engine, was developed, which soon threatened the Watt engine’s monopoly. High-pressure engines provided increased power from engines lighter and smaller than older counterparts, and were thus ideal for transportation; and after years of experimentation they were successfully adapted to locomotives by Robert and George Stephenson, in 1825. Yet the steam engine, its psychological impact and technological future aside, had a relatively minor impact on the British economy before the advent of the railroad. Of about twenty-two hundred machines operating in Britain in 1800, almost half were employed in mining and quarrying, and about 40 percent in manufacturing. By 1835 Lancashire had switched over to steam, but the cotton industry in the rest of Britain still depended on water mills for about half its horsepower. The Industrial Revolution witnessed enormous progress in the utilization of waterpower, above all Smeaton’s breast wheel (which combined the advantages of over- and undershot wheels), and the growing use of iron in the manufacturing of water wheels. Even more than did steam, waterpower benefited from the growing scientific understanding of its principles, especially among hydraulic engineers in France. In other nations, especially the United States, France, and Switzerland, waterpower remained of central importance. A second industry often identified with the most dynamic aspects of the technology of this time is textiles. By the middle of the eighteenth century, cotton was a small and rather unimportant sideshow in the British textile industry, famous for its woolens. Cotton’s growth during the Industrial Revolution was truly amazing. Value added in cotton went from less than half a million pounds in 1760 to around 25 million in the mid-1820s. It is no wonder that some economic historians have thought of this industry as the “leading sector” in the Industrial Revolution. The reason for this success was cotton’s physical characteristics. It lent itself uniquely to mechanization and mass production and produced a good that was of even quality, attractive, and above all inexpensive. The weaving of cotton had already gained in productivity when the flying shuttle was introduced in the 1730s and 1740s, but spinning in 1760 was still carried out by hand. As long as spinning remained a manual process, the yarn produced remained both costly and of uneven quality. This bottleneck was resolved by a string of brilliant mechanical inventions between 1765 and 1779, which led to the famous mule (so-named because it consisted of a combination of the 1765 spinning jenny and the throstle), patented in 1769. The mule became the industrial machine par excellence, and within a few years it was coupled to the steam engine, so that the first truly “modern” factory (or “mill” as it was known at the time) was born. The mule was perfected in 1825 by making it automatic through the introduction of the self-actor. An indication of the magnitude of the improvements attained is shown by the number of hours needed to spin a hundred pounds of cotton. The “old” technology employed an Indian hand spinner, who took about 50,000 hours. The mule brought that number down to around 300 hours in the 1790s, and three decades later the self-actor reduced the figure to 135. Many of the other processes used in manufacturing cotton were also mechanized to some extent, though some of the problems proved more difficult than others. Carding, the process that prepared the cotton for spinning, was mechanized early on; ginning, the removal of the seeds from the raw cotton, was mechanized in 1793. Weaving by machine turned out to be more difficult, and power looms did not become successful until after 1820, though their use then spread rapidly. Calico printing was mechanized by the invention of copper rollers that printed patterns on finished cloth. Bleaching was revolutionized by the introduction of chlorine-based bleaching agents in the 1790s. By 1830 only the extremes of the upstream and the downstream of the industry were not mechanized: raw cotton was still grown and picked by hand in American fields, largely by black slaves; and finished clothes were still sewn together by hand by apparel makers, seamstresses, and tailors. Growth in the mechanization of textiles was not confined to cotton, but the other textiles inevitably lost a great deal of market share. Worsted (combed wool) yarns were easily adapted to the cotton spinning machinery, but the combing process itself was not mechanized successfully until the middle of the nineteenth century. In the heavy woolen industry, the labor-intensive preparation and finishing processes were successfully mechanized early on, but spinning and weaving proved more difficult and were not fully mechanized until the 1840s. Linen, the other major textile, made from the stem of flax, was also hard to spin mechanically. A French inventor, Philippe De Girard, tempted by a large prize promised by the Emperor Napoleon, solved the problem in about 1810; and his “wet spinning” process was introduced into the flax-spinning industry in Britain in about 1825. One of the most interesting inventions of the Industrial Revolution was the loom invented by Joseph-Marie Jacquard in 1801, which automated the weaving of patterns in a piece of fabric. Used for upmarket silks and worsteds, this machine was the first to code information using a binary code; and it inspired the work of Charles Babbage, a British mathematician who pioneered the first digital calculating machine. A third area in which the Industrial Revolution achieved major advances was iron making. One important innovation was the use of new fuels in the smelting of iron ore in blast furnaces. The replacement of charcoal by coke (purified coal) in blast furnaces remedied the costly need to access remote forest areas. Blast furnaces became bigger, hotter, and more efficient as more powerful machinery was used to blow air into the furnaces. In 1828 a Scotsman, James Neilson, discovered that by using the blast furnaces’ own gases he could cut fuel usage by up to a factor of three. The problem remained, however, to refine the end product of the blast furnace, known as pig iron, into the more malleable and usable wrought iron. After decades of experimentation and searching, a British ironmaster named Henry Cort solved the problem in 1785, through what became known as the puddling and rolling process, a truly epochal breakthrough of the Industrial Revolution. Cort’s process took Britain (and soon after that, the rest of Europe) by storm. In one dramatic stroke, the bottleneck that had occupied thousands of small-time forges and smithies was resolved. Even in steelmaking, a difficult art in which specialists fiercely kept their trade secret, there was progress: Benjamin Huntsman, a Sheffield steelmaker, perfected what became known as crucible steel, a high quality product that became famous the world over. Steel remained expensive, however, and would not be mass-produced until the second half of the nineteenth century. These three sectors—energy, textiles, and iron—are rightly famous for their bold and path breaking innovations. Yet the period witnessed a large number of other industries that in some way or another modernized, either by revolutionizing the manufacturing process itself or by adopting some form of machinery. In chemicals, two major inventions stood out. The first was the manufacturing of alkalis (used in industries such as soap-boiling and glassmaking) by means of a soda-making process perfected by Nicholas LeBlanc in 1787. This process dominated world production until the 1860s. Even more revolutionary was the second invention, the use of a new chemical (discovered only in 1774), chlorine, for the bleaching of textiles. Long, expensive processes of bleaching were replaced, almost overnight, by a fast and reliable alternative. Machine and instrument making also made enormous progress. John Wilkinson, a Shropshire ironmaster, patented a boring machine to be used for cannon, which he adapted to make the cylinders needed for Watt’s engines. One of the most famous technological challenges in the Western world, how to measure longitude at sea, was solved by a British clock maker, John Harrison, around 1762; although it still took a few decades for such clocks to be made cheaply, the invention stands as further testimony to British ingenuity in these years. A long list of British engineers and instrument makers, including Joseph Bramah, his brilliant student Henry Maudslay, and Maudslay’s gifted student Richard Roberts, redesigned every machine-making tool known; lathes, planning machines, boring machines, screw cutting machines, and measuring tools, all looked very different in 1820 compared to 1760. These tools made it possible to build parts and machines with greater and greater accuracy and thus increased industrial efficiency. Many of the “old” industries also were overhauled. In papermaking, a machine that produced paper in a continuous roll rather than by individual sheet, patented by a Frenchman named Nicholas Louis Robert, was introduced around 1800. In glassmaking, pottery, flour milling, sugar refining, printing, and mining, the use of machines, whether steam-driven or not, changed the way production took place. The invention of gas lighting in the 1790s not only helped to light streets but allowed factories to work longer hours in the short winter days of northern Europe. Roadbuilding was revolutionized by John McAdam, canal building by James Brindley, and bridge construction by Thomas Telford. The iron bridge, the first of which was completed in 1779, became a symbol of the Industrial Revolution. Even before the electromagnetic telegraph, long distance communication made a giant step forward with the introduction of the semaphore telegraph. Food canning, invented in 1795, was picked up quickly; and in 1814 the British navy and army were already being supplied with canned soups and meats. Many small but useful inventions that came into being in those years simplified daily life: matches, steel pens, lawnmowers, safety lamps for miners. Innovation was simply in the air: in 1783 for the first time in history humans flew, if only in hot air balloons; in 1796 Edward Jenner vaccinated people against smallpox. In short, the years of the Industrial Revolution were truly years of miracles. The economy wide effects of the Industrial Revolution were less than spectacular, however. Estimates about growth of income per capita for the years from 1760 to 1800 put it at 0.2 percent a year, and for the period from 1800 to 1830 at the modest level of 0.5 percent. These modest numbers have persuaded some authors that perhaps the entire concept of Industrial Revolution is misplaced. Clearly, one should not identify the Industrial Revolution with the entire British economy for this period. The dimensions of the “modern” sector—those industries and services in which technological progress was the most marked—were quite modest in the early stages; although this sector was growing rapidly, its impact on the economy at large was limited. For the hundreds of thousands of workers employed in agriculture, construction, shipbuilding, retail trade, personal services, and other traditional occupations, the new technology as yet made little or no difference. Furthermore, the Industrial Revolution was a period of rapidly growing population, and the economy had to feed, cloth, and shelter ever-increasing numbers of people. To make things worse, Britain fought a number of expensive wars (the American independence war and the French wars) between 1756 and 1815, with only two decades of peace in between. Wars raised taxes and, because of trade disruptions, the prices of consumer goods. It is no wonder that real wages and average living standards show little trend upward until the 1840s. Those who lived through the Industrial Revolution did not enjoy its fruits. In the process of structural transformation of the industries, a great deal of human suffering was experienced along with the obvious gains to consumers. The new technology produced cheaper and better goods that competed with those produced by home-workers, who gradually lost their desperate struggle with the machines. The plight of the handloom weaver who was gradually pushed aside by the power loom after 1815 is well known, but in many other areas in textiles and handicraft production the Industrial Revolution also meant the end of independent producers and their way of life. Moreover, work in the early factories was very difficult. Work hours were long, and the shop floors were noisy, cold, and often dangerous. The workers—many of them women and teenagers—had to submit to the discipline and regime of the factory, controlled by strangers, in which transgressions were severely penalized. The industrial novels describing the harshness of this life made a deep impression on contemporary readers, but it took a long time for effective measures to restrain child labor and factory conditions to be enforced. To make things