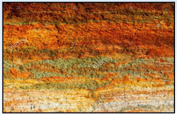
350,000 BC

Communication by Color**

With ocher and manganese, our ancestors marked objects and possibly their own skin. Colors were symbols by which they identified themselves and their group. WAN*

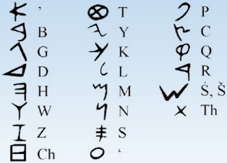


40,000 BC

Visual and symbolic communications. WAN*

1050 BC

Phoenician alphabet created. Language using sound and visual. WAN*



600 BC

Lodestone and magnetism discovered.

350,000 BC 200,000 BC 40,000 BC 7,000 BC 1,050 BC 776 BC 600 B

200,000 BC

Words by sound**

Birth of human speech.

WAN*

7,000 BC

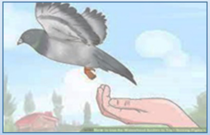
Writing symbols.

WAN*

776 BC

Written words over a distance, carrier pigeon.

WAN*

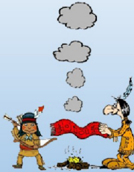


200 BC

Words by vision,

smoke signals.

WAN*



**Speculation

* Wide Area Network

V A

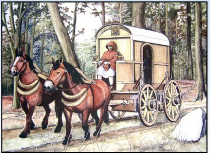
NATIONAL
VOICE OF AMERICA
museum
OF BROADCASTING

Timeline

Presidents - Wars - VOA - Crosley Communications - Technology and Wireless

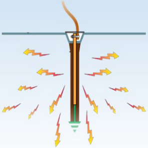
100 AD

State-run courier service, Roman Empire. WAN*



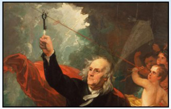
1747

Sir William Watson demonstrated electrical signals can pass through earth over a two mile distance.



1767

Benjamin Franklin discovered a connection between lightning and electricity.

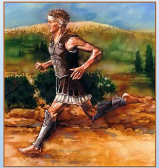


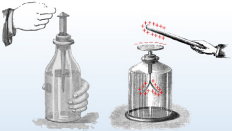
C 200 BC | 1750 1760 1770 1780

| American Revo

100 AD

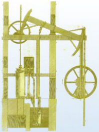
Written words by runner. WAN*





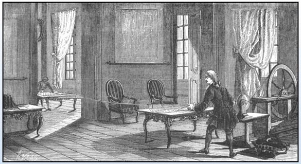
1745

Ewald Georg von Kleist and Pieter van Musschenbroek discovered the Leyden Jar will store an electrical charge.



1769

James Watt improved the Newcomen steam engine which became the dominate engine and powered most of the industrial revolution, including electric generators.



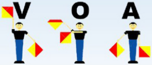
1774

Electric telegraph invented by Le Sage. A separate wire for each of 26 letters between two rooms.

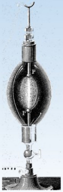
* Wide Area Network

1780
George Adams notices sparks between charged and uncharged conductors when a Leyden Jar (stored electricity) was discharged nearby. An early example of electromagnetic radiation.

1792
Words by vision, optical telegraph semaphore.
WAN*

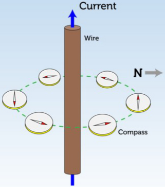


1810
Electric arc lamp invented by Humphry Davy.



1810
Voice by tin can communications.

1820
Hans Orsted discovered electricity can generate a magnetic field.



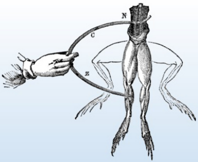
1827
Electric telegrap
by Cooke and Wheatstone,

which led to the
Morse Code.

| Washington | Adams | Jefferson | Madison | Monroe

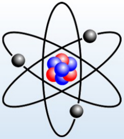
1790 1800 1810 1820

lutionary War | | Northwest Indian War | | First Barbary War | | War of 1812 |

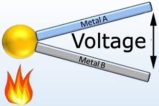


1780
Bio electromagnetics - control of muscles by electrical pulses along the nerves. Discovered by Luigi Galvani. Recognized as the pioneer of bio electromagnetics.

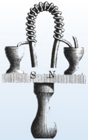
1799
Battery discovered by Alessandro Volta.



1805
Atomic theory, John Dalton developed a workable atomic theory by calculating atomic weight, greatly expanding our understanding of the atom.



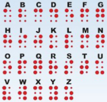
1821
Thermoelectric effect discovered by Thomas Johann Seebeck, leading to electric thermocouples and thermopiles, greatly enhancing the measurement of temperature.



