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### **ENGINEERING HISTORY PAPER #101**

## **“A Chronology of Engineering Anniversaries”**

**by Andrew H. Wilson**

(previously produced as Cedargrove Series #55/2021 – Nov 2021)

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**THE CEDARGROVE SERIES OF  
DISCOURSES, MEMOIRS AND ESSAYS**

**#55/2021**

**ENGINEERING ANNIVERSARIES**

by Andrew H. Wilson

November 2021

## **Abstract**

Anniversaries are often used to remind people of an occasion, an achievement, a birthday, or simply something that happened, like 'D-Day, Sixth of June.' They can be as associated with engineering as they can with any other field of activity. And people need reminding of them.

The purpose of this paper is to suggest anniversaries associated with engineering, worldwide and historically, to highlight a number of its notable achievements, feats, and successes, as well as some of the disasters that have been associated with it and, by so doing, to do some needed reminding. For all too soon, engineering people and what they have done (or not done) seem to be forgotten - overshadowed by today's news, or simply let go from memory as not very significant.

## **About the Series**

Principally, the Cedargrove Series is intended to preserve some of the research, writings and oral presentations that the author has completed over the past half-century or so but has not yet published. It is, therefore, a modern-day variant of the privately published books and pamphlets written by his forebears, such as his paternal grandfather and grandmother and his grandfather's brother John.

## **About the Author**

He is a graduate in mechanical engineering and the liberal arts and has held technical, administrative, research and management positions in industry in the United Kingdom and the public service of Canada, from which he retired over 30 years ago.

He became actively interested in the history of engineering on his appointment to chair the first history committee of the Canadian Society for Mechanical Engineering in 1975 and served both CSME and the Engineering Institute of Canada in this capacity for varying periods of time until 2003. He has researched, written and edited historical material for both organizations, as well as for the Canadian Society of Senior Engineers. He is also a past president of CSME and the *EIC*.

## **To set the scene...**

People, it seems, have been around engineering since time immemorial, or almost.

The inspiration for this present paper has been the collection of very short articles published by a Canadian daily newspaper, Toronto's *Globe & Mail*, and reprinted as a regular column. Each *Moment in Time* includes a title, a photograph and some explanatory text. Each describes a notable happening across the spectrum of human activity...including engineering. The date-days of publication of each of the *Moments* have usually coincided with their anniversaries. For example, the *Moment* that appeared in the January 18, 2021 issue of the newspaper commemorated the day of the start of the digging for the construction of the Eiffel Tower in 1887. The one that appeared in the February 10, 2021 issue commemorated the opening in 1977 of Toronto's Eaton Centre.

The *Moment* that appeared on March 3, 2021, commemorated the birth of Alexander Graham Bell, in Edinburgh, Scotland, in 1847. The text included these words, "On this day...one of the world's most important inventors was born...He started inventing at 12 and became interested in acoustics because of his mother's growing deafness. He moved with his parents to Brantford, Ontario, where he learned the Mohawk language from the nearby Six Nations Reserve and translated its unwritten vocabulary into symbols for speech..."

A *Moment* that appeared on March 8, 2021 was headlined, *Booms and Busts in B.C. Shipbuilding*. The accompanying text, by Philip King, reads as follows:

“British Columbia’s shipbuilding industry, with its century-old history of vessels for fishing, natural resources, defence and ferries is boom and bust. The first boom was wooden fishing ships. The First World War ushered in a boom with steel ships....(but) the next dozen years were a bust. (The) Second World War was a boom, including 250 freighters, 15 frigates, 10 corvettes and 10 minesweepers. About 10 years ago, the National Shipbuilding Strategy Program awarded Seaspan International of North Vancouver, B.C., a multi-billion dollar contract for three fisheries/science vessels, an ocean-research vessel, a Coast Guard icebreaker and two navy support ships. Recently, it was announced that the price of the ocean research ship (had grown) to \$1-billion, almost 10 times the original estimate. Call that one a boom too.”

The lists of international and Canadian - mostly engineering-related - anniversaries that follow appear in chronological order. Some go back a millennium or more, and a few have been derived from *Moment* columns. Most have very short explanations supporting their inclusion. Listings of this kind may not be ‘good history,’ since the explanations provide limited enlightenment. But as the lists’ purpose is to stimulate further enquiries of a historical nature by readers, they have been deemed justified!

Readers will know that, originally, there were two disciplines of engineering: military and civil. Years later, the mechanical and mining parts of the civil discipline stood alone and the civil one itself acquired a structural partner. A marine discipline evolved out of the advances in ship design that began with the advent of steam propulsion in the early 19<sup>th</sup> century. By the end of that century, there were also chemical, electrical, aeronautical and automobile disciplines. Since then, and especially after World War II, the numbers of new disciplines, and subdivisions of old ones, have increased. The current listing of recognized disciplines now stands at over two dozen. The items in the lists below reflect this historical development.

Readers will also know that, for a very long time, there were no lady engineers. More recently, this situation has been changing and, while numerical parity is not in sight, the ladies are much more in evidence than they once were.

There are two lists: the later, much longer and more current one covering the ‘modern’ era of engineering has been preceded by a shorter one covering the earlier period of it with relatively fewer, and much less precisely defined dates. However, the dates when a handful of engineering’s principal (and very early) constructions, machines and devices first appeared are either unknown, uncertain or unknowable - for example: the wheel, the wedge, the controlled use of fire, the early tools and weapons of stone and metal, including the bow and arrow, and the use of tamed animals for transportation. These lists should be read along with CEDARGROVE No. 35, No. 47 and No. 52.

## **The Early List...**

The Last Ice Age ended and the Agricultural Revolution began around 10,000 BC; also, by then the thrown, flat aerofoil boomerang was in use, independently, in several countries (including Australia) as a hunting weapon.

The horse disappeared from North America around 9,000 BC, for reasons not yet understood; the domestication of the horse, elsewhere, began around 6000 BC.

The building of the large burial monument at Stonehenge, England, may have begun as early as 8000 BC.

Dugout canoes were being used around 6000 BC.

The axle came together with the wheel, probably in the form of a potter's wheel, somewhere around 5000 BC; levers were first applied, possibly in the Middle East, also around then.

Around 4000 BC, it was discovered that charcoal could be used to melt iron ore.

The Bronze Age lasted from about 3300 BC to about 1200 BC.

The building of the sewer system at Skara Brae in Scotland's Orkney Islands may have begun around 3000 BC.

The earliest shaduf, or water-lifter-bucket, may date from 3000 BC, in Mesopotamia.

The first two-wheeled, two-horse-drawn chariots appeared around 2000 BC; their construction was dependent on the availability of spoked wheels.

Silk was first made in China around 2700 BC.

The oldest of the Seven Wonders of the Ancient World, the Great Pyramid of Giza, was built around 2500 BC.

The building of the public sewage/drainage system at Moenjodaro, in the Indus Valley, may have begun around 2300 BC; water-flushing toilets are thought to have been developed seven centuries later.

The use of pulleys began somewhere around 2000 BC.

Water clocks were in use in the 16<sup>th</sup> century BC.

The Iron Age lasted from about 1200 BC to about 500 BC.

The trireme, the foremost of the ancient fighting ships, had its disputed origin around the 8<sup>th</sup> century BC, somewhere in the Mediterranean.

The Chinese started the construction of their famous Great Wall in the 7<sup>th</sup> century BC; around this time, also, they developed the crossbow.

The other six of the Seven Wonders were built between the 7<sup>th</sup> and the 3<sup>rd</sup> centuries BC: the Hanging Gardens of Babylon, the statue of Zeus at Olympia, the Colossus of Rhodes, the Lighthouse of Alexandria, the Temple of Artemis, and the Mausoleum of Halicarnassus.

The earliest endless-chain water bucket lifting system likely dates from around 600 BC; the so-called Archimedes hand-operated screw pump for lifting water, dates from 350 BC.

In the 6<sup>th</sup> century BC, Eupalinus of Megara, a Greek, drove a 4000-foot tunnel through Mount Kastro on the Island of Samos, starting from both ends, to provide a water supply.

Gears were being used by the Greeks in the 4<sup>th</sup> century BC.

Sometime during the 3<sup>rd</sup> century BC, the 'male thread' screw was developed.

By the 3<sup>rd</sup> century BC, the Romans had perfected the semi-circular stone arch, which they applied extensively to a wide variety of constructions; around this same time, they also discovered pozzolana cement, of volcanic origin, which they used to strengthen mortar and which hardened under water.

By 300 BC, the Romans had mastered the art of building of aqueducts.

In the 3<sup>rd</sup> century BC, Philo of Byzantium developed a military catapult.

The first of the ancient Silk Roads was opened in China during the 2<sup>nd</sup> century BC.

The magnetic compass was developed in China sometime between the 2<sup>nd</sup> century BC and the 1<sup>st</sup> century AD.

The Pont du Gard at Nimes, France, one of the earliest large scale bridges, was completed during the 1<sup>st</sup> century BC.

Vitruvius, a Roman engineer and architect, wrote the world's first 10-volume book on engineering and architecture sometime during the 1<sup>st</sup> century BC.

Paired stirrups were also in use during the 1<sup>st</sup> century BC in the Middle East, coming to Europe in the Middle Ages.

### **From here on, all dates are AD...**

99: Vesuvius volcanically erupted and destroyed Pompeii and Herculanium.

By 200, the Romans had built 50,000 miles of roadway.

The building of St. Peter's Cathedral in Rome began around 333.

The building of the *Hagia Sophia* in Istanbul began in 532 and was completed five years later.

889: The first small fortress, on the site of the present Alhambra, in Spain, was completed; by 1358, the structure had been rebuilt using its characteristic red stone to double as a palace; the building was further modified in the 16<sup>th</sup> century and later.

Around 904, gunpowder was first used in China.

Beginning in the 10<sup>th</sup> century, water-driven, stone-grinding grist mills became commonplace in Northern Europe.

Sometime after 1066, the original Windsor Castle was built in England as a Norman keep; extensive additional building was done in the 13<sup>th</sup> century, and a palace was built inside the Castle; both Henry VIII

and Elizabeth I contributed to later building; of much more recent interest has been the serious fire that engulfed part of the castle in 1992.

1078: The first, wooden, hill-top version of the Hohenwerfen Castle in Austria was completed; it was subsequently rebuilt in stone, fortified and renovated from time to time, until recently.

1093: St. Margaret's Chapel, the first building, was erected on the volcanic rock on which, in the 12<sup>th</sup> century, Edinburgh's Castle was built.

1156: This is the date of the original Kremlin enclosure in Moscow; the present one dates from the 16<sup>th</sup> century.