worse, the Industrial Revolution was accompanied by rapid urbanization. The industrial towns, such as Manchester and Glasgow, grew at unprecedented rates, attracting thousands of rural workers or their family members. Yet life in the early industrial towns was very unpleasant. The overhead capital in cities—devoted to water supply, sewage and garbage disposal—could not accommodate the sudden surge in the number of inhabitants. People lived in overcrowded, dirty, ugly, dark tenements, and poor sanitary conditions led to high mortality rates. These conditions inspired an angry literature, of which Friedrich Engels’s Condition of the Working Class in England (1844) is the most celebrated contribution. Part of the higher wages earned by factory workers thus must be regarded as compensation for deterioration in their quality of life relative to village conditions. Life was not easy even for the industrialists and entrepreneurs who were the driving force behind the innovation process. For every successful capitalist such as Richard Arkwright or Boulton, there were many who failed for one reason or another. Britain’s legal framework was not friendly to limited-liability corporations, and many bankruptcies ensued because of complex networks of partnerships with unlimited liability. Henry Cort, for one, lost all his business because of such a partner and in the end had to be satisfied with a modest pension while others used his invention. Dr. John Roebuck, Watt’s first partner, also went bankrupt, because of the troubles of one of his other partners. On the surface patent law meant protection for inventors, but with some notable exceptions it actually provided few financial safeguards. Richard Arkwright, the cotton spinner, just gave up his patent altogether rather than continue to spend time and money on litigation. Then, as now, entrepreneurial activity was a highly risky gamble, with the odds stacked against bold innovators. The historical record, by recounting the success stories, tends to obscure these risks. The people who became rich and richer during the Industrial Revolution were those who owned land, particularly urban real estate and lots with favorable physical characteristics such as mining or waterpower sites. Also merchants, ship owners, and the providers of financial services to trade generally did well. Moreover, many of the successful industrialists came from the ranks of the mercantile and landowning classes. The Industrial Revolution created a class of rich capitalists, but not all of the newly rich were industrialists and certainly not all industrialists became rich. The most remarkable social consequence of the Industrial Revolution was the emergence of the factory. It is insufficiently realized today that before the Industrial Revolution the vast majority of people worked in their homes or in fields or attached workshops. Even workers who had lost their economic independence, such as those in the so called putting-out industries (in which a merchant supplied them with raw materials or intermediate products that the worker then processed at a fixed piece wage), worked in their own homes. Independent artisans, shopkeepers, and farmers were domestically based, and employed members of their own households. Even those whose work required being away from home, such as masons and carters, normally operated from a home base. Colliers, soldiers and sailors, and some workers in manufacturing (in large ironworks, breweries, and shipyards) were among the few who worked under conditions that would remind one of modern labor arrangements. With the Industrial Revolution, this situation began to change. The “mill,” in which production took place in a large room in coordinated fashion and under supervision, slowly spread; and although the changeover took many years to reach its full course, its roots are clearly in the fateful years of the late eighteenth century. Karl Marx, one of the first social commentators to fully realize this, found the rise of the factory to be a deplorable development. Workers were “alienated” from the means of production, treated as machines, exploited, and often humiliated. Modern research is a bit more cautious: conditions in the mills were harsh, but the domestic manufacturing system was not less backbreaking, and the harsh discipline of factories has to be compared with the discipline to which apprentices, wives, and children were subjected in the traditional economy. In the nineteenth century, those domestic industries that remained were known significantly as “sweated trades.” At first, factory masters preferred the more docile and malleable labor supplied by women and youngsters and found it difficult to manage adult males, who were often unruly and intoxicated. Over time, however, many factory owners came to realize that factory labor required male workers as well and did their best to convince these workers, by a mixture of propaganda and incentives, to conform to factory requirements of punctuality and obedience. The new factories required more than just buildings, machinery, and lighting. With the emergence of large production units, new management problems surfaced. Some of the most successful entrepreneurs—such as Robert Owen, the cotton spinner, and Josiah Wedgwood, the pottery manufacturer—were able to overcome lack of experience and training through intuition and genius, and put together well-organized operations. But in this age most managers had little experience in cost and capital accounting, inventory control, personnel management, financial organization, and marketing. All of those functions had to be improvised and mastered through experience. A few did well, but many got it wrong and suffered the consequences. Moreover, there was no “venture capital” in this age. Banks and other financial institutions rarely risked their funds on the new technology. Much of the fixed capital in which the firms invested—the purchase of buildings and equipment—came from retained earnings, that is, the owner’s own resources. Why were factories necessary? Part of the answer must be that the minimum scale of production increased for a variety of reasons. Power was cheaper, horsepower for horsepower, in larger steam engines. Most machines had a minimum efficient scale that exceeded the small size of household labor, even if augmented by apprentices. Heating and lighting, inventory management, and, least appreciated of all, the growing requirements of engineering and technical knowledge made for economies of scale. This was not true for all industries, not even for all “new” industries; what is now known as flexible specialization held its own in many industries. Mass production required the design, construction, and maintenance of machines that could not be mass-produced themselves; but in some cases, deliberate choices were made to specialize in mass-produced factory-made goods. The custom-made products of self-employed, highly skilled specialists required less machinery and provided fewer scale economies but also avoided some of the more egregious excesses of the factories and the early industrial towns. France chose a trajectory that, compared to Britain, was along more traditional lines. Physical economies of scale were not the only reason why factories emerged. The putting-out system could work only if its employees could be paid a piece wage, as employers could not monitor the time employees spent working. For many products this system was becoming increasingly difficult to follow because of a finer and finer division of labor or because the monitoring of the quality of the product was getting harder. As products became more sophisticated, and markets expanded, the need for standardization was felt more acutely. Manufacturers realized that direct and continuous monitoring of production workers to conform with product specifications was necessary. Furthermore, as technological changes became more and more frequent, workers had to be trained on the job, instructed in the use of new tools and equipment. The emergence of factories thus was partly due to the economics of information. However, more must have been involved because even when workers were paid a piece wage, they were often put in mills and worked under supervision. The expensive equipment owned by the master needed to be tended with care; raw materials and fuel had to be protected against pilfering. Factories, then, offered many advantages, and no single explanation will do for all cases. Consideration of why the Industrial Revolution occurred at all needs to be split into why it happened when it did, why it happened in Britain before anywhere else, and why it took the form it did. These three questions are likely to have different answers. The timing clearly has something to do with the ability of inventors and engineers to crack technical problems that were beyond them a century earlier. It is also argued that the timing depended on the existence of a market in which the new products could be sold. Up to a point, this latter argument must take into account that the products pretty well sold themselves through lower prices and higher quality. Perhaps the really important question is not one of why did the great inventions of the 1760s and 1770s take place, but why the wave of technological progress did not peter out after 1815 or so, as it had always done in the past. As to why it happened in Britain, as opposed to some other economy, there is a large and lively literature on the “British advantages,” ranging from Britain’s good fortune of having large supplies of iron and coal, to its being an island, that—almost alone in Europe—saved it from the invasion of foreign armies. Above all, however, Britain had the kind of institutions that were conducive to economic development and technological progress. Its government was by no means laissez-faire, but it supported innovating entrepreneurs and inventors against the fury of artisans and domestic workers who tried to protect their turf. The British government opposed the conservative forces who petitioned Parliament for legislation to prohibit the new machines or tried to stop mechanization by breaking the new devices and threatening with violence those who intended to employ them. Britain was comparatively peaceful, it had good internal transportation, and its social institutions above all respected private property. Laws, contracts, and ownership could be and were enforced. Labor and capital were relatively free to move around and deployed wherever their return was highest. Furthermore, British culture, more than others, recognized commercial and industrial success as a legitimate source of social status, and members of its elite were often fascinated with the mundane technical details of farming, bridge building, and pumping. The significance of the Industrial Revolution in economic history cannot be overestimated. Its immediate effect was to establish Britain as the leading economic and technological nation in the world, with all the political prestige and power that came with that, and it imposed the Pax Britannica on Europe for a century. Beyond that, it changed the parameters of economic change. Growth before the Industrial Revolution had been usually short-lived, a passing episode that with luck might propel an economy to a somewhat higher plateau. After 1830, it became a permanent condition of those economies that followed the British example and continually introduced new techniques into their production processes. New technology acquired increasing importance in the process of growth. Before 1750, most economic growth, when it occurred, was the result of institutional improvement that permitted trade where none had existed before, or secured better property rights that allowed people actually to enjoy the fruits of labor and patience. Technological change did occur, but its role in growth as such was probably modest. During the Industrial Revolution and after, growth became increasingly dominated by improvements in technology. As people increasingly realized, this was the one form of economic growth that did not run into diminishing returns, that did not slow down, and that could sustain itself. Not all countries that emulated Britain followed its precise technological example. Some specialized in upmarket, high-quality products. Others relied on different sources of energy, such as water or wind, or found niches in specialized industries. The Industrial Revolution, however, was not about one technical detail or another. It was about the willingness to use a growing understanding of nature (physics, chemistry, biology) in industrial production, implemented by private enterprise, for the sake of profit. It was about the ability of capitalists to mobilize capital and labor on a large scale to introduce these new techniques. It was this feature of the Industrial Revolution that prepared the ground for modern economic growth and the unprecedented prosperity it has brought to much of humanity, a prosperity that would have been unimaginable anywhere in 1750.

