



A Short History of Radio

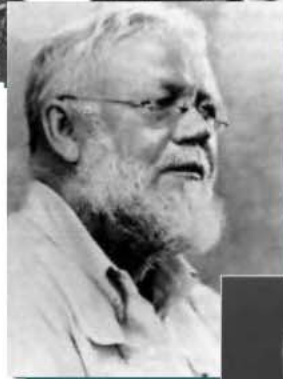
With an Inside Focus on Mobile Radio

PIONEERS OF RADIO

If success has many fathers, then radio is one of the world's greatest successes. Perhaps one simple way to sort out this multiple parentage is to place those who have been given credit for "fathering" radio into groups.

The Scientists:

- **Henrich Hertz**—this German physicist, who died of blood poisoning at age 37, was the first to prove that you could transmit and receive electric waves wirelessly. Although Hertz originally thought his work had no practical use, today it is recognized as the fundamental building block of radio and every frequency measurement is named after him (the Hertz).
- **Nikola Tesla**—was a Serbian-American inventor who discovered the basis for most alternating-current machinery. In 1884, a year after coming to the United States he sold the patent rights for his system of alternating-current dynamos, transformers, and motors to George Westinghouse. He then established his own lab where he invented, among other things, the Tesla coil, an induction coil widely used in radio.
- **Ernst Alexanderson**—born in Sweden, this remarkable inventor developed the first alternator to make transmission of speech (as opposed to the dots and dashes of telegraphs) possible. It is said that this holder of 344 patents "virtually invented everything General Electric did in the field of AM, FM, and TV."
- **Reginald Fessenden**—this Canadian spent much of his working life in the U.S. where he developed a way to combine sound and radio carrier waves. His first effort to transmit this mixed signal—to a receiver where the carrier wave would be removed and the listener could hear the original sound—failed. However, in 1906, using Alexanderson's Alternator, Fessenden made the first long-range transmission of voice from Brant Rock, MA.



- **Edwin Armstrong**—this WWI Army officer, Columbia University engineering professor, and creator of FM radio invented the regenerative circuit, the first amplifying receiver and reliable continuous-wave transmitter; and the superheterodyne circuit, a means of receiving, converting and amplifying weak, high-frequency electromagnetic waves. His inventions are considered by many to provide the foundation for cellular phones.

Clockwise from bottom—Ernst Alexanderson (1878-1975), Reginald Fessenden (1866-1932), Heinrich Hertz (1857-1894), Edwin Armstrong (1890-1954), Lee DeForest (1873-1961), and Nikola Tesla (1856-1943). Center color photo is Guglielmo Marconi (1874-1937).

The Businessmen:

- **Guglielmo Marconi**—this Italian creator spent most of his working life in England where he introduced many of the first uses of wireless telegraphy to European navies. His radio apparatus is widely considered to be the reason that over 700 people survived the Titanic disaster in 1912—instead of dying as they likely would have if ships at sea were still using carrier pigeons to communicate over great distances.
- **Lee DeForest**—credited with being the "father of American radio." DeForest was a direct competitor to Marconi at the turn of the century (1899), when he was the chief scientist at the U.S.'s first radio firm—American Wireless Telephone and Telegraph—until Marconi took over the company's assets in 1912 after a series of financial scandals. Although he held 300 patents, DeForest's greatest technological contribution is considered to be his 1906 "Audion" vacuum tube.



MOBILE RADIO AT WORK

GENERAL RADIO TIMELINE

1888 Heinrich Hertz proved that electricity can be transmitted in electromagnetic waves. He conducted experiments in sending and receiving these waves during the late 1880s.

1896 Radios (what we'd call wireless telegraphs today) began to appear on ships at sea. This reduced the isolation of the ships thus improving both reliability and safety.

1897 Nikola Tesla wirelessly transmitted electromagnetic energy. He made the first public demonstration of radio in St. Louis in 1893.