The first castle at Carnaervon in North Wales lasted from the late 11<sup>th</sup> century until 1223, when replacement began, and ended in 1330; although subsequently used for warlike purposes during Welsh-English quarrels, it became dilapidated over the next 500 years, after which funding was again provided to improve its condition, such that it could be used for Prince of Wales Installations in 1911 and 1969.

1250: The Pont d'Avignon Bridge across the Rhone River in France, was completed.

1271-95: Travels to, and within, China by Marco Polo, his father and uncle.

Beginning in the 14<sup>th</sup> century, windmills were being used to remove water from low-lying land in Holland.

June 24, 1314: King Robert-the-Bruce and his Scottish army defeated the English at Bannockburn.

1337: The Hundred-Years-War (a series of conflicts) began in Europe.

1345: Notre Dame Cathedral completed in Paris; construction began in 1163; a fire gutted the building on April 15, 2019, from which rebuilding repairs are currently under way.

1345: The Ponte Vecchio was completed, over the River Arno at Florence, Italy; it was arch-type and inhabited.

1348-1351, a plague - the Black Death - reached Europe from Asia by way of rats and ships; 20 million people (one-in-three) in Europe eventually died from it.

1436: Brunelleschi completed the installation of his dome on the Cathedral in Florence, Italy.

Around 1450, Johannes Gutenberg developed the first moveable type printing system in Europe.

April 15, 1452; Italian polymath Leonardo da Vinci was born near Florence.

March 24, 1490: German Georg Bauer, also known as Georgius Agricola, was born at Glauchau; he later wrote the first comprehensive textbook on mining and metallurgy, *De Re Metallica*.

The voyages associated with the discoveries of the American continent in the 15<sup>th</sup> and 16<sup>th</sup> centuries include the following:

Columbus: 1492, 1493, 1498, 1502

Vespucci: 1499, 1501

Ponce de Leon: 1513  
Bilbao: 1513  
Magellan: 1519-1520  
Cortes: 1519-21  
Pizarro: 1529, 1532, 1535  
Verrazano: 1524  
Cabot: 1497  
Cartier: 1534  
Champlain: 1603  
Gilbert: 1583  
Hudson: 1609-11  
Drake: 1577

Plus the initial voyage to India by way of the Cape of Good Hope: Vasco da Gama: 1497-99.

Columbus (1493) and Cortes (1519), and others, were responsible for the reintroduction of the (domesticated) horse into the Americas.

1559: St. Giles Cathedral, Edinburgh, Scotland, declared a Protestant church; the building of the present church began in the 14<sup>th</sup> century and continued in the 16<sup>th</sup>.

1606: The Pont Neuf, the first single-span bridge to cross the River Seine at Paris, was completed.

1609: Galileo the first to point a telescope skyward.

In 1614, Scotsman John Napier invented logarithms; based on these, the Rev Oughtred and his contemporaries invented the slide rule which, in the late 19<sup>th</sup> and for much of the 20<sup>th</sup> centuries provided engineers with the ability to do faster calculations.

January 4, 1643: English scientist (Sir) Isaac Newton was born in Lincolnshire.

1672: The first coal was mined at Sydney, Cape Breton, Nova Scotia.

1679: The original Highclere Castle, in Hampshire, England, was completed; renovated in the 1840s, and with 300 rooms, it became famous on TV in the 2010s as 'Downton Abbey.'

By 1680, the wooden Acadian sluice - the *aboiteau* - was in use in and around the Bay of Fundy, to help drain marshy areas for agriculture.

1685: German Johann Zahn developed the first successful photographic image.

July 2, 1698: Englishman Thomas Savory patented a steam-powered pump.

Major advances in the use of gearing took place during the 17<sup>th</sup> century.

In 1702, largely under the influence of Thomas Savary, with Thomas Newcomen in the background, the power developed by steam engines was linked - for comparative purposes - to the work done by draft horses.

January 17, 1706: American polymath Benjamin Franklin was born in Boston.

December 25, 1711: St. Paul's Cathedral, London, declared complete by Parliament.

1712: Thomas Newcomen invented the 'atmospheric' steam engine; it was the first practical device to harness steam to do mechanical work.

July 8, 1714: The British Parliament passed an Act establishing a prize for a practical solution to the Longitude Problem; John Harrison was the eventual winner but, even by 1773, he had not collected all of its promised amount.

1720: Coal was first exploited by underground mining on Cape Breton Island, Nova Scotia.

1720-40: The building of fortifications at Louisbourg, Nova Scotia; the fort was besieged and captured in 1745 (by forces from New England) and 1758 (by the British); after 1768, it was demolished, to be rebuilt in the 20<sup>th</sup> century as a national historic monument.

June 3, 1724: English engineer John Smeaton was born at Leeds; he was reputed to be the first to call himself a *civil* engineer; he designed the third Eddystone Lighthouse, rediscovered pozzolana cement, and founded the Smeatonian Society of Civil Engineers in 1771.

In 1730: Les Forges de St. Maurice opened in the Mauricie Region of Quebec, fed by iron ore deposits from nearby Trois Rivières; they closed in 1883.

January 19, 1736: Scottish engineer James Watt was born at Greenock.

The first Industrial Revolution began around 1750 (the second around 1850, and the third around 1950).

August 9, 1757: Scottish civil engineer Thomas Telford was born at Eskdalemuir.

March 22, 1765: The American Revolution began; it ended on 14 January 1784.

January 5, 1769: James Watt received a patent for his separate condenser.

October 10, 1770: American engineer Benjamin Wright was born in Connecticut; he was later involved in the construction of the Erie, Delaware, Hudson, Chesapeake and Ohio Canals and has been called the 'father of American civil engineering.'

The unit of *horsepower* was defined by James Watt in the late 18<sup>th</sup> century (and used to help sell his steam engines) as the work done to lift 550 pounds by 1 foot in 1 second, later defined as working at the rate of 33,000 ft.lb per minute. It was also eventually deemed equivalent to 746 watts. And most recently, a watt of energy became the same as working at the rate of a joule-per-second.

June 7, 1761: Scottish civil engineer John Rennie (the Elder) was born at East Linton; he died on October 4, 1821; he was professionally associated, for example, with lighthouse-builder Robert Stevenson.

In 1761, James Brindley completed England's first major canal, the Bridgewater, which enabled the Duke to ship coal from his mines to its markets.

1766: Coal mining began at Sydney Mines, Nova Scotia; it began at Glace Bay in 1863.

August 22, 1771: English mechanical engineer and machine-tool builder Henry Maudslay was born at Woolwich.

June 8, 1772: Scottish engineer Robert Stevenson was born in Glasgow; from 1797 to 1843, he (or one of his family) built most of Scotland's principal coastal lighthouse.

December 27, 1773: English aeronautical scientist (Sir) George Cayley was born at Scarborough.

January 1, 1781: The Iron Bridge at Coalbrookdale in Shropshire, England, was completed; it was the first to be built from iron castings.

June 4, 1783: The Montgolfier brothers made the first human flight in a balloon, in France.

The French Revolution began on May 5, 1789 and ended on November 9, 1799.

September 22, 1791: English physicist/electrical engineer Michael Faraday was born in London.

August 30, 1794: Scottish/English civil engineer (Sir) John Rennie (the Younger) was born in London; he died 80 years later.

August 26, 1796: Scottish/Canadian engineer Nicol Hugh Baird was born in Glasgow.

The screw-cutting lathe had been invented by the end of the 18<sup>th</sup> century.

## The Later List...

1800: Italian Alessandro Volta generated dc power for the first time, by battery.

1800: Englishman James Potts developed an above-the-knee prosthesis significantly more articulated than earlier ones.

1801: Frenchman J.M. Jacquard invented a loom that used wooden punched cards.

December 21, 1803: English mechanical engineer (Sir) Joseph Whitworth was born at Stockport.

1803-1815: Generally, the years of the Napoleonic Wars in Europe.

1807: The lighting of Scotland's Bell Rock Lighthouse began; it was automated in 1988.

April 9, 1806: English engineer Isambard Kingdom Brunel was born; he began his career by finishing his father's Rotherhithe Tunnel under the River Thames, by building the Great Western Railway, and by launching three steamships that significantly advanced naval architecture; he died at the early age of 53.

June 12, 1806: German/American civil engineer John A. Roebling was born at Muhlhausen.

1807: Robert Fulton's steamboat *Clermont* went into service on the Albany River, New York; John Molson's steamboat *Accommodation* went into service on the St. Lawrence in 1809; and Henry Bell's *Comet* went into service on the River Clyde in 1812.

October 20, 1810: American engineer Alfred W. Craven was born in Washington; he was later a founding member of the American Society of Civil Engineers.

1813: Polish/Russian/American/Canadian engineer (Sir) Casimir Gzowski was born in Russia; much later, he was appointed an Honorary ADC to Queen Victoria.

1814: The first train of wagons was drawn by a steam locomotive, at Merthyr Tydfil, in Wales.

1815: The British Institution of Civil Engineers was founded.

April 1, 1816: Canadian agricultural entrepreneur Alanson Harris was born at Ingersoll, Ontario.

1816: Frenchman Nicephore Niepce invented photograph film.

December 17, 1817: American engineer Henry R. Worthington was born in New York City; he later invented the first direct-acting steam driven pump at his eponymous firm; and he was a founding member of the American Society of Mechanical Engineers.

March 28, 1819: (Sir) Joseph Bazalgette, builder of the London's first sewer network 50 years later, was born in London.

August 25, 1819: Scottish engineer James Watt died; the electrical unit of power - the watt - was later named after him.

November 4, 1821: Canadian engineer and author Thomas Coltrin Keefer was born at Thorold.

1825: The Erie Canal was completed in New York State, providing access for American water transport from the Great Lakes to the Atlantic seaboard at New York.

Also in 1825, in Canada, the first Lachine Canal was completed at Montreal; the first Welland Canal, at Niagara, in 1829, and the Rideau Canal from Ottawa to Kingston in 1832.

1826: Thomas Telford's Menai Strait's Suspension Bridge was completed, the first of its kind.

January 7, 1827: Scottish/Canadian engineer (Sir) Sandford Fleming was born at Kirkcaldy, Scotland; he was notably involved in the construction of railways in Canada and for his promotion of international standard time; he died on July 22, 1915.

1827: Charles Babbage's first *difference engine* was developed.

June 13, 1831: Scottish physicist/electrical engineer, James Clerk Maxwell, was born at Edinburgh.

1831: The five-arched, granite London Bridge designed by John Rennie Sr., and built by John Rennie Jr., was completed; in 1968, the bridge was sold to American interests, dismantled, and re-erected in 1971 in Arizona.

July 20, 1832: American engineer/metallurgist Alexander Lyman Holley was born in Connecticut; he was later a founder of the American Society of Mechanical Engineers; he was instrumental in having the Bessemer steel process adopted in the United States.

