In the heart of the Municipality of Austin in Quebec's Eastern Townships, the Historic Sites and Monuments Board of Canada has placed a commemorative plaque to honour the inventor Reginald Aubrey Fessenden. He was born in Austin on October 6, 1866 in the rectory of his father, Elisha Joseph Fessenden, an Anglican minister.

Reginald's mother, Clementina Trenholme, was the grand-daughter of William Trenholme who left Yorkshire to come to Canada in 1820. William Trenholme purchased a farm near Richmond, also in the Eastern Townships, and there he built a school, a church, a saw mill and a farm house. The village he founded still bears his name today.

House where Reginald was born in 1866

His son Edward was an inventor. He created the grain elevator and grain cooler to lighten the work load of farmers, and a snow plough for railway tracks. Reginald Fessenden probably inherited his talents as an inventor from his forbear.

A few years later, the Fessendens left Austin and moved to Bolton Centre where the Anglican Church had assigned a new parish to Reverend Elisha Fessenden. Reginald's two brothers, Kenneth Harcourt and Cortez Ridley, were born in this village. In 1871, the family moved to Chippawa near Niagara Falls. During this time, another son, Victor, was born to the family.

Reginald was an extraordinarily gifted student who easily learned Latin, Greek and French. In 1876, his uncle, Cortez Smith Fessenden, sent him a subscription to the journal *Scientific American*, each issue of which had an article about the work of Alexander Graham Bell. This was of great interest to Reginald. As early as the age of fifteen, he questioned his uncle Cortez, who was a professor of physics, about such things as why we can hear thunder rumble when it is not connected to any wire. He was already interested in the sciences. His life became a quest to be the first to broadcast the human voice.

In the summer of 1881, his father received a proposal from Bishop's University, in Lennoxville, his alma mater, to hire Reginald as a professor of mathematics. The offer was particularly attractive in that it would allow Reginald to obtain a Master's degree in mathematics while teaching. He accepted and returned to the Eastern Townships. At the end of his first year of teaching, he was offered a job in Bermuda, and he left Bishop's, without obtaining his degree, to become the director of the Whitney Institute in Hamilton Parish. This was to be a place of central importance in his life. There he met his future wife, Helen May Trott, the daughter of Thaddeus Trott, a member of one of the oldest families on the island.

Since his adolescence, Fessenden had saved newspaper articles about the inventions of Thomas Alvin Edison, and he dreamed of one day working with this genius. In the hopes of doing so, he left Bermuda in 1886 to move to New York. He visited the Edison Machine Works frequently and, one day, the foreman left his job unexpectedly. Reginald inquired about the job and was hired. He became inspector of electric lines for the Edison Company. Near his workplace was the house of financial magnate J. Pierpont Morgan. One day, some difficulties at the house had been caused by a broken generator. Fessenden repaired the apparatus and found solutions to the various problems of the estate. Edison was very impressed by the work of his employee, and took him on as assistant in his laboratory in New Jersey, considered at that time to be one of the best in the world. In 1890, Fessenden became the head chemist in the lab. This position was short-lived, however, as Edison was forced to close his factory because of financial concerns.

Reginald found himself obliged to take a job as an assistant in the United States Company, a division of Westinghouse in Newark. It was George Westinghouse himself, whom Fessenden had met in the Edison labs, who offered him this job. Reginald was a workaholic, but in 1887, he allowed himself a few days of holiday to visit his betrothed in Bermuda. They did not see each other again until 1890, in New York for their wedding, celebrated on September 4.

In 1892, Purdue University in Indiana offered Fessenden a professorship as well as the Chair of the Engineering Faculty. This was an opportunity he could not refuse - to teach and do research at the same time. The following year, Western University in Pittsburgh offered him the same post he had held at Purdue. This was a new life for the Fessendens. In Pittsburgh, besides working with James Edward Keeler and John Alfred Brashear, two genius inventors, he was part of Westinghouse's circle. With his new associates, he built an X-ray machine for local surgeons. His work gave him the opportunity to study the theories of Heinrich Hertz and carry out experiments in the field of electricity. At the time, a number of other inventors from all over the world were also interested in Hertz's work. A race against the clock began in the field of wireless telephony, with Fessenden one of the contestants.