**WAR AND PEACE IN THE 20TH & 21ST CENTURIES**

Chemical and Biological Warfare

|  |  |  |
| --- | --- | --- |
| I |  | INTRODUCTION |

Chemical and Biological Warfare, method of warfare in which toxic or incapacitating chemicals or biological agents are used to further the goals of the combatants. Until the 20th century such warfare was primarily limited to starting fires, poisoning wells, distributing items contaminated by smallpox, and using smoke to confuse the enemy.

|  |  |  |
| --- | --- | --- |
| II |  | CHEMICAL AGENTS |

Greek fire, invented in the 7th century as an incendiary mixture sprayed at the enemy, was probably the first form of chemical warfare. Gases such as tear gas, chlorine gas and phosgene (lung irritants), and mustard gas (causing burns) were first used in World War I to break the trench warfare stalemate. Flame-throwers were also tried but at first proved ineffective because of their short range. Technical improvements and the development of napalm (composed of napthenic and palmitic acids), a thickened petrol that sticks to surfaces and causes horrendous injuries, led to the widespread use of flame weapons in World War II and to its further, extensive use in the Vietnam War.

By the end of World War I, most European powers had integrated gas warfare capabilities into their armies at some level, and nerve gases such as sarin, small amounts of which cause paralysis or death, were developed in Germany between World Wars I and II. Despite the availability of gases, only Japan used them—in China—as World War II became global. After World War II, knowledge of nerve-gas manufacture became widespread.

Gases such as tear gas have been used in limited wars since World War II, such as in the Vietnam War; tear gas is also employed by civilian police forces to quell riots. The use of more deadly agents such as mustard gas and nerve gas has been generally condemned by most countries, but such weapons remain in arsenals, and there is evidence that they were used by Iraq during its war with Iran in the 1980s and that both countries continue to develop them.

Various chemical compounds, such as Agent Orange, that alter the metabolism of plants and cause defoliation, have been employed in modern jungle warfare to reduce the enemy’s cover or deprive the civilian population of necessary food crops. Such chemicals, generally sprayed from the air, also contaminate water and fish; their long-lasting effect on the entire environment and ecosystem makes them particularly devastating. Evidence exists that Agent Orange has caused cancer and birth abnormalities.

|  |  |  |
| --- | --- | --- |
| III |  | BIOLOGICAL WARFARE |

Several major nations have worked to some degree on the development of biological agents for use in warfare. Selected or adapted from pathogens causing various diseases that attack humans, domestic animals, or vital food crops, such agents include bacteria, fungi, and viruses or the toxins they produce. The pathogens causing botulism, plague, anthrax, foot-and-mouth disease in animals, and stem rust in wheat are among the many that could be directed against opposing armies or the civilian economies supporting them. Genetic engineering also offers the possibility of developing new virulent strains against which an opposing force could not be prepared in advance. Unlike chemical weapons, which become less potent as they disperse, biological weapons can become more potent, sometimes mutating into even more virulent forms.

Large-scale biological warfare has thus far remained theoretical, although in the 1980s it was learned that Japan used biological agents against the Chinese in the 1930s and early 1940s. In the early 1980s, controversial claims were also made that the Soviets, in Afghanistan, and the Vietnamese, in Laos and Cambodia, were using fungal toxins—in a form called “yellow rain”—as biological weapons.

|  |  |  |
| --- | --- | --- |
| IV |  | DISSEMINATION AND PROTECTION |

The earliest method of disseminating chemical agents was simply to release them from pressurized containers, as the Germans did in World War I. This made the use of these weapons dependent on the wind; quite often the wind would change and bring the chemicals back on to the troops that had dispatched them. Thus, armies turned to better ways of projecting weapons, including mortars, artillery, rockets, aerial bombs, and aerial spray. Biological agents can also be disseminated by releasing insects or animals in a target area.

Whatever the means of dissemination, there are problems incurred in trying to protect “friendly” forces and populations. Many nations are developing programmes to detect lethal agents and decontaminate them. The United States has embarked on an extensive programme for the safe decommissioning of these weapons. Elaborate protective clothing has to be worn in areas of conflict where contamination is possible, with ground forces (and other people entering dangerous areas, such as inspectors and journalists) being trained regularly in how to use the protective equipment within moments of an attack warning.

|  |  |  |
| --- | --- | --- |
| V |  | WARFARE POSSIBILITIES |

The chemical and biological weapons employed in nuclear or conventional war may also play a part in future guerrilla warfare or terrorist sabotage actions. In such situations, inert toxic materials, such as dusts that are activated on contact with moist surfaces such as the lungs, might be surreptitiously sprayed into city air from moving vehicles or from offshore vessels. Another possible tactic is the delivery of soluble toxins into urban water supplies.

Chemical and biological agents have possibilities for use in limited wars. The fact that it does not take a very sophisticated industrial base to produce lethal chemicals makes this a viable means of warfare for developing countries and has led to them being dubbed “the poor man’s atomic bomb” as they are close to nuclear weapons in terms of their destructive power.

|  |  |  |
| --- | --- | --- |
| VI |  | IRAQ |

The use of chemical weapons by Iraq on its Kurdish population and evidence of Libya’s growing chemical warfare capability reinforces the danger that these weapons will not only proliferate, but could be used not only in future wars, but also in civil war or for the oppression of minorities. On April 3, 1991, the UN Security Council passed Resolution 687, which required Iraq to declare and destroy its stockpile of weapons of mass destruction. In the years following the Gulf War, the UN found no evidence of biological weapons stocks, though it did find thousands of chemical weapons.

According to the UN Special Commission (UNSCOM), following a series of increasingly hampered inspections of Iraqi weapons sites in the 1990s, Iraq was found to have ingredients to make 200,000 litres (44,000 gallons) of the nerve agent VX, a quantity sufficient to kill the world’s population. It was also thought to have the capacity to produce more than 20,000 kg (20 tons) of anthrax; it is estimated that an aerosol spraying 100 kg of anthrax from a height in a densely populated area could kill three million people. In addition to anthrax, plague and botulinum toxin, which Iraq was suspected of having before the Gulf War, UNSCOM inspectors also found 2,000 litres of aflatoxin, which produces liver or lung cancer, and clostridium (gas gangrene). It was also believed that Iraq had built up large stocks of Agent 15, which incapacitates victims by attacking the central nervous system, proving fatal in heavy doses. However, after the US-led invasion of Iraq of 2003 to both disarm that nation and depose the regime of Saddam Hussein, no significant finds were made (*see* War on Iraq).

|  |  |  |
| --- | --- | --- |
| VII |  | TERRORISM |

The attraction of such weapons for terrorists is also a matter of great concern, since release of relatively small amounts of toxins in a water supply or into the air could cause a widespread catastrophe. In March 1995, the first major terrorist incident involving chemical warfare occurred in Tokyo, where a weak form of sarin was released into the underground transport system by members of a religious cult. Four people were killed and 3,000 were affected by the sarin. Up to 6 tonnes of the chemical were discovered at premises occupied by cult members. Four subsequent attacks were made on railways in Japan, two of which involved hydrogen cyanide gas.

