

Guglielmo Marconi.

Prepared by John Horsefield, Cowra U3A

In the 1890s – even before Einstein developed his Theory of Relativity - scientists believed that electrical & magnetic forces existing in the atmosphere could be electronically activated to carry energy. One such visionary was Italian physicist Guglielmo Marconi



Guglielmo Marconi was born at Bologna, Italy, on April 25, 1874, the second son of Giuseppe Marconi, an Italian country gentleman, and Annie Jameson, daughter of Andrew Jameson of Daphne Castle in the County Wexford, Ireland. He was educated privately in Bologna, Florence and Leghorn. Even as a boy he took a keen interest in physical and electrical science and studied the works of Maxwell, Hertz, Righi, Lodge and others. In 1895 he began laboratory experiments at his father's country estate at Pontecchio where he succeeded in sending wireless signals over a distance of one and a half miles.

In 1896 Marconi took his apparatus to England where he was introduced to Mr. (later Sir) William Preece, Engineer-in-Chief of the Post Office, and later that year was granted the world's first patent for a system of wireless telegraphy. He demonstrated his system successfully in London, on Salisbury Plain and across the Bristol Channel, and in July 1897 formed The Wireless Telegraph & Signal Company Limited (in 1900 re-named Marconi's Wireless Telegraph Company Limited). In the same year he gave a demonstration to the Italian Government at Spezia where wireless signals were sent over a distance of twelve miles. In 1899 he established wireless communication between France and England across the English Channel. He erected permanent wireless stations at The Needles, Isle of Wight, at Bournemouth and later at the Haven Hotel, Poole, Dorset.

The path to discovery

Most technologies begin as a method in search of a problem, and communication by radio is no exception. For most of the half-century following successful use and expansion of the electric telegraph, a number of experimenters had added contributions to radio. Some even seemed to have had useful radio in their grasp, only to let it lie fallow. American dentist Mahlon Loomis had demonstrated in 1865 that an electrical disturbance could be caused in a kite-flown "aerial wire" by opening and closing the circuit of another kite-flown "aerial wire" at a distance of 18 miles between mountain tops in Virginia. He even obtained a U.S. patent (issued in 1872) indicating it might be used for "telegraphy," but never obtained funding to back further development, in all likelihood because the then-powerful Western Union Telegraph Company had a number of other, nearer-term technological fish to fry, not the least of which were both transcontinental and transatlantic telegraph businesses in addition to a burgeoning domestic telegraph network. Loomis died a broken and bitter man.

Karl Braun in Germany discovered "one-way conduction" in metal sulfide crystals in 1874, but the applicability of this phenomenon to detecting radio signals was not to be thought of for several decades.

Based on taking up a prize challenge in 1879, German physicist Heinrich Hertz demonstrated in 1887 and 1888 transmission of electromagnetic waves indoors across university lecture halls, showing students that invisible waves that propagated much like light did indeed exist. Since Hertz's laboratory demonstration devices consisted simply of spark gaps in metallic rings resonant at around 150 MHz, with no amplification, he could show and announced the contention that whatever was being transmitted, it had no commercial potential. Although a young man, Hertz unfortunately died at age 36, just before he might have seen others adding to his work and leading toward everyday use.

Edouard Branly in France started work to study nerve conduction in 1885. His need for a sensitive electrical detector resulted in the Branly Coherer, a tube of loosely packed metal filings that would clump together when a weak current flowed through it. The coherer, adopted and modified by others, became radio's first practical signal detector.

William Crookes suggested in 1892 that electromagnetic waves might be used for wireless telegraphy, although it was to be five years before J.J. Thompson would announce the existence of electrons. At the time, no one was interested.

Oliver Lodge, an English professor at University College, Liverpool, independently achieved results similar to Hertz, publishing just a month after Hertz (which means we might have called radio waves "Lodgian waves") By 1894, Lodge was demonstrating transmission of electromagnetic waves through walls in London and later at Oxford University. Lodge added an important

function to the Branly coherer; a mechanical "tikker" that randomized the filings in the coherer after each detection event.