October 21, 1832: American engineer John E. Sweet was born in New York State; he was later a founder of the American Society of Mechanical Engineers.

December 15, 1832: French civil engineer Gustav Eiffel was born at Dijon.

1833: The Canadian-built *SS Royal William* was among the first ships to cross the Atlantic under steam.

March 17, 1834: German automobile engineer, Gottlieb Daimler, was born at Schorndorf.

1838: Canadian engineer (Sir) John Kennedy was born at Spencerville, Ontario, and educated at McGill University; he later participated in the enlargement of the Port of Montreal and in the founding of the Canadian Engineering Standards Association.

1839: The history of the un-manned, load-carrying drone may go back to a war between Austria and Venice when unmanned balloons dropped explosives on the opposition.

February 5, 1840: American/English engineer (Sir) Hiram Maxim was born at Sangervilk, Maine.

1842: The Canadian Geological Survey was founded; its existence did much over the years to encourage the country's mining and metallurgical industries; timber slides became common on major rivers such as the Ottawa.

1843: The rotary drum printing press invented by Englishman R.M. Hoe.

1844: The Morse Code was used commercially for the first time.

May 27, 1846: The first *Maid of the Mist* - a steamship - was launched at Niagara Falls to ferry passengers between the U.S. and Canada; however, the erection of a suspension bridge between the two sides of the Niagara Gorge two years later turned the ferry into a sightseeing vessel; a second *Maid* - and second steamship - was launched on July 14, 1854.

1846: A telegraph line was installed between Toronto and Hamilton; kerosene lamps, developed by Abraham Gessner began to replace whale oil lamps.

January 27, 1847: The British Institution of Mechanical Engineers was founded.

February 11, 1847: American inventor Thomas Alva Edison was born in Ohio.

March 3, 1847: Scottish/Canadian inventor Alexander Graham Bell was born in Edinburgh.

May 23, 1848: German glider aviator Otto Lilienthal was born in Prussia; he was killed in a glider accident on August 9, 1896.

November 2, 1852: The American Society of Civil Engineers was founded.

1852: Coal mining began at Nanaimo, B.C; Gisborne's submarine cable from PEI to New Brunswick.

October 1853: The Crimean War began; it ended in February 1856.

1853: James Good built the first Canadian locomotive, in Toronto.

July 14, 1854: American George Eastman was born at Waterville, New York; he later founded the Eastman Kodak Company, which significantly advanced the popular use of photography.

1854: The first university-level engineering courses were given at King's College, New Brunswick; Grand Trunk Railway shops established at Point-St-Charles, Montreal.

July 10, 1856: Nikola Tesla, distinguished electrical engineer, was born in Croatia.

1856: First patent awarded in connection with the Bessemer steel process.

February 22, 1857: German physicist/electrical engineer Heinrich Hertz was born at Hamburg.

1858: J.M. Williams drilled the first successful oil well in Canada, at Black Creek, Ontario.

1858: The Fraser Canyon Gold Rush began; it ended two years later.

December 12, 1859: The first freight train crossed the (original tubular) Victoria Bridge across the St Lawrence River at Montreal; Foulis developed a foghorn on the Bay of Fundy.

1859: French battlefield surgeon Ambrose Pare developed upper- and lower-limb prostheses.

September 15, 1860: The Hamilton Waterworks, designed by Thomas Keefer, were officially opened.

1860: The Caribou Road, from Fort Yale to Barkerville, through central British Columbia, was built originally as a wagon road by the British Royal Engineers; it existed in three forms between the 1860s and 1880s.

April 12, 1861: The American Civil War began: it ended on April 9, 1865.

April 12, 1861: Toronto Street Railway horsecars replaced the horse-drawn omnibuses.

1862: The modern diamond drill was developed by Swiss engineer, J.R.Leschot.

July 30, 1863: American auto manufacturer Henry Ford was born in Michigan.

June 6, 1866: The new Parliament Buildings in Ottawa were opened.

September 1, 1883: The building of the Alexandra Bridge in the Fraser River Canyon (by Joseph W, Trutch) was completed; this bridge helped open up the interior of the province to commerce.

1883: The Reversing Falls Bridge was built at Saint John, New Brunswick.

May 7, 1867: Alfred Nobel received a British patent for dynamite.

November 7, 1867: Polish/French physicist, Marie Curie, was born at Warsaw.

By 1867, the Canadian Lachine, St. Lawrence, Rideau, Ottawa River, Welland, Chambly, Sault Ste Marie and Shubenacadie Canals had all been built and were working, but the Trent-Severn Canal was only partially finished.

August 29, 1868: After a decade of construction, the Mount Washington, New Hampshire, mountain cog railway - the world's first - was opened.

August 9, 1869: Canadian mining professor Herbert Haultain was born at Brighton, England.

1869: The Suez Canal was opened in Egypt.

1869: The Wallace Monument opened near Stirling, Scotland, commemorating the spot where (Sir) William Wallace stood during the Battle of Stirling Bridge in 1297.

1870: The first part of London's Underground Subway opened, using steam locomotives (the first electrical locomotives were used in 1904).

1871: Samuel Ingersoll promoted the adoption of the modern pneumatic air drill.

May 20, 1873: Levi Strauss and Jacob Davis obtained a patent for blue jeans.

April 25, 1874: Italian/English inventor Guglielmo Marconi was born at Bologna.

November 30, 1874: Englishman Winston S. Churchill was born at Blenheim Palace.

1874: Coal mining began in Southern Alberta.

1874: The Cavendish Laboratories were opened at the University of Cambridge by the Duke of Devonshire.

1874: The arch bridge designed by James Buchanan Eads across the Mississippi River at St. Louis was completed.

1875: The offset printing press was invented by Englishman Robert Barclay.

1876: The Intercolonial Railway was completed from Central Canada to the East Coast; Sandford Fleming was its chief engineer and was notable for insisting that bridges NOT be built of wood.

1876: Asbestos was discovered at Thetford, Quebec; production began two years later.

1876: A large two-cylinder, 44-inch bore, Coreless beam engine was specially built as an exhibit, as well as to power the exhibits, at the International Exhibition at Philadelphia, USA; this Exhibition began the supremacy of American engineering (over the British).

December 18, 1878: Russian Joseph Stalin born in Georgia.

1878: The approximate year when *chemical engineering* became a continuous production industry and a profession in North America.

March 14, 1879: German/American physicist, Albert Einstein, was born at Ulm.

December 28, 1879: The high girders of (Sir) Thomas Bouch's railway River Tay Bridge in Scotland were blown down in a gale (75 killed).

February 1880: The American Society of Mechanical Engineers was founded.

April 29, 1880: The Bell Telephone Company of Canada was founded.

August 14, 1880: The building of Germany's Cologne Cathedral was completed; it was the tallest building in the world at the time; construction had begun more than 600 years earlier.

1880: The First Boer War began (and ended 1881)

May 1, 1881: Ottawa, Ontario became the first city in the world to have all its streetlights electrically lit; this was due in part to the enterprise of electrical engineer Thomas Ahearn and his partner Warren Soper.

1881: The first triple-expansion marine steam engine was installed on Clydeside by Mechanical Engineer A.C. Kirk.

January 2, 1882: Canadian engineer F.W. (Casey) Baldwin was born in Toronto.

January 13, 1882: American Franklin D. Roosevelt was born at Hyde Park, NY.

1883: The Brooklyn Suspension Bridge in New York City, designed by John A. Roebling and built by him and his son, W.A. Roebling, was completed.

1883: The first moves towards universal health care were launched in Germany.

1883: German engineer Gottlieb Daimler designed a gas-powered engine, and patented a vehicle two years later. German engineer Gottlieb Benz built his first auto in 1885, and sold cars from 1887.

April 9, 1884: English electrical manufacturer (Sir) Sebastian de Ferranti was born at Liverpool.

December 4, 1884: Philip L. Pratley, a principal contributor to Canadian bridge design, was born in Liverpool, England.

1884: The Garabit Arched Viaduct, near Saint-Fleur, France, designed and built by Gustave Eiffel, was completed.

By 1885, Hiram Maxim had invented the gun that bears his name.

January 15, 1886: American/Canadian engineer Clarence D. Howe was born at Waltham, Mass.

January 29, 1886: German engineer Karl Benz received a German patent for an automobile; he began selling them a year later.

1866: English engineer Robert Whitehead invented the first effective self-propelled torpedo.

1886: The Copper Cliff, Ontario, nickel mine was opened; smelting began two years later.

1886: Large, hilltop Neuschwanstein Castle in Germany was opened; sometimes called 'The Sleeping Beauty Castle,' it was designed as a palace but operated as a museum; relatively few rooms were open to the public.

1886: Cochrane and Butters made the first commercially successful automatic dish washer.

June 23, 1887: The Charter for the Canadian Society of Civil Engineers received Royal Assent.

June 9, 1888: Canadian chemical engineer John S. Bates was born at Woodstock, Ontario.

July 10, 1888: Canadian engineer/administrator Chalmers Jack Mackenzie was born at St. Stephen, N.B.

1988: The North Sea oil rig Alpha Piper exploded.

April 20, 1889: Austrian-Hungarian (and later German dictator) Adolf Hitler was born.

1890: The discovery of gold and copper at Red Mountain near Rossland, B.C., and the establishment of smelting facilities at nearby Trail in 1895, led to industrial activity managed by the CPR, to the incorporation of Trail in 1901 and of Consolidated Mining & Smelting Ltd in 1906., to Cominco Ltd. in 1966, and to the merger of Cominco and Teck Resources Ltd. in 2001.

1890: Enlargement and modernisation of the Port of Montreal began under the supervision of chief engineer (Sir) John Kennedy.

1890: Germans Daimler and Maybach formed a joint stock company to make automobiles; it sold their first one in 1892.

1890: The cantilever truss bridge across Scotland's River Forth at Queensferry was completed; it was designed by two English engineering knights, Baker and Fowler, and built largely by Sir William Arrol's company; when built, it was the longest steel cantilever in the world.

1890: Henry Hollerith developed his punched card system; steam tractors became common on the Prairies for breaking up the soil.

1891: The first major mining disaster took place at Springhill, Nova Scotia (125 killed); the second, in 1956 (39 killed); and the third in 1958 (74 killed).

1892: Electric streetcars first replaced the horsecars in Toronto. The General Electric Company of Canada established a plant at Peterborough, Ontario.

1892: A lead-zinc discovery at Kootenay, B.C. led to the development of the Sullivan Mine at Kimberley.

1893: Canadian George Moore built a prototype robot made of steel and powered by a steam engine.

1894: Charles Parsons designed the first steam turbine, in England.

1894: London's Tower Bridge was completed; of bascule/suspension design, it is the only movable bridge over the River Thames.

1894: Early irrigation engineering on the Prairies.

November 8, 1895: German Wolfgang Roentgen discovered X-rays.

