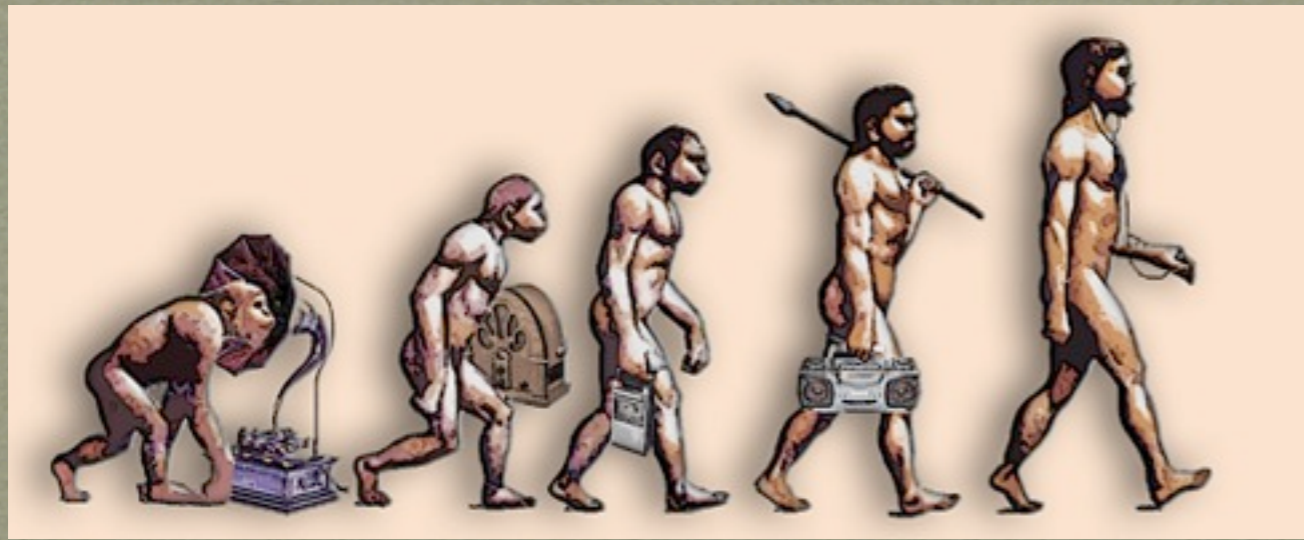




The History and Development of Radio



This presentation is part of my
Year 1 - Media Technology -
Radio Project

Andrew Robson
DMU Leicester



Luigi Galvani 1737 - 1798

Reading the first section of the report on the right tells you that Galvani had missed this great discovery of 'wireless transmission' and says that he was too dumb to notice it, yet his findings were published in the 7th volume of memoirs of the Institute of Sciences at Bologna in 1791.

The experiments Galvani undertook helped to establish not only the basis for study on neurophysiology and neurology but also the electrical nature of the nerve muscle function.

This was instrumental in leading Volta to the invention of the first electric battery and future development of radio which Heinrich Hertz and others took the credit for.

It all began back in the 18th Century when Mrs Galvani was preparing a tasty dish of frogs' hind legs for her husband's lunch. He was fond of them, Mrs G noticed that whenever she touched a skinned frog's leg with a metal implement, the leg jumped. So did Mrs Galvani.

She told her husband about it. But he still ate the frogs' legs, all except one - which he selflessly spared in the interests of science. Into its thigh muscles he implanted two metal electrodes and to them he applied a weak current from a primitive wet battery. Straightaway the frog's leg jumped. Galvani didn't - his wife had told him what to expect!

Some months later, Galvani sat idly cranking the handle of an electrical machine, generating a stream of sparks. He often did this because it frightened his mother-in-law. Suddenly, he noticed that a frog's leg lying nearby was jumping like crazy, although there was no direct electrical connection to it. Perhaps we should explain, since his wife's discovery, Galvani always kept a few frogs' legs lying around the house in case of developments. They also came in useful as snacks, if the cat didn't get them first!

Now Galvani was too dumb to notice it - and perhaps you haven't twigged it yet either - but he had just discovered radio. One full century before Heinrich Hertz, who got all the credit anyway. Galvani had lighted on the main principle of wireless transmission. How so? Like this; the sparks from the electrical generator emitted electromagnetic waves, these were collected by the electrodes in the thigh muscle and the nerve fibres and muscle salts combined to act as a detector of the waves. And Galvani missed it!

Moving on through time

At this point we say goodbye to Luigi Galvani and skip a century and a half. This brings us to around 1918 and to Dr. Lefevvre, a professor at the University of Rennes, France. Dr. Lefevvre decided to hook up a radio utilising Galvani's discoveries. From the output terminals of a crystal set he led two wires to a newly killed frog mounted spread-eagled on a vertical panel. Lefevvre connected the wires to a nerve in the frog's thigh muscle, then he tied one end of a thread around its kneecap and the other end to a pivoted lever mounted below the frog. There's only one more thing; the lever was able to inscribe on a smoked paper sleeve surrounding a revolving drum. Something like a seismograph except it didn't need an earthquake to operate it, a bolt of lightning would do.

Well perhaps it is time you heard the story.

All set to make a test run, Dr. Lefevvre tuned in his brainchild to FL, the callsign of France's most powerful transmitter, the Eiffel Tower. Radio FL didn't have particularly interesting programmes. All it did was broadcast time signals in Morse. But that was fine by Dr. Lefevvre. The time signal impulses acted on the thigh muscle nerve, the muscle contracted and expanded and the leg kicked accordingly. The thread from the kicking leg then jerked the lever up and down and this drew zigzags on the smoked paper in time with the impulses from FL. The world's first Frog's Leg Radio was a success!

Craziest radio?

That, in brief, is the true story of the craziest radio of all time. Why didn't it catch on? Because it suffered from a serious defect

– rigor mortis. After only a few hours' use, the frog would no longer operate and the bother of frequently plugging-in a replacement amphibian killed the FLR dead - a bit like the frog really! So the thermionic valve triumphed and men came to boast of their 'six-valve superhet' instead of their 'six frog superhet'.



It happens every hour, on the hour!!

