SCIENCE AND TECHNOLOGY HISTORICAL TIMELINE

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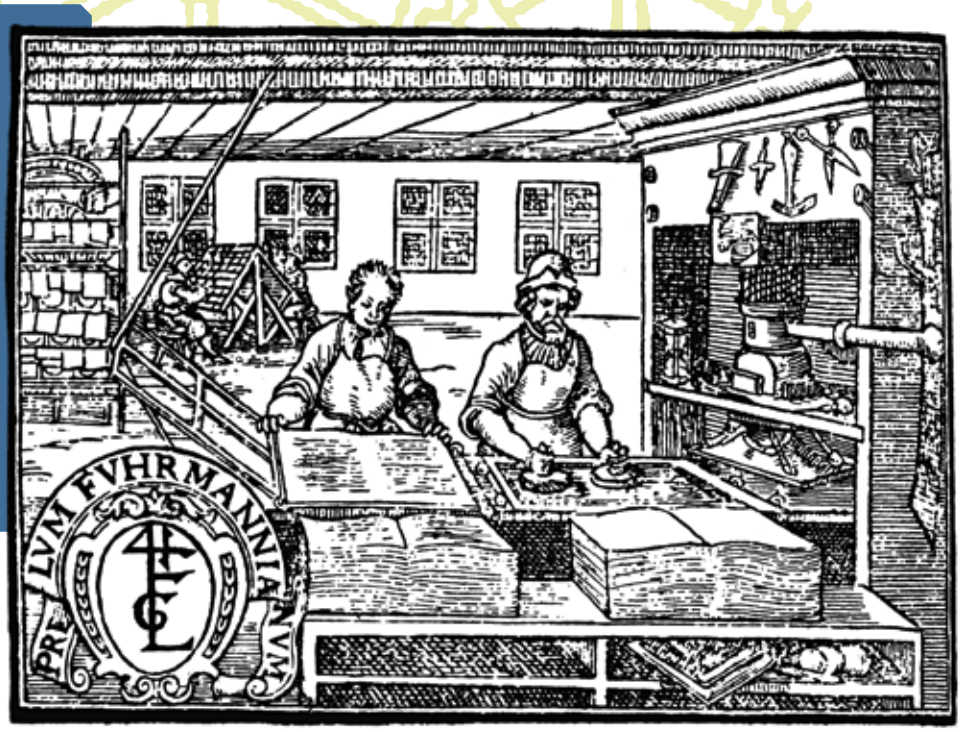
THE DEVELOPMENT OF SCIENCE AND TECHNOLOGY IS AS OLD AS MANKIND. MANY 'INVENTIONS' CLAIMED AFTER THE 11TH CENTURY IN FACT DATED BACK TO THE GREEKS AND CHINESE MANY CENTURIES BEFORE. SCIENTIFIC INFORMATION PROPOSED BY THE GREEK PHILOSOPHER ARISTOTLE (384 – 322 BC) AND OTHERS WAS LOST IN THE DARK AGES IN BRITAIN AND EUROPE AFTER THE COLLAPSE OF THE ROMAN EMPIRE.



The 15th century saw the start of mechanical printing machines able to make identical copies of sheets of paper and books.

THE BIRTH OF TECHNOLOGY (2 MILLION YEARS BC)

TOOLS

The birth of 'technology' was when the first human-like species, *Homo habilis* ('skilful person' 2.6 million years BC) made sharp **cutting edges** from stone. Later, *Homo neanderthalis* or cave men (200 000 – 30 000 years BC) used tools and weapons and were the very successful **ancestors** of *Homo sapiens,* the species we recognise as our ancestors today.

Swords, daggers and other weaponry represented a warlike society but are also interpreted as items of social status, perhaps given as diplomatic gifts between tribes; pictured is the Iron Age Celtic dagger from 250 – 50 BC

METALS

Lead (Pb), one of the softest metals, was being **extracted** from rock in 6500 BC in Anatolia (now Turkey) followed by **copper** (Cu) three thousand years later in Mesopotamia. The Iron Age was built on a hard, strong and **versatile** metal, iron (Fe).

