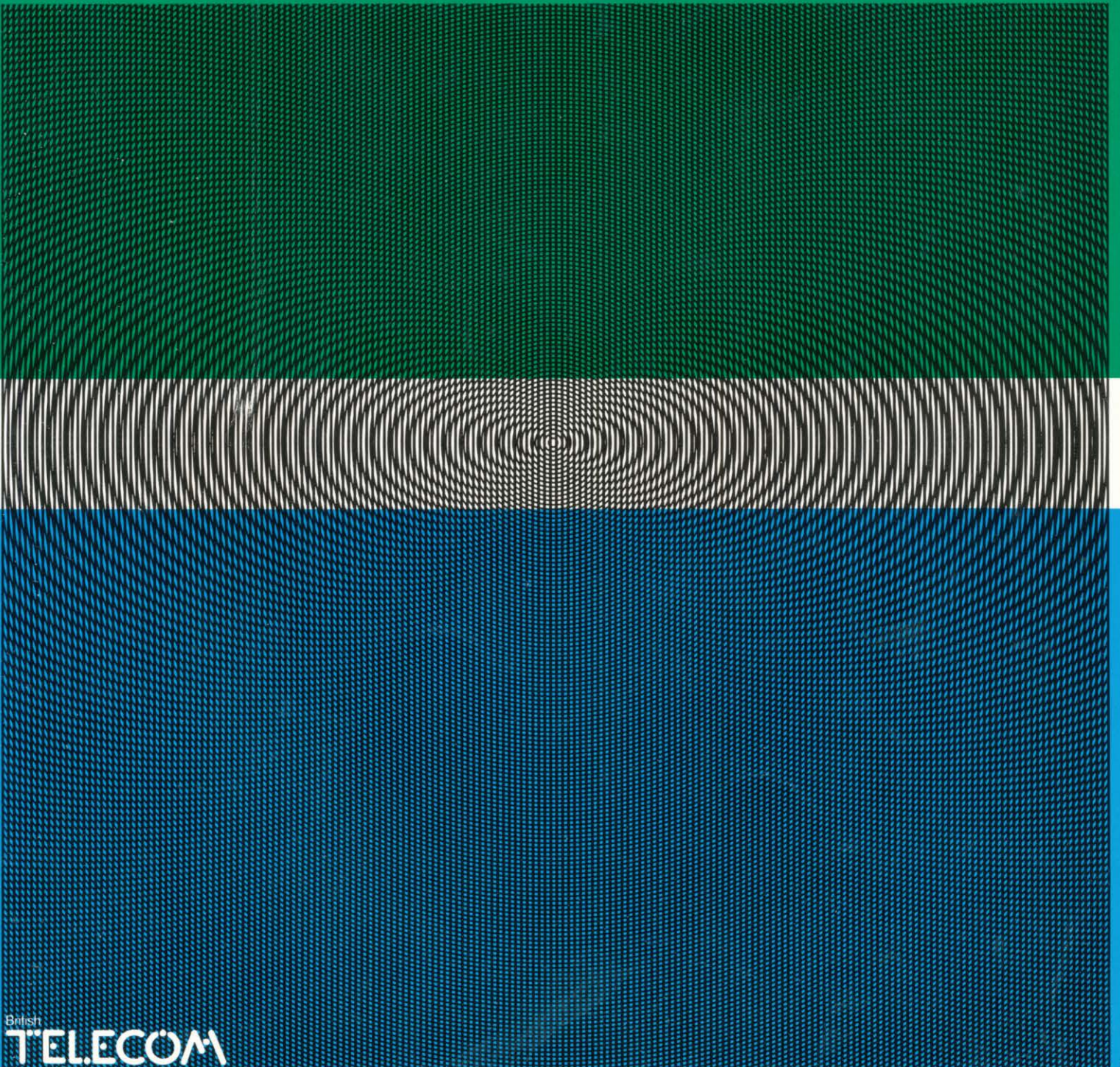


Telecommunications Projects

Names and dates for students



Telecommunications a Definition by
International Telecommunication Union

'any transmission, emission or reception of signs, signals, writings, images and sounds, or intelligence of any nature by wire, radio, visual or other electromagnetic systems.'

Telecommunications is a fascinating subject.

Interwoven in the fabric of daily life it caters for the country's social, commercial and industrial needs. Whether it is radio or television, telephony or telegraphy, telex or data transmission, or satellite communication, there is no aspect that British Telecom does not play a vital part.

Many students undertake communications projects making telecommunications their especial study.

If you wish to do so, the names, dates, and information we give you will help. However, **you** will have to do the work which will make meaningful the information we supply.

Because the subject is such a wide one you may like to pursue one particular line of enquiry, say the development of the telephone system or the life and work of one man. We are sure you will realise that, in a publication of this size, we cannot include all the aspects of telecommunications given in the ITU definition quoted above.

To assist you, we have included a 'Further Sources of Information' section.