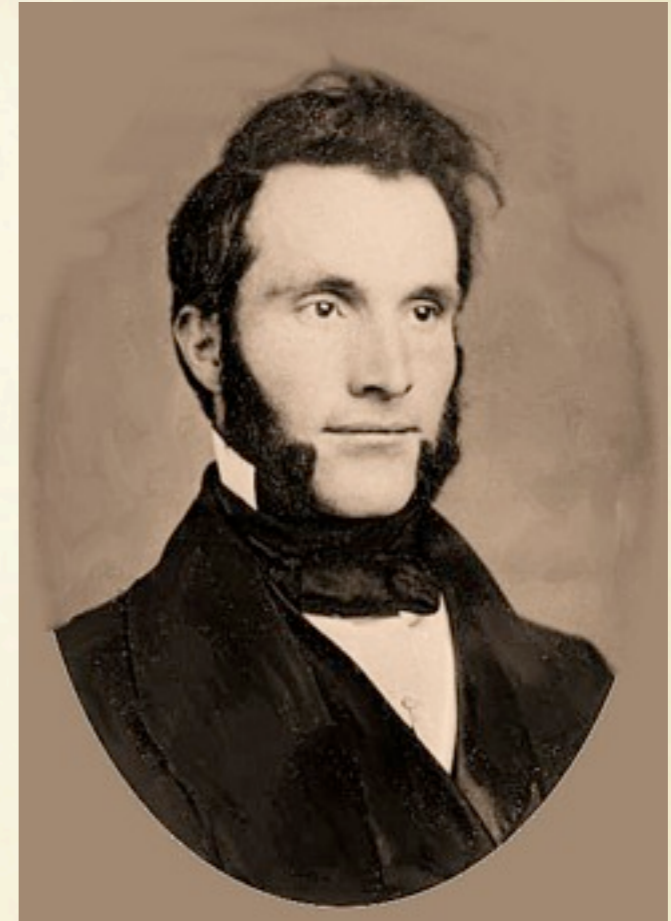
Finally

To get serious for just a moment and to give full credit for Galvani's work, he concluded that animal tissue contained an innate vital force, which he termed 'animal electricity'. He believed this to be a new form of electricity in addition to the 'natural' form that produced lightning and to the 'artificial' form that is produced by friction (ie static electricity). He also believed the brain secreted an 'electric fluid' and that the flow of this fluid through the nerves

provided a stimulus for the muscle fibers.

Scientific colleagues generally accepted Galvani's views; but Alessandro Volta, a professor of physics, was not convinced. Volta demonstrated that the electricity did not come from the animal tissue but was generated by the contact of different metals, brass and iron, in a moist environment. However, in another experiment, Galvani caused muscular contraction by touching the exposed muscle of one frog with the nerve of another and thus established for the first time that bioelectric forces exist within living tissue.

Lets move forward a
few years!!!!



In 1864, Mahlon Loomis an American dentist and amateur inventor wrote : "I have been for years trying to study out a process by which telegraphic communications may be made across the ocean without any wires, and also from point to point on the earth"

Two and a half years later, Loomis would do this very thing between two mountaintops in Loudoun County, Virginia. In October 1866, Mahlon Loomis successfully demonstrated what he called "wireless telegraphy." Loomis was able to make a meter connected to one kite cause another one to move, marking the first known instance of wireless aerial communication.

He accomplished this eight years before Guglielmo Marconi was born.



A Scottish physicist and Mathematician who, in the 1860's whilst experimenting with magnetic fields and light, predicted the existence of radio waves.

In 1864 Maxwell, before the Royal Society of London, said:

“We have strong reason to conclude that light itself - including radiant heat and other radiation, if any - is an electromagnetic disturbance in the form of waves propagated through the electro-magnetic field according to electro-magnetic laws.”

Heinrich Hertz was a professor of physics in Germany who clarified and expanded the electromagnetic theory of light that had been put forward by James Clerk Maxwell.

Hertz proved that an electric current swinging rapidly, back and forth in a conducting wire would radiate electromagnetic waves into a surrounding space (an antenna) which travel at the speed of light. These oscillations were recorded in his lab and today we call these ‘WAVES’

It was these experiments with those electromagnetic waves that led to the development of the wireless telegraph and the radio.

In recognition of his work, the unit of frequency of a radio wave - (one cycle a second) is named Hertz (Hz).



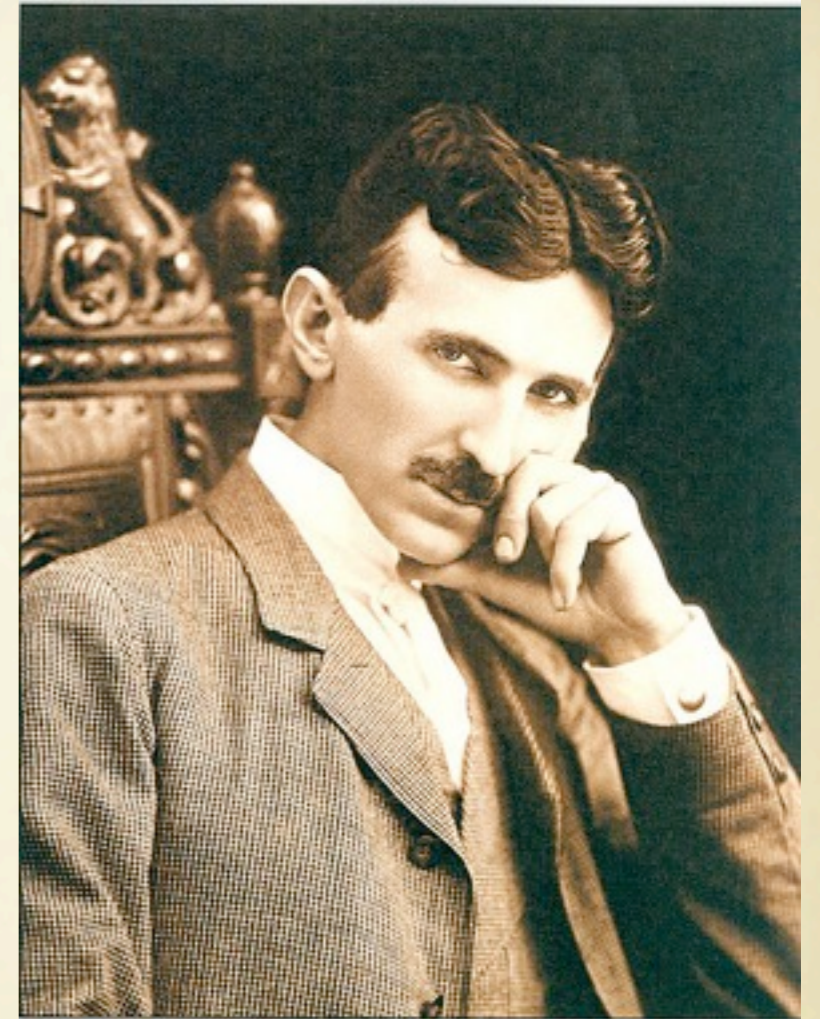
Nikola Tesla

Around 1891, a circuit was invented by Nikola Tesla which could produce a high voltage, low current, high frequency, alternating current which commonly became known as the Tesla Coil.

It was this Tesla Coil that helped him discover that he could transmit and receive powerful radio signals when tuned to resonate at the same frequency.

By early 1895, Tesla was ready to transmit these signals over 50 miles to New York when in the same year a fire consumed Tesla's lab, destroying his work.