1825
Electromagnet invented by William Sturgeon.

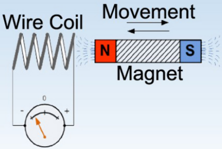
1829

Text by Braille by Louis Braille. WAN*



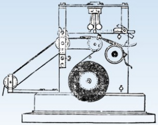
1831

Michael Faraday discovered a changing magnetic field creates an electric current.



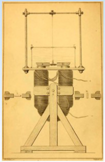
1843

Facsimile over wires invented by Alexander Bain, known as Bain's telegraph. WAN*



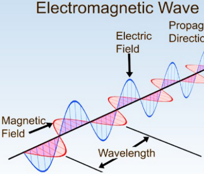
1850

John Tyndall discovered magneto-optic properties of crystals, and the relation of magnetism and diamagnetism to molecular arrangement.



1864

James Maxwell predicts the existence of electromagnetic waves.



Harrison

| Adams | Jackson | Van Buren || Tyler | Polk

Fillmore | Pierce | Buchanan | Lincoln | Joh

1830

1840

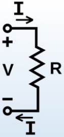
1850

1860

|Second Seminole War| | |

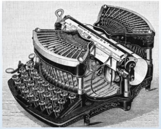
Mexican–American War

| Civil War



1827

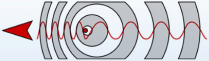
Ohms law discovered by Georg Ohm and forever enhanced our understanding of the relationship among voltage, current and resistance.



1829

Typewriter Invented by W. A. Burt. Opens up a completely new form of communication.

* Wide Area Network

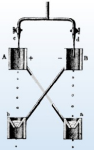


1842

Doppler effect discovered by Christian Doppler. Notices the frequency of a wave depends on the relative speed of the source and the observer. It is like the changing pitch of a train whistle when it approaches and departs your location.

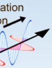
1857

Phonautograph invented, a precursor to Edison's phonograph.
Sound waves were traced as a visual image through the vibrations of a bristle on a sheet of soot-covered paper.



1867

Electrostatics: Lord Kelvin's water drop experiment greatly enhanced our understanding of electrostatic induction.

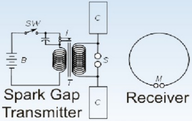


1876

Telephone, the work of many. Alexander Graham Bell first to patent the concept. Candlestick version shown. WAN*

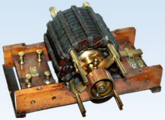
1885

Heinrich Hertz proves existence of electromagnetic waves using spark gap technology.



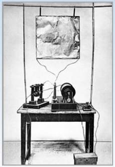
1888

Nikola Tesla discovered alternating current (AC) which greatly enhanced the efficient transmission of electricity over long distances.



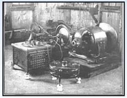
1895

Guglielmo Marconi builds a spark gap wireless system capable of transmitting signals at long distances.



1900

Reginald Fessenden first transmission of speech by radio using a high frequency alternator.



1903

Poulsen ar transmitte invented. One of the first to transmit sound usin amplitude modulatio

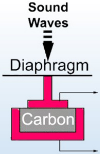
Garfield

nson | Grant | Hayes || Arthur | Cleveland | Harrison | Cleveland | McKinley |

1870 1880 1890 1900

|Red Cloud's War| |Great Sioux War| || |

Spanish–American War



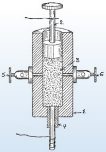
1877

Carbon Microphone independently developed by David Hughes and Emile Berliner. Berliner was working for Thomas Edison, who patented the device.

1884

Mechanical television invented using a scanning disk which lead to electrotechnical radio, aka electric television.

* Wide Area Network



1890

Coherer detector, first successful radio receiver by Branly. Iron filings change resistance with an applied radio frequency.

1892

Rotary Dial phone first used in La Porte, Indiana based on a 1891 patent by Almon Brown Strowger. Shown is the potbelly candlestick version.

1901

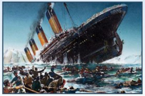
John Fleming transmits a radio signal across the Atlantic ocean to Guglielmo Marconi, who used a kite antenna, at Newfoundland, Canada, and claimed to have heard the Morse code signal (S).

1904

John Fleming develops the two element vacuum tube, the Fleming valve, which greatly enhanced crystal radio reception.

1912

Titanic disaster causes Wireless Ship Act. Ships over 200 miles from coastline to be equipped with wireless radio.

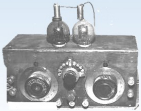


1912

Regeneration radio circuit (positive feedback) invented by Edwin Armstrong, greatly enhanced reception for a weak received signal.