In February 1998, two white supremacists were arrested in Las Vegas, United States, on suspicion of plotting a terrorist attack with a biological agent, believed to be anthrax. Although the agent was later found to be harmless, one of the detainees, a scientist, was at the time of his arrest on probation for obtaining bubonic plague bacteria from a laboratory.

These isolated events have highlighted growing concern over possible terrorist use of chemical or biological agents. Analysts point to the growth of increasingly marginalized groups, including religious fanatics and separatist or survivalist factions, who may be less constrained by the need for public sympathy for their cause.

|  |  |  |
| --- | --- | --- |
| VIII |  | INTERNATIONAL CONTROL |

The Hague Conference of 1899 made an attempt to outlaw projectiles carrying poison gases; the agreement to this effect lasted only until World War I. In Geneva in 1925 a League of Nations protocol against chemical and biological war was signed; it was not, however, ratified by the United States until 1974. The treaty outlaws the first use of such weapons in warfare, but nations generally reserve the right to use them in retaliation. Arms control agreements totally banning chemical warfare have proved difficult to achieve.

|  |  |  |
| --- | --- | --- |
| A |  | Chemical Weapons Convention |

At the George Bush-Mikhail Gorbachev summit in June 1990, a treaty was signed providing for both the United States and the Union of Soviet Socialist Republics to reduce stockpiles of chemical weapons. In May 1991, 19 industrial nations—including the United States—committed to adopt controls on the export of 50 common chemicals used to manufacture these weapons. The Chemical Weapons Convention (CWC) of 1993 banned manufacture of chemical weapons and restricts trade in substances used to make them. In April 1997 the CWC came into force, and as a result it is estimated that just under 10 per cent of the world’s stockpile had been destroyed by 2004.

|  |  |  |
| --- | --- | --- |
| B |  | Biological Weapons Convention |

A treaty totally banning biological warfare was drawn up by the Geneva Disarmament Conference in 1971 and approved by the UN General Assembly. Some 80 nations signed the Biological Weapons Convention (BWC), which the United States ratified in 1974. This treaty is unique because it outlaws the use of a whole class of weapons among most of the nations of the world. Its effectiveness, however, is still questionable; progress in genetic engineering has also complicated this issue. The 1994 BWC has still to finalize a legally binding protocol for all nations. Verification of a ban on biological weapons is far harder to enforce than its chemical equivalent, as biological agents have to be produced in laboratories before antidotes to them can be made; only small amounts of such stocks would be needed by saboteurs.

When a crisis over weapons in Iraq in February 1998 was resolved by an agreement that allowed UN weapons inspectors unconditional access to all sites, world attention was concentrated on the threat of biological weapons. However, the many discoveries made by UNSCOM inspectors made a successful verification programme more possible in the future. The United States have called for the protocol of the 1994 BWC to be finalized, which would include setting up a rigorous biological warfare inspectorate capable of investigating any illegal use of biological agents, and an international network to monitor emerging infectious diseases. These measures are expected to elicit support from governments aware of the dangers of terrorist attack within their boundaries, although the pharmaceuticals and biotechnology industries may oppose intrusive measures.

WAR AND PEACE IN THE 20TH & 21ST CENTURIES

ARMS CONTROL AND DISARMAMENT

|  |  |  |
| --- | --- | --- |
| I |  | INTRODUCTION |

Arms Control and Disarmament, attempts through treaty, proclamation, convention, and tacit agreement to limit the incidence and destructiveness of warfare by controlling the acquisition and use of weapons and military technology. The more traditional term “disarmament” usually refers to limits on the numbers or lethality of weapons. Disarmament may be by tacit or explicit agreement or may be imposed unilaterally on nations, as it was on Carthage by Rome and on Germany by the Allies after both World Wars. “Arms control”, a term invented only in the 1950s, embraces efforts to curb the frequency or destructiveness of war by means which may include, but are not limited to, reductions in armaments; it can involve, for example, such “confidence building” measures as mutual inspections or hotlines for communication in crisis, or a preference for weapons that do not conduce to surprise attack.

|  |  |  |
| --- | --- | --- |
| II |  | HISTORY |

Historically, war appears as a constant feature of human affairs. In three millennia of recorded history, less than 300 years have been free from armed conflict; yet people have always recognized the wasteful, brutal, and inhumane aspects of warfare and have continually attempted to limit its devastation and the spread of increasingly destructive weapons.

One of the earliest formal attempts to limit the scope of war was organized by the Amphictyonic League, a quasi-religious alliance of most of the Greek tribes, formed before the 7th century bc. League members were pledged to restrain their actions in war against other members; thus, for example, they were barred from cutting a besieged city’s water supply. The league was empowered to impose sanctions on violating members, including fines and punitive expeditions, and could require its members to provide troops and funds for this purpose. An early example of an imposed disarmament treaty was the Rome-Carthage Treaty of Peace (202 BC), which ended the Second Punic War; it required the destruction of all but ten Carthaginian warships, and limited the possession of armaments in general. It also banned Carthage’s training and possession of war-fighting elephants.

|  |  |  |
| --- | --- | --- |
| A |  | The Middle Ages |

Because arms technology remained nearly static from the 3rd century bc to the Middle Ages, few attempts were made to control innovation or the spread of new weapons. In feudal societies, such as those of medieval Europe or Japan, laws and customs developed to keep weapons a monopoly of the military classes and to suppress arms that might democratize warfare. These customs tended to disappear as soon as some power saw a decisive advantage in the use of a new weapon.

In medieval Europe the Roman Catholic Church attempted to use its power as a supranational organization to limit both new weapons and the intensity of warfare. The Peace of God, later the Truce of God, instituted in 990, protected Church-owned property, defenceless non-combatants, and the agrarian base of the economy from the ravages of war. In 1139 the Second Lateran Council prohibited the use of the crossbow against Christians, although not against those the Church considered infidels.

|  |  |  |
| --- | --- | --- |
| B |  | Early Modern Period |

Firearms widened the scope of war and increased the potential for violence, culminating in the devastation of central Europe in the Thirty Years’ War (1618-1648). Widespread revulsion against the horrors of that conflict led to attempts in many countries to lessen the brutality of warfare by limiting combat to recognized armed forces, by formulating conventions for the humane treatment of prisoners and the wounded, and by organizing logistics to end supply by pillage. These rules prevailed throughout the 18th century, making war a relatively limited and civilized “game of kings”.

Many Utopian plans for the total abolition of war were also formulated during this period by such men as French philosopher Jean-Jacques Rousseau and Charles Castel, Abbé de St Pierre. Frederick the Great, King of Prussia, cynically but realistically commented that all these plans needed to succeed was the cooperation of all the kings of Europe.

The rise of mass armies during the American War of Independence (1775-1783) and Napoleonic Wars (1799-1815) again enlarged the size and devastation of war; yet throughout that period no attempts were made to reduce or limit national arsenals other than those imposed by the victors upon the defeated. The one exception was the Rush-Bagot Treaty (1817), under which the United Kingdom and the United States reduced, equalized, and eventually eliminated their naval and other forces on the Great Lakes and the US-Canadian border. This reflected the discovery by the two nations during the War of 1812 that the vulnerability of the American coast to the Royal Navy was balanced by the openness of Canada to American invasion.

|  |  |  |
| --- | --- | --- |
| C |  | The Hague Conferences |

In the 19th century the manufacturing capabilities created by the Industrial Revolution were applied to the production of war materials, the first major example being the American Civil War (1861-1865). Technological innovation led to the development of rifled artillery, breech-loading rifles, machine-guns, and other weapons that revolutionized warfare. The resources of entire nations could now be turned to war, making possible conflicts of unprecedented scale and destructiveness. Although many government leaders saw the arms build-up in Europe as potentially disastrous, nothing was done to reduce armaments until the First Hague Peace Conference of 1899.

The First Hague Peace Conference was convened at the initiative of Nicholas II of Russia to control arms development and improve the conditions of warfare. Twenty-six nations attended the conference, which codified the laws and customs of land warfare, defined the status of belligerents, and drafted regulations on the treatment of prisoners, the wounded, and neutrals. It also banned aerial bombardment (from balloons), dumdum (expansion) bullets, and the use of poison gas. Most important, it established a court, the Permanent Court of Arbitration, for the arbitration of international disputes (although this court had no enforcement powers).

The Second Hague Peace Conference of 1907 was marked more by discord than discourse, a sign of the deteriorating world situation. However, it furthered the cause of mediation and arbitration of disputes by establishing additional courts to arbitrate cases involving ships’ cargoes seized during war, and resolution of international debts. A Third Hague Conference was scheduled for 1915. Tragically, World War I caused its abandonment.

|  |  |  |
| --- | --- | --- |
| III |  | 20TH-CENTURY INTERNATIONAL AGREEMENTS |

After the carnage of World War I, the international climate was more receptive to the idea of arms control. The Treaty of Versailles, signed at the end of the war, virtually disarmed Germany. During the years between World Wars I and II many formal arms-control conferences were held and many treaties were drawn up.