Bad timing for Tesla. Guglielmo Marconi had been working hard himself



Nikola Tesla

World of Tesla: The AC motor patents patented in 1888.

"We are to seize and eliminate from our industrial world the results of Mr. Tesla's work, the seeds of industry would cease to turn." —J. A. Edison

A prolific inventor of keen intelligence and exceptional insight, Tesla patented more than 300 inventions in his lifetime. He was born in Croatia and immigrated to the U.S. in 1884, bringing with him a discovery that would transform the world: by 1876, direct current (DC) technology was used in every machine, but only with minor success. What was needed was an alternating current (AC) motor and associated electrical energy to power industry. Tesla's discovery of the rotating magnetic field principle brought forth the AC motor and polyphase AC, the worldwide standard. He then turned his attention to high-frequency research and discovered the resonant circuit, the foundation of all radio-communication.

The first modern polyphase AC generating station has received the patent of Thomas Edison in 1875, allowing Tesla to patent AC patents which are globally operational in 1892. It was not until the late 1890s that Tesla's AC system, utilizing the age of wireless electrical power.

1856 - Tesla invents the rotating magnetic field principle for the polyphase AC motor and the induction motor.

1884 - Tesla patents the AC motor and polyphase AC system.

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Around this time there were a lot of scientists, inventors and physicists who were working on all sorts of projects.

Arguments were common and even up until 1943 when the US Supreme Court overturned a patent by Marconi in 1904 in favour of Tesla.

ELECTRICAL ENGINEERING MILESTONE

TRANSATLANTIC RADIO SIGNALS

AT SIGNAL HILL ON 12 DECEMBER 1901, GUGLIELMO MARCONI AND HIS ASSISTANT, GEORGE KEMP, CONFIRMED THE RECEPTION OF THE FIRST TRANSATLANTIC RADIO SIGNALS. WITH A TELEPHONE RECEIVER AND A WIRE ANTENNA KEPT ALOFT BY A KITE, THEY HEARD MORSE CODE FOR THE LETTER "S" TRANSMITTED FROM POLDHU, CORNWALL. THEIR EXPERIMENTS SHOWED THAT RADIO SIGNALS EXTENDED FAR BEYOND THE HORIZON, GIVING RADIO A NEW GLOBAL DIMENSION FOR COMMUNICATION IN THE TWENTIETH CENTURY.

OCTOBER 1985



INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

Guglielmo Marconi & George Kemp



In 1895 Italian inventor Guglielmo Marconi built the equipment and transmitted electrical signals through the air from one end of his house to the other which really was the birth of practical wireless telegraphy or radio.

Following the successes of his experiments at home, Marconi became obsessed with the idea of sending messages across the Atlantic. With a transmitter, 100 times more powerful than any previous station built at Poldhu, England and a receiving station built at St John's, Newfoundland, signals were historically sent in between these two stations and across the ocean. This was December 12th 1901.



On December 23rd 1900 American scientist R.A. Fessenden transmitted the first human speech via radio waves. This was on Cobb Island, Maryland and the signal was picked up over a mile away by his assistant.

“Hello test, one, two three, four. Is it snowing where you are Mr Thiessen? If it is, telegraph back and let me know”



R.A. Fessenden

Twin radio towers at Cobb Island



The world's first wireless transmission of speech and music was performed by Ing. Otto Nußbaumer at the Graz University of Technology on June 15, 1904.

The wavelength used was about 18 metres and the distance travelled by this transmission, which was the song 'Hoch vom Dachstein an' was 20 metres.

This experiment was never patented by Nußbaumer and wasn't supported by his colleagues who believed that it would not work.



Otto Nußbaumer



Hoch vom Dachstein an - Lyrics and mp3

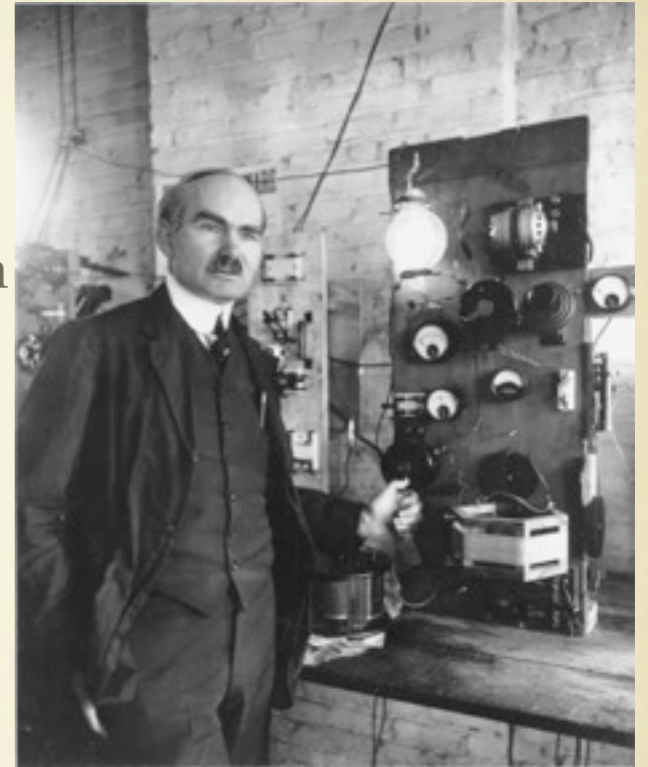
http://www.music-free-download.net/mp3/Traditional/Download_Hoch-Vom-Dachstein--_mp3_117189.html

American Inventor Lee De Forest is another of the pioneers of radio development and experimented with the sending and receiving of long distance radio signals.

Around 1907, De Forest had invented a three electrode vacuum tube which boosted the radio waves which allowed any broadcast signal to be heard loud and clear.

On January 12th, 1910, using his 'wireless telephony' De Forest sent a signal from the Metropolitan Opera House in New York to listeners up to 50 miles away.

This was the first time that excerpts from a live Met performance were heard by an audience not present.



Metropolitan Opera House 1905

The New York Times reported on January 14th 1910,

Opera broadcast in part from the stage of the New York City Metropolitan Opera Company was heard on January 13, 1910, when Enrico Caruso and Emmy Destinn sang arias from Cavalleria Rusticana and I Pagliacci, which were "trapped and magnified by the dictograph directly from the stage and borne by wireless Hertzian waves over the turbulent waters of the sea to transcontinental and coastwise ships and over the mountainous peaks and undulating valleys of the country." The microphone was connected by telephone wire to the laboratory of Dr. Lee De Forest.



THE FIRST BROADCAST: In 1906 at Brant Rock MA, Fessenden plays his violin, sings a song, reads a bible verse or two into a wireless telephone of his own invention.

This is the first broadcast and it happens Christmas Eve, 1906. It is a broadcast because it is designed for more than one listener (not 2-way) it is pre-announced.