The names of a few of the men of many nations who, by their research, inventions or work made possible today's telecommunications

Baudot Jean Maurice Emile 1845-1903
Bell Alexander Graham 1847-1922
Betulander Gotthelf Ansgarius 1872-1941
Branly Edouard 1844-1940
Braun Carl Ferdinand 1850-1918
Brett Jacob 1808-1898
Brett John Watkins 1805-1863

Clark Latimer 1820-1898
Cooke William Fothergill 1806-1879

Davy Humphrey 1778-1829
De Forest Lee 1873-1961
Du Fay Charles Francoise 1698-1739

Edison Thomas Alva 1847-1931
Erlang Anger Krarup 1878-1929
Erwin Edson L not known

Faraday Michael 1791-1867
Field Cyrus W 1819-1892
Fleming John Ambrose 1849-1945
Flowers Thomas Harold 1905-
Franklin Benjamin 1706-1790

Galvani Luigi 1737-1798
Gauss Johann Carl Friedrich 1777-1855
Gilbert Williams 1540-1603
Gray Elisha 1835-1901
Gray Stephen c.1670-1736

Hauksbee Francis -d.c.1713
Heaviside Oliver 1850-1925
Henry Joseph 1797-1878
Hertz Heinrich Rudolf 1857-1894
Hughes David Edward 1831-1900

Kelvin (William Thomson) 1824-1907

Lodge Oliver Joseph 1851-1940

Marconi Guglielmo 1874-1937
Maxwell James Clerk 1831-1879
Molina E C 1877-1964
Morse Samuel Finley Breeze 1791-1872

Nollet Jean Antoine 1700-1770

Oersted Hans Christian 1777-1851

Palmgren Nils Gunner 1887-1975
Popoff Alexander Stepanovitch 1859-1905
Pupin Michael Idvorsky 1858-1935

Reis Philipp 1834-1874
Reynolds John N not known
Righi Augusto 1850-1920
Roberts Homer J not known
Roberts J G not known
Ronalds Francis 1788-1873

Schilling Pavel Lvovitch c.1780-1836
Senlecq Constantin 1842-1934
Siemens Ernst Werner von 1816-1892
Soemmerring S T von 1755-1830
Strowger Almon Brown 1839-1902
Sturgeon William 1783-1850

Thomson William (Lord Kelvin) 1824-1907

Varley Cromwell Fleetwood 1828-1883
Volta Alessandro 1745-1827

Watson Thomas A 1854-1934
Weber Wilhelm Eduard 1804-1891
Wheatstone Charles 1802-1875

This list is not comprehensive

Important dates and events in the development of telecommunications

- 1753** A letter from a correspondent with the initials 'C.M.' was sent to the Scots Magazine, and published on 17th February. The letter predicted the electric telegraph and suggested a way in which such a telegraph might be worked.
- 1786** Luigi Galvani, professor of anatomy at the University of Bologna in Italy, observed electrical convulsion in dead frogs' legs when in contact with dissimilar metals.
- 1793** Ignace Chappe, a Frenchman, (a brother of Claude Chappe who invented a system of semaphore) first used the word 'telegraph' in April 1793. The word is derived from the two Greek words 'tele' meaning 'far' and 'graphein' meaning 'to write'. The name was later applied to the electric telegraph.
- 1800** Alessandro Volta, professor of the University of Pavia in Italy, announced his invention of the Voltaic Pile, the first electrical battery.
- 1819** Hans Christian Oersted of Copenhagen, showed that a wire carrying an electric current would deflect a magnetic needle.
- 1839** The world's first commercial telegraph line, using equipment invented by William Fothergill Cooke, and Charles Wheatstone of King's College, London, was built between Paddington and West Drayton.
It was working to Hanwell by 6th April and was completed to West Drayton on 9th July.
This was also the first commercial use of electricity.
- 1841** Charles Wheatstone invented the first type printing telegraph.
This year he also proposed a time-division multiplex telegraph system.
- 1843** A message was sent by telegraph (the first telegraph line in the USA) from Washington to Baltimore by Samuel Morse.
Morse used equipment of his own invention which was totally different from that of Cooke and Wheatstone. (He also used what became known as 'Morse Code'.)
The line was not fully operational until 1st January 1845.
- 1849-1850** The world's first central telegraph station was opened by the Electric Telegraph Company in Founders' Court, Lothbury in the City of London.
- 1850** The first telegraph cable was laid between England and France, this was also the first telegraph cable laid in the open sea and was laid by H.M. Tug 'Goliath' accompanied by H.M. Packet 'Widgeon'. It failed after only a few messages, but a successful cable was laid the following year.
- 1851** An Englishman, Thomas Russell Crompton, devised the first armoured submarine cable which was laid between England and France.
- 1858** The first trans-Atlantic telegraph cable was laid between Valentia Island, County Kerry, Ireland and Trinity Bay, Newfoundland.
The cable was laid by HMS 'Agamemnon' and the USNS 'Niagara'.
The first messages were sent on 5th August.

Charles Wheatstone patented the automatic telegraph system in which the message is first transposed into the form of perforations in a paper tape, and then transmitted and received at high speed.
This was the forerunner of modern systems using punched tape.