Fessenden, man of genius that he was, was also a man of wide-ranging interests. He became interested in photography and its applications. On August 22, 1896, he published an article in the journal Electrical World entitled *"Use of Photography in Data Collection"*. Following a series of inventions, he received a patent from the American government for his work in microphotography. It could be said that he was the spiritual father of the slide transparency.

In 1897, he spent his vacation in Ontario with his uncle Cortez. While on a visit at Lake Chemung, near Peterborough, Fessenden threw a pebble into the water. As he studied the concentric waves that circled out from the point where the pebble hit the water, he saw the answer to the problems which always confounded him.

> Fessenden was doing it successfully, and over a considerable distance. The Canadian, Reginald Aubrey Fessenden, was one of the most influential and important figures in the technical and scientific history of radio in the world. The little fame he enjoyed does not do justice to his talents and his role as the father of wireless telephony. (translated, from *La radio et ses inventeurs,* p. 74)

An editorial in the *New York Herald Tribune* (July 1932), Fessenden against the world, said:

> It sometimes happens, even in science, that a man is right despite everything. Professor Fessenden was that man. He fought bitterly and alone to prove his theories. It was he who insisted, against the stormy protests of every recognized authority, that what we now call radio was worked by continuous waves sent through the ether by the transmitting station as light waves are sent out by a flame. Marconi and others insisted that what was happening was a whiplash effect. The progress of radio was retarded a decade by this error. The whiplash theory passed gradually from the minds of men and was replaced by the continuous wave with all too little credit to the man who had been right.

In radio, three geniuses left their mark at the end of the 19th century. Alexander Graham Bell invented the wire telephone in 1876; Guglielmo Marconi was the creator of wireless telegraphy in 1896. And Reginald Aubrey Fessenden crowned these achievements by inventing the wireless telephone in 1900.

Commemorative plaque honouring Fessenden placed by the Historic Sites and Monuments Board of Canada, in the heart of the village of Austin.

Stamp issued June 25, 1987 showing Reginald Aubrey Fessenden

This genius was born here in Austin.
Ignored by the Canadian government
and his fellow countrymen, he never
enjoyed the fame he deserved.

Fessenden, the father of wireless telephony,
deserves our admiration and recognition.

Françoise Hamel-Beaudoin
Austin, March 2004

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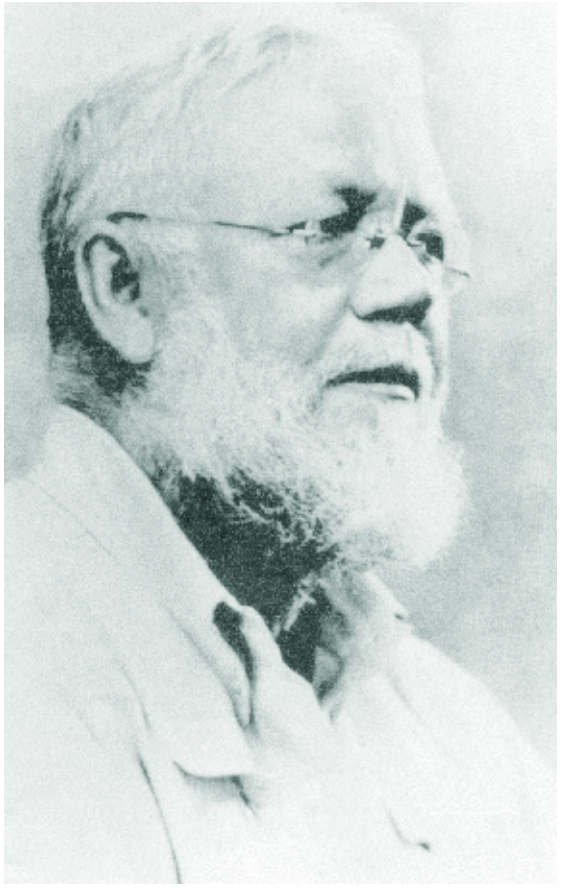
The Father of Wireless Telephony

Reginald Aubrey Fessenden

Abridgement of the Biography of
Fessenden (1866-1932)
by Françoise Hamel-Beaudoin.



> "Hertzian waves must radiate like that, [Reginald] said to his uncle. If they are going to carry the whole range of voice sounds, [they] must radiate like that from the antenna at the transmitting end, and they must keep going in a steady stream until they encircle the antenna at the receiving station. They must never let up even for a split second."
> "I see," replied Reg Cortez. "In Marconi's thinking, they stop and go, stop and go."
> *"Continuous*. That's the word that describes them."