1895: Count von Zeppelin received a German patent for his rigid airship; they were flying commercially by 1910 and were prominent on the German side in World War I.

1895: Canadian Frederick G. Creed developed the teleprinter, in South America.

1895: The first American mainline railway electrification began at Baltimore, USA.

1895: Marconi invented the wireless telegraph; he also made the first UK radio transmission from the Isle of Wight.

June 4, 1896: Ford drove his self-propelled quadricycle for the first time.

1896: The Klondike (Yukon) Gold Rush; it had ended before the end of the century.

1896: American chemist Wallace Carothers, who invented neoprene for Dupont in the 1930s, was born in Iowa.

May 13, 1897: Streetcars ran for the first time in Toronto on Sunday (but not every Sunday for many more years!)

1897: The first successful U.S. drilling for offshore oil, off Santa Barbara on the California Coast.

1897: Rudolf Diesel operated the first successful diesel engine.

1897: The Kiel Canal was opened in Germany.

1898: Graf von Zeppelin was awarded the U.S. patent for the airship.

1899: Second Boer War began (ended 1902).

July 19, 1900: The first line of the Paris subway was opened.

January 10, 1901: The oil drilled at Spindletop, Texas, guaranteed that automobiles would use gasoline, and not steam or electricity.

1901: The International Nickel Company of Sudbury, Ontario, was formed by merger; INCO's Creighton Mine was also opened at Lively - an open pit from 1901-1908 - it went underground in 1906, its No 9 shaft eventually becoming the world's deepest in the Western Hemisphere in 1969, at over 7,000 feet.

1901: The company, Montreal Light, Heat and Power was established.

1901: Power from Shawinigan 1 power station was transferred by line to Montreal.

June 1902: The Flatiron (Fuller) Building, in New York City, was completed.

1902: Canadian chemical engineer Frank A. Forward was born in Ottawa.

December 10, 1902: The original Low Aswan Dam opened.

June 16, 1903: The Ford Motor Company was formed.

1903: The Northern Ontario gold/silver rushes began, with Cobalt (silver, 1903), Porcupine and Timmins (gold, 1909), and Kirkland Lake (gold, 1911).

October 27, 1904: After almost five years of construction involving 28 stations and over 11 miles of tunnels, the New York subway system was opened.

December 17, 1903: The Wright Brothers flew the *Wright Flyer* at Kittyhawk, North Carolina, the first heavier-than-air aircraft.

1903: Marketing of the Harley Davidson Motorcycle began.

September 29, 1904: Canadian engineer, Robert F. Legget, was born at Liverpool, England; he was the founding director in 1947 of NRC'S Division of Building Research; and the founding president of the Canadian Academy of Engineering in 1987.

1904: Ambrose Fleming invented the diode vacuum tube.

1904: Trans-Siberian Railway completed.

1904: Prandtl and the Boundary Layer theory associated.

1904: The first diesel engine was installed in a commercial vessel, in France.

1904: The Peterborough Lift Lock was the first to be completed on the Trent-Severn Canal; the second lift lock, at Kirkfield, in 1907.

March 27, 1905: Elsie Gregory McGill, the first woman electrical engineering graduate in Canada, the first to hold a degree in aeronautical engineering, and the only one to design a complete aeroplane, was born in Vancouver.

1905: Englishman Herbert Austin began making cars at Birmingham; his first was a four-seater with a chain drive.

1905: Canadian geotechnical engineer Robert M. Hardy was born in Winnipeg.

December 9, 1906: American Grace Hopper, pioneering computer programmer, was born in New York City; she later devised one of the first computer languages (COBOL).

December 14, 1906: The first German U-Boat was commissioned.

1906: Lee deForest invented the triode vacuum tube.

1906: Canadian Reginald Fessenden made the first radio broadcast in the United States.

June 1, 1907: RAF officer and engineer, Frank Whittle, was born in Coventry, England; in the late 1930s he was credited with the invention of the turbojet aeroengine and was later knighted for his contributions to its development; late in his career, in the United States, he worked with Hans von Ohain who, prior to and during, World War II, had led the development of jet engines in Germany.

August 29, 1907: The first collapse of the Quebec Bridge, over the St. Lawrence, while under construction (75 killed).

November 20, 1907: Canadian entrepreneur Samuel MacLaughlin converted his carriage manufacturing company into one that made Buick motor cars under licence; 11 years later it merged with General Motors in the United States.

1907: Canadian mechanical engineer Armand Bombardier was born at Valcourt, Quebec.

1907: Was the first crop year for Marquis wheat.

1907: A detachable outboard motor marketed for a boat.

1908: Canadian (broadcasting) electrical engineer Marcel Ouimet was born at Montreal.

1908: Casey Baldwin, the first Canadian to fly in a heavier-than-air machine, flew at Hammondsport, New York.

February 6, 1909: A.G. Bell's *Silver Dart* flown at Baddeck, Nova Scotia over the ice, by J.A.D. McCurdy, the first flight by a Canadian in Canada.

April 1909: The first aircraft, a Farnum, flew with a rotary engine.

July 25, 1909: Bleriot's famous overflight of the English Channel; the first use of combination of joystick and foot rudder.

1909: Haber Bosch fixation system developed for nitrogen.

June 23, 1910: The Alfa Romeo car company founded in Italy.

August 18, 1910: Canadian Cabinet minister and engineer, Robert H. Winters, was born at Lunenburg, Nova Scotia.

November 14, 1910: The first aircraft took off from a ship.

1910: A wood trestle railway bridge at Briggs, near Red Deer, Alberta, was completed; it survives.

May 30, 1911: First Indianapolis 500 Road Race.

1911: Freyssinet and the development of reinforced concrete.

April 15, 1912: SS *Titanic* struck an iceberg and sank (largest ship in service at the time).

July 14, 1911: American Hiram Bingham III 'rediscovered' Machu Picchu.

1911: The Wilson Cloud Chamber - the first particle detector - developed; the first superconducting material developed by Heike Kamerlingh Onnes.

1912: Canadian chemical engineer W. Howard Rapson was born at Toronto.

1912: English bicycle manufacturer W.R. Morris switched from making bicycles to making cars.

April 24, 1913: The Woolworth Building in New York City (the tallest 1913-1930) was completed.

1913: The Keno Hill silver mine opened in the Yukon; it closed in 1989.

May 20, 1914: RMS *Empress of Ireland* collided with another vessel in the St. Lawrence River and sank; over 100 lives were lost.

July 28, 1914: The First World War began; it ended on November 11, 1918; engineering played a large part in the conduct of the warfare, including the introduction of the aeroplane, the tank, poison gas and the submarine; Canadian contributions included battlefield railway support, personnel for the Air Force, and Atlantic convoy escort.

1914: The original Panama Canal connecting the Atlantic and Pacific Oceans was opened.

August 17, 1915: Kettering developed his electric car starter.

1915: ASME Boiler and Pressure Vessel Code first published.

February 3, 1916: The centre Block of the Parliament Buildings in Ottawa was destroyed by fire...and later rebuilt.

September 11, 1916: Second collapse involving the Quebec Bridge, while under construction (13 killed).

1916: Drywall first used in the U.S. by the Gypsum Corp.

1916: The Parliament of Canada created the National Research Council, to be responsible for providing the Government with advice on science and industrial research, but with no laboratories of its own; the laboratories were added in 1932.

May 24, 1917: Patent issued to James Macdonald for a device for carrying out the slip-forming construction technique.

December 6, 1917: The collision of two ships in Halifax (Nova Scotia) Harbour caused an explosion that did enormous physical damage (1782 people killed).

April 15, 1918: By Act of Parliament, the name of the Canadian Society of Civil Engineers was changed to the Engineering Institute of Canada; a new magazine, the *Engineering Journal*, was established by the Institute.

May 18, 1918: Airmail service began in the U.S.

July 15, 1918: Bertram N. Brockhouse, co-winner of the 1994 Nobel Prize in Physics, for work done on neutron scattering at Chalk River, Ontario, and using apparatus designed and built there, was born at Lethbridge, Alberta.

1918: Canadian James Shand patented the first portable chain saw.

January 21, 1919: Letters Patent were granted to the Canadian Engineering Standards Association; Sir John Kennedy had led the Association to its founding.

March 1919: Flu pandemic began (ended mid-1920).

September 9, 1919: The *HD-4* hydrofoil designed, developed and built by Alexander Graham Bell, Walter Pinaud and Casey Baldwin at Bras d'Or, Nova Scotia, set a world marine speed record of just over 70 mph.

December 3, 1919: The Quebec Bridge opened, finally.

1919: The first Canadian radio broadcasts were made from Montreal.

March 26, 1921: The Nova Scotia replica racing schooner, *Bluenose I*, was launched at Lunenburg; on January, 1946, it sank after colliding with a reef off Haiti.

August 3, 1921: The first crop-dusting flight, at Dayton, Ohio.

January 25, 1922: An EIC Committee (chaired by H.H. HAULTAIN) was struck in Montreal to examine the possibility that engineers in Canada might be obligated to a life of service (as medical doctors were); this resulted in the development of the *Iron Ring Ceremony* (written by Rudyard Kipling), with the first initiations taking place in April 1925 in Montreal and Toronto.

February 11, 1922: Thomas Alva Edison's 75<sup>th</sup> birthday.

1922 was the year that two important engineering innovation were made by Canadian engineers: Wallace Rupert Turnbull produced his variable pitch propeller; and Armand Bombardier his first snowmobile.

November 1923: By then, Canada's first full-time insulin-production factory, at the University of Toronto, was producing 250,000 units of insulin weekly.

1923: William Stephenson (later known as *Intrepid*) invented his wireless wirephoto apparatus.

1923: Arthur Scharbaur developed the *Enigma* coding machine used by the Nazis during World War II.

January 24, 1924: J.L. Baird demonstrated his working TV for the first time.

April 8, 1925: The battery-less radio, running on the domestic electric power supply, developed by Edward S. Rogers Sr. in Toronto, was in commercial operation; it was the first of its kind.

1925: the Association of Consulting Engineers of Canada (ACEC) was formed to encourage the use of domestic consulting companies for Canadian projects and, especially, in regard to the placing of consulting contracts by the federal government.

1925: Work began to build up aluminum production at Arvida, Quebec.

1925: The Tribune Tower in Chicago was completed.

1925: Copper and gold discovered at Rouyn/Noranda, Quebec.

March 16, 1926: Robert Goddard launched the first liquid fuel rocket.

June 28, 1926: The German Daimler and Benz automobile companies merged.

1926: The *Pierce Arrow*, the first car to have power steering.

February 4, 1927: Malcolm Campbell established a new land speed record in his car, *Bluebird*.