Fessenden (right) in his Brant Rock laboratory with two colleague

The Titanic

On Monday, April 15th at 12.30am, in the middle of the night, the RMS Titanic struck an iceberg in the North Atlantic and sank.

Thanks to wireless transmission, 745 passengers were saved but 1595 people lost their lives.

Two wireless operators, John 'Sparks' George Philips and Harold Bride were employed by Marconi Telegraph Company were onboard and sent these signals by Morse Code using a spark gap transmitter.



Harold Bride in the Titanic's Marconi room



John G. Phillips



Harold Bride

Some key dates and events

1901 - A radiotelegraph service was instituted between five hawaiian islands

1903 - A Marconi station located at Wellfleet, Massachusetts carries an exchange between President Theodore Roosevelt and King Edward VII

1905 - The naval battle of Port Arthur in the Russo-Japanese war was reported by wireless

1906 - The US Weather Bureau experiment with radiotelegraphy to speed up notice of weather conditions

1909 - Robert E. Peary, Arctic explorer, radiotelegraphed : “I found the Pole”

1910 - Marconi opened up an American-European radiotelegraph service, which months later enabled an escaped British murderer to be apprehended on the high seas

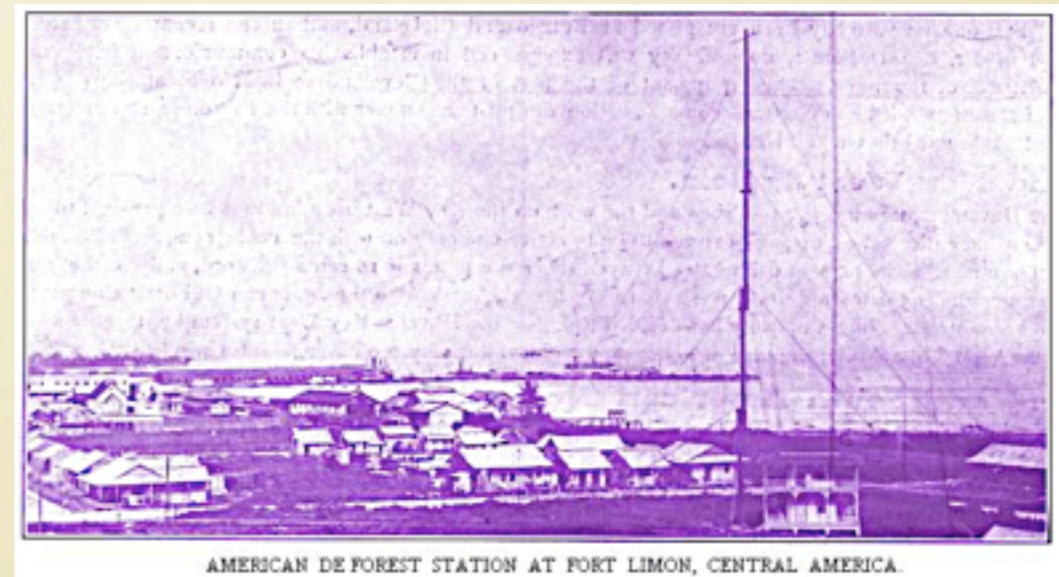
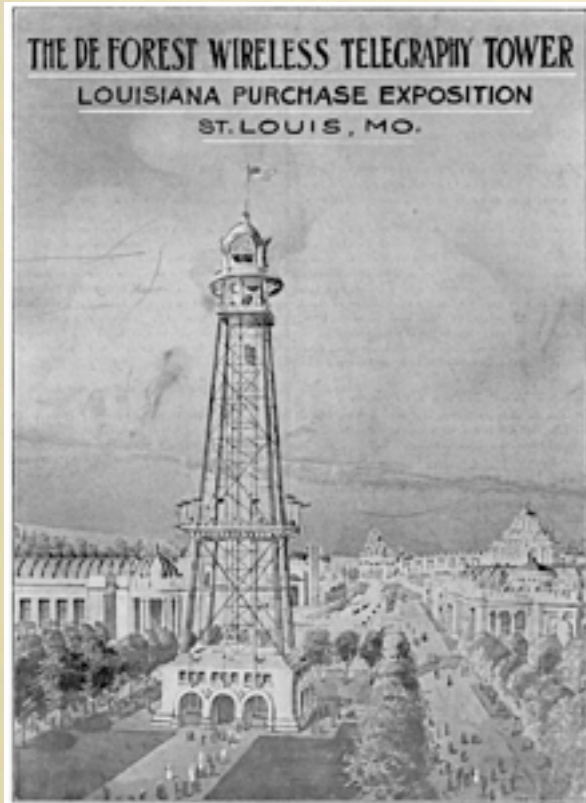
1912 - The first Transpacific radiotelegraph service is linked between San Francisco and Hawaii

The Triode amplifier and the Audion had now made transcontinental telephony (wire & wireless) more practical and led to the foundation of the radio industry. This had led Lee De Forest to be known as the 'father of radio'.

Another result of De Forest's work was the invention of amplitude-modulated (AM) radio that allowed for a multitude of radio stations.

The earlier spark-gap transmitters did not allow for this.

The first high-powered naval radio stations were designed and installed by De Forest



In 1917, when the United States entered the first world war, all radio development was controlled by the US Navy to prevent its possible use by enemy spies.

All radio stations were ordered to shut down or be taken over.

The U.S. government took over control of all patents related to radio technology

It was obvious that wireless had become a technology of great strategic importance.

The British government immediately took control of parts of the Marconi Company and established training programmes for wireless operators.



Marconi wireless equipment in the trenches during World War I

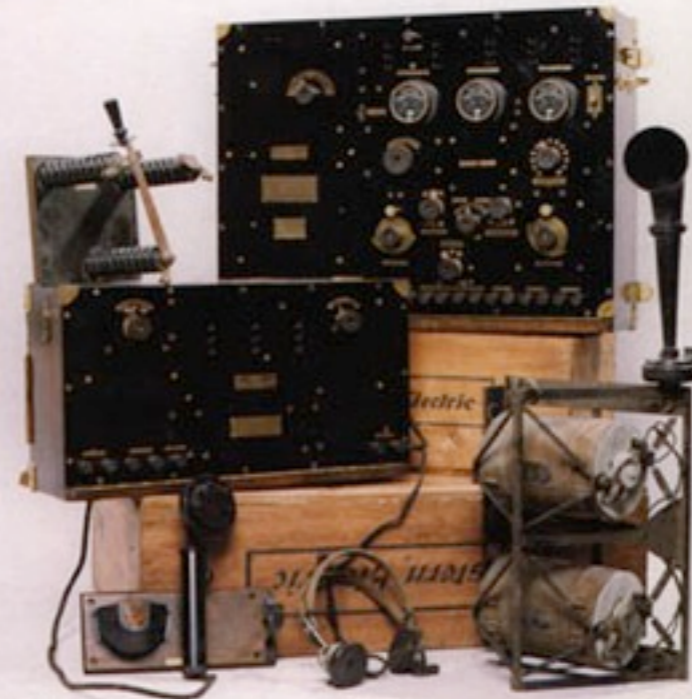


Marconi Bellini-Tosi Direction Finder
Designed for detecting the positions of enemy wireless stations



VOLUME 18 SEPTEMBER 2001 NUMBER 9

W.E. CW-936 System



Also: Muchow Auction Tops \$1,000,000!