Alexander Graham Bell
with first telephone
that recorded speech.



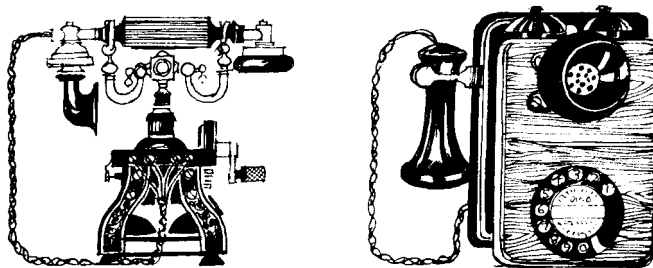
- 1865** On 17th May, twenty countries formed the International Telegraph Union, the object being to achieve international co-operation in the field of telegraph communication. (This ultimately became today's International Telecommunication Union.)
- 1867** The Scottish physicist James Clerk Maxwell proved mathematically that in certain circumstances it would be possible to produce electro-magnetic waves, that is, radio waves, and that these waves would travel with the speed of light.
- 1868** An Act of Parliament gave the Postmaster-General the exclusive right to set up and operate inland telegraphs.
- 1869** A second Act of Parliament allowed the Postmaster-General to take over the telegraphs from the private companies operating in the United Kingdom.
- 1870** The transfer of telegraphs from the private companies operating in the United Kingdom took place on 3rd February. Some 60,000 miles of aerial line, 2,800 telegraph offices were taken over and £5,717,048 was paid in compensation.
- 1871** Great Britain was admitted to the membership of the International Telegraph Union.
- 1874** Emile Baudot invented the Baudot printing telegraph system using the multiplex principle suggested by Wheatstone. The Baudot system was the first to use a code consisting of five units of equal length.
Five unit codes of this type were later adopted for use with teleprinters
- 1875** Alexander Graham Bell constructed his first experimental telephone.
- 1876** Alexander Graham Bell applied for a patent for the telephone on the 14th February; this was granted on the 7th March. The first recognisable sentence, 'Mr. Watson come here I want to see you', was transmitted by telephone on the 10th March.
- 1877** Thomas Alva Edison invented the carbon transmitter for telephones.
- 1878** In January, Alexander Graham Bell demonstrated the telephone before Queen Victoria at Osborne House on the Isle of Wight.
The Telephone Co. Ltd. was registered on 4th June with a capital of £100,000 to work the Bell Patents in Britain.
- 1879** The Edison Telephone Co. of London Ltd. was floated on 2nd August with a capital of £200,000 to work the Edison telephone patents.
Daniel Connolly, T. A. Connolly and T. J. McTighe patented the automatic telephone exchange and exhibited an eight line automatic exchange in Paris.
The Telephone Co. Ltd., opened Britain's first public telephone exchange at 36 Coleman Street, London.
The same year the rival Edison Telephone Co. of London Ltd. started to operate with exchanges in Lombard Street and Queen Victoria Street.
- 1880** On 13th May the Telephone Co. Ltd. and the Edison Telephone Co. of London Ltd. were amalgamated to form the United Telephone Co.
- 1881** The Government authorised the Post Office to offer the public telephone as well as telegraph service.
The first Post Office Telephone Exchange was opened at Swansea on 23rd March.

- 1882** G. L. Anders of London patented a central battery system by which telephones could be supplied with electrical power from the exchange thereby making batteries at the telephone unnecessary.
- 1884** L. M. Ericsson of Sweden combined the transmitter and receiver to form the earliest telephone handset.
- 1885** The Post Office reduced the charge for telegrams to sixpence for twelve words and embarked on a vast programme of expansion.
In this year fifty million telegrams were sent compared with 33 million the previous year.
- 1886** Dane Sinclair invented an automatic line selector which was installed at Coatbridge near Glasgow.
- 1887** An Englishman, Oliver Heaviside, propounded the theory that the effect of the large electrostatic capacitance of cables could be minimised by increasing their inductance. This led to the successful development of long-distance telephone cables.
- 1888** Heinrich Hertz, a German, successfully transmitted electro-magnetic waves, that is, radio waves, proving that they could be reflected and refracted, thus confirming the mathematical theory of James Clerk Maxwell.

Almon Brown Strowger, an undertaker of Kansas City USA, built the first automatic telephone selector capable of being interconnected to form a large exchange.
- 1889** The United Telephone Co. and its subsidiaries were amalgamated to form the National Telephone Co.
- 1891** The first telephone cable was laid by HMTS 'Monarch' (No 1) between England and France enabling telephone conversations to be made between London and Paris.
- 1894** Oliver Lodge, an Englishman, transmitted wireless signals a distance of 150 yards.
- 1896** The Post Office took over the trunk telephone lines of the United Kingdom in accordance with a government decision of 1892. £459,114.3s.7d was paid in compensation.
The telephone dial was invented by the Americans E. A. Keith, C. J. Erickson and John Erickson.
- 1897-1898** Britain's first long-distance cable was laid between London and Birmingham. This cable was normally used for telegraphy but was also used experimentally for telephony.
- 1900** The first large central battery type exchange in Europe was installed in Bristol.
- 1901** On 12th December, Guglielmo Marconi, an Italian, transmitted the first radio signals across the Atlantic from Poldhu in Cornwall to Signal Hill, Newfoundland.