1927: Copper and zinc ores were found at Flin Flon in Northern Manitoba; C.T.R. Wilson was co-winner of the 1927 Nobel Prize in Physics for his invention of the first particle detector.

1927: The Canadian Electrical Code was first issued; it was the responsibility of the Canadian Engineering Standards Association; CESA became the Canadian Standards Association (CSA) in 1944.

1927: The first public demonstration of television, by Philo Farnsworth; the last model T Ford came off the assembly line: both in the United States.

1927: Portuguese physician, Egas Moniz, performed the first cerebral angiogram in Lisbon.

1927: Edward Rogers developed the battery-less radio and the first 'all-electric' radio station.

1927: The Holland Tunnel between New Jersey and New York completed (then the world's longest continuous tunnel).

May 1928: Canadian aeronautical engineer Philip A. Lapp was born in Toronto; dubbed 'the father of Canadian astronautics;' he founded the Canadian Astronautical Society in 1957, worked for the de Havilland Company of Canada, SPAR Aerospace and his own consulting companies, was associated with the Canadarms and the Radarsats and co-authored the Chapman Report on Canada's future space activities; he died on September 25, 2013.

September 3, 1928: Discovery of penicillin by Fleming; Baird produced colour TV images.

1928: The Falconbridge Nickel Company was established in Toronto, based on the claim staked by Thayer Lindsay at Sudbury.

1928: E.H. Armstrong developed FM Radio.

October 29, 1929: 'Black Tuesday,' the day the New York Stock Exchange crashed, ending the Roaring Twenties and starting the 'Great Crash' and what became known as the 'Great Depression.'

November 11, 1929: The Ambassador Bridge opened between Ontario and Michigan.

1929: The year of award of Karl Clark's first patent for the extraction of oil from the Athabasca tar sands.

October 5, 1930: Britain's airship R101 crashed at Bayeux, France, dashing British hopes for trans-world airship service; several months earlier, the airship R100 paid a visit of several weeks to Eastern Canada with the same purpose in mind.

1930: The Kettle Valley Railway was completed across Southern B.C.; the first experimental oil sands extraction plant was built at Bitumont. The first hydro plant in Saskatchewan was built at Island Falls.

1930: Nuclear medicine began when Ernest O. Lawrence built his first cyclotron at University College, Berkley; Sliced bread put on the market.

1930: Silicones were developed by J.F. Hyde at Corning Glass.

May 1, 1931: Empire State Building opened in New York City; tallest building in the world, 1931-1972.

March 19, 1932: The single arch Sydney Harbour Bridge was opened; it was designed by Australian John Bradfield and built by Englishman (Sir) Ralph Freeman.

May 20, 1932: Amelia Earhart took off from Harbour Grace, Newfoundland, in a Lockheed *Vega* 5B aircraft, to make the first solo crossing of the Atlantic by a woman.

August 6, 1932: Canadian civil engineer Bernard Lamarre was born at Chicoutimi, Quebec.

September 19, 1932: Canadian engineering professor Alan G. Davenport was born in India; he was educated in South Africa, Britain and Canada; as a professor at Western University, he was the founder of the Boundary Layer Wind Tunnel Laboratory there and a pioneer in the measurement of wind loads on buildings and other structures.

1932: C.J. Mackenzie designed and built the Broadway Bridge in Saskatoon; the Welland Ship Canal was opened (the fourth Welland); the NRC main laboratories were opened.

August 18, 1933: The Tennessee Valley Authority Act was passed in the United States to deal with Depression Era problems associated with flood control, electrification, the building of structures, reforestation and other problems in the region of the Tennessee River.

November 6, 1935: Britain's World War II fighter aircraft, the Hawker *Hurricane*, made its first flight; the first flights of several other WW II combat aircraft were: the Vickers Supermarine *Spitfire*, 5 March 1936; the Messerschmitt *109*, 29 May 1935; the Focke-Wulf 190, 5 June 1939; the Mitsubishi *Zero*, 1 April 1939; the Boeing *Flying Fortress*, 22 July 1935; the Avro *Lancaster*, 9 January 1941.

December 17, 1935: First flight of the American Douglas *DC-3*, passenger/freight aircraft; a few were still flying in 2021, somewhere in the world.

December 17, 1935: The Hoover Dam completed on the Colorado River in Nevada.

1935: The PFRA Act was signed into Law; the PFRA was an agency of the Canadian Government designed to tackle engineering and other problems associated with the Depression on the Canadian Prairies.

1935: Introduction of the Noorduyn *Norseman* bush aircraft; this aircraft was manufactured at Montreal and served internationally for 30 years.

1935: U.K. Patent awarded to Robert Watson Watt for the first practical radar.

June 22-24, 1936: The International Conference that established geotechnical engineering as a separate discipline was held at Harvard University; six of the 200 delegates were from Canada.

1936: During the first attempt that was being made to consolidate the engineering profession in Canada, the Provincial Engineering Associations then existing formed a national body - the Dominion Council of Professional Engineers - to represent them in professional matters and with the federal government.

1936: The 80,000-ton gross RMS *Queen Mary* was launched at Clydebank, Scotland.

1936; Englishman Alan Turing developed the central concept of the modern computer.

May 6, 1937: The German airship *Hindenburg*, the largest ever built, perished in flames when docking at Lakehurst, New Jersey; this disaster effectively ended regular long-distance passenger travel by airship.

1937: Completion of the Golden Gate Bridge across Golden Gate Strait, California.

1938: Engineer Tom Carroll and his team at the Massey-Harris Company in Toronto completed the development of the first self-propelled combine harvester.

1938: The Lion's Gate Bridge at Stanley Park, Vancouver, was opened; the Mackenzie Highway was opened in the Northwest Territories, it had begun life as a winter road.

Summer 1939: HM The Queen opened the Queen Elizabeth Highway between Toronto and Hamilton during the summer's Royal Tour of Canada.

September 1, 1939: The Second World War began; it ended on September 2, 1945; engineering played a significant role in the conduct of the warfare, including radio location (radar), larger bombers and faster fighter aircraft, large battleships, plus U-boats and aircraft carriers, V1 and V2 rockets, and the atomic bomb.

1939: With C.J. Mackenzie at its head, the NRC took on wartime scientific/engineering tasks for the Canadian Government; these included the further development of radar and other military weapons and components, and the country's contribution to the Allied atomic/nuclear program.

November 7, 1940: A month after its completion, the (suspension) Tacoma Narrows Bridge, near Seattle, Washington, collapsed in a gale.

November 25, 1940: First flight of the British *Mosquito* reconnaissance aircraft, many of which were built in Canada.

November 30, 1940: HMS *Vanguard* was launched at Clydebank (the last British battleship).

1940: The cavity magnetron, developed by Randall and Boot in England, significantly advanced radar technology; the Willis Jeep Company designed a bantam reconnaissance vehicle with 4wd drive; Oldsmobile introduced the first fully automatic drive car.

1941: Development of the military Bailey Bridge, by (Sir) Donald Bailey; this lightweight, modular, transportable bridge was used extensively by the British and other Allied armies during the later years of World War II; a Canadian Building Code was first issued; by 1947, responsibility for its development and future issues had been given to the new Division of Building Research at NRC, under the direction of Canadian geotechnical engineer Robert F. Legget; a National Fire Code was later added; an Electrical Code had been issued earlier, and was the responsibility of the Canadian (formerly Engineering) Standards Association.

October 3, 1942: First successful launch of what soon became the German V2 rocket, produced by the team led by Werner von Braun.

By October 29, 1942: The U.S.-Canada Alaska Highway was at full operation.

1942: Oak Ridge National Laboratory established in the U.S.

August 29, 1943: Queens Physicist Arthur B. McDonald was born at Sydney, Nova Scotia; he was a co-winner of the 2015 Nobel Prize in Physics for work done on the detection of solar neutrons at the underground Sudbury Neutrino Observatory.

November 1943: The Shipshaw Hydro Plant was opened on the Saguenay River in Quebec, to supply power to the Arvida aluminum production operations.

December 1943: The first synthetic rubber was produced at the Polymer Plant at Sarnia, Ontario.

1943: Hanford, Washington Plant established in Washington State for the production of plutonium.

1943: The Steep Rock Iron Mines were opened at Atikokan, Ontario; they closed in 1980.

August 18, 1944: Chalk River, Ontario, chosen as the permanent site for Canada's nuclear laboratories.

November 11, 1944: Canadair Ltd. formed from Canadian Vickers Ltd. and a U.S. company on behalf of the RCAF.

April 16, 1945: HMCS *Esquimalt* was torpedoed off Canada's East Coast.

July 16, 1945: The first 'atomic' bomb was exploded at Alamogordo, New Mexico.

August 6, 1945: The United States Air Force dropped the first 'atomic' bomb on Hiroshima, Japan; on August 9, the USAF dropped the second one on Nagasaki, Japan; these bombs were famously named *Little Boy* and *Fat Man*.

September 5, 1945: The *ZEEP* nuclear reactor went critical at Chalk River, Ontario, the first to do so outside the United States.

1945: First successful kidney dialysis machine was built in Holland.

February 10, 1946: Bikini Atoll chosen for nuclear bomb tests.

February 15, 1946: The 'unveiling' of the ENIAC computer; designed by Mauchly and Eckhart.

July 15, 1946: First flight of the Canadair *North Star* passenger/freight aircraft, built specially for Trans Canada Airways.

1946: The aluminum R&D Centre at Arvida, Quebec, was opened.

1946: Willard Libby and radiocarbon dating.

April 1947: Defence Research Board of Canada was founded in Ottawa, with O.M. Solandt as director general; DRB took over seven laboratories formerly parts of the National Research Council.

August 16, 1947: First flight of the Canadian de Havilland *Beaver* (DHC2) bush aircraft.

1947: The so-called 'Cold War' between the Western Powers and the USSR began; it ended in 1991.

1947: The NRX reactor at Chalk River produced its first commercial isotopes.

1947: Shockley, Bardeen and Brittan developed the transistor at Bell Labs.

March 3, 1948: The first basic oxygen steel plant went into operation in the United States.

June 24, 1948: The Berlin Airlift began (mostly by British and American planes); it ended on 12 May, 1949.

February 23, 1949: Canadian Cabinet minister, engineer and astronaut, Marc Garneau, was born at Quebec City.

May 16, 1949: A Patent issued for a Zamboni ice machine in the U.S.

August 10, 1949: The Avro *Jetliner* (CF102 - jet commercial aircraft) made its first flight; only one aircraft was ever built; the project was cancelled to allow for the production by Avro Canada CF100 fighter aircraft for the Korean War.

August 23, 1949: The second commercial jet aircraft, the British de Havilland *Comet*, made its first flight.

August 29, 1949: The USSR exploded its first 'atomic' bomb.

October 1, 1949: The Peoples' Republic of China was proclaimed.