THE WHEEL

Around 4500 BC the wheel and **axle** combination became the most important invention of all time. **Carts** came into common use. By 2000 BC wheels had **spokes**, and then rapid development occurred with waterwheels and **windmills** to provide power.

The wheel, the longest-used invention in human history, had the biggest influence on the development of modern civilization.

NEW INVENTIONS (9TH – 18TH CENTURY)

ARAB ALCHEMY

Turning common metals **into** precious metals, **proved to be a dead end** around the 9th century AD. Nevertheless, Arabs were clever chemists and discovered many chemicals that we use today.

GUNPOWDER

The recipe for making gunpowder appeared in a book in Europe in 1242. Roger Bacon (1214 – 1294), an English

Gunpowder is a substance used in guns to propel (= move forward) the bullet.

friar and philosopher, was the first to describe its **formula**. Guns soon followed.

PRINTING

Spreading knowledge and information was a very slow process before the invention of typography. Johannes Gutenberg (1398 – 1468) developed the first mechanical printing machine in the 1440s. The first printed book was the Bible in 1456 **with a run of** 150 **copies**. Each Bible previously took three years to make by hand.

THE TELESCOPE

The telescope was invented by Dutchman Hans Lippershey (1570 – 1619). In 1610, using his improved design, Galileo Galilei (1564 - 1642) was able to prove that the Earth **revolved around** the Sun. This **confirmed** the ideas of the Polish astronomer Nicolaus Copernicus (1473 – 1543) but it **angered** the Catholic Church who had adopted the idea that the Earth was at the centre of everything.

The Harlan J. Smith Telescope, McDonald Observatory in Fort Davis (USA). Founded in 1932, it is the observatory of the University of Texas and operates six telescopes.

THE MICROSCOPE

Looking at small things became possible when a Dutch maker of **spectacles**, Hans Janssen and his son, put glass **lenses** together in 1590 to make a primitive microscope. Anton van Leeuwenhoek (1632 – 1723) **took this invention a step further** in 1676 **with a magnification of 270 times** and discovered **tiny single-celled creatures in pond water**. **Ultimately**, this helped our understanding of microorganisms and disease.

LIGHTNING CONDUCTOR

In 1752, Benjamin Franklin (1706 –1790), the American statesman, philosopher

Lightning conductor, Nieuwe Kerk (New Church), Delf, Holland

and scientist proved that **lightning** was a form of electricity when he flew a **kite** in a **thunderstorm**. Around 1754, Franklin and the Czech scientist, Prokop Diviš (1698 - 1765) **independently** developed the lighting conductor to protect buildings from being hit and damaged by lighting.

THE FIRST INDUSTRIAL REVOLUTION (1760 – 1840)

STEAM POWER

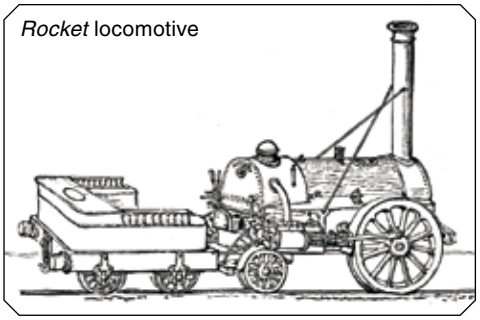
This era saw the development of **steam engines** to **power** factory machinery. Heating water in a boiler to make steam to power a vehicle was a major technological **advance**. James Watt (1736 – 1819) is

A microscope is an instrument for viewing objects that are too small to be seen by the unaided eye. Today, there are electron miscroscopes, using magnetic fields and electron rays instead of lenses and light, making it possible to see even atoms.

Steam engines enabled the development of pumps, locomotives, steam ships, steam lorries, etc.

recognised as the inventor of the steam engine in 1765. Water could be pumped out of **mines** and industrial processes **speeded up**.

George Stephenson's (1781 - 1848) *Rocket* was the first locomotive to pull heavy **loads** a long distance. This led to the rapid expansion of railways throughout Britain and the world. The combination of iron and steam **paved the way for** the great Victorian engineering projects of Isambard Kingdom Brunel (1806 - 1859). He designed bridges, tunnels, viaducts and ships.