1897 Guglielmo Marconi filed for patent protection of his radio apparatus. He established the Wireless Telegraph and Signal Company in 1897.

1899 The R.F. Matthews was the first ship to request emergency assistance using a wireless apparatus (Marconi's system).

1901 First transAtlantic signal sent by Marconi from Ireland to Canada.

1909 Amateur (today known as "ham") radio introduced to the U.S. via a *Scientific American* article on "How to Construct an Efficient Wireless Telegraphy Apparatus at Small Cost."

There are hundreds, if not thousands, of uses of radio spectrum and technology. Everything from baby monitors and broadcasting to radar and radio beacons are applications of radio. These two pages focus on the first historical use of radio—mobile radio.

Robert Loraine was the second pilot to demonstrate wireless transmission from a plane (1910).

But mobile radio isn't just for safety purposes today. Taxi drivers, tow truck dispatchers,

Technologies that underpin mobile radio were first put to work in the 1890s on behalf of ocean-going ships, which had previously relied on carrier pigeons and flags for their communications.

In 1910, Frederick Baldwin and John McCurdy were the first to trail an aerial behind their bi-plane to demonstrate radio's uses for aviation.

In 1921, Detroit police commissioner William Rutledge was the first public safety official to use radio equipped vehicles.

Today, maritime, aviation, and land-based mobile radio systems remain among the most important non-broadcast uses of the radio spectrum.

Detroit police radio car with antennas running across the roof (1921).



The Titanic, showing its radio antennas strung from bow to stem (1912).

and package delivery services are just a few of the businesses that make innovative use of mobile radio.

In fact, mobile radio has become such a key tool in all business communications that one of the FCC's major challenges is ensuring

efficient and effective use of the radio spectrum by business, while guaranteeing the reliability and interoperability of all public safety radio uses.

In finding a way to make this all work, the FCC helps make America a safer and better place to live.



CELL PHONES—ONE OF TODAY’S MOST POPULAR USES OF MOBILE RADIO

Cellular phones, including Personal Communication Service devices, may seem like one of the newest land mobile services, but the idea of a mobile radio telephone has been around for quite a while.

In the early 1920s both the Marconi company and the Bell Laboratories were testing car-based telephone systems. Bell Labs believes its 1924 system was actually the first two-way, voice-based radio telephone.