Ambrose Fleming, later to become a close associate of Marconi, was in the audience and later wrote he had seen Lodge transmit alphabetic characters using the Morse telegraphic code; letters that formed intelligible messages. (The actual message content, regrettably, seems to have been lost.) Also, Lodge, in connection with related interests he had concerning the nature of lightning, had already defined basic properties of electromagnetic waves, showing that the period of a wave in a resonant circuit was equal to $2\pi LC$. At the time Lodge stayed within his role as Professor of Experimental Physics and had no interest in further developing his nascent "wireless telegraph." Although he has developed the concept of tuning a circuit, using the musical term "syntony," Lodge did not begin to exploit his discoveries until 1901, after Marconi has begun to use the concepts in practical wireless telegraphy.

In the face of all this, Marconi's first knowledge of electromagnetic waves did not occur until 1894, when, as an unmatriculated protégé of Professor Righi at Bologna, he read about Hertz' demonstrations. Professor Righi was himself replicating and expanding on Hertz's work, but with even smaller loops than Hertz; loops that suggest Righi's waves had a frequency in the region of 3 gigaHertz, which would, of course, result in an even shorter transmission range than Hertz had achieved.

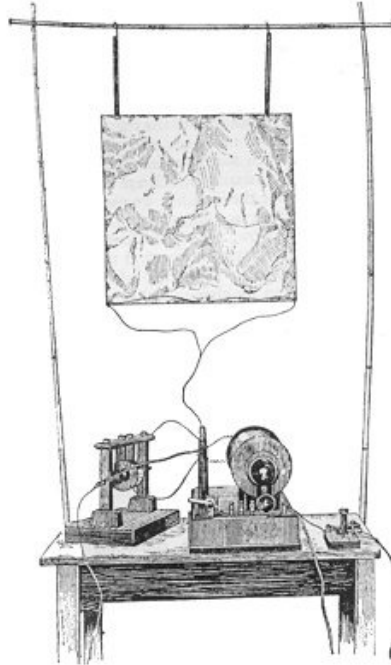
Marconi conducted his own experiments on the family estate and by 1895 succeeded in signaling over a distance of about 2 kilometers. Most exciting to him was that the signals traveled over a hilltop, between a transmitter and receiver that were out of sight of each other. At the time, and for some years later, many still contended that electromagnetic waves behaved exactly like light, implying a range

no farther than line of sight. Marconi had to repeatedly demonstrate transmission beyond the optical horizon to a skeptical world.

By 1896, receiving no interest from the Italian government in his work, Marconi took his apparatus to England, where he could count on influence and land owned by relatives based on his family's connection to the Irish Jameson Whisky family. On his arrival in England, frightened customs inspectors smashed his machinery, fearing it to be part of an Italian anarchist plot. Fortunately, it was simple enough to be rebuilt without difficulty.

Also in 1896, Nikola Tesla of Serbia, whose primary interest was electrical power transmission rather than communications, had developed a rotary arc transmitter and the notion of a vertical "aerial wire" as parts of a proposition to transmit electric power without wires. At the same time Marconi applied for British patents covering "wireless telegraphy," showing a clear purpose to transmit information by electromagnetic waves as the end purpose of his invention.

By 1897, starting a barrage of experimentation and development that was to characterize the personality of both Marconi and his companies, Marconi was demonstrating a range of first 7½ then 14 kilometers. Based on that success, he founded his first English company, *The Marconi Wireless Telegraph Company, Limited*.