Rocket locomotive

PHOTOGRAPHY

In 1826, after years of experiments, the French inventor Joseph Nicéphore Niépce (1765 - 1833), using 'bitumen of Judea' **spread on a pewter plate** and an **exposure** of eight hours in bright sunlight, produced the first permanent picture. His technique was improved upon by his colleague Louis Daguerre (1787 - 1851) by using **compounds of silver**, the basis of modern photography.

Already in the 16th century, a device called "camera obscura" was able to project images on a board, however, it wasn't able to capture permanent images.

THE SECOND INDUSTRIAL REVOLUTION (19TH CENTURY – 1945)

THE ELECTRIC LIGHT

After many **refinements**, Thomas Edison's (1847 – 1931) electric light **bulbs** were the best and by 1879 they would last for hundreds of hours, much longer than any of their rivals. They were also cheap. To sell bulbs, energy was needed, so Edison's Electric Illumination Company built their own **power station** in New York. After many decades he successfully **persuaded the public to opt** for clean, convenient electric light rather than **gas** lights.

Edison made his first lightbulbs from bamboo fibres.

THE TELEPHONE

This is an invention that made money. Alexander Graham Bell (1847 – 1922) was the first **in the race to patent** a machine in 1876 that you could use to talk to someone on the other side of the world. **Admittedly**, it was **initially** from one room to another. The message was "Mr. Watson, come here, I want you". A year later in 1877 he **set up** his company and demonstrated long distance calls.

Pioneer Village Telephone Office

In 1888, George Eastman (pictured on the left) registered the trademark Kodak, (which was simply a combination of some of his favourite letters), long known for its wide range of photographic film products.

THE MOTOR CAR

Until the 1860s all prototype motor cars were **steam driven**. German inventor Nicolas Otto (1832 - 1891) created an improved **internal combustion engine** in 1876 and this is still the way cars work today. In 1885, the first car, the Benz Patent Motorwagen, was developed by Karl Benz (1844 - 1929). It was a long time before cars became common. **Petrol**, a **cleaning fluid**, was only available from the chemist. Famous names such as Rolls Royce and Henry Ford developed the technology; Rolls Royce for the rich and Henry Ford for the man in the street.

Replica of the Benz Patent Motorwagen built in 1885

THE MOVIES

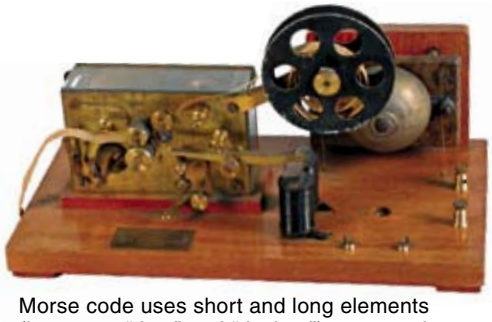
It has been only just over one hundred years since the first movie, or film, was shown by the brothers Auguste and Louis Lumière (1862 - 1954 and 1864 - 1948) in 1895 at the Grand Café in Paris. The terrifying film was entitled *The Arrival of a Train at Ciotat Station*. Surprisingly, the brothers decided that films didn't have much of a future and went back to photography. In 1889, George Eastman (1854 - 1932) **pioneered celluloid** film with holes **punched in the side** so that the movie camera could show the film precisely **frame** by frame.

X-rays were quickly adapted for their use in medicine. They are especially useful in examining the skeletal system, but they can also identify other diseases, for example pneumonia and lung cancer.

X-RAYS

Science is impressive when something is discovered that cannot be seen. German physicist Wilhelm Rontgen (1845 – 1923) working with **electrical discharges in glass tubes** noticed in 1895 that there was a **faint glow** on a nearby screen. These **rays were invisible** and could

pass through most materials. He also recorded them on photographic paper and thus the first X-ray image was developed. He quickly realised the **medical potential** of his discovery. Henri Becquerel (1852 – 1908) discovered radioactivity in 1896 while trying to find more out about X-rays. Marie Curie (1867 – 1934), a Polish born French chemist and physicist and two times Nobel Prize winner, is best remembered for her research into radioactivity and new radioactive elements.