The Covenant of the League of Nations established criteria for reducing world armaments. The League’s Council was to establish reasonable limits on the military forces of each country and submit them for consideration to the member governments. Members of the League were also called upon to limit the private manufacture of arms and munitions and to exchange information on the size and status of their military establishments and arms industries. The League’s lack of enforcement capability, however, made compliance strictly voluntary.

|  |  |  |
| --- | --- | --- |
| A |  | Washington Conference |

From 1921 to 1922 the Washington Naval Conference was held to establish stable relationships among the naval forces of the various powers. Three treaties were enacted at the conference: the Four-Power Treaty, the Five-Power Treaty, and the Nine-Power Treaty. By the terms of the first, France, the United Kingdom, Japan, and the United States agreed to respect the status quo in the fortification of Pacific possessions and promised consultation in the event of a dispute. An associated agreement was signed with the Netherlands regarding the Netherlands East Indies (now Indonesia).

The second treaty focused on arms limitations. A 5-5-3-1.75-1.75 ratio was established between US, UK, Japanese, French, and Italian battleships. That is, for every 5 US and UK battleships, Japan was allowed 3, and France and Italy were allowed 1.75. Maximum total tonnage was limited, as well as specification of a maximum single-ship tonnage of 35,000 tons. A ten-year moratorium on battleship building (except to fill out the treaty), and a limit on size and armament were also included. The third treaty was an attempt to accommodate the signatories’ interests in China.

|  |  |  |
| --- | --- | --- |
| B |  | Geneva Conference |

The use of poison gas on a large scale during World War I produced very large casualties: The total for all belligerents was some 1.3 million. While about 100,000 were fatalities, it was the high degree of maiming that did even more to arouse popular revulsion. A convention negotiated at Geneva in 1925 banned the use of toxic gas in warfare though not its possession. By 1939 most countries, the major exceptions being Japan and the United States, were signatories. (Japan signed in 1970 and the United States in 1974.) This accord has been observed by most of the signatories, although Italy used poison gas in Ethiopia in 1936. Other uses of gas have been by Japan in China in the 1930s, by Egypt in the Yemen between 1964 and 1967, and by Iraq in the late 1980s and early 1990s. Some critics have regarded the use by the United States of chemical defoliants (see Agent Orange) in Vietnam as an instance of chemical warfare.

|  |  |  |
| --- | --- | --- |
| C |  | The Fate of Disarmament in the 1930s |

In 1930 a naval conference was held in London to amend the Washington Conference treaties. Its most important effect was to change the US-Japanese battleship ratio to 5-3.5. It also extended the battleship moratorium through to 1936.

In 1932, after nearly ten years of preliminary discussions, a World Disarmament Conference was held in Geneva under the auspices of the League of Nations. The keystone of the conference was the so-called Hoover Plan, which entailed proposals put forth by the United States based on the concept of qualitative disarmament—that is, the progressive elimination of offensive weapons. The result was to have been an increasingly unfavourable ratio between offensive and defensive power. As has always been the case, it proved virtually impossible to draw acceptable distinctions between offensive and defensive weapons, partly because the tactical and strategic effect of weapons is so dependent on circumstances. Qualifications imposed by many of the major nations diluted the Hoover Plan until little remained but a statement of principles.

A final naval conference was held in London in 1936. There the United States and United Kingdom reaffirmed the naval limitation treaties, with an acceleration clause (that is, one providing for a proportional increase in the US-to-UK ratio) to counteract any German or Japanese violations. The Japanese, increasingly militaristic and fearful of US and UK superiority, withdrew from further negotiations. This was the last major arms-control conference before World War II.

|  |  |  |
| --- | --- | --- |
| IV |  | CONTROL OF THE MEANS OF MASS DESTRUCTION |

After World War II considerable support again developed for disarmament and for alternatives to military conflict in international relations. Thus, Article 11 of the United Nations (UN) Charter stated that the General Assembly could consider the general principle of disarmament and the regulation of armaments. Article 26 required the Security Council to submit plans for a system of armament regulation. Article 47 established a military staff committee to assist the Security Council in this task.

|  |  |  |
| --- | --- | --- |
| A |  | Nuclear Arms Race |

The development of the fission bomb by the United States towards the end of World War II brought with it the capability of wreaking devastation on an entirely new scale. While the United States still maintained a monopoly on nuclear weapons, it made overtures in the UN for the control and elimination of nuclear energy for military purposes. In June 1946, Bernard Baruch presented a plan to the UN Atomic Energy Commission calling for the abolition of nuclear weapons, international control over the processing of nuclear materials, full sharing of all scientific and technological information concerning atomic energy, and safeguards to ensure that atomic energy would be used only for civilian purposes. The Soviet government, which was working on its own nuclear weapons programme and was certainly not willing to trust the United States not to maintain a covert monopoly, vetoed the Baruch Plan in the Security Council, objecting to the UN’s authority over disarmament and citing the domination of that body by the United States and Western Europe.

In 1949 the Soviet Union exploded an atomic weapon of its own, ending the US monopoly. The possibility of a nuclear war was now present for the first time and relations between the Soviet Union and the West were sufficiently tense to make this seem not unlikely. Both the United States and the Union of Soviet Socialist Republics (USSR) were engaged in a race to develop thermonuclear fusion (hydrogen) devices, which have many times the destructive power of fission bombs. These weapons, along with the rapid development of missile delivery systems, raised the possibility of destroying civilization in the northern hemisphere in all-out war. Within a few years the United Kingdom, France, and China had joined the ranks of nuclear powers. The control of nuclear weapons took on an overriding priority in arms control policy.

|  |  |  |
| --- | --- | --- |
| B |  | Agreements Limiting Nuclear Weapons |

In 1957 the International Atomic Energy Agency was established to oversee the development and spread of nuclear technology and materials, and to safeguard the peaceful use of nuclear technology under safeguards to prevent the diversion of nuclear materials to military applications. Two years later a treaty was negotiated to demilitarize the Antarctic and to prohibit the detonation or storage of nuclear weapons there. Both the United States and the USSR were among the signatories.

|  |  |  |
| --- | --- | --- |
| B1 |  | Nuclear Test-Ban Treaty |

In 1961 the UN General Assembly passed the Joint Statement of Agreed Principles for Disarmament Negotiations. It was followed in 1963 by the (Limited) Nuclear Test-Ban Treaty, which bound the United States, United Kingdom, and the Soviet Union not to test nuclear weapons in space, in the atmosphere, or under water.

|  |  |  |
| --- | --- | --- |
| B2 |  | Outer Space Treaty |

In 1967 the Outer Space Treaty, also between the US, UK, and USSR, banned the placing in space of nuclear and other weapons of mass destruction. The deployment of nuclear weapons in orbit was expressly prohibited.

A second treaty in 1967, the Treaty of Tlatelolco, banned nuclear weapons from Latin America. This regional nuclear agreement was followed later by others covering other areas: South East Asia (Treaty of Bangkok, 1995), Africa (Pelindaba, 1996), and the South Pacific (Raratonga, 1985). While most countries have joined these agreements many have done so with reservations. Thus the UK has excluded the transit of weapons from its version of Raratonga while the US has not ratified it at all.

In 1971 the Sea-Bed Treaty banned the placement on the seabed and the ocean floor of nuclear weapons and other weapons of mass destruction.

|  |  |  |
| --- | --- | --- |
| B3 |  | Anti-Ballistic Missile Treaty |

One of the most important treaties of this period was the 1972 US-Soviet Treaty on the Limitation of Anti-Ballistic Missile Systems. It permitted anti-ballistic missile (ABM) deployments around two areas in the United States and the USSR: one for the defence of each national capital (Washington, D.C. and Moscow) and the other for the defence of an intercontinental ballistic missile (ICBM) site. The deployment of ABMs for the defence of the whole territory of the United States and the USSR was banned. Later, each country agreed to have only one site and in practice the United States abandoned the programme. Believing by the beginning of the 21st century that the main missile threat was no longer from a major nuclear power but from so-called rogue states such as Iraq or North Korea, the United States formally announced its withdrawal from the treaty in June 2002 to concentrate instead on plans for a missile defence shield, or Strategic Defense Initiative (SDI).

|  |  |  |
| --- | --- | --- |
| B4 |  | Nuclear Non-Proliferation Treaty |

Another fundamental agreement is the Nuclear Non-Proliferation Treaty (NPT) of 1968. This treaty bans non-nuclear-states from acquiring nuclear weapons and nuclear-weapon states (defined as those possessing nuclear weapons on January 1, 1967, that is, the US, UK, China, France, and USSR—now Russia) from assisting or encouraging non-nuclear-weapon states to acquire nuclear weapons. The nuclear states are also supposed to make efforts to bring about the complete abolition of nuclear weapons. Under the NPT the non-nuclear-weapon states are entitled to receive assistance in developing nuclear technology for peaceful purposes. Since that time four countries are generally believed to have acquired nuclear weapons: India and Pakistan, explicitly, and Israel; South Africa claims to have developed but later destroyed nuclear weapons.