"And so our present continuing wave approach to radio communications was born," said John Belrose, Radioscientist Emeritus. "But generating CW, modulating the waves and receiving them was yet to be accomplished." (15th Annual Alexander Graham Bell Lecture, MacMaster University, 12 November, 1992)

Fessenden continued his research after this discovery. Though the first trials were disappointing, he persevered nevertheless and, on December 23, 1900, tried a new experiment. His assistant, Thiessen, prepared to receive the signal in the high tower about a mile from his boss's tower.

"One, two, three, four," said Fessenden. "Is it snowing where you are, Mr. Thiessen? If it is snowing, tell me!"

Thiessen, upon hearing his boss's voice transmitted for the first time, replied immediately that it was indeed snowing. This heralded the invention of radio broadcasting on December 23, 1900 at Cobb Island, Virginia.

Fessenden wrote, "This afternoon, here at Cobb Island, intelligible speech by electromagnetic waves has, for the first time in the world's history, been transmitted."

Fessenden transmitting a radio message

Jean-N. Paquet says, "Thus, what we today call radio, was born." (translated, from *La radio et ses inventeurs*, Édition Naaman, 1980, p. 67). For Fessenden, the system was merely a toy that only functioned over a short distance, but he was soon to deal with this problem. He had won the first round over Marconi, who was still using Morse code, which was slow and required skilled operators to decode.

During this period Marconi was pursuing his own experiments. He succeeded in making the first transmission from England to Newfoundland in 1901. Fessenden, however, was not afraid that his rival, who had transmitted signals in one direction and only in Morse code, would best him. He was sure he would be able to broadcast over the ocean, but this time, with the human voice.

In September, 1902, he and two millionaires from Pittsburgh, T.H. Given and Hay Walker, founded a company, the National Electric Signalling Company (NES Co). In order to become a shareholder in this company, Fessenden was forced to give up all patents on his inventions. He really had no choice.

In August, 1903, he received an interesting offer from his country of birth. The Ontario Electric Company wanted to harness the energy from the Niagara Falls, and asked Fessenden to act as consulting engineer. He worked with Ross & Holgate, the company studying the potential of the falls. While working on this project, he yielded to the wishes of partners, who wanted to make their company profitable by setting up intercontinental communications. Reginald worked at building two 420-ft. towers, one in Brant Rock, Massachusetts, and the other in Machrihanish in Scotland. In January, February and March, 1906, two-way telegraphic messages were sent successfully between these stations.

At the end of the summer of 1906, Fessenden built a station at Plymouth. He succeeded in transmitting his voice between Brant Rock and Plymouth, 11 miles away. That November, the operator of the station in Scotland reported that he had heard a conversation between the technicians in Brant Rock and Plymouth.

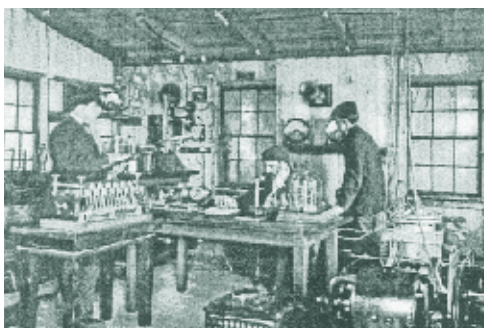
On Christmas Eve, 1906, Fessenden felt that he was ready to show that the human voice could be transmitted without wires. He proposed a new experiment to the U.S. Navy and the United Fruit Company whereby he would communicate with their ships at sea, by voice. The miracle happened. The dumbfounded sailors heard him singing, playing the violin and reciting a biblical text. It was a complete success. Fessenden thus carried out the first amplitude-modulated radio broadcast on December 24, 1906.

The War

In August, 1914, war was declared in Europe. The directors of Submarine Signalling, for whom Reginald worked, asked him to go to England. There, he saw German submarines attack English merchant navy ships. He offered his services and found himself onboard a submarine for a battle on the Channel. After three months of research, he invented an oscillator that produced signals under water. Acoustic waves could be heard at a distance of 50 miles with a receiver of the same type. Fessenden had invented sonar.