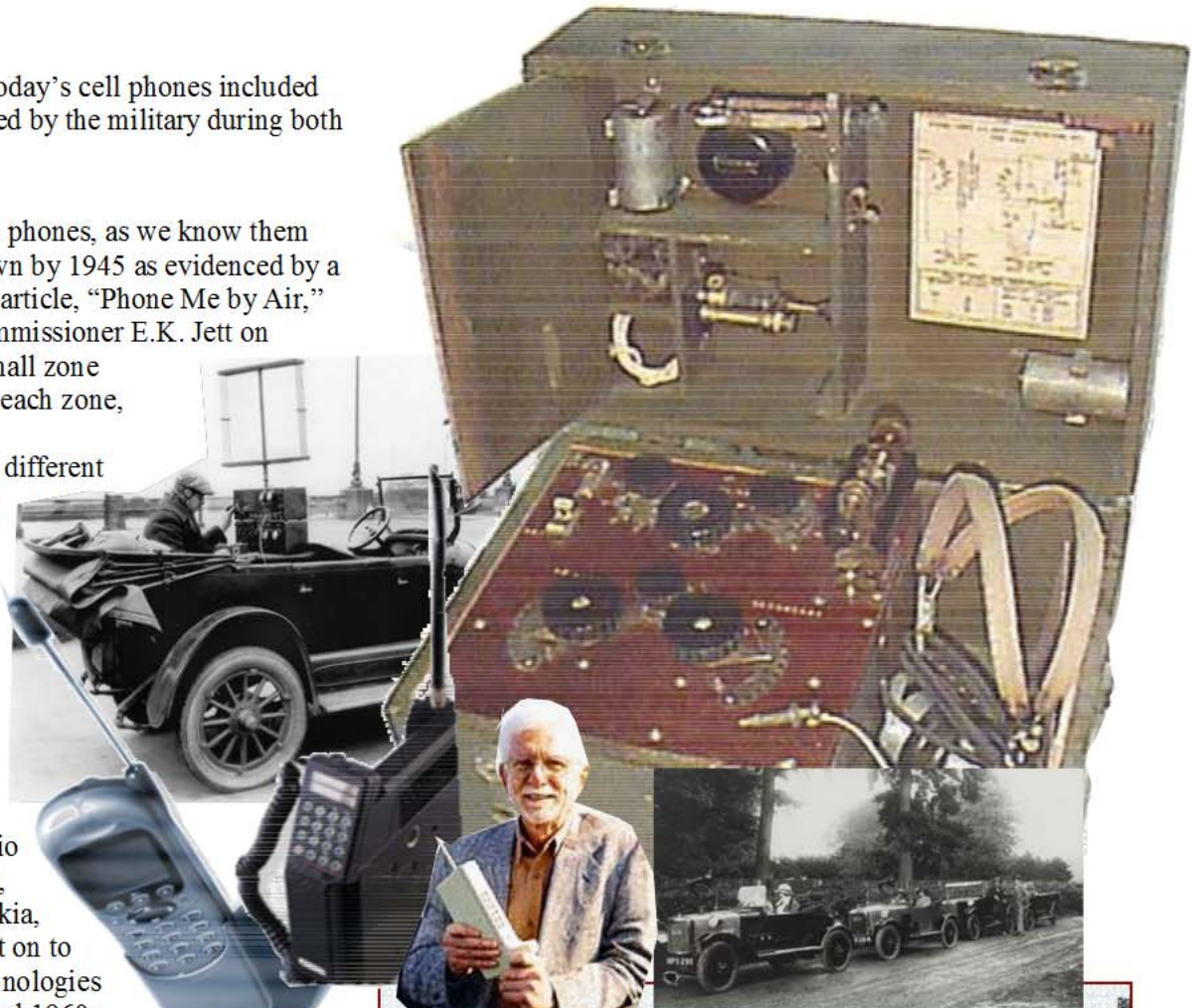
Other predecessors to today’s cell phones included the radio telephones used by the military during both World Wars.

The science behind cell phones, as we know them today, was clearly known by 1945 as evidenced by a *Saturday Evening Post* article, “Phone Me by Air,” which quoted FCC Commissioner E.K. Jett on frequency reuse for “small zone systems.” He said, “In each zone, the...frequencies will provide from 70 to 100 different channels, half of which may be used simultaneously in the same area without overlapping.”

Although not yet a cellular system, in 1946 Bell initiated America’s first commercial mobile radio telephone system. Bell, as well as Ericsson, Nokia, and Motorola then went on to develop cell phone technologies throughout the 1950s and 1960s. The FCC approved a major allocation of spectrum for mobile radio systems in 1970. In 1973, Motorola’s Martin Cooper was credited with the invention of the first personal, handheld cellular radio telephone.

The year after the FCC made its final 1982 decision on spectrum for cellular systems, Ameritech Mobile Communications (Chicago) and CellularOne (Washington, D.C.) became the first operational commercial cellular providers in the United States.

Personal communications for people on-the-go, not just those in vehicles, evolved further in the 1990s and continues growing today.



Clockwise from top right—a WWI mobile military phone, of the type Edwin Armstrong used to develop his ground-breaking inventions; Marconi’s 1922 car phone system with receivers, amplifiers, and speakers mounted on the running boards; Martin Cooper with his 1973 cellular telephone; older and newer generations of mobile radio telephones; and Bell Labs’ 1924 test of a mobile radio telephone.