In 1993 North Korea threatened to withdraw from the treaty after refusing to let inspectors examine its sites of stored radioactive waste. The International Atomic Energy Authority (IAEA) wanted to take samples of the waste to analyse it and estimate the amount of plutonium North Korea had separated from spent reactor fuel elements. In 2003, however, North Korea finally withdrew from the treaty. France and China have now acceded to it.

In May 1995 the Non-Proliferation Treaty Extension Conference extended the treaty indefinitely. The conference also agreed a set of Principles and Objectives for Nuclear Non-Proliferation and Disarmament to serve as a guide for future disarmament negotiations, and agreed to strengthen the treaty’s quinquennial (every five years) review process committing the parties, particularly the nuclear-weapon parties, to a greater degree of accountability concerning their fulfilment of their obligations under the treaty.

A number of arrangements exist under which technologically advanced nations try to curb the transfer of nuclear weapon or dual use technology and of delivery systems, including the Missile Technology Control Regime set up in 1986 and the “Australia Group” dealing with trade in nuclear or nuclear-related materials, established in 1985.

|  |  |  |
| --- | --- | --- |
| B5 |  | SALT I and II |

In the late 1960s negotiations known as the Strategic Arms Limitation Talks, or SALT, were initiated between the USSR and the United States on the regulation of their strategic (long-range) weapons arsenals. The SALT I negotiations resulted in a series of agreements in May 1972 limiting the size and composition of the two nations’ nuclear weaponry. Also in 1972 an agreement (the Executive Agreement Covering Certain Offensive Systems) was reached that placed limits on the sizes and numbers of specific weapons systems. SALT II talks were held from 1972 to 1979, but the resulting treaty was not ratified by the US Senate because US-Soviet relations were deteriorating.

|  |  |  |
| --- | --- | --- |
| B6 |  | Intermediate-Range Nuclear Forces Treaty |

During the early 1980s, controversy surrounded the placement by the United States of ballistic missiles on the territory of some of its Western European allies. This US policy in response to Soviet deployment of large numbers of SS20 intermediate range missiles proved highly controversial. US-Soviet arms negotiations resumed in 1985 and at a summit meeting in Washington in December 1987, President Reagan and the Soviet leader Mikhail Gorbachev signed a treaty abandoning intermediate-range nuclear missiles altogether (the so-called double zero or INF Treaty), including many deployed long before the latest dispute. The treaty called for the destruction of all US and Soviet missiles with ranges of about 500 to 5,500 km (300 to 3,400 mi) and established a 13-year verification programme. The INF treaty was ratified by the US Senate and the Soviet Presidium in May 1988.

|  |  |  |
| --- | --- | --- |
| C |  | Non-Nuclear Weapons Agreements |

In addition to nuclear weapons, technology enables the production of chemical and bacteriological weapons capable of mass destruction, as well as more lethal conventional weapons. Trade in the latter is regarded by many as a disruptive feature of international life, particularly when it absorbs the resources of poorer nations. On the other hand, some nations, India having been particularly outspoken on the point, regard any attempt to restrict their access to whatever they deem necessary for their security as a kind of latter-day colonialism. In an effort at least to introduce some transparency into the question, the United Nations decided in December 1991 to establish an annual register of arms transfers. The coverage of this is being gradually extended in terms both of participation and content.

A number of features of the conventional arms environment have received special attention in arms control agreements.

|  |  |  |
| --- | --- | --- |
| C1 |  | Mines |

In 1977 a resolution of the Diplomatic Conference on the Reaffirmation and Development of Humanitarian Law Applicable to Armed Conflict banned the use against civilians of certain area-effect conventional weapons, such as booby traps, landmines, and napalm.

|  |  |  |
| --- | --- | --- |
| C2 |  | Chemical and Biological Weapons |

Agreements to limit these have also been concluded, following up the Geneva Convention of 1925. In 1972 the Biological Convention was signed by the United States, the USSR, and most other nations to prohibit the development, production, and stockpiling of biological and toxic weapons. Despite the treaties, however, both the United States and the USSR were accused of continuing research and development in this area, and at least eight other nations were suspected of developing such weapons. A well-documented escape of anthrax modified for military purposes took place at Yekaterinburg in the USSR in 1979. Prompted by the use in 1987 and 1988 of poison gas by Iraq in its war against Iran, and by US allegations of the building of a chemical weapons plant in Libya in 1988, representatives of more than 140 nations met in Paris in January 1989. They reaffirmed the previous conventions and called for a treaty that would ban all such weapons. The office of the Secretary-General of the UN was empowered to investigate suspected chemical weapons use. As recently as 1992 suspicion was aroused by the presence of large amounts of material relevant to the manufacture of the poison gas sarin in the Israeli El Al Boeing 747 that crashed in Amsterdam. The use of the same gas by a Japanese terrorist group in the Tokyo subway testified to the real danger of weapons of mass destruction in unofficial hands.

The Chemical Weapons Convention finally agreed in 1993 bans the manufacture, possession, or use of chemical weapons, and restricts trade in substances used to make them. States have ten years to destroy stocks. The Treaty came into force in April 1992 and involves a very intrusive form of inspection that met with considerable resistance from commercial chemical companies for fear of endangering proprietary secrets. The Organization for the Prohibition of Chemical Weapons began operations in May 1997.

|  |  |  |
| --- | --- | --- |
| C3 |  | Environmental Modification Convention |

The Environmental Modification Convention, signed in 1977, prohibits military or other hostile use of genetic engineering or environmental modification techniques, although it does not ban genetic engineering as such. The convention is regarded by some as essentially meaningless in that the environmental modifications envisaged—generating tidal waves, hurricanes, and so on—are not technically feasible and may not be in the foreseeable future. However, as advances are made in these fields, the importance of such agreements will increase.

|  |  |  |
| --- | --- | --- |
| C4 |  | CFE Treaty |

The 1990 Treaty on Conventional Armed Forces in Europe, also known as the CFE Treaty, sets ceilings on numbers of battle tanks, armoured combat vehicles, artillery pieces, combat aircraft, and attack helicopters in an area stretching from the Atlantic Ocean to the Ural Mountains. Various revisions have attempted to deal with changed circumstances following the break-up of the Soviet Union, a process complicated by warfare in the Caucasus region.

|  |  |  |
| --- | --- | --- |
| D |  | Anti-Personnel Mines |

Largely as a result of a powerful public campaign, a treaty prohibiting anti-personnel mines was negotiated in Ottawa, Canada, in December 1997, and came into force in March 1999. This treaty, inspired by revulsion at the high number of civilian casualties inflicted by such mines even long after wars have concluded, because of the difficulty of locating and clearing them, calls for stockpiles to be destroyed in four years and fields to be cleared in ten. Several signatories have entered sweeping reservations, and as of early 2001 the United States, China, and Russia, among others, had refused to sign the treaty.

|  |  |  |
| --- | --- | --- |
| E |  | Cold War Aftermath |

As the 1990s began, the United States and the then USSR continued to negotiate arms-control accords. In May 1990, President Gorbachev and US President George Bush approved principles for a treaty to end production and reduce stockpiles of chemical weapons, and in July 1991 the two leaders signed the START I agreement requiring both nations to reduce their strategic nuclear arsenals by about 25 per cent. Both sides also moved to reduce conventional weapons and to continue phased withdrawal of their forces from Europe. Unlike the SALT treaties START thus entailed an actual reduction on numbers of weapons.

The collapse and break-up of the USSR in late 1991 raised complex new problems, as strategic nuclear weapons were located at sites in Ukraine, Kazakhstan, and Belarus, as well as Russia proper. A major diplomatic success was the decision by Belarus, Kazakhstan, and Ukraine to yield weapons on their soil and accept non-nuclear status under the NPT.