Inductance was added experimentally to the London-Birmingham cable laid in 1897-1898 applying the theory of Oliver Heaviside of 1887.

F. G. Creed (founder of the firm of Creed & Co. of Croydon), developed a receiving reperforator enabling telegraph signals received from line to be recorded in the form of perforations in a paper tape at speeds of up to 200 words per minute.
- 1904** John Ambrose Fleming, an Englishman, invented the thermionic valve.
- 1906** Twenty-nine countries formed the International Radiotelegraph Convention. (Later known as the International Radiotelegraph Union.)



Early telephones.

- 1907** Lee de Forest of the USA added a grid to the Fleming valve and showed how it could be used for amplification.
- Charles L. Krumm and his son H. Krumm introduced the first stop-start type of telegraph. This instrument known as the 'teletype' used a typewriter keyboard for direct sending and a 5-unit code with stop-start signals, as used by modern teleprinters.
- 1908** The Post Office opened its first ship-to-shore radio station at Bolt Head in Devon.
- 1912** On the 1st January the Postmaster-General took over the National Telephone Co. and for the first time a unified telephone system was available throughout most of Britain. 1,565 exchanges were transferred of which 231 had more than 300 subscribers each; 68 were of the central battery type, most of the rest were of the magneto type.
- There followed a period of rapid expansion
- In the next three years no fewer than 450 new exchanges were opened in places with no previous telephone service.
- On the 13th March, the Post Office opened Britain's first public automatic telephone exchange in Epsom.
- 1913** The first long-distance telephone cable in Europe was laid between Leeds and Hull.
- 1916** The Post Office made the first effective use of amplifiers on telephone circuits when their research staff installed experimental repeaters in the London to Belfast and London to Dublin circuits at Liverpool. A few weeks later, the first permanent repeaters were installed in the London to Liverpool cable at Birmingham.
- 1918** British scientists W. H. Eccles and F. W. Jordan invent the first electronic switching circuit.
- 1920** G. A. Campbell, an American, invented the anti-sidetone telephone circuit. In the older type of telephone circuit the power from the transmitter was divided between the line and the local receiver, so that the caller heard his own voice. This is called 'sidetone'.
- In the circuit which G. A. Campbell devised, this unwanted current is considerably reduced, leading to greater efficiency.
- The Post Office commenced their long-distance radio-telegraph service to ships.
- 1921** The first of the 'rural automatic exchanges', which were intended to give automatic telephone service to sparsely populated areas, was opened at Ramsey in the Peterborough Area. The name 'rural automatic exchange' was later changed to 'unit automatic exchange'.
- 1922** After a series of full scale experiments in which six different automatic telephone systems were tried, the Post Office decided to adopt the Strowger system as its standard. It has been thought that there might be difficulties using the Strowger system in very large cities such as London but this problem was solved when the Automatic Telephone Manufacturing Co. Ltd. of Liverpool, working in conjunction with the Post Office developed the 'director'. This is a piece of equipment designed to 'direct' telephone calls through the complex network of circuits linking telephone exchanges in large cities.
- 1927** Regular telephone service between Britain and the USA began on 7th January using radio.
- The first director exchange was used at Holborn, London.
- 1928** The first high-frequency radio telephone link between Britain and the USA opened in June.

1929 The development of the immersed electrode principle in transmitter design and advances in plastics technology, made it possible for the Post Office to introduce a new telephone with a plastic case and a handset suitable for all types of exchange.

The Post Office decided to adopt the teleprinter as the standard instrument for inland telegraph circuits.

1930 The radio-telephone service was opened to Australia, Buenos Aires and Capetown.

1931 The page printing teleprinter (the teleprinter 7B) was introduced by Creed.

The first voice frequency telegraph system with 12 carrier channels was installed between London and Dundee.

1932 The International Telecommunication Union (the oldest of the inter-governmental organisations which form the specialised agencies of the United Nations) was created from the International Telegraph Union and the International Radiotelegraph Union.

The Post Office introduced the Telex Printergram service.

The first ultra-short-wave radio telephone link, used as part of the inland telephone network, was set up across the Bristol Channel, over a distance of 13 miles.

The first submarine cable for carrier working was laid from Britain to La Panne in Belgium. It contained 120 wires arranged as 4-wire circuits and provided ninety telephone circuits using one-plus-two carrier equipment.

The Post Office introduced trunk service on demand, relieving telephone users of the need to book trunk calls in advance.

The Post Office introduced telephones with anti-sidetone induction coil (see 1920 entry).

The first British experiments in carrier telephony were carried out using the London-Derby cable.

1933 Imperial Chemical Industries Ltd. discovered Polyethylene, or Polythene, as it has become known. This material, because of its low dielectric constant, became widely used for submarine cable insulation and for many other purposes in telecommunications.