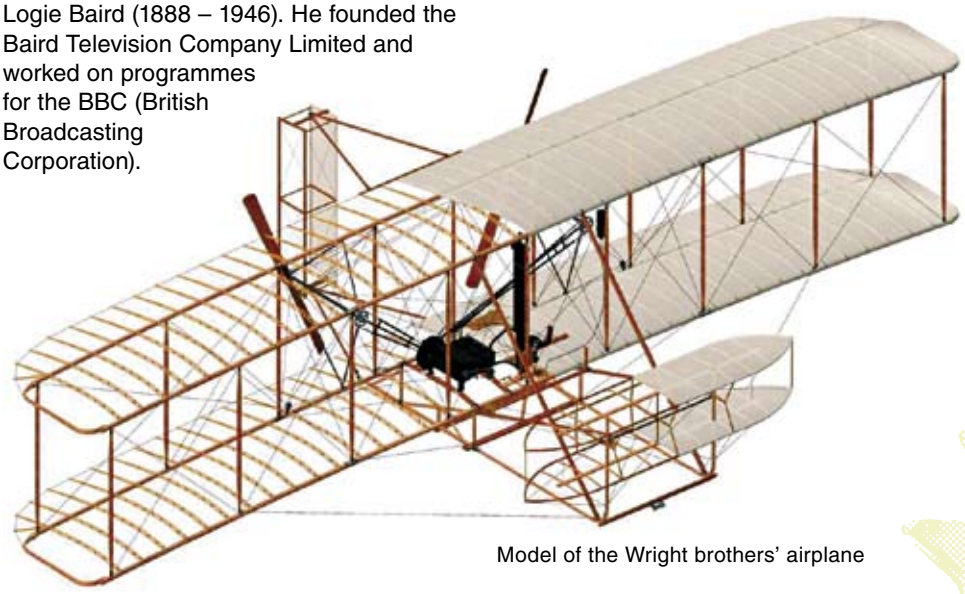


Morse code uses short and long elements (known as "dots" and "dashes") to transmit information. Originally created for an electric telegraph, it was often used for early radio communication.

COMMUNICATIONS

Radio waves travel in all directions **at an incredible** 300 000 km per second. The German physicist Heinrich Hertz (1857 – 1854) was the first to prove they existed but it was Guglielmo Marconi (1874 – 1937) who set up the world's first radio stations to **transmit** and receive **Morse code**. In 1896, he sent the first message across the Atlantic from Cornwall to Newfoundland. He was awarded the Nobel Prize for Physics in 1909. It was not until 1915 that engineers were able to transmit sound effectively. The first clear television pictures to be transmitted were sent by Scottish-born John Logie Baird (1888 – 1946). He founded the Baird Television Company Limited and worked on programmes for the BBC (British Broadcasting Corporation).

The Proton rocket is a type of Russian space vehicle. It was first launched in 1965 and it is still used today, which makes it one of the most successful rockets in the history of space flight.



Model of the Wright brothers' airplane

FLIGHT

At the turn of the century, in 1903, two bicycle **repairmen** from Ohio, Wilbur and Orville Wright (1867 – 1912 and 1871 – 1948) built and flew the first really successful aeroplane near Kitty Hawk, North Carolina. From that time progress was rapid and the military advantages of flight were realised in WWI.

ROCKETS AND SPACE FLIGHTS

The earliest rockets were used in China in the 11th century but by the 19th century speed and **accuracy** were much improved. Knowledge of astronomy meant that scientists knew the relative movements of the planets **in relation to** the Earth. A Russian mathematics teacher, Konstantin Tsiolkovsky (1857 – 1935), was the first person to **draw up** plans for space stations and air locks to allow space walks. He correctly calculated that a rocket would have to travel at 8 km per second to leave the atmosphere and that **liquid rocket fuel** would be essential. American scientist Robert Goddard (1882 – 1945) not knowing of Tsiolkovsky's ideas, independently developed liquid fuelled rockets from 1926. Ultimately, NASA **took up the challenge** but the Russians eventually won the race to put a man into **orbit**. Yuri Gagarin (1934 – 1968) **orbited** the earth in 1961. In the US, NASA scientists **redressed the balance in the space race with their moon landing** in 1969.