1917

Heterodyne detector pioneered by Canadian inventor, Reginald Fessenden and patented by Lucien Lévy. Later, Edward Armstrong added amplification naming the circuit superheterodyne, which greatly increased sensitivity allowing the reception of more distant stations.



CROSLEY

1921

Powel Crosley, Jr. creates and produces the Harko, a low-cost crystal radio receiver, becomes known as the "Henry Ford" of radio.

1925

Crosley creates a low cost 1-tube radio named the Pup and began a revolution in affordable radios.

Roosevelt | Taft | Wilson | Harding | Coolidge

1905 1910 1915 1920

Moro Rebellion

World War I

Russian Civil War

1906

Lee de Forest adds third element to control the current in a Fleming Valve, named the Audion.

This eventually enabled amplification for weak received signals and broadcasting stronger ones.

1872 – 1923

Oliver Heaviside laid the foundation for electrical engineering and forever changed the relationship among mathematics, telecommunications and science. He invented techniques for the solution of differential equations, Laplace transforms, reformulated Maxwell's field equations in terms of electrical and magnetic forces and energy flux, and independently co-formulated vector analysis.

* Wide Area Network

RCA VICTOR

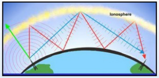
1919

General Electric agrees to patents release to settle anti-trust suit which leads to creation of Radio Corp. of America for the purpose of distributing control of radio patents.

1922

WLW

Crosley radio station began with 20 watts using 8CR as ID and increased to 50 watts when at the Blue Rock road facility.



1924

Crosley's W8XAL radio station broadcast long distance using shortwave with a power of 10,000 watts.

1941

WLWO

Cola, Planters
uts, Firestone Tire
ubber and others
ased commercials
pport KGEI Treasure
, CA and WLWO
n, Ohio.

1942

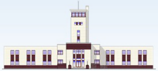
VOA

Broadcast in English, French, Italian and German.

1944 - Sept.

VOA

Bethany Relay Station, built by Crosley engineers, opens as world's most powerful shortwave transmitter.



1944 Nov./Dec.

VOA

Delano and Dixon CA stations began broadcasting.

1953

VOA

The US Information Agency was established and VOA became its single largest effort.

1954

VOA

VOA moves HQ from New York to Washington, DC.

1959

VOA

VOA special English began.

1960

VOA charter drafted.

1962

VOA

USIA*/VOA take direct ownership of three VOA rel
stations:
Bethany, OH
Delano, CA ar
Dixon, CA.

Truman
Truman
Eisenhower

1940
1945
1950
1955

World War II
Korean War

lcast
h,
lian
an.

1944

Germany now has 15 million Volksempfangers (People's radio) introduced in 1933.

1945

Crosley Radio Corp. became Crosley-AVCO and survives today known as L3Harris.

WLWT

1947

Crosley's W8XCT experimental television began 1939, became WLWT in 1947 on channel 4, then channel 5 in 1953.

1947

Transistor developed to replace vacuum tubes. Made digital world possible.

1951

First general purpose commercial computer introduced.

UNIVAC

1952

First product to use a transistor, hearing aid by Raytheon.

1954

First transistor radio by Regency, Indianapolis, IN.

1957

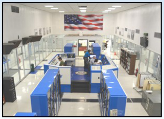
Soviet Union launches the Sputnik satellite and began a space race between the USA and USSR.

*United States Information Agency

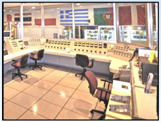
ay

nd

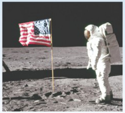
1962
VOA
VOA builds the Greenville, NC station, largest ever constructed by the agency. Two large transmitting plants and a large receive site.



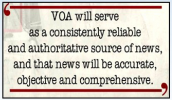
1965
VOA
Bethany, Delano and Dixon stations modernize. Three 250,000 watt Collins transmitters and two Continental transmitters installed at each facility.



1969
VOA
800 million people listened to VOA's coverage when Neil Armstrong set foot on the moon.

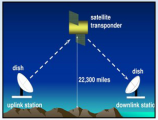


1976
VOA
VOA Charter became public law 94-350. President Gerald Ford signed the legislation.



"VOA will serve
as a consistently reliable
and authoritative source of news,
and that news will be accurate,
objective and comprehensive."

1976
VOA
VOA charter becomes law.



1977
VOA
VOA began using satellite communications.

Harrison

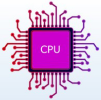
| Kennedy | Johnson | Nixon |Ford | Carter

1960 1965 1970 1975

Vietnam War |

1960
First commercial integrated circuit (IC) by Texas Instruments, 502 binary flip-flop, began a revolution in micro electronics.