1934 H. S. Black, an American, formulated the principle of negative feedback revolutionising the design of telephone repeaters.

On the 1st October, the Post Office introduced cheap night rates for trunk telephone calls as part of the Kingsley Wood (the then Postmaster-General) plan for advertising and popularising the telephone.

1936 A specially designed 12-channel carrier cable between Bristol and Plymouth was laid by the Post Office.

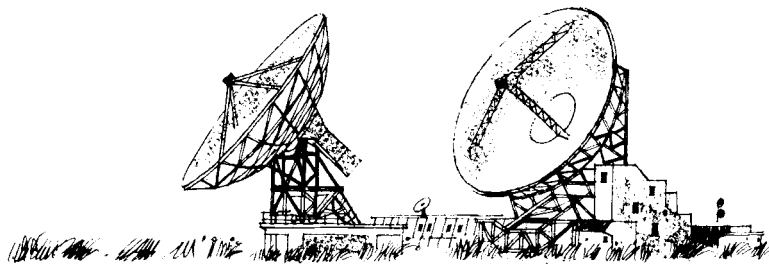
The Post Office laid the world's first coaxial telephone cable between London and Birmingham.

The Post Office extended the Telex service to give a limited service to the Continent.

1937 The '999' emergency telephone service was introduced in London and later extended throughout the country

A pair of coaxial submarine cables was laid between Britain and Holland.

The Post Office installed the world's first underground cable for television, linking Alexandra Palace with Broadcasting House and other places in central London.



Earth station aeriels.

- 1938** The first Administrative Telegraph and Telephone and Radio Conferences of the new International Telecommunication Union were held in Cairo.
- Pulse Code Modulation (a digital telephone transmission system) was invented by an Englishman, A. H. Reeves.
- 1943** A Post Office Research Branch team led by Thomas Harold Flowers, designed and constructed 'Colossus' the World's first programmable electronic computer. It contained 1,500 electronic valves.
- The first submerged repeater was laid. It was inserted in a submarine coaxial cable between Anglesey and the Isle of Man.
- 1945** The West Country space expert, Mr. Arthur C. Clarke, in an article in the 'Wireless World' was the first to suggest using synchronous satellites for communication.
- 1948** The Bell Telephone Laboratories, USA, announced the invention of the transistor.
- 1950** The first long-distance television cable was brought into service in October between London and Sutton Coldfield.
- 1951** Post Office research engineers evolved an entirely new type of deep sea telephone cable. Known as lightweight submarine cable, it had a steel strand in the centre instead of the conventional layer of steel armour wires on the outside. This lightweight type of cable was both cheaper and easier to lay.
- 1953** Agreements were signed on 1st December between the British Post Office, the American Telephone and Telegraph Company, the Canadian Overseas Telecommunication Corporation and the Eastern Telephone and Telegraph Company for the provision of the Transatlantic Telephone Cable.
- 1954** A new inland Telex service was established using a separate network integrated with international Telex circuits.
- A submarine telephone cable was laid between Aberdeen and Bergen, Norway. This cable, 300 nautical miles in length was, at the time it was laid, the longest telephone submarine cable in the World. The cable was laid by the Post Office cable ship HMTS 'Monarch' (No 4).
- 1956** The first transatlantic telephone cable between Oban in Scotland and Clarenville in Newfoundland, a distance of 2,240 miles, was laid by the Post Office cable ship HMTS 'Monarch' (No 4). After crossing Newfoundland, a further submarine cable was used to complete the connection to the mainland of North America, some of the circuits terminating in Canada and some in the USA.
- 1958** On 5th December, Her Majesty the Queen inaugurated the Subscriber Trunk Dialling service by making a call from Bristol Central telephone exchange, the first to have STD facilities.
- The first automatic Telex exchanges were opened at Shoreditch in London and Leeds.
- 1959** The trans-Atlantic telephone cable (TAT 2) was laid by the Post Office cable ship HMTS 'Monarch' (No 4).
- 1960** The conversion of the inland Telex service to automatic working was completed.

1961 The Anglo-Canadian cable (CANTAT 1) was laid by the Post Office cable ship HMTS 'Monarch' (No 4), as the first section of a submarine telephone cable network linking the Commonwealth. This was the first time that the lightweight submarine cable, developed by the Post Office in 1951, was brought into service.

1962 The Post Office Satellite Communications Station at Goonhilly Downs began working. The station was designed to track communication satellites and, through them, transmit and receive telephone, telegraph and television signals. The station used a British designed dish-type aerial which was the first of its type. Dish-type aerials were later adopted throughout the world for satellite communication. The station took part in the first trans-Atlantic television transmission made via an artificial satellite - Telstar.

Telstar was the first broad-band active communications satellite and was launched into orbit from Cape Canaveral on 10th July. It circled the earth once every 158 minutes at a height of between 600 and 3,500 miles. The day after it was launched, Telstar was used to transmit the first high-definition television pictures across the Atlantic.

An experimental electronic telephone exchange was opened at Highgate Wood in London.