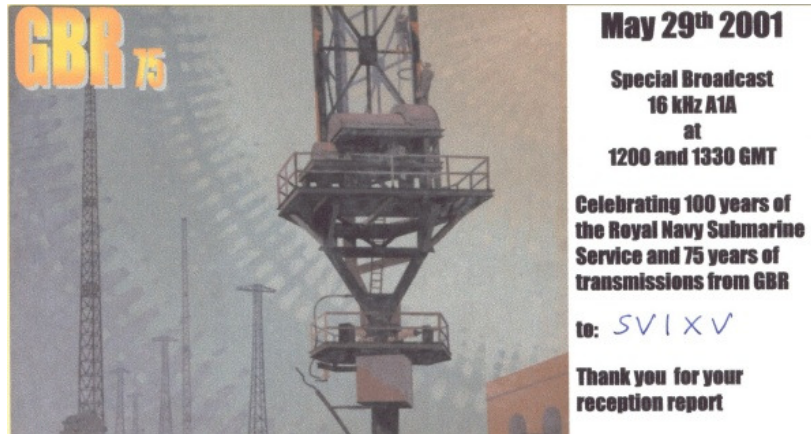


An early Marconi transmitter

Returning to Italy in the latter half of 1897, he demonstrated wireless telegraphy with ships 18 kilometers offshore and over the horizon. At the end of 1897, he was back in England showing that a station on the Isle of Wight could communicate with ships as far as 30 kilometers distant, By 1898, he opened a commercial wireless telegraph service to Rathlin O'Birne Lighthouse Island near the entrance to Donegal Bay in northwestern Ireland.

On March 27, 1899, Marconi joined England to Europe with wireless telegraphy between his shore station at South Foreland Light and a station he built at Wimereux, 50 kilometers across the Channel. He was nearly in a position to compete with submarine telegraph cables across the Dover Strait that had been operating since 1851. The notion of competing with telegraph companies was obvious.

By the summer of 1899, Marconi had finally waited out and overridden political obstacles within the Royal Navy and was invited to place his wireless on three naval ships during manoeuvres.. The range to his shore station was as much as 160 kilometers, while ships could signal each other over distances of 110 kilometers and occasionally 136 kilometers.



On 29th May 2001 the British Royal Navy celebrated their centenary of the Royal Navy Submarine service and 75th anniversary of the operation of the GBR transmitter at Rugby with a special event transmission on the longwave frequency of 16,0 kHz in morse telegraphy.

By this point, interference was becoming intolerable, with no real tuning or band-limiting of emissions. Marconi had to get to work on employing the "syntony," which Lodge had patented in 1897. However, he took it a step further than Lodge, providing tuning at both the spark transmitter and the coherer receiver as part of his famous Patent 7777. (This did not keep Lodge from later suing Marconi in 1910 for patent infringements and settling for cash in 1911.)

However, in 1900, encouraged by his recent successes, Marconi told the board of his newly formed Marconi International Marine Communication Company" that

he wanted to construct high-powered wireless transmitters to span the Atlantic Ocean. The result was the epochal transmission of the Morse letter "S" between *Poldhu Point* near Mullion on England's Lizard Peninsula (Cornwall) and *Heart's Content* in Newfoundland on December 12, 1901..



The first transatlantic wireless telegraph messages were transmitted from this station at Table Head in Glace Bay, Nova Scotia to a similar station in Poldhu, Cornwall.



The photograph shows Marconi at Signal Hill, St. John's, Newfoundland,

seated beside the apparatus that he used to receive the first transatlantic radio signals on December 12, 1901. The object near the corner of the table is probably the telephone receiver on which he heard the signals.

In 1905 Marconi patented his horizontal directional aerial and in 1912 a "timed spark" system for generating continuous waves. In 1907 the first transatlantic commercial service was opened between Glace Bay and Clifden, Ireland. In the same year the first shorter-distance public service of wireless telegraphy was established between Bari in Italy and Avidari in Montenegro.

In 1914 he was commissioned in the Italian Army as a Lieutenant and later promoted to Captain. In 1916 transferred to the Navy with the rank of Commander. He was a member of the Italian Government mission to the United States in 1917 and in 1919 was appointed Italian plenipotentiary delegate to the Paris Peace Conference. He was awarded the Italian Military Medal in 1919 in recognition of his war service.