A.R.C. — THE NATIONAL PUBLICATION FOR BUYERS AND SELLERS OF OLD RADIOS AND RELATED ITEMS — PUBLISHED MONTHLY

Western Electric provided the US with the CW 936 Radio Telephone System

In 1919, after the government released its control of all patents, the Radio Corporation of America (RCA) was established with the purpose of distributing control of the radio patents that had been restricted during the war.



**RCA ELECTRONICS KEEPS A RADAR
"WEATHER EYE" ON YOUR COMFORT ON
THE GREAT AIRLINES**



Airlines equipped with RCA all-weather radar include: United Air Lines (DC-7 shown), Trans World Airlines, American Airlines, Continental Airlines, Pan American, Braniff, QAA, Air France, Air West, Northwest, Southern, Sabena, BOAC, Iberia, BAAW, Air India, Canadian, Colombia, Eastern, Swiss Air Lines, TWA, Japan Air Lines, Korean Air Lines, Northwest Pacific, Eastern Airlines, GAT, The Atlantic Line, El Al, Singapore Airlines, Garuda Airlines.

Flying into a stormy night, the pilot's vision may reach a mere 50 yards. Yet he sees a storm brewing 150 miles ahead. Within minutes he plots a slight change in course and flies a smooth, safe corridor through the weather. His passengers complete their trip in comfort and on schedule. Credit RCA Electronics for the "Weather Eye" radar that makes all this possible. And United Air Lines' all-weather fleet for being first (among 24 leading airlines) to

use this important development. RCA has also produced radar to guide ships at sea, and track moon-rocket satellites through space. RCA pioneered and developed color TV, produced the world's largest electronic computer, transistorized transistors and much, much more. Progress like this helps explain why RCA means electronics—and why electronics means a happier, healthier, more secure future for you.



RADIO CORPORATION OF AMERICA

Following World War One, the Marconi Company in Great Britain began producing vacuum-tube continuous-wave transmitters, which were tested in a number of experimental stations. One of these was the Chelmsford station, built in late 1919. By early 1920 it was operating with a 15,000 watt transmitter.

From February 23rd to March 6th two daily half-hour news and entertainment broadcasts were made, mainly by Marconi staff.

At this point a major London newspaper, the Daily Mail, became interested in the activities, and made the arrangements to have Dame Nellie Melba make a historic broadcast from the station.



The British Broadcasting Company was set up by a group of executives from radio manufacturers in December 1922. John Reith became general manager of the organisation.

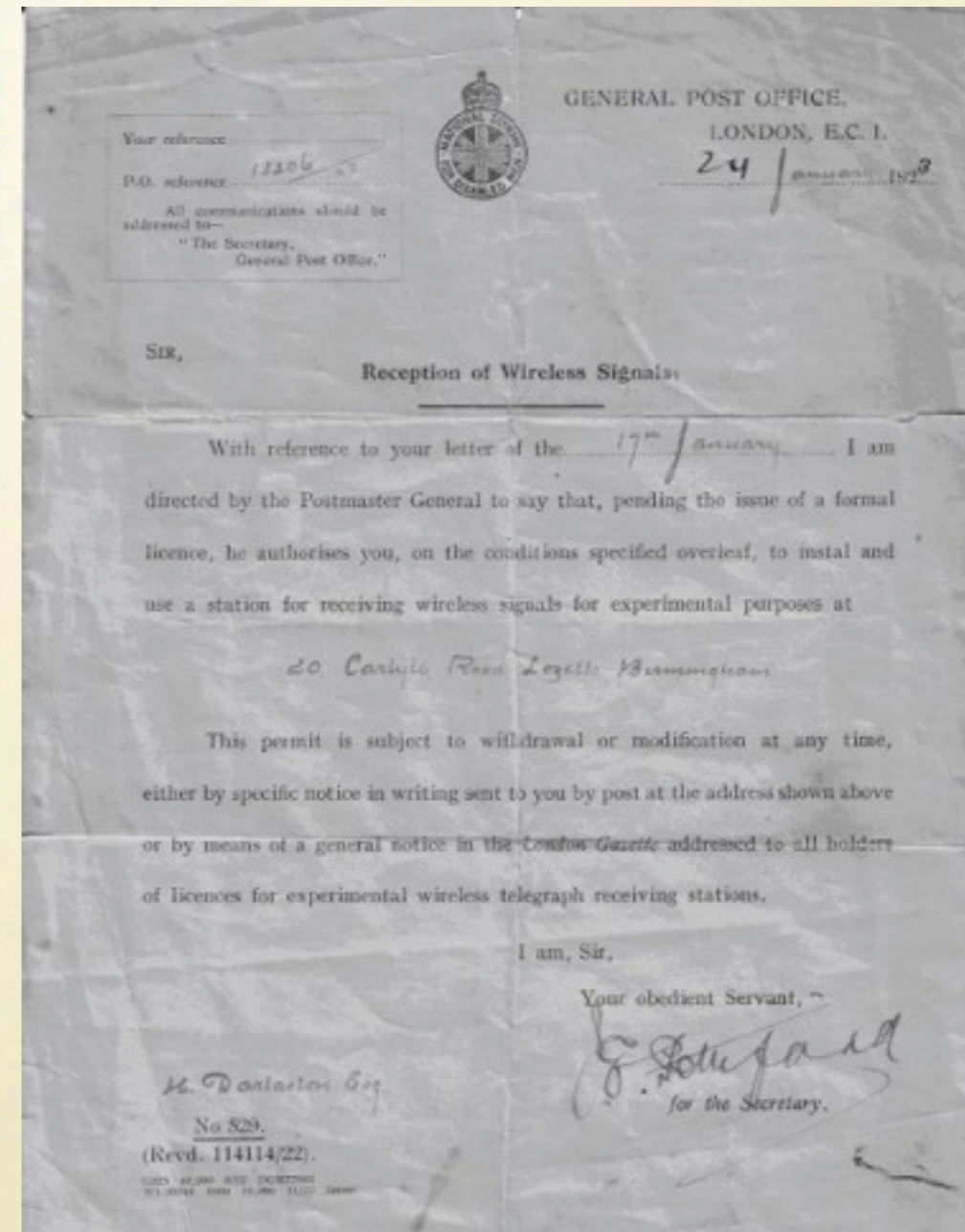
In 1927 this became the British Broadcasting Corporation as we know it today.