The cloud of smoke and flame produced by a nuclear explosion is called a "mushroom cloud" because of its typical shape.

THE ATOMIC BOMB

Science and technological advances can be seen as good or bad. The invention of gunpowder must have seemed like that. In 1932, physicists John Cockcroft (1897 – 1967) and Earnest Walton (1903 – 1995) did the impossible. They **split** the atom. They proved Albert Einstein's (1879 – 1955) theory of relativity ($E=mc^2$) and **unlocked** the secrets of the atomic **nucleus**. Splitting the atom was a brilliant scientific achievement. However, having that knowledge allowed scientists to develop the atomic bomb. The use of an atomic bomb on Hiroshima and Nagasaki in Japan to end the WWII in 1945 was a political decision that was highly controversial. We now know that **there is no turning back once** scientific and technological discoveries have been made.

THE THIRD SCIENTIFIC-TECHNICAL REVOLUTION (1945 -)

After the WWII new discoveries and advances in science and technology came **thick and fast**. Plastics were developed for the first time. In 1949, the first practical programmed electronic computer ran mathematical problems. It **fitted into** one room! In the 1960s, the electronic silicon chip was invented, computers became smaller and more powerful. In 1984, the CD was born and the digital revolution began. The worldwide web has given us access to billions of documents with information and images as well as online shopping and banking. Mobile telephone technology means we have **instant** contact with friends and family. During this period, there have also been huge advances in genetics since the discovery of the structure of DNA in 1953. Today, Biotechnology and genetic engineering show fast growth trends and, also, are big business. It is interesting to wonder what next? Maybe space is the final frontier, as suggested in *Star Trek*!

DNA contains the genetic information for the reproduction of life.

One of the latest **gadgets**, the Blackberry, combines the worldwide web with the mobile telephone.

In the beginning, computers were mostly used for mathematical operations.

The first electro-mechanical computer was built in the USA in 1946 by Eckert and Mauchly.