1963 On 8th March, International Subscriber Trunk Dialling (ISD) was inaugurated allowing London subscribers to dial Paris numbers. Now called International Direct Dialling (IDD)

The Commonwealth trans-Pacific cable (COMPAC) was laid between Canada and Australia. The Post Office cable ship HMTS 'Monarch' (No 4) participated in the lay.

1965 INTELSAT 1 (Early Bird) the first commercial communications satellite was launched into a synchronous orbit of 22,300 miles on 6th April.

The Post Office introduced the Datel services.

The Prime Minister, Mr. Harold Wilson, opened the Post Office Tower in London, Britain's highest building. The Tower was designed to carry aerials for the Post Office micro-wave network covering some 130 stations throughout the country including the Post Office satellite earth station at Goonhilly; the Tower is the focal point of this network.

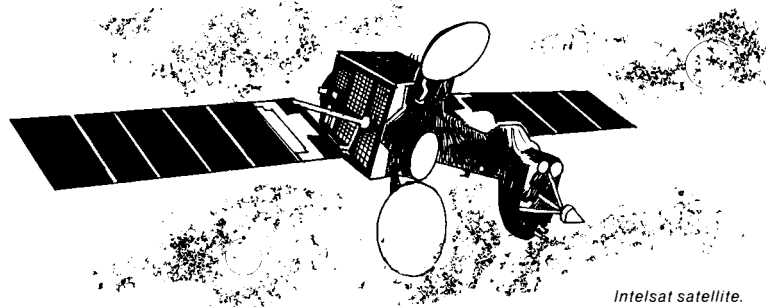
The Tower and the four storey building below are equipped to handle 150,000 simultaneous telephone connections and provide 40 channels for black and white or colour television.

1966 The first fully-operational production electronic telephone exchange in Europe (the first small-to-medium sized one in the World) was opened at Ambergate, Derbyshire. This was a TXE2 reed relay exchange.

1967 The final section of the South East Asia Commonwealth (SEACOM) cable linking Australia, Hong Kong and Singapore became operational

1968 Europe's first Pulse Code Modulation transmission system, in which calls are carried in digital form, was installed between London and Sunbury-on-Thames, Middlesex.

Empress telephone exchange, the World's first Pulse Code Modulation (digital) exchange, was opened in London.



Intelsat satellite.

- 1969** The Post Office ceased to be a Government Department and became a Corporation on 1st October.
- A second aerial at the Post Office Satellite Communications Station, Goonhilly Downs, was completed.
- The station could then communicate simultaneously with satellites over the Atlantic and the Indian Oceans. In July, Goonhilly was the European terminal for the television coverage of Man's first steps on the moon at the time of the Apollo 11 moon landing.
- 1970** The World's first telephone directories produced by a fully integrated computer printing process, were completed for the Post Office in January.
- The International Subscriber Trunk Dialling service was extended to allow London subscribers to dial New York numbers - the World's first major inter-Continental subscriber dialling service.
- The 100th electronic telephone exchange (TXE2) was opened at Bawtry near Doncaster.
- 1971** Trans-Atlantic dialling was extended. Six British cities: Birmingham, Edinburgh, Glasgow, Liverpool, London and Manchester were able to dial direct to the whole of the mainland of the USA by dialling 0101 followed by the USA area code and local number.
- In July the Post Office announced the development of the one-plus-one subscribers carrier system by means of which two subscribers can speak simultaneously on one line.
- Confravision, the World's first public bothway television system giving conference facilities to groups of people in different cities, was made available by the Post Office at its studios in Birmingham, Bristol, Glasgow, London and Manchester.
- 1972** A third aerial was completed at the Post Office Satellite Communications Station at Goonhilly Downs, making the station the largest in Europe and the first in the world to operate simultaneous commercial services through three satellites.
- The ten millionth telephone exchange line was installed in the United Kingdom.
- 1973** The Post Office adapted the application of the hovercraft principle for moving pre-packed containers of submarine cable weighing up to seventy tons at their new Southampton cableship depot.
- The World's first experimental international Confravision link was set up by the Post Office between London and Sydney, Australia.
- 1974** The World's first commercial international Confravision service was opened between the United Kingdom and Sweden.
- International Subscriber Trunk Dialling (ISD) was extended to additional countries including New Zealand making UK subscribers the first in the World able to dial their Antipodes.
- 1975** Two new Post Office cableships, the 'Monarch' (No 5) and the 'Iris' were launched. These were the first cableships in the World to be designed for rapid cable loading using the 'pan loading' system developed by the Post Office.
- 1976** The Post Office opened the World's largest international exchange at Stag Lane, Edgware.
- The first production TXE4, Britain's large-size Reed electronic telephone exchange, was opened at Sutton Coldfield, Birmingham.
- The last manual telephone exchange in the United Kingdom at Portree, Isle of Skye, was closed.

1978 The first optical cable system in Europe to form part of the public telephone network was installed between the Post Office Research Centre, Martlesham, and Ipswich telephone exchange. Optical cables contain glass fibres along which telecommunication signals can be transmitted using light.