January 19, 1950: The first flight of the Avro CF100, fighter aircraft.

April 4, 1950: Shockley, Bardeen and Brittan received their first patent (US2502488) for a transistor; they received a second patent (US2524053) on October 3, 1950, and led the way to eventual electronic miniaturization.

June 25, 1950: The war in Korea began; it ended on July 27, 1953.

1950: The All-Aluminum Bridge was built across the Saguenay River, at Shipshaw, Quebec.

1950: Canadian electrical engineer, General A.G.L. McNaughton, was appointed to the International Joint Commission (on Boundary Waters between Canada and the U.S.) and shortly thereafter was appointed Canadian Chairman; among the projects considered during his chairmanship were the St. Lawrence Seaway, power and navigation on the Columbia River, and the potential of Passamaquody tidal power; in his youth, McNaughton invented a device that preceded radar, the patent for which he donated to the nation.

October 27, 1951: The first Canadian cancer patients received radiation treatment using Cobalt-60 therapy, at Victoria Hospital, London; the following month, patients were similarly treated at the University of Saskatchewan Hospital in Saskatoon.

November 1, 1951: First (US) Hydrogen Bomb exploded at Eineweetok atoll.

November 10, 1951: Long-distance dialling possible, New Jersey to California.

1951: Canadians, Hopps, Bigelow and Callaghan, developed the world's first external (heart) pacemaker.

1951: Eckert and Mauchly designed the UNIVAC Computer and were the first to use magnetic tape instead of punched cards.

1951: The Chrysler *Imperial* was the first modern car to have power steering.

April 15, 1952: The B52 U.S. Bomber flew for the first time.

1952: Atomic Energy of Canada Limited was founded to undertake R&D in the peaceful uses of atomic energy, at Chalk River, with J. Lorne Gray as president.

February 1, 1953: The date of the disastrous North Sea flood that devastated 2000 square kilometres of southwest Holland, and killed 2000 people; by 1997, it had led to the construction of the *Delta Works* across the southwest Netherlands, a defensive combination of storm surge barriers, locks, dams, sluices

and dykes which the American Society of Civil Engineering has dubbed one of the wonders of the modern world.

1953: Canadian surgeon, Dr Wilfred Bigelow, did open-heart surgery on a patient.

1953: American Admiral Grace Hopper invented the first computer language - COBOL.

January 21, 1954: US Nuclear Ship *Nautilus* was launched.

March 1, 1954: The United States exploded its first thermonuclear weapon; the USSR did so on March 22, 1955; and China did so on October 16, 1964.

March 30, 1954: Toronto's (Yonge Street) underground subway opened.

June 27, 1954: The first nuclear power plant to generate electricity for the grid, at Obninsk, USSR.

September 8, 1954 - September 9, 1976: Chairman Mao took office in China.

October 15, 1954: Perhaps the most notorious tropical storm to reach and damage the already rain-soaked city of Toronto was *Hurricane Hazel*, actually the confluence of two storm systems and no longer a hurricane, on this day (81 people died); in his text for the published *Moment in Time*, Rob Gilroy said that subsequently the Ontario Government banned the building of structures on floodplains.

1954: A 418-km rail line went into service from Labrador City to Sept Isles, Quebec.

1954: The Kitimat-Kemano-Nechaco Aluminum/Power Project opened in Northwestern B.C.

1954: The first digitally programmable robot was invented by American engineer George Devol Jr.

1954: A basic oxygen steel process was in operation at Dofasco.

August 8, 1955: The first *Sony* transistor radio went on sale in Canada (not the USA).

November 1, 1955: Viet Nam War began (ended April 30, 1975)

1955: The world's first purpose-built container vessel, the *Clifford J. Rogers*, was built at Montreal (independently of Malcolm McLean).

1955: American entrepreneur Malcolm McLean and engineer Keith Tantlinger developed the modern standard shipping container, which is transferable intermodally.

1955: The Sabin oral polio vaccine developed in USA.

1955: A fast-breeder nuclear reactor was commissioned at the UKAEA plant at Dounreay, Scotland.

October 17, 1956: The first full scale (British) nuclear power plant began operations at Calder Hall, England.

October 29, 1956: Beginning of the Suez (Canal) Crisis; it ended on November 7, 1956; Canadian diplomat Lester B. Pearson was awarded a Nobel Peace Prize for his efforts to end it.

1956: The consulting firm of J.D. Mollard & Associates was established in Regina, Saskatchewan; it gained its international reputation initially from work in remote sensing and photo interpretation, and later in satellite image interpretation.

1956: TV wireless remote control invented by Robert Alder; Trans-Atlantic submarine cable laid.

1956: the first Artificial Intelligence Conference was held at Dartmouth College in the United States and influenced the AI work done over the next 20 years.

1956: Nickel found at Thompson, in Northern Manitoba.

March 25, 1957: Treaty of Rome signed and European Common Market began.

July 29, 1957: The official birthday of the International Atomic Energy Agency, in Vienna.

October 4, 1957: The USSR launched the world's first unmanned earth satellite, *Sputnik I*; it made three orbits of the earth.

December 2, 1957: the Boeing 707 made its maiden flight; on 30 May 1958, the Douglas DC-8 made its maiden flight; during the 1960s, aircraft from these two companies were largely instrumental in the switch of passenger travel across the Atlantic from very large ships to very large aeroplanes.

December 2, 1957: The first U.S. nuclear power plant went critical at Shippingport, Pa: The Mackinac Bridge, across the Straits of Mackinac, Michigan, was completed (from 1957-1998, it had the longest suspension span in the world).

1957: Kilby and Noyce, independently developed computer chips, leading to further miniaturization of electronic circuitry.

1957: Alastair Pilkington and his colleague Bickerstaff, in England, invented float glass.

January 31, 1958: The first American earth satellite in its space program, *Explorer I*, was launched.

February 7, 1958: The U.S. Advanced Product Research Agency (ARPA) was established to help offset the engineering advantage gained by Russia with the launching of the *Sputniks*; it became Defense ARPA (DARPA) in 1972, reverted to ARPA in 1993 and DARPA in 1996.

March 25, 1958: First flight of the CF105 (Arrow).

June 18, 1958: The Trans-Canada Microwave System, then the longest such system in the world, was completed.

July 29, 1958: NASA established as a legal entity by the U.S. Government.

July 30, 1958: A *Redstone* rocket successfully launched by the United States from an atoll in the South Pacific.

1958: Xerox photocopier went into production.

1958: Roger Bacon at Union Carbide developed high-performance carbon fibres.

1958: The International Society of Cybernetic Medicine was founded; its first international conference was held in Naples in 1960.

February 20, 1959: Cancellation of the Avro *Arrow* program by the Government of Canada, throwing thousands of skilled people out of work and badly damaging the domestic aircraft industry.

May 27, 1959: Physicist/engineer Donna T. Strickland, co-winner of the 2015 Nobel Prize in Physics for her invention of chirped pulse amplification, was born at Guelph, Ontario.

June 26, 1959: The St. Lawrence Seaway was opened by HM Queen Elizabeth and President D.D. Eisenhower.

August 26, 1959: Designed as a fuel-efficient car, the British Motor Company's *Mini* was first marketed on this date; a transverse engine, and front-wheel drive were incorporated, but a radio, window rollers and seat belts were omitted.

August 29, 1959: Canadian engineer and astronaut, Chris Hadfield, was born.

1959: Kilby and Noyce, independently, invented the integrated circuit, or 'chip.'

1959: Digital Equipment Company (DEC) introduced the PDP Series of computers to the engineering and science markets.

By 1959 there were 23 uranium mines in 5 districts across Canada; by 1965, this number of mines was down to four.

April 1, 1960: The first *Tyros* weather satellites were launched.

May 7, 1960: The Pill marketed in the United States.

1960: Canadian RR conversion from steam to diesel was complete.

1960: Federal government incentive programs to encourage industrial R&D began.

1960: The *Diefenbunker*, a fall-out shelter for the Federal Government, was opened at Carp, Ontario.

April 12, 1961: Uri Gagarin (USSR) in space; May 5, 1961 Alan Shepherd (USA) in space.

June 13, 1961: American inventor George Devol Jr. granted a U.S. Patent for the first programmable robot arm; the application had been submitted on December 10, 1954.

1961: Canadian Drs. Till and McCulloch discovered transplantable stem cells, at the Ontario Cancer Institute in Toronto.

1961: After many years of construction, the Beauharnois Power Plant on the St. Lawrence Seaway was completed.

May 9, 1962: Sikorsky *Skycrane* helicopter first flew.

June 4, 1962: The NPD plant at Rolphton generated the first nuclear power for the Ontario grid.

June 10, 1962: U.S. Telstar I satellite launched.

August 15, 1962: Port Authority of New York opened the world's first container port.

September 3, 1962: The 8,000 km Trans Canada Highway was officially opened.

September 29, 1962: Canada launched its first earth satellite, *Alouette I*, only the third country to do so; for the next decade and more, this satellite generated scientific information which it sent back to earth for analysis; this satellite carried STEM antennae.

October 16, 1962: The U.S.-Russia October Crisis began; it ended on November 29.

October 1962: First light-emitting diodes marketed.

1962: The processing of iron ore pellets from the Labrador Trough began.

January 1963: The Institute of Electrical and Electronic Engineers was founded in the United States from the merger of the American Society of Electrical Engineers and the Institute of Radio Engineers.

March 7, 1963: The Pan Am Building in New York City was completed.

June 16-18, 1963: Russian Valentina Tereskova flew in space.

November 18, 1963: *Touchtone* phone introduced to U.S.; first home -VCR developed in England.

November 22, 1963: Assassination of President Kennedy at Dallas, Texas.

1963: The replica racing schooner, *Bluenose II*, was launched.

1963: Hydro-Quebec nationalized.

August 30, 1963: The Philips Company (of Holland) released its cassette tape commercially, at the Berlin Radio Show; it had been developed the year before by a team led by Lou Ottens.

September 4, 1964: The first Forth Road Bridge went into service.

November 4, 1964: Verrazano Bridge, New York City, went into service.

1964: The National Aeronautical Collection established at Rockcliffe Airport, Ottawa.

1964: The first electrified high-speed rail line began operations between Tokyo and Osaka, Japan.

1964: Douglas Engelbart developed the first computer 'mouse.'

May 20, 1965: First flight of the Canadian de Havilland *Twin Otter* STOL aircraft.

November 29, 1965: The first 735kva transmission line went into operation at Hydro-Quebec.

1965: Canada's *Alouette II* research satellite was launched.

1965: Western University's Boundary Layer Wind Tunnel was installed.

1965 First flight of the DHC *Twin Otter*.

1965: First Quebec Hydro 735kv transmission line completed.

1965: First fibre optic data transmission by Borner in Germany.

1965: American Motors introduce cruise control.