This enabled the British, Canadians and Americans to detect the German submarines even when they were silent on the ocean floor. The acoustic waves revealed the targets; the Germans were unable to figure out how they were being spotted. The invention of an instrument that allowed communication between land and submarines was of such great importance, as the Allied Forces later declared, that it accounted for their victory.

When he returned to America in the spring of 1919, Fessenden purchased a property in Boston. His most recent work had shown that if he used a frequency of 50 kilohertz per second, he could transmit the human voice. With a frequency of 100 megahertz per second, he could transmit real, though admittedly unclear, images. He turned his attention to this project which was the forerunner of television.



The radio telephone facilities of Brant Rock

Most of his time was occupied by the development of an apparatus to measure the depth of water under the keel of the ship, for the navy: the fathometer. This apparatus was an immediate success in commercial shipping. Today, a remnant of this invention is used by divers; it is called the "pneumafathometer". The navy no longer uses the fathometer because *fathoms*, the unit of measurement employed, became obsolete after international usage adopted the metre.

While not otherwise occupied by his inventions, Fessenden enjoyed writing about such subjects as heredity and creativity. He published *The Deluged Civilization or the Caucasus Isthmus* in 1923, *Finding a Key to the Sacred Writings of the Egyptians* in 1924, and *How it was Discovered that all so-called Myth-Lands were the Caucasus Isthmus* in 1926.

Fessenden surrounded by his staff

In the first manuscript, dedicated to his wife Helen, Fessenden explored antediluvian civilizations. He studied the Great Flood and expressed his desire to carry out research to find the Ark of the Covenant. He even offered funding to the Department of Archeological Research in the United States to cover the costs of a first expedition. To visit the place as a tourist became his dearest wish. As he studied the area, he believed that crossing the narrow gorges of the Caucasus Mountains would lead to the rich fertile land that is described in the Bible as leading to the Garden of Eden. Nothing less! Illness and old age would rob him of this dream.

Recognition

In 1921, he was recognized by many groups for his contribution to the scientific world. He was awarded the medal of the *Institute of Radio Engineers*, the highest honour in the profession. Marconi had received it, and Fessenden could not have borne to be trumped by his arch rival.

Fessenden, middle back row, with his wife Helen, at his right.

The following year, he received the *John Scott* medal with a prize of $800 for his invention of *continuous* or *constant* radio waves. On October 16, 1929, he received the *Scientific American Medal* for the invention of the ultrasonic depth finder (fathometer).

Over the course of his life, Fessenden held patents for some five hundred inventions, covering everything from work on light to the transmission of sound and electric waves. He was the author of some three hundred inventions just for radio. These alone were worth three million dollars, the amount R.C.A. paid to obtain them from NES Co. He invented the oscillator, the fathometer, the wireless compass, the turbo-electric steering mechanism for warships, the radio telephone, the vertical antenna, various instruments needed for underwater signalling, the tracking heterodyne receiver and the electric gyroscope to help sailors at sea.

After years of fighting to recover his patent royalties, in 1928 he obtained an out-of-court settlement with Radio Trust of America, the last user of his inventions. AT&T, General Electric, Westinghouse and RCA paid him an amount that is difficult to put a figure to. Only Helen Fessenden knew how much the companies paid him and she never revealed the amount. It was thought to have been a million dollars. With this money, Fessenden bought a property in Bermuda, and retired there. He enjoyed growing old surrounded by Helen's family and his friends. On a bright, sunny day in July, he took his boat out on the water. The next day, July 22, 1932, a heart attack killed him.

"Reginald Aubrey Fessenden," says John Belrose (Radioscientist Emeritus, Communications Research Centre, Canada, 1993,) "was without doubt the greatest inventor, engineer and man of science born in Canada."

Author Jean-N. Paquet wrote in his book entitled *La radio et ses inventeurs* (Éditions Naaman, 1980):

> With the passing of time, we can state that had Marconi not lived, Fessenden would probably have arrived at the same discoveries, because from 1899 on, he was already carrying out tests on radio telephony independently of the work being done by Marconi. The reverse is much less likely: had Fessenden not been conducting his work, Marconi would have remained at the level of simple telegraphy for a long time, until someone else had found a way to transmit the human voice. In 1906, Marconi had not even thought of the possibility of modulating a carrier wave by a human voice, at a time when