There was, and still is, concern that the Soviet break-up and the difficult economic conditions in Russia might hasten the spread of sophisticated weapons to the Middle East, the Indian subcontinent, and other world troublespots. The United States and United Kingdom have instituted aid programmes to try to restrain this and to help Russia dispose of nuclear material. The START II Treaty, signed by George Bush and Russian President Boris Yeltsin in January 1993, limited submarine-launched ballistic missiles, and called for the elimination of almost three-quarters of the nuclear warheads and all the multiple-warhead land-based ones held by the United States and the former Soviet republics. It was hoped that by the year 2003 the strategic warheads of each power would be reduced to around 3,000. START I came into force in December 1994. However, it was clear to Russia that its poor economic condition would make it very hard to compete with the United States, and after failing to force the United States to drop its plans for a missile defence shield, or Strategic Defense Initiative (SDI), reluctantly decided to abandon START II in 2002. Instead, in May of that year, in Moscow, President George W. Bush and President Vladimir Putin agreed to cut the nuclear arsenals of both nations from total levels of between 6,000 and 7,000 weapons each to between 1,700 and 2,200 each over the next ten years. Such a timescale reflects the expense involved in dismantling nuclear weapons safely and disposing of the fissile material.

|  |  |  |
| --- | --- | --- |
| E1 |  | Comprehensive Test Ban Treaty |

In 1976 underground testing was limited to weapons of no more than 150 kilotons yield. A Comprehensive Test Ban Treaty was approved by the UN General Assembly in September 1996 and opened for signature. It prohibits all nuclear tests that take the form of actual explosions, though some tests of precursor events are still possible, as is extensive computer simulation. The Treaty thus does not make the development of weapons completely impossible. The Treaty will not enter into force until all of the 44 nations in possession of advanced nuclear capability have signed and ratified. As of early 2001 several known nuclear powers, including China, India, Pakistan, and the United States, had not ratified the treaty; others who had not ratified included Iraq, Israel, and North Korea.

|  |  |  |
| --- | --- | --- |
| E2 |  | World Court |

On July 8, 1996, the World Court declared that the use of, and the threat of the use of, nuclear weapons, was illegal. The Court was, however, unable to make a decision regarding situations where the survival of the state was threatened.

WAR AND PEACE IN THE 20TH & 21ST CENTURIES

MILITARY TECHNOLOGY

|  |  |  |
| --- | --- | --- |
| I |  | INTRODUCTION |

Military Technology, technology applied to warfare and the development of weapons and weapons systems. Its effect on war-making and military strategy has been greatest in the 20th century, the ultimate example being nuclear weapons.

Although aggression and violence were inherent characteristics of early hunter-gatherer societies, organized large-scale warfare is a product of civilization. Walls, moats, and towers—the earliest known, at Jericho, dating back to 7000 bc—were built to protect the new, organized city-states.

|  |  |  |
| --- | --- | --- |
| II |  | EARLY WEAPONS AND FORTIFICATIONS |

Spears, slings, bows and arrows, stone axes and clubs, and flint knives were the first instruments used in both hunting and war, with the discovery of materials appropriate for weapons-making. Flint was first used by early peoples as a material to be fashioned into sharp weapons such as knives and arrowheads. The ancient Egyptians used bows and arrows 5,000 years ago to fight the Persians, who were armed only with spears and sling-shots. The potency of shock weapons and basic missiles was enhanced by the discovery of metals, which made weapons stronger and sharper, and the use of fire for smelting. Initially, copper was used; later, tougher bronze-copper alloyed with tin was developed by the Sumerians of Mesopotamia. By 1700 bc the use of bronze had spread to Egypt and thereafter throughout the Mediterranean. The technology of the wheel, as applied to the horse-drawn chariot, which had evolved from the Sumerian war-wagon, increased the offensive mobility of soldiers. Missile power was augmented by the development of the powerful composite bow, made from bone, sinew, and wood. Bronze was used to make armour for charioteers and beaten copper was made into helmets which often covered the entire head.

Technology and strategy were now interlinked. Powerful imperial armies, such as the Egyptian and Hittite, were equipped by skilled and specialized industries producing high-quality armaments. As populous centres of political and economic power, cities were commensurately protected by elaborate walls, towers, and ditches—the products of great civil engineering investment. Strategy and war were based on the dynamic of territorial expansion and the acquisition of greater human, mineral, and agricultural resources. This strategic pattern has continued until the 20th century.

The Hittites introduced iron weapons around 1400 bc, having discovered how to smelt iron and mix carbon (as charcoal) with it, to produce a substance harder than bronze. By 1000 bc iron weapons were widely used around the Mediterranean littoral. Weapons design stabilized, although marked improvements were made in siege engines, and cavalry replaced chariots.

Despite the sophistication of its war machine, the Hellenistic world was ultimately absorbed by Rome, the basis of whose power was the Roman Army—professionally recruited, organized, administered, and supplied—a rare example of a highly organized and effective military machine. Forming the core of the army was the veteran professional centurions; the Roman Legion, comprised of heavy armoured infantry with light cavalry and light artillery (mainly catapults for hurling rocks at enemy lines and fortifications), proved more flexible than the phalanx. An early imperial legion of the 1st century numbered over 5,000 men with 50 catapults, and fought intense close-quarter battles with extreme ferocity.

The Byzantine Army was composed of heavy, chain-mailed, stirruped cavalry armed with lance, bow, and sword, similarly armed light cavalry, and infantry composed predominantly of archers and javelin throwers. Elaborate fortifications were constructed. Constantinople was defended by a moat and triple walls, while a front-line system of 300 fortresses and towers protected the empire.

The Byzantines also produced a fearsome weapon known as Greek fire. Invented by a Syrian architect (Kallinikos) in around ad 673, this deadly incendiary mixture of pitch, naptha, sulphur, saltpetre, and quicklime burnt even more ferociously on contact with water and was hurled in pots with a burning fuse or squirted from tubes on warships. It was first used during the unsuccessful Arab siege of Constantinople in the 7th century.

As dynasties and empires rose and fell a technological struggle continued between missile power and mobility; for example, at the Battle of Crécy, a decisive battle fought in 1346 at the beginning of the Hundred Years' War, the English longbow demonstrated the superiority of missile power over the shock power of the armoured, mounted French cavalry; the English are reported to have also used cannon. Larger versions of catapults, developed in Germany in the 13th century, were mounted on platforms to hurl rocks and other objects over walls and across moats during the sieges of castles and towns. In the 11th and 12th centuries mail shirts, made of thousands of metal rings, were the main protection against sword-fighting, although spears could penetrate them, as could crossbow bolts used in the 14th century. This lead to the development of full plate armour.

The 16th century saw rapid technological change. The missile dominance of the longbow and crossbow was ended by wheelock and flintlock small arms. Siege engines and high stone-walled fortifications were replaced by cannon and complex low-profile bastion structures. Heavy-armoured cavalry declined further in importance. Heavy, broadside-mounted cannon fitted to carracks and galleons revolutionized naval tactics; cannon-equipped ships spearheaded the oceanic expansion of the Portuguese, Spanish, French, Dutch, and English to the Americas, Africa, the Indies, and the Pacific.

With their power based on the new military technology, the extant European empires dominated the world until the 20th century. By the late 17th century the introduction of mobile artillery, the musket and bayonet, and superior ammunition, had further improved the close-combat firepower of European armies. During the 18th and early 19th centuries the dynamic nation-states of Europe and their military leaders used developed military technology on a massive scale wherever their geopolitical and economic interests clashed.

|  |  |  |
| --- | --- | --- |
| III |  | EXPLOSIVES |

|  |  |  |
| --- | --- | --- |
| A |  | The Gunpowder Age |

Although it is reputed to have been originally discovered by the Chinese as far back as the 10th century, gunpowder was first used in weapons in Europe in the 14th century. The first true explosive, it was to have a revolutionary effect on land and sea warfare. In 1453 Turkish cannon breached the powerful defences of Constantinople and signalled an end to the success of Graeco-Roman military technology. In 15th-century Europe large, expensive, muzzle-loading cannon, their supporting foundries, and gunpowder were deployed exclusively by Spain, France, and England. These assertive monarchies used cannon either to defeat external enemies and establish natural frontiers, or to smash the feudal strongholds and political independence of turbulent aristocracies and centralize monarchical power. Until nitroglycerine and cellulose nitrates were discovered in 1846, gunpowder remained the only explosive in use.

|  |  |  |
| --- | --- | --- |
| B |  | Dynamite to TNT |

The efforts of the explosives inventor Alfred Nobel in reducing the volatility of nitroglycerine resulted in the making of dynamite, which largely replaced gunpowder. During World War I and throughout the 20th century TNT (trinitrotoluene) was the chemical high explosive most used in warfare—incorporated into artillery shells and other explosive devices. Before and during World War II a number of extremely efficient new high explosives were developed, including cyclonite, which is used in detonators, and when mixed with TNT and wax is used in bombs. Smokeless powder is used for the propulsion of projectiles in firearms and rockets.

|  |  |  |
| --- | --- | --- |
| IV |  | PRE-NUCLEAR MILITARY TECHNOLOGIES |

Together, 19th-century science and industry catalysed a technological revolution which has continued at a rapid pace to the present day. Explosives technology, firearms, and artillery were continually being developed to produce more destructive explosives, repeating rifles, machine-guns, other rapid-fire weapons, and robust breech-loading artillery. The tank was first used in World War I, as was the landmine. Poison gases, such as mustard gas, were first used in World War I (*see* Chemical and Biological Warfare), and added another method of waging war. Deadly chemicals such as Agent Orange were used to defoliate large areas of Vietnam in the Vietnam War, one of the most protacted conflicts of the 20th century. The hand grenade which, with the addition of its mechanism, was the first throwable bomb, had first been used in a more primitive form in Europe in the 17th and 18th centuries. The growing complexities of logistics and technology led to the creation of permanent military staff. These professional military elites, epitomized by the Prussian General Staff, planned and aligned military strategy, the mobilization of manpower reserves, and the control of industrial resources in increasingly militarized societies.