The key principles of Reith were :

- Broadcast to everyone who wanted to listen
- Maintain high standards

To achieve this however, the corporation had to operate as a monopoly and would be funded by a license fee which listeners would pay



An example of a license from 1923

Broadcasts would only last for a few hours a day, but included music, talk, sport, drama and children's programmes

Due to pressure from Fleet Street, news broadcasts were forbidden until after 7pm

Political commentary and speeches were banned



Some key dates and events

1913 - The cascade-tuning radio receiver and the heterodyne receiver are introduced.

1919 - Shortwave radio is developed.
RCA is founded

1905 - The naval battle of Port Arthur in the Russo-Japanese war was reported by wireless

1920 - KDKA broadcast the first regular licensed radio broadcast out of Pittsburg, US

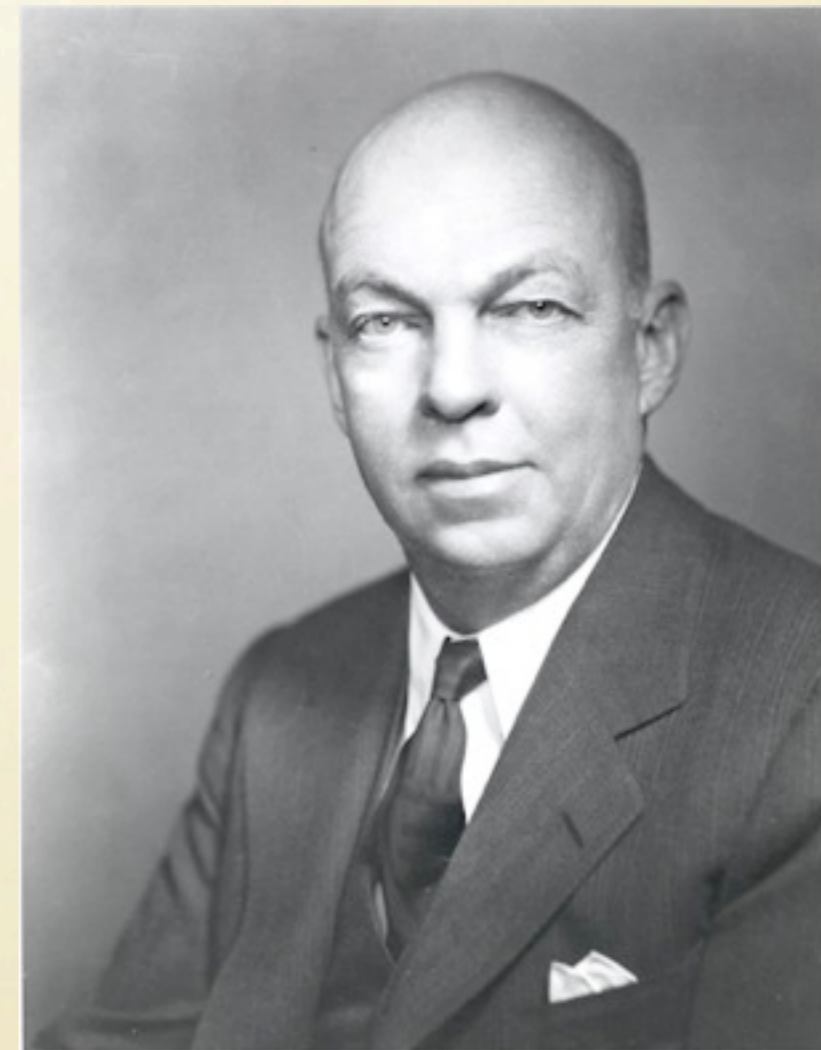
1922 - The British Broadcasting Company is founded

1927 - The British Broadcasting Company becomes a Corporation and begins to set standards for itself and charges a license fee to listeners

1931 - The UM School of Music pursues the idea of radio as education. It taught band lessons via radio.

FM radio

Edwin Howard Armstrong invented frequency-modulated or FM radio in 1933. FM improved the audio signal of radio by controlling the static caused by electrical equipment and the earth's atmosphere.



The Home Service

When World War 2 was declared in 1939, the BBC immediately replaced all regional medium wave programmes with a simultaneous channel called the Home Service.

This was done so that it may prevent German aircraft using localised transmissions for direction finding.



British Prime Minister Neville Chamberlain announces on the BBC Home Service that Britain is at war with Germany.
3rd September 1939



LISTEN TO THE ANNOUNCEMENT

[http://
www.bbc.co.uk/
schoolradio/history/
worldwar2audioclipslib
rary_clip01.shtml](http://www.bbc.co.uk/schoolradio/history/worldwar2audioclipslib/rary_clip01.shtml)



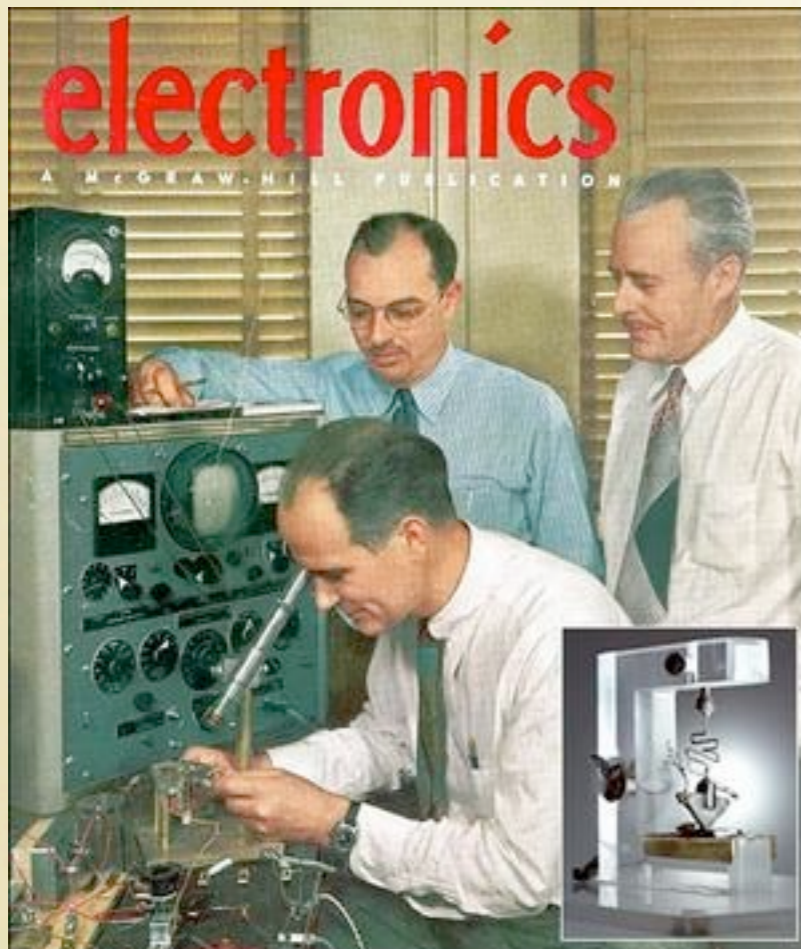
The Germanium Transistor.