After a design study in which British Post Office staff participated, the Orbital Test Satellite of the European Space Agency (of which Britain is a member) was launched from Cape Canaveral. Its purpose was to test the feasibility of satellite communication between the countries of Europe.

A fourth aerial was completed at the Post Office Satellite Communications Station at Goonhilly for use with the Orbital Test Satellite.

The Post Office opened its second satellite communications station at Madley, Hereford.

One of the World's largest all-electronic telex exchanges, and the first in Britain to use stored programme computer control, was brought into service in London.

1979 Prestel, the World's first public viewdata service, was opened in London and extended progressively to other centres. It was invented by the Post Office and enables information held in computers to be transmitted via an ordinary telephone line and displayed on a television screen.

Digital telephone exchange opened in Glenkindie, Aberdeenshire, making Glenkindie subscribers the first to be connected directly to a digital exchange.

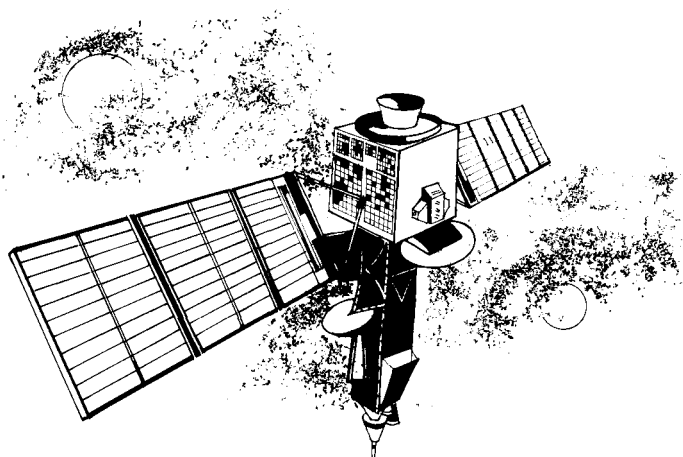
The STD system, commenced in 1958, was completed allowing direct dialling between all United Kingdom subscribers.

1980 The World's first purpose designed optical fibre submarine cable was laid in Loch Fyne, Scotland.

The first of the British designed, processor controlled digital switching systems designated 'System X' was installed in Baynard House, London, to carry tandem calls between London exchanges.

1981 The first System X exchange to which subscribers were directly connected was opened at Woodbridge, Suffolk. This was also the first exchange to have 'voice guidance', that is, verbal announcements to help subscribers use the exchange.

Under the British Telecommunications Act of 1981 the Telecommunications services provided by the British Post Office were formed into a separate organisation on 1st October. The new public corporation was called British Telecommunications and for trading purposes was shortened to British Telecom.



Intelsat satellite.

Further sources of information

There are wider benefits to be gained from doing project work quite apart from the knowledge you acquire about the specific subject you are studying. You add to your experience by undertaking your own research; by learning to be selective about the material at your disposal; by attempting to achieve a high degree of accuracy. You learn too, to familiarize yourself with the resources of libraries, museums and other institutions.

Here are a bibliography and a list of some places we suggest you visit to further your knowledge of telecommunications.

Some books to read

Do not be discouraged because you find that many of the books on telecommunications subjects are very technical.

These are intended for engineers.

Below is a section of books you will be able to understand.

There are, of course, many others.

title	author	publisher	date	ISBN
The Telephone and the Exchange	Povey, P J	Pitman	1979	0 273 01355 6
Radio and British Telecom (Tele Ed 50)		British Telecom Education Service	1979	
The Post Office from Carrier Pigeon to Confravision	Martin, N	Dent	1969	460 06602 1
From Semaphore to Satellite	Michaelis, A R	International Telecommunication Union	1965	
Alexander Graham Bell and the Conquest of Solitude	Bruce, R V	Gollancz	1973	0 575 01561 6
How it Works - The Telephone	Carey, D	Ladybird Books	1972	0 7214 0309 3
Cooke and Wheatstone and the Invention of the Electric Telegraph	Hubbard, G	Routledge	1965	7 100 156 7
Voice Across the Sea	Clarke, Arthur C	Luscombe	1974	0 86002 068 1
Early Electrical Communication	Marland, E A	Abelard-Schumann	1964	
A History of Electrical Engineering	Dunsheath, P	Faber	1969	571 09072 9
Words and Waves An Introduction to Electrical Communications	Beck, A H W	Weidenfeld and Nicolson	1967	303 74719 6
The Story of Communications	Clark, J and Hanson, D	Ginn	1971	0 602 21267 7
The Book of Telecommunication	de Vries, L	Murray	1962	0 7195 03167
An Illustrated History of Science	Taylor, F S	Heinemann	1971	435 54892 1
Great Pioneers of Science	Shepherd, W	Ward Lock	1964	
A Biographical Dictionary of Scientists	edited by Williams, Trevor I	A & C Black	1974	7136 1511 7
Chambers Dictionary of Science and Technology	edited by Collocott, T C and Dobson, A B	Chambers	1974	0550 13202 3
Chambers Biographical Dictionary	edited by Thorne, J O and Collocott, T C	Chambers	1974	0550 16002 7
Oxford Junior Encyclopaedia Vol. 4: Communications (distribution of news)		Oxford University Press	1976	019 910024 1
Vol. 8: Engineering (electrical engineering)			1976	019 910028 4

Some places to visit

British Telecom Museum

TAUNTON

Somerset

TA1 1LY

Telephone No. Taunton (STD Code 0823) 73391

Open Saturdays 1.30pm to 5pm and at other times by arrangement.