During his war service in Italy he returned to his investigation of short waves, which he had used in his first experiments. After further tests in collaboration with others in England, an intensive series of trials was conducted in 1923 between experimental installations at the Poldhu Station and Marconi's yacht "Elettra" cruising the Atlantic and the Mediterranean. This led to the establishment of the beam system for long distance communication. Proposals to use this system as a means of Imperial communications were accepted by the British Government and the first beam station, linking England and Canada, was opened in 1926, other stations being added the following year.



In 1931 Marconi began research into the propagation characteristics of still shorter waves, resulting in the opening in 1932 of the world's first microwave radio telephone link between the Vatican City and the Pope's summer residence at Castel Gandolfo. Two years later at Sestri Levante he demonstrated his microwave radio beacon for ship navigation and in 1935, again in Italy, gave a practical demonstration of the principles of radar, the coming of which he had foretold in a lecture to the American Institute of Radio Engineers in New York in 1922.

Marconi was the recipient of honorary doctorates from several universities and many other international honours and awards, among them the 1909 Nobel Prize for Physics, which he shared with Professor Karl Braun; the Albert Medal of the Royal Society of Arts, the John Fritz Medal and the Kelvin Medal. He was decorated by the Tsar of Russia with the Order of St. Anne, the King of Italy created him Commander of the Order of St. Maurice and St. Lazarus, and awarded him the Grand Cross of the Order of the Crown of Italy. Marconi also received the freedom of the City of Rome (1903), and was created Chevalier of the Civil Order of Savoy in 1905. Many other distinctions of this kind followed. In 1914 he was created a Senatore in the Italian Senate and appointed Honorary Knight Grand Cross of the Royal Victorian Order in England. He received the hereditary title of Marchese in 1929.



*Guglielmo Marconi & his second wife (the former Countess Bezzi Scala)
holding their daughter Elettra on her 8th birthday.*

In 1905 he married the Hon. Beatrice O'Brien, daughter of the 14th Baron Inchiquin. The marriage was annulled in 1927, in which year he married the Countess Bezzi-Scali of Rome. He had one son and two daughters by his first wife and one daughter by his second.

Marconi died in Rome in 1937 at age 63 following a series of heart attacks. Italy awarded him a state funeral. As a tribute, all radio stations throughout the world observed two minutes silence. His remains are housed in the Villa Griffone at Sasso Marconi, Emilia-Romagna, which assumed that name in his honour in 1938.



One hundred yards north east of this column there stood, from 1900 to 1935, the famous Poldhu (Cornwall, U.K.) wireless station designed by John Ambrose Fleming and erected by the Marconi Company of London from which were transmitted the first signals ever conveyed across the Atlantic by wireless telegraphy. The signals consisted of a repetition of the Morse letter 'S' and were received at St Johns Newfoundland by Guglielmo Marconi and his British associates

From this station in 1923 and 1924, Charles Samuel Franklin, inventor of the Franklin beam aerial, directed his short wave wireless beam transmissions to Guglielmo Marconi on his yacht 'Electra' cruising in the south Atlantic. The Epoch making results of these experiments laid the foundation of modern high speed radiotelegraphy communication to and from all quarters of the globe.

To commemorate the pioneer work done by Guglielmo Marconi and his research experts and radio engineers at the Poldhu wireless station between 1900 and 1935, the Marconi company presented this historic land to the National Trust. Some six acres of cliff land were given in 1957 and four acres behind the cliffs, on which stood the station and mast, were given in 1960.



Bill Appleton of Sydney's amateur radio club transmits a commemorative message to Poldhu, Cornwall on December 15, 2002, one hundred years after Marconi's first official transatlantic wireless telegraph message. (Photo: Cape Breton Post, Nova Scotia)