May 30, 1966: Satellite *Surveyor I* landed on the moon (first of seven).

July 19, 1966: First use of artificial turf, at Houston, Texas.

October 14, 1966: Montreal Metro underground subway opened.

Christmas 1966: The first fax introduced commercially by Xerox.

April 28, 1967: EXPO 67, *Man and His World*, a formal component of Canada's Centennial in 1967, was opened to the public in Montreal; it drew 50 million visitors in its six-month run and was built on artificial islands in the St. Lawrence River.

October 23, 1967: First flight of the Canadair CL215 *Waterbomber*.

December 3, 1967: Dr. Christiaan Barnard performed the first human heart transplant operation in Capetown, South Africa.

1967: The Louis-Hippolyte Lafontaine Bridge-Tunnel over and under the St. Lawrence at Montreal was opened.

1967: The Lavolette Bridge was completed at Trois-Rivieres.

1967: Production began at the Great Canadian Oil Sands Plant in Alberta.

1967: CNCP introduced broadband service for the more efficient transmission of data, voice and facsimile.

1968: Canada's first container shipping terminal was inaugurated at Montreal; container terminals were later established at Vancouver, Prince Rupert, Saint John and Halifax.

1968: Central Heat Distribution Limited's district heating plant began its service of 180 buildings in the downtown core of Vancouver.

1968: The W.A.C. Bennett Dam and generating station (and Lake Williston) were completed on The Peace River in B.C.

1968: The Floodway, designed to divert Red River floodwaters round Winnipeg, was completed.

1968: The Douglas Point 200 MW CANDU nuclear reactor went on-line.

1968: The TRIUMF experimental and isotope production facility was established on the UBC Campus.

February 9, 1969: First flight of the Boeing 747, the first wide-bodied jet; some were still flying in 2021.

March 2, 1969: First flight of supersonic airliner *Concorde*; the aircraft was retired from service on October 4, 2003.

September 30, 1969: The Manic V, later the Daniel-Johnson, Dam on the Manicouagan River in Quebec was inaugurated; it was, and still is, the world's highest multiple arch dam.

July 16, 1969: U.S. Spacecraft, *Apollo 11*, launched for the first moon landing, driven by a *Saturn V* rocket, produced by a team led by Werner von Braun.

1969: MacDonald Dettwiler & Associates was founded; later bought SPAR Aerospace Ltd.; became the leading Canadian 'space engineering' company.

1969: Canadair Ltd. marketed CL-215 *Water Bombers*.

April 13, 1970: An oxygen tank exploded aboard spacecraft *Apollo 13* on its way to the moon, initiating an international rescue mission (that involved Canadian engineers) that brought the crew safely back to earth.

April 22, 1970: The first 'Earth Day' and the beginning of consciousness of climate/environmental change, worldwide.

May 12, 1970: The International Olympic Committee named Montreal the site of the 1976 Summer Olympic Games; several special buildings were planned.

July 21, 1970: The Aswan High Dam completed on the Nile River.

October 5, 1970: Canada's FLQ/October Crisis began; it lasted on and off until January 5, 1971 and involved a murder, a kidnapping and the application of the War Measures Act.

November 2, 1970: The Pierre Laporte Bridge opened at Quebec.

1970: James Bay Project began.

December 15, 1970: After *Sputnik*, the Soviets chose to 'reach for' the gaseous inner planet, *Venus*; their satellite, the 490 kg *Venera 7*, was launched on August 17, 1970 and landed on Venus on December 15 that same year.

1970: The John Hancock Center in Chicago was completed.

April 19, 1971: Soviet Salyut space station placed in orbit.

May 4, 1971: After some unusual weather, a sudden and devastating mudslide destroyed the small Quebec town of Saint-Jean Vianney; it was later revealed that the town had been built on the site of another landslide 500 years earlier.

May 1971: The first four CANDU-6 reactors at Ontario's Pickering Nuclear Power Plant went into operation.

1971: The commissioning of the Churchill Falls Generating Station in Labrador began.

1971: Aswan High Dam opened.

1971: The first permanent IMAX exhibition (a Canadian invention) was set up at Toronto's Ontario Place; the first demonstration of IMAX was at EXPO 67 in Montreal.

1971: First e-mail sent by ARPANET.

May 22, 1972: The 90 acres of islands and lagoons of Toronto's Ontario Place opened on Lake Ontario.

December 11, 1972: Launched on December 7, just after midnight, the *Apollo 17* broke a number of moon-shot records, but was the last of the series to land on the moon.

1972: The Transamerica Building in San Francisco was completed.

1972: Churchill Falls (Labrador) Hydro Plant began commercial operations.

1972 and 1974: The twin World Trade Center Buildings in New York City were completed; destroyed by terrorists, September 11, 2001.

1972: First clinical CAT scan performed at a London Hospital (EMI Labs, UK).

April 3, 1973: The first cellphone call was made by Martin Cooper, who had led the team at Motorola that invented it.

May 14, 1973: The U.S. *Skylab* launched.

October 1973: First international 'oil shock.'

October 20, 1973: The Sydney Opera House was opened.

1973: In Ontario, the Bruce nuclear plant in operation, and all four Pickering reactors.

1974: The first 500 mev beam was generated by the TRIUMF particle accelerator at the University of British Columbia.

1974: Stelco's Lake Erie Works were built.

January 1975: The *Altair 8800*, a single-chip microprocessor - the first personal computer - was marketed.

1975: Canada adopted the metric system.

1975: The C-CORE Laboratory established at Memorial University, Newfoundland.

1975: Geotechnical engineer Danielle Zaikoff was elected the first woman president of l'Ordre des ingénieurs du Quebec; in 1978, she was elected the first woman president of the Canadian Council of Professional Engineers, now Engineers Canada.

June 26, 1976: Toronto's *CN Tower* was opened.

1976: The Canadian Medical and Biological Engineering Society (CMBES) was founded.

1976: Canada's millionth patent awarded.

22 April 1977: Fibre optic cable telephone traffic began.

June 10, 1977: The *Apple II*, an 8-bit home (desk) computer, was put on sale by Wozniak and Jobs.

July 3, 1977: The first MRI examination of a human being.

April 22, 1978: Edmonton LRT rail line was opened.

1978: NSERC took over responsibility for University Research Grants from NRC.

1978: de Havilland Dash 7 plane began service.

1978: Word processing using computers began to replace typewriting.

1978: Canadian Teledon was overtaken by the Internet.

August 18, 1979: The Dempster Highway, Canada's first all-weather highway to cross the Arctic Circle was opened.

March 28, 1979: Three-Mile Island nuclear incident.

1979: Sony Walkman cassette player marketed.

1979: Roy Thompson Hall opened in Toronto.

1979: The first of the James Bay Hydro Plants began operating.

1979: The Hibernia oil field discovered off Newfoundland; the world, however, had its second 'oil shock.'

September 5, 1980: Gotthard tunnel through the Alps was opened; it was the longest in the world when opened.

1980: Canadair began marketing the *Challenger* jet aircraft.

May 25, 1981: Calgary LRT rail line was opened.

August 12, 1981: IBM began to market its personal computer.

November 13, 1981: The first *Canadarm* robotic arm, was built by Spar Aerospace under direction from the NRC, went into space aboard the Shuttle *Columbia*; five were built for use in Shuttles, and one was lost in the *Challenger* disaster; the last, the 90<sup>th</sup>, flew in July 2011.

November 1982: The compact disc introduced.

1982: The *Saddledome* stadium opened in Calgary.

1982: The Hibernia *Ocean Ranger* mishap.

1982: The Thames Barrier became operational.

October 25, 1983: Microsoft word processor released.

January 1, 1983: The Internet of linked computer systems opened.

1983: BC Place Stadium, Vancouver, with its air-supported roof, was opened.

1983: Point Lepreau Nuclear Reactor, New Brunswick, began service.

1983: By then, video games had become established.

June 20, 1983: first flight of the Canadian de Havilland *Dash-8* STOL aircraft.

October 1983: The Bank of America Center in Houston, Texas, was completed.

1984: The Revelstoke Dam Powerhouse was in operation in B.C.

1984: Canadian Astronaut, Marc Garneau took his first trip in space, aboard the Shuttle, *Challenger*.

November 20, 1985: Microsoft introduced *Windows 1*.

1985: The anti-lock braking system (abs) became available on U.S. cars.

1985: The first cellphone marketed.

1985: Vancouver light rail service opened.

January 28, 1986: The U.S. shuttle *Challenger* exploded on lift-off at the beginning of its mission.

February 20, 1986: The Russian *MIR* Space Station was launched.

September 12, 1986: The of a system of sideways launching uncommon in the shipbuilding business; located on Georgian Bay, at the foot of the town's Hurontario Street, the yard and its giant steel hulls were eminently visible to the general public; the *Moment in Time* column for March 15, 2021 was devoted to it.

1986: Dr Wilbert Keon was the first Canadian surgeon to implant an artificial heart in a human, at the Ottawa Heart Institute.

1986: EXPO 86 opened at Vancouver

1986: U.S. Patent issued to Charles Hall for 3D printing.

1986: The first wide-bodied jet aircraft was marketed.

May 20, 1987: The Canadian Academy of Engineering was founded in Montreal; the first of the Fellows was John B. Stirling, former president of the Engineering Institute of Canada and of E.G.M. Cape Ltd., consulting engineers, Montreal.

1987: The Sunshine Skyway Bridge was completed at Tampa Bay, Florida; it was the first cable-stayed bridge in North America to have a precast concrete span.

1987: The Anti-CFC Montreal protocol passed.

April 29, 1988: First flight of Boeing 747 *Dreamliner*.

1988: The UN Intergovernmental Panel on Climate Change was established; it has since produced several reports, the latest in August 2021.

1988: The 15 km-long Macdonald Tunnel was opened by the CPR at Rogers Pass, BC.

April 21, 1989: The first Nintendo Game Boy was released in Tokyo.

June 3, 1989: The *Skydome* (later the Rogers Centre) was officially opened in Toronto; it featured a retractable roof.

1989: Patent Act change...from first to file to first to invent criterion.

1989-94: Canadian geotechnical engineer, N.R. Morgenstern, of the University of Alberta, served as president of the International Society for Soil Mechanics and Foundation Engineering.

1990: Application of GPS to private cars began.

January 17, 1991: The Gulf War began in the Middle East; it lasted five weeks.

November 1992: Canadian mechanical engineer George Klein died; a long-term staff member of the NRC, he was involved in projects as diverse as the *Zeep* reactor at Chalk River, skis for aircraft flying in Canada's North, and STEM antennae for the *Alouette I* and other satellites.

1992: Ottawa's Freenet went into operation

1993: Second St. Clair Tunnel opened.

May 19, 1994: The (English) Channel (Railway) Tunnel construction was completed and put into service.