The Photograph to the left is a replica of the first working transistor.

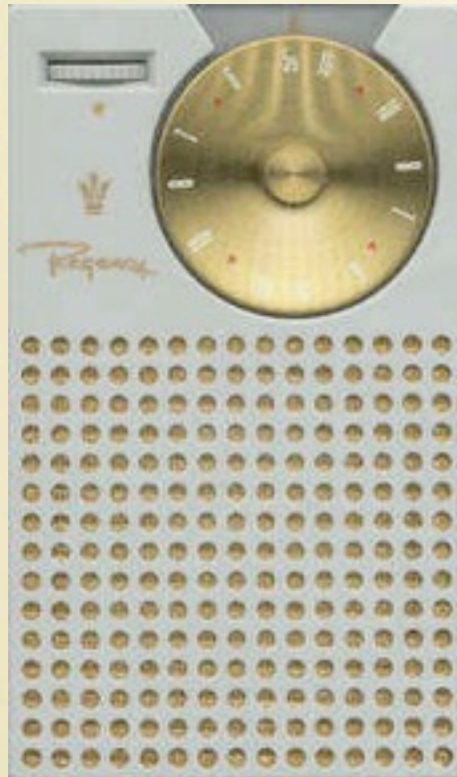
It was built by John Bardeen, William Bradford Shockley and Walter Houser Brattain (see photo) at Bell Telephone Laboratories USA, and was demonstrated for the first time on December 24th 1947.

The transistor was to replace vacuum tubes and mechanical relays and would change the future of electronics.

The team involved in the invention were awarded a Nobel Prize in 1956.



First Transistor Radio 1954



WORLD'S FIRST POCKET RADIO

Regency

\$49.95
less battery

Uses tiny transistors . . . no bulky tubes, combines amazingly compact size, high performance

● First truly personal radio! Weighs only 12 ounces, measures 3" x 5" x 1 1/4". Slips in pocket or purse, available with leather carrying case. Genuine superheterodyne circuit; astonishingly clear tone . . . through acoustically-baffled speaker or tiny earphone. Shock-resistant, virtually service-free . . . engineered for lifetime performance. Uses standard 22 1/2 V. battery. Smart plastic case in black, ivory, mandarin red, cloud gray, mahogany or olive green. See it! Hear it! Get it!

REGENCY DIVISION, I. D. E. A. INC., INDIANAPOLIS, INDIANA

Goes anywhere . . . plays everywhere!

In tune with outdoor living!

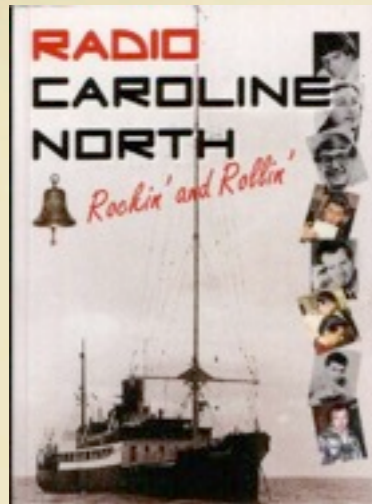
Year's most exciting new gift idea!

ACCESSORIES

Leather carrying case has belt loop, pocket for earphone or spare battery. **\$3.95**

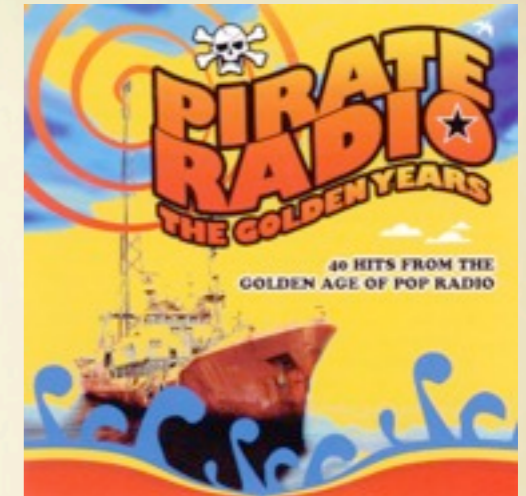
Feather-light earphone is no larger than a hearing aid, fits comfortably to ear. **\$7.50**

In 1954, I.D.E.A (Industrial Development Engineering Associates) of Indiana USA put on sale the Regency TR-1 costing \$49.95.



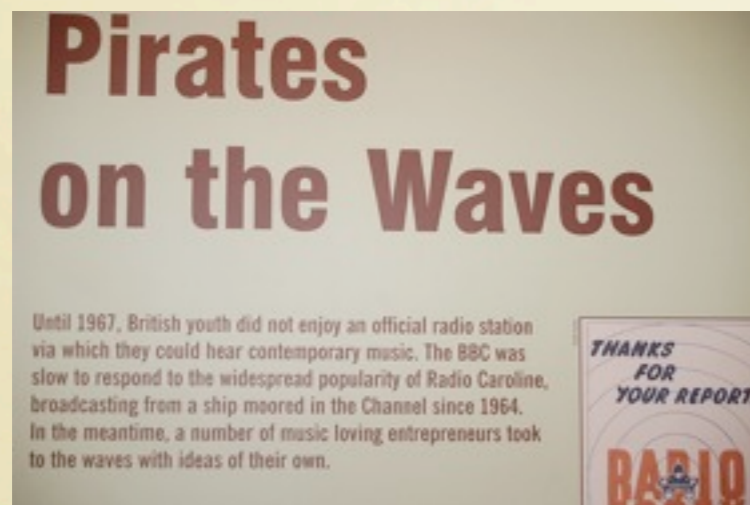
Pirate Radio

<http://www.youtube.com/watch?v=qX1SSiFWF-s>
TRAILER FROM NEW FILM



<http://www.marinebroadcasters.com/galaxy/mv%20Galaxy.htm>
PICTURE OF THE BIG L (RADIO LONDON)

<http://www.youtube.com/watch?v=XxKUhkHK4pQ->
Radio London Transmission



Radio London broadcast from 16th December, 1964 (the first test transmissions) to August 14th, 1967, from the mv *Galaxy*, anchored outside the three-mile limit of British territorial waters. This was in order to circumvent the country's stringent broadcasting laws; at the time, BBC radio was the only station licensed to broadcast in the UK. The stations were dubbed 'pirates' by the press, but because the stations were broadcasting from International Waters, which are ungoverned by any laws, their operations were never actually illegal

‘And good morning everyone, welcome to the exciting new sound of Radio 1.’