Two further technogical developments in propulsion and communications increased the violence and speed of warfare and yet facilitated its control.

|  |  |  |
| --- | --- | --- |
| A |  | Propulsion and Mechanizaton |

Steam locomotives were a vital factor in the strategic movement of troops and supplies during the Crimean War and the American Civil War. Railways proved equally vital in World War I, both in initial vast troop mobilizations and in supplying the various fronts.

Steam engines and propellers were fitted on existing wooden sailing ships in the 1850s. The appearance of the iron-armoured French vessel *La Gloire,* launched in 1859, escalated competition in marine technology, culminating in the strategically destabilizing Anglo-German naval race which took place in the early part of the 20th century. The first use of marine turbine engines in 1897 enhanced ship performance and the invention of electric motors and oil-fuelled engines led to the development of submarines, which were to displace the battleship and aircraft carrier as the premier warship.

The dimensions and speed of warfare on land were transformed in 1885 by the internal-combustion engine, when fitted to a wheeled vehicle. The first flight of a heavier-than-air flying machine in 1903, and the emergence of the armoured tank in 1916 meant land warfare became increasingly dominated by mechanization; the dawn of air power added a third deadly dimension to the technological processes of war.

|  |  |  |
| --- | --- | --- |
| B |  | Communications |

While railways enabled the industrialized powers to mobilize, transport, and supply armies consisting of millions of troops, and steam-powered warships, relatively independent of wind and tide, became increasingly more powerful, radiocommunications gave military commanders and their political overlords more decisive command and control over massive armies and distant fleets. Radio reduced to minutes the time taken to make global communications.

|  |  |  |
| --- | --- | --- |
| C |  | Radar and Electronics |

World Wars I and II were total wars fought by the major powers utilizing all their human and economic resources. Military aircraft, tanks, lorries, submarines, radio communications, and signals intelligence were important factors in World War I. With the addition of the aircraft carrier, they proved to be overwhelmingly important in World War II. However, the emergence of electronics (of which radio was the precursor) in the 1940s, nuclear weapons during World War II, and missile technology in the post-war era represented the most complex technological advances so far achieved.

The development of radar and the cathode ray tube in the 1930s was the basis for the burgeoning post-war electronics industry. Early-warning and navigational systems, airborne and ground control interception, gunnery control, and proximity fuse radar proved decisive in specific theatres in World War II. New VHF (very high frequency) radios and more powerful long-range equipment enhanced the command and control of armies, navies, and air fleets. Signals intelligence, particularly the Ultra programme set up to break the German Enigma Code, proved of inestimable value, as did the invention of Colossus— the first real computer—and subsequent models to facilitate decryption and analysis.

By 1944, rapid advances in jet propulsion technology resulted in jet fighters and bombers becoming operational. The first cruise missile, the German V-1, incorporating the first usable rocket motor, was launched against Britain. The most startling weapon was the huge German V-2 rocket, which reached a height of 95 km (60 mi) before dropping on England and Belgium. The missile enabled the devastation of cities, but even before its invention, massive aerial bombing blurred the distinction between combatant and civilians in war.

|  |  |  |
| --- | --- | --- |
| V |  | THE NUCLEAR AGE |

The most revolutionary military technological development of the century to date, the atomic bomb, was the product of the vast American-financed Manhattan Project, which built the bombs that were dropped on Hiroshima and Nagasaki in Japan in August 1945. This project, which cost $2 billion, formed the basis of the burgeoning military-industrial complex after World War II. Signalling the beginning of the nuclear age, it epitomized to many the extent to which science and technology could be harnessed to the services of war.

The American monopoly of nuclear weapons was ended when the Soviet Union exploded a nuclear device in 1949. The new technologies were synthesized by the nuclear powers, joined by Britain in 1952, to produce a series of nuclear delivery and weapons systems which, by the early 1980s, were powerful and numerous enough to destroy much of the world's population.

|  |  |  |
| --- | --- | --- |
| A |  | Research and Development |

Powerful armaments industries had grown up during the 19th century. Research on military technology was funded from profits, but the increased complexity of weapons systems led to more government funding. During World War II an unprecedented level of research and development (R & D) was carried out on weapons systems, leading to greater government spending and political control. Large-scale projects during the Cold War were virtually geared to government operational requirements and contracts and involved thousands of scientists and engineers. Centralized, bureaucratic government and the military-industrial complex commensurately grew in power and resources.

|  |  |  |
| --- | --- | --- |
| B |  | Missiles |

By 1950, long-range jet bombers were in service in the United States' Strategic Air Command (SAC). The development of the hydrogen bomb in the 1950s brought a new dimension of terror to the post-war world. As nuclear weapons and their delivery systems were being mass-produced by the military-industrial complexes of the East and West, theories of deterrence, such as the West's concept of massive retaliation formulated in 1954, emerged from “think-tanks” of scientists and analysts.

By the late 1950s, missile technology had produced the intercontinental ballistic missile (ICBM) and the submarine-launched ballistic missile (SLBM). America's first ICBM, Atlas, entered service in 1959; its first SLBM, Polaris, in 1960; and the Soviet Union's first ICBM, the SS-7, in 1961.

Ballistic missiles have become sufficiently accurate and powerful to destroy targets 8,000 km (5,000 mi) away. The US MX missile, which was developed in the 1980s, was designed to have a mobile launching site capability, while the “air-breathing” cruise missile can be launched from ground, ship, air, or submarine against short-range tactical targets such as ships, or against strategic targets several thousand kilometres away, locating the target through its own sensing devices. Most current air-to-ground guided missiles depend on their own target-sensing mechanism once launched; some US weapons use a miniature television homing system, while others, such as the Strike, follow radar emissions from hostile positions. The unpowered “smart bombs” that were used in the Vietnam War use laser or infrared designators to guide the missile to its target.

Conventional (non-nuclear) missiles—light, rocket-powered projectiles with sophisticated internal guidance systems—represent the limits of military technological effort witnessed in recent conflicts. In the Gulf War, the action and effects of advanced weaponry such as laser-guided bombs and cruise missiles could be seen on television news, which showed the bombing of Iraqi targets via video cameras installed on US F-117 aircraft. Set in contrast with the remote-control aspects of high-technology weaponry is the existence of 100 million uncharted landmines throughout the world, left over from conflicts in Afghanistan, Bosnia, Iraq, and South East Asia. An estimated 800 people a month are maimed by mines, which kill ten times as many civilians as soldiers; modern plastic mines can escape discovery by mine detectors and improved methods of mine detection are technological challenges faced by British and other units conducting mine-clearing operations in these countries.

|  |  |  |
| --- | --- | --- |
| VI |  | STAR WARS AND BEYOND |

The possible zenith of military technology, the Strategic Defense Initiative (SDI) announced by President Reagan in 1983, was also viewed as a potential destabilizing factor. SDI was set up to create a vast, sophisticated ground and space anti-missile defence system to protect the United States, but became viewed as a means of provoking another round of the nuclear arms race. Although the subsequent economic debilitation and disintegration of the Soviet Union at the end of the 1980s diminished the possibility of a massive nuclear exchange, subsequent versions of SDI receive large amounts of government funding. Out of a total cost of a trillion (million million) dollars, about $40,000 million was spent on R & D, making SDI the world's most costly military technology programme to date—involving hundreds of companies, universities, scientists, and engineers.

Military technology has transformed modern forces from the mainly unskilled “cannon-fodder” of large armies to smaller, less visible forces deploying highly complex, increasingly remote-controlled weapons systems, with control over these systems in the hands of the few. Rather than abolishing conventional forces, some types of nuclear weapons have been adapted to serve as “battlefield” weapons, as though they could be used in war like any other weapon.

It is argued by some that adaptations of some military technology to civilian products has produced “spin-off” benefits, such as in microwave equipment, communications, and medical laser techniques. However, others question whether a handful of spin-offs justify the vast expenditure and overuse of resources (human and material) on military technology.

There is no doubting the heightened role of scientists and technocrats since the 1940s in creating the great war machines. The growing proliferation of nuclear and biochemical technology, and associated rapid delivery systems has increased beyond doubt the importance of mature political leadership in avoiding their use. Whether balanced policy can control this technology, or whether it can continue to be afforded by both the Western world and, increasingly, the developing world, will ultimately affect us all.