1961
First amateur radio satellite launched with over 400 by 2020. Greatly advanced development.



1971
Intel introduces first programmable microprocessor, the 4004, and forever enhanced technology products.

1971
EMAIL began. Invented using ARPANET** by Ray Tomlinson in 1969.

1973
Motorola introduces cell phone.

1975
Beginning in 1958, Citizen's band radio was approved as a hobby in 1975.

1975
ALTAIR 8800
First commercially successful microprocessor based computer. Next year, 1976, Apple computer emerged.

**Advanced Research Projects Agency Network by DOD

1979
VOA
Dixon, CA station closes.

1983
VOA
Builds new sites at Botswana, Morocco, Thailand, Kuwait and Sao Tome. Added 19 new studios at HQ.

1983
VOA
Worldnet TV began and merged with VOA in 2004.

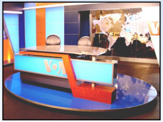
1983
VOA
Dixon, CA station opens.

1988
VOA
Dixon, CA station closes again.

1994
VOA
Bethany, Ohio station closes.

1994
Voice of America became the first international broadcaster to offer its program material through the Internet.

1996
VOA began simulcasting radio and TV for Serbian independent TV stations and others.



WORLDNET

VOA News

TV
Radio
Internet
VOA

| Reagan | Bush (H) | Clinton

1980 1985 1990 1995

Invasion of Grenada

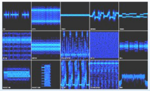
Invasion of Panama

Persian Gulf War

WWW

Marti

DVB Digital Video Broadcasting



SiriusXM
XM SATELLITE RADIO

1982
Internet protocol established making access to open architecture available to everyone.

1985
VOA
Radio Marti began broadcast to Cuba with TV Marti beginning in 1990.

1990s
Digital transmissions applied to broadcasting.

1990s
Amateur Radio began use of personal computers with audio cards to process radio signals known as Packet Radio.

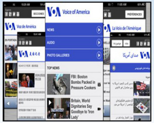
1991
Bethany station installs three 250,000 watt Asea Brown Boveri transmitters.

1999
SiriusXM Radio merges with XM Satellite Radio and began broadcast in 2001.

2000

VOA

VOA website launched. VOANews.com



2000-2007

iPod, Android, Facebook, YouTube, Twitter, Kindle, Apple TV , iPhone, Camera Phone, USB Flash Drive, Bluetooth, Blue-ray disc, Skype and Wikipedia, founded.

2007

VOA

Delano station closes leaving Greenville, NC as the last operating station.

2013

VOA

Distribution of VOA content inside the United States was prohibited by the Smith-Mundt Act of 1948.

VOA and U.S. international broadcasters now allowed to provide content on demand to American citizens by the Smith-Mundt Modernization Act of 2013.

2020

VOA

Worldwide weekly audience exceeds 280 million listeners.

Today the VOA is a multi-media international broadcaster providing products in 47 languages on multiple platforms. VOA's audience accesses programming content on radio, television, the Internet, social media, and through more than 2,200 radio and television stations around the world that receive VOA programming by satellite.

today@VOA

Informing, engaging & connecting the people of the world.

Bush (W) | Obama | Trump | Biden

2000 | 2005 | 2010 | 2015 | 2020

Iraq War | War on Isis >> Today

War in Afghanistan >> Today

Libyan Civil War

2000

Radio cell phones now 3G and in widespread use from a slow start in 1973.

GNURadio
THE FREE & OPEN SOFTWARE RADIO ECOSYSTEM

2001

Beginning in the 1970s and widely used today, the software defined radios, SDR, emerged when the GNU software became open source in 2001.

drm

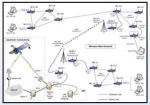
2003

Digital short wave, medium wave and long wave radio began. Drm, Digital Radio Mondiale (Worldwide) greatly enhances broadcast clarity. Used by BBC, India, New Zealand, Vatican, Romania and Kuwait.

2.7" Diagonal E-Ink Display
2.7" E-Ink
Tri-Color

2008

e-paper/e-ink began. Developed in the 1990s, e-ink displays can be read in direct sunlight like a newspaper and uses very little energy. They find a home for electronic shelf labels, billboards, e-readers and smart phones.



2020

Beginning in the 1970s, radio evolved into a wireless mesh network (WMN) using radio nodes organized in a mesh topology. This greatly enhances reliability and offered redundancy by self forming and self healing.

SDR

2020

Now, software defined radios, SDR, known as internet radio, web radio, net radio, streaming radio, e-radio, IP- radio, online radio, digital radio, USB radio, webcasting, Instagram and podcasting are in wide spread use worldwide.

Version: May 2020