→ Vocabulary

cutting edge [ɛdʒ] - ostří
ancestor ['ænsɛstə] - předek, předchůdce
lead [lɛd] - olovo
to extract [ɪk'strækt] - získat
copper ['kɒpə] - měď
versatile ['vɜ:sətaɪl] - univerzálně použitelný
axle ['æks(ə)l] - náprava
cart [kɑ:t] - vůz
spokes [spəʊks] - paprsky kola
windmill ['wɪn(d)mɪl] - větrný mlýn
alchemy ['ælkɪmi] - alchymie
turning... into - přeměna... na
proved to be a dead end [pru:vd] - se ukázala jako slepá ulička
gunpowder ['gʌnpaʊdə] - střelný prach
friar ['fraɪə] - mnich
formula ['fɔ:mjʊlə] - složení
with a run of... copies - v nákladu... výtisků
to revolve around [rɪ'vɒlv] - točit se kolem
to confirm [kən'fɜ:m] - potvrdit
to anger ['æŋgə] - rozhněvat
spectacles ['spɛktək(ə)lz] - brýle
lens [lɛnz] - čočka
took this invention a step further... with a magnification of 270 times [ɪn'vɛnʃ(ə)n 'fɜ:ðə mægnɪfɪ'keɪʃ(ə)n] - dotáhl tenhle vynález ještě o krok dál... když dosáhl 270-tinásobného zvětšení
tiny single-celled creatures in pond water [sɛld 'kri:tʃəz pɒnd] - drobounké jednobuněčné organismy v rybniční vodě
ultimately ['ʌltɪmətlɪ] - nakonec
lightning conductor ['laɪtnɪŋ kən'dʌktə] - bleskosvod
lightning - blesk
kite [kaɪt] - papírový drak
thunderstorm ['θʌndəstɔ:m] - bouře
independently [ɪndɪ'pɛnd(ə)ntlɪ] - nezávisle na sobě
steam engine [sti:m 'ɛndʒɪn] - parní stroj
to power ['paʊə] - pohánět
advance [əd'vɑ:ns] - pokrok
mine [maɪn] - důl
to speed up - zrychlit
load [ləʊd] - náklad
paved the way for - připravila cestu
spread on a pewter plate ['pju:tə pleɪt] - rozetřený po cínové desce
exposure [ɪk'spəʊʒə] - doba expozice
compounds of silver ['kɒmpaʊndz 'sɪlvə] - sloučeniny stříbra
refinement [rɪ'faɪnm(ə)nt] - vylepšení, zdokonalení
bulb [bʌlb] - žárovka
power station ['paʊə 'steɪʃ(ə)n] - elektrárna
persuaded the public to opt [pə'sweɪdɪd ɒpt] - přesvědčil veřejnost, aby dala přednost
gas - plynový
in the race to patent ['peɪt(ə)nt] - v závodě o to, kdo si dřív nechá patentovat
admittedly [əd'mɪtdlɪ] - je pravda, že
initially [ɪ'nɪʃ(ə)lɪ] - zpočátku
to set up - založit
steam driven ['drɪv(ə)n] - poháněné párou
internal combustion engine [ɪn'tɜ:n(ə)l kəm'bʌstʃ(ə)n 'ɛndʒɪn] - spalovací motor
petrol ['pɛtr(ə)l] - benzín
cleaning fluid ['flu:ɪd] - čistidlo
pioneered celluloid... punched in the side [paɪə'nɪəd 'sɛljʊlɔɪd pʌn(t)ʃt] - zavedl celuloidový... s dírkami po okrajích
frame [freɪm] - okénko (filmu)
X-rays ['ɛksreɪz] - rentgen
electrical discharges in glass tubes [ɪ'lɛktrɪk(ə)l 'dɪstʃɑ:dʒɪz tju:bz] - elektrické výboje ve skleněných trubkách
faint glow [feɪnt gləʊ] - slabá záře
rays were invisible [reɪz ɪn'vɪzɪb(ə)l] - záření bylo neviditelné
to pass through (sthg.) - proniknout (něčím)
medical potential ['mɛdɪk(ə)l pə(ʊ)'tɛnʃ(ə)l] - medicínský potenciál, možné využití v medicíně
at an incredible [ɪn'krɛdɪb(ə)l] - neuvěřitelnými (neuvěřitelnou rychlostí)
to transmit [trænz'mɪt] - vysílat
Morse code [mɔ:s kəʊd] - morseovka
repairman [rɪ'pɛ:mæn] - opravář
accuracy ['ækjʊrəsi] - přesnost
in relation to - ve vztahu k
to draw up [drɔ:] - vypracovat, vytvořit
liquid rocket fuel ['lɪkwɪd 'rɒkɪt fjʊəl] - kapalné raketové palivo
took up the challenge ['tʃælɪn(d)ʒ] - přistoupila na výzvu (pustila se do soupeření)
orbit (to orbit) ['ɔ:bɪt] - oběžná dráha (obletět zemi po oběžné dráze)
redressed the balance in the space race with their moon landing [rɪ'drɛst 'bæl(ə)ns speɪs 'lændɪŋ] - dotáhli soupeře v závodě o dobývání vesmíru díky tomu, že přistáli na Měsíci
to split - rozštěpit
to unlock [ʌn'lɒk] - rozluštit, odhalit
nucleus ['nju:klɪəs] - jádro
there is no turning back once - že cesta zpět není možná, jakmile
thick and fast [θɪk] - ze všech stran
it fitted into [fɪtɪd] - zaplnil
instant ['ɪnst(ə)nt] - okamžitý
gadget ['gædʒɪt] - aparát, vynález

Glossary

bitumen of Judea - a black sticky substance, such as asphalt, usually obtained from the Dead Sea (hence called "of Judea")

air lock - a chamber in which the air is kept under pressure, permitting passage to or from a space