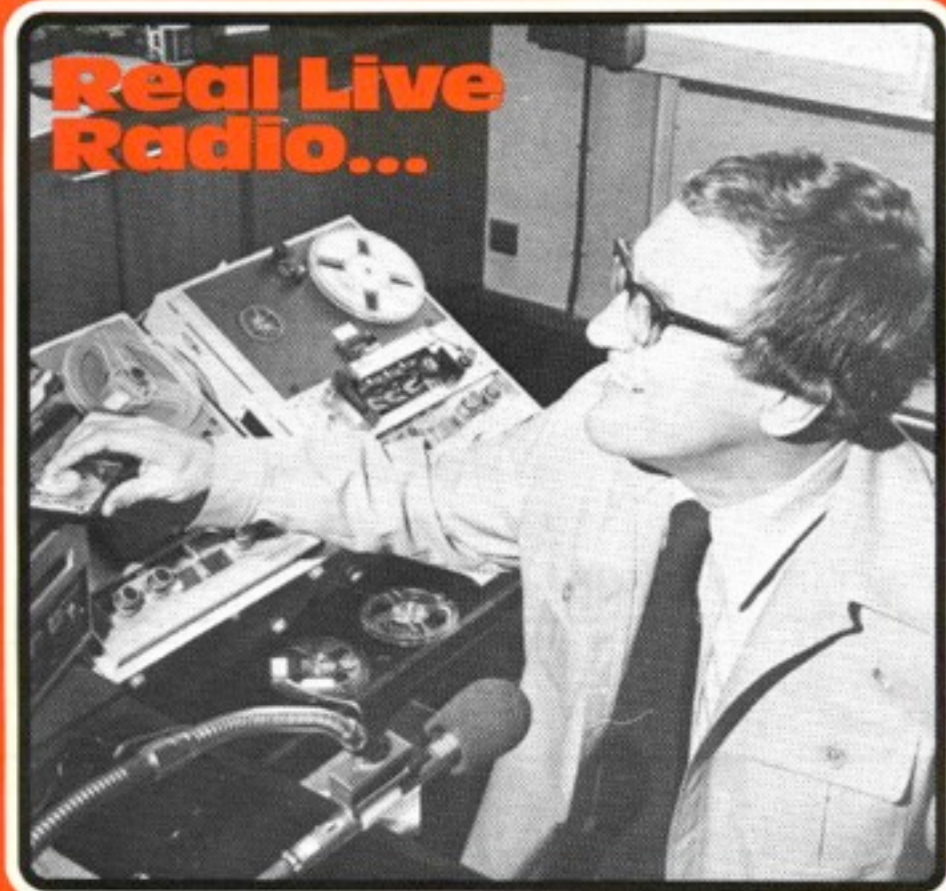
On 30th September 1967, Radio 1 goes on air



Following the forced closure of the pirate radio stations, BBC Radio launched Radio 1 which would cater for the young.

Along with this came Radio 2, 3, and 4 to replace other programmes before, including the World Service

BBC Radio Leicester was the first BBC local radio station and started broadcasting on 8th November 1967



BBC RADIO LEICESTER

a BBC local radio publication

10p

BBC Radio Leicester
OPENS WEDNESDAY NOVEMBER 8

Welcome to your own station

THIS IS BBC RADIO LEICESTER ...
This evening, an emotional and special occasion will take place in Earl Court, Charles Street, as the first of the first 100 new programmes, November 8, will be broadcast. The first programme, 'The 100th Anniversary', will be broadcast at 7.30pm. It will be followed by the first programme, 'The 100th Anniversary', at 8.15pm. The first programme, 'The 100th Anniversary', will be broadcast at 8.15pm. The first programme, 'The 100th Anniversary', will be broadcast at 8.15pm.



THE 100TH ANNIVERSARY
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BBC RADIO LEICESTER
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Some key dates and events

1973 - Radio 1 Roadshow launched by Alan Freeman

1973 - Birth of commercial radio or independent radio. LBC was the first, followed by Capital Radio, both in London

1980 - After Reagan is elected in the US, CBN play 'It's my Party' by Leslie Gore for 18 hours straight.

1988 - Radio 1 launched on FM

1990 - The Broadcasting Act will allow for more deregulation in the radio industry, giving the BBC more competition

1991 - Radio 1 goes permanently 24 hours a day, last done during the Gulf War

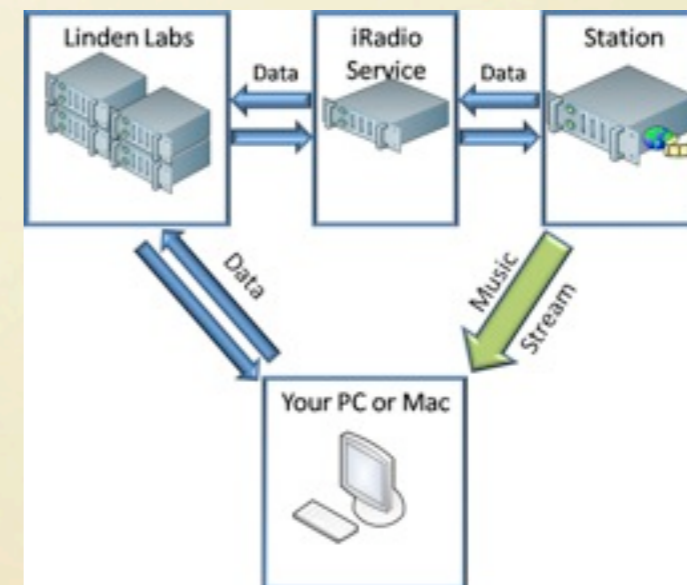
1992 - Launch of Classical FM

Some key dates and events

1986 - In Europe, FM radio stations begin to use the subcarrier signal of FM radio to transmit digital data. This RDS (radio data system) is used to transmit messages on display screens to radios.

1995 - BBC launch DAB Digital Radio

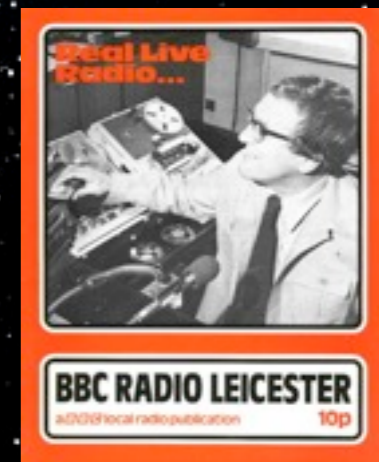
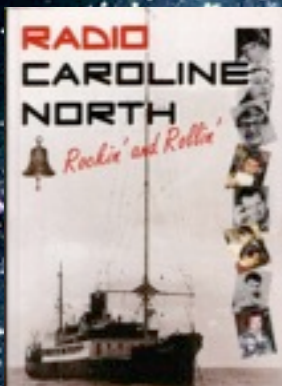
1990's and beyond - Internet radio is born allowing people to listen to whatever they want when they want.



Where next?



RADIO



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