1995: *Radarsat I*, Canada's first earth observation satellite was launched.

January 23, 1996: First version of computer language JAVA released.

1996: The Erasmus Bridge was completed at Rotterdam in Holland; van Berkel's bridge combines three-in-one: cable-stayed, viaduct and bascule.

1996: Blackberry marketed.

December 1997: Production began in Japan of the Toyota *Prius*, the first mass-produced hybrid electric passenger car

1997: The Confederation Bridge was completed between New Brunswick and Prince Edward Island; this 13-kilometre, concrete and steel, box girder bridge was designed for extreme ice conditions - and lobster fishing - in the Northumberland Strait, and replaced a long-time ferry service.

April 27, 1997: The Tsing Ma Suspension Bridge, connecting Hong Kong with the mainland, was completed; it was the first fixed connection between the two, and combined road and rail tracks.

1997: Publication date for *Lines of Country: An Atlas of Railway and Waterway History in Canada* by Christopher Andreae (Publisher: The Boston Mills Press).

1997: Toyota *Prius* hybrid car went on sale.

November 20, 1998: The first elements of the International Space Station were sent into space.

March 4, 1989: Massive Exxon Valdez oil spill at King William Sound, Alaska.

1998: The Etaki gold mine opened in the Northwest Territories.

1998: Building of the International Space Station began. (4x MIR; 5x SKYLAB)(10 years; 30 missions; 250 miles)

March 18, 1999: The Jin Mao Tower in Shanghai was opened.

March 1999: Jones and Pickard completed the first non-stop balloon flight round the world, in 20 days.

May 1999: The large, heavy water detector of the underground Sudbury Neutrino Laboratory was turned on to detect the arrival at earth of solar neutrinos; this experiment was terminated on November 28, 2006; the Observatory was then rebuilt for further astrophysical work.

June 26, 1999: The USSR grounded the Tu-144 Supersonic aircraft in 1978; but the aircraft did not have its final flight until 1999.

1999: Quantum computing by the D-Wave Company, Vancouver.

July 29, 2000: The *Concorde* accident in Paris, which led eventually to the cancellation of the service.

July 31, 1999: The American satellite *Lunar Prospector*, having detected the presence of hydrogen on the moon, was deliberately crashed into the moon's surface, 27 years after the last Apollo moon landing.

August 31, 1999: The Petronas Towers in Kuala Lumpur were opened.

December 1, 1999: The Burj Al Arab Hotel in the United Arab Emirates was opened.

December 31, 1999: Prime Minister Tony Blair formally opened the Millennium Wheel on London's South Bank as a tourist attraction; at 135 metres, it was then the world's tallest Ferris wheel.

December 31, 1999: London's Millennium Dome opened.

1999: Dr Douglas Boyd, the first Canadian surgeon to perform robotics-assisted closed-chest bypass surgery, at London Health Centre for Advanced Surgery.

1999: MacDonald Detwiler & Associates (MDA) acquired SPAR Aerospace Ltd. and the *Canadarm* technology.

July 1, 2000: Oresund Bridge opened between Denmark and Sweden.

November 2, 2000: The continuous occupation of the International Space Station began.

November 21, 2000: *Anik 1*, the first geostationary communications satellite, was launched.

2000: Electrical engineer Micheline Bouchard was elected the first woman president of the Canadian Academy of Engineering.

2000: Electrical engineer Linda Weaver was elected the first woman president of the Engineering Institute of Canada.

2000: The Oresund Bridge was completed between Denmark and Sweden; with a cable-stayed span and a submerged tunnel, this 8 kilometre-long bridge has two levels, one for road traffic and one for rail.

2000: The term, *nanotech*, to describe contemporary technology began to be applied.

September 11, 2001: The '9/11' terrorist attack on the World Trade Center in New York and The Pentagon in Washington took place. Thousands of airline passengers sought temporary refuge in and around Gander, Newfoundland.

October 23, 2001: The Apple Company in the United States introduced the iPod device and solidified the company's position in the music business.

2001: The *Canadarm 2* was added permanently to the International Space Station's equipment.

May 24, 2002: The Falkirk Wheel tourist attraction was opened near Falkirk in Scotland; a rotating boat lift, it connected the Union and Forth & Clyde Canals; the project had been announced in February 1997.

July 2, 2002: Steve Fossett completed his two-week 'first alone' hot air balloon trip round the world.

October 2002: The first 'dot-com' bubble burst.

February 1, 2003: The U.S. shuttle *Columbia* disintegrated on re-entry from a regular mission.

2003: The Diavik diamond mine opened in the North West Territories.

December 31, 2004: The Taiwan Financial Centre, Taipei, was opened (tallest building in the world 2004-2009).

2004: The cable-stayed Millau Viaduct was completed; it crosses the Tarn Valley in France; built on seven slender towers, it was - when built - the highest bridge in the world; it was designed by Foster & Partners, of England.

2004: The construction of the Burj Kalifa/Burj Dubai in the UAE began; the building was inaugurated in 2010; it was then the tallest in the world.

April 29, 2005: First flight of the Airbus A30.

August 23-31, 2005: All that was left of the U.S. Highway 90 Bridge across the Mississippi at Biloxi, after Hurricane *Katrina*, were the support columns.

2005: The Giant Mine at Yellowknife closed.

June 28, 2006: The *Bird's Nest Stadium* was opened at Beijing.

October 2006: Brazil's Vale Company bought Canada's INCO Ltd.

2007: Radarsat II launched.

2008: The Canadian-built *Dextre* manipulator (also built by MDA) added to the International Space Station's equipment.

2008: The Port of Vancouver joined with two others to form the largest port in Canada.

2008: Canadair's "C" Series aircraft production line activated.

2008: Apple iPhone available in Canada.

February 6, 2009: Astronaut/engineer Bjarni Tryggvason flew a replica of the Bell/McCurdy *Silver Dart* at Baddeck, Nova Scotia in recognition of the centennial of the aircraft's maiden flight.

2009: Cloud computing/Internet available in Canada.

January 4, 2010: The Burj Khalifa Building in the United Arab Emirates was opened (tallest in the world since 2010).

April 3, 2010: The iPad was released commercially.

April 20, 2010: The *Deepwater Horizon* oil rig exploded in the Gulf of Mexico, causing a massive oil spill and a great deal of physical damage; many lives were lost; fines and clean-up cost the rig's owner (BP) about US\$40 billion.

2010: Electricity generation in Canada: 60 % hydro; 40 % other sources.

2011: The construction of the International Space Station completed.

July 4, 2012: Opening of the Three Gorges Hydro Dam project in China, then the world's largest.

March to May 2013: Col. Chris Hadfield served as Commander of the International Space Station; in earlier space flights, he had been the first Canadian to walk in space and the first to use the *Canadarm* in orbit.

September 25, 2013: Canadian consulting engineer Philip A. Lapp died; earlier associated with a number of prominent manufacturing companies and with projects such as the *Canadarm* and *Radarsat*, he earned the title of 'father of Canadian astronautics.'

October 29, 2013: The 13.5 km Marmaray Tunnel under the Bosphorus Strait was opened.

March 12, 2014: The Canadian Military Mission ended in Afghanistan: it began in December 2001.

October 2014: One World Trade Center Building was opened, in New York, replacing the twin towers destroyed on September 11, 2001.

December 12, 2015: An international agreement on climate change was concluded in Paris.

2015: Arthur MacDonald and his Queen's Team awarded the 2015 Nobel Physics Prize for their research using the underground Sudbury Neutron Source.

May 1, 2016: Immense fire began at Fort McMurray, Alberta, and 'morphed' into one of Canada's largest fires.

June 26, 2016: The enlarged Panama Canal was reopened, to take Panamax-sized ships.

2017: Philips N.V. (Netherlands) introduced the *Azurun* coronary angiogram system.

2017: 84% of Canadians had home computers; 89% had access to them.

October 23, 2018: China opened the world's longest sea-crossing bridge, 55 km long, across the Pearl River, connecting the mainland with Hong Kong and Macau; the bridge incorporates a 7 km underground tunnel between two artificial islands to allow for the passage of ships.

March 13, 2019: The Canadian and U.S. Governments grounded the new Boeing 737 MAX aircraft, following the crashes of two aircraft of this type in Indonesia and Ethiopia that had killed over 300 people.

March 11, 2020: The COVID-19 pandemic declared by the World Health Organization.

December 2, 2020: The 50,000<sup>th</sup> PT-6 aero-engine rolled off the production line at Pratt & Whitney Ltd., Longueuil, Quebec.

September 2020: Zhangjieajie Glass Suspension Bridge, Taizhou City, China, was opened; 980 ft. long, 600 ft above the valley floor; it is a combination of three undulating bridges, part of the deck of which is glass.

May 13, 2021: Jim Thompson, a Canadian businessman and engineer, died in London, Ontario at the age of 94; he designed from scratch the speedboat, *Miss Supertest III*, which won the Harmsworth Trophy for Canada in 1959; this boat's predecessor, *Miss Supertest II*, also designed by Thompson, had earlier broken the unlimited class world waterspeed record.

## **To Conclude...very briefly...**

This paper is mostly about people and end products, in contrast with many other papers with historical connections, which are about the building of these products or about what had happened by the ends of the individual lives.

It covers only a small fraction of the possible range of factual and biographical information. The emphasis, if one is distinguishable, is Canadian although, the United States, and much earlier, China, dominate from the purely engineering point of view. It is not about details of the building or manufacturing, about deals or end-products, not details nor components, nor trade-offs.

Three kinds of dates are used and not all can be tied down to a particular day. The suggested anniversaries have been listed in three ways. The first, most common and most important, is by actual date. The second is by month and year, when the actual date is either unavailable or not really relevant; and the third is by year, alone, which is the closest to an anniversary that the targets can be taken and still have relevance. In each case, however, enough descriptive information is given to clearly identify the product or person.

The paper may be especially useful in identifying successes and disasters from which much has been learned. It may also help to gather merit for the way in which certain problems have been solved, lives saved and plans carried out. They might become the modern equivalent of the parable and, each year, provide a choice of national stories worth repeating or re-examining.

It may also serve to provide better bases for future public as well as private decisions, and more accurate accounts of what exactly happened.

And perhaps, with time and experience we may acquire the bragging rights to anniversaries that we, as Canadians, have not been accustomed to claim ownership!

## **Sources**

Because of its detailed content, a full list of sources for this paper could be as long as the paper itself. So shortcuts have been taken.

Most sources are from Wikipedia, others from the *Globe & Mail's Moment Series*. Some are from other newspapers. But also from the following books and papers:

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**One final comment...** As a result of research for this paper, I have discovered that Canadian astronaut-engineer, Col. Chris Hadfield, was born on the same day that my wife and I were married!