School parties are welcome and there is no age restriction. Admission is free of charge.

Telephone Exchanges

You should be 14 years or older but exceptions are sometimes made in the case of groups of children accompanied by a teacher or youth group leader. Contact your local Telephone Area Sales office.

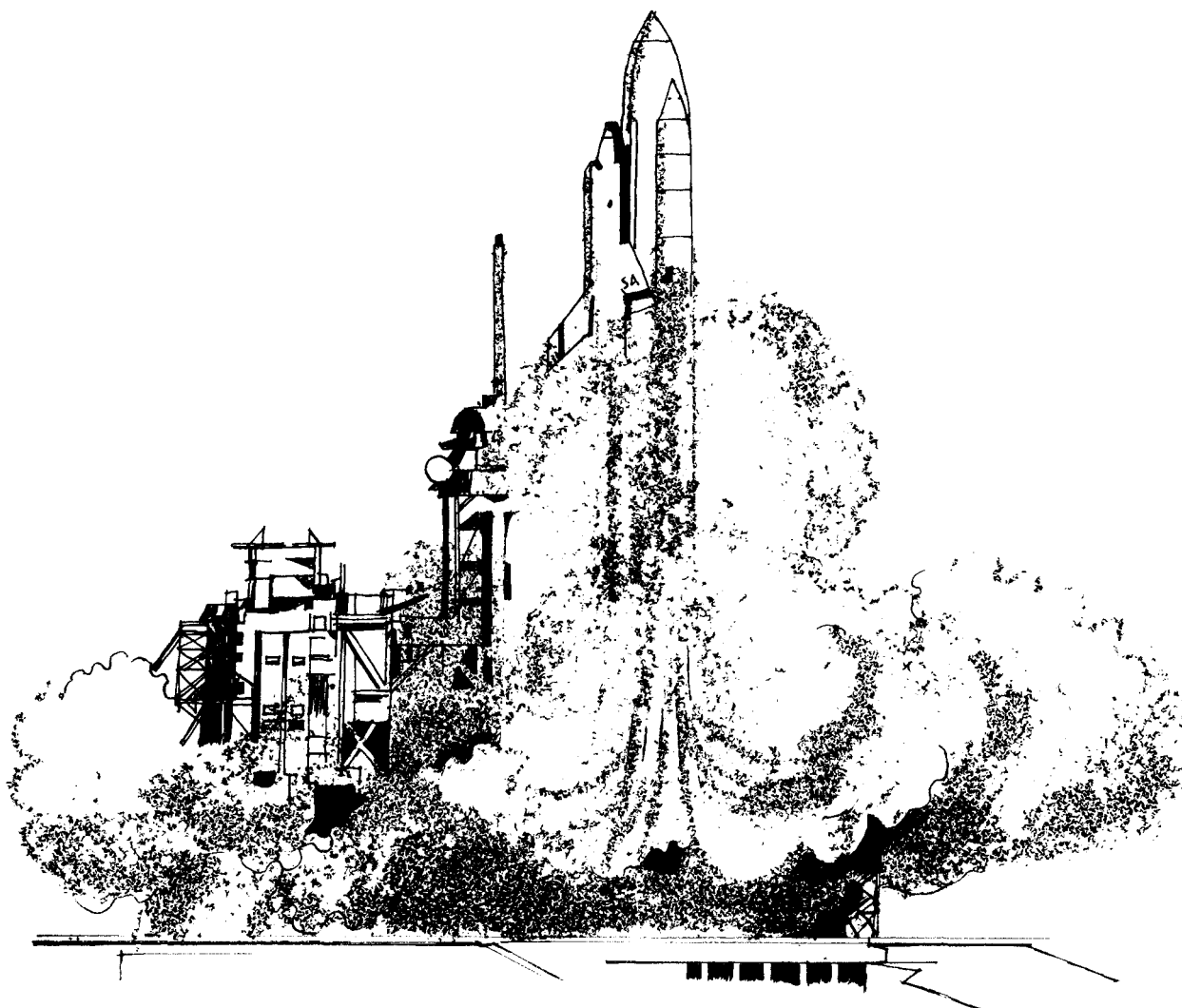
The Science Museum

Exhibition Road

LONDON

SW17 2DD

The Telecommunications Gallery (Gallery No. 66) is on the 3rd Floor. The Museum is open on weekdays 10am to 6pm and Sundays 2.30pm to 6pm. It is closed on Bank Holidays. Admission is free of charge.



Space Shuttle Columbia.

Teachers who wish to know about other British Telecom publications for schools should write to their local General Managers office. The address is in the preface of your Telephone Directory.