Distant Sparks*

VOL. 14, ISSUE 1 *DISTANT SPARKS - TRANSLATION; 'TELEFUNKEN'

Long Island Radio & Television Historical Society

(PRESERVING WIRELESS HISTORY)

43 SAYVILLE BLVD., SAYVILLE, N. Y. 11782 (631) 378-4564

Spotlight on Marconi's Transatlantic Wireless Work In Canada

by Henry M. Bradford

Operator, James Holmes ,receives Morse code messages from Clifden while Guglielmo Marconi relaxes at left.
Note the row of "Fleming valve" diode detectors on the window sill.

MISSION STATEMENT

To disseminate history and encourage a greater knowledge of Long Island's wireless history.

To promote history and original historical research.

To gather, collect, own, hold, preserve, display and make available appropriate artifacts, books, manuscripts, photographs, and other records and materials.

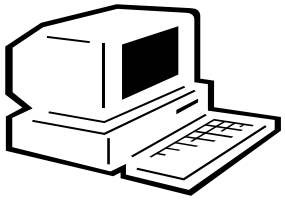
To encourage the suitable marking of places of historical interest.

To acquire, restore, preserve and maintain historic sites and structures.

To encourage public interest in history, hold meetings, programs and events, sponsor exhibits, and issue publications in any format.

To cooperate with County and State officials and historical organizations to collect and preserve materials of countrywide, regional and statewide significance.

The Long Island Radio & TV Historical Society publishes a weekly newsletter, hosted by Bill Mozer. The newsletter features: notices of our monthly meetings; articles of interest to radio and TV historians, hobbyists, and professionals; the *Historical Photo of the Week*; *Dates in Radio & TV History*; a *Quote of the Week*; a *Website of the Week*; notices of other organization's events; and feed-back from our readers. The LIRTVHS Newsletter is distributed to members as well as non-members. Sign-up for the newsletter by sending an email to: LIRTVHS@gmail.com You can also join the LIRTVHS on Facebook.



Check our
Home Page at:
www.LIRTVHS.org

Hosted by Neil M. Heft

"DISTANT SPARKS"

Send in those articles and photographs regarding Long Island's early wireless to:

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MEETINGS

Our meetings are held on the 3rd Saturday of each month at 10 AM at the Long Island Maritime Museum (at foot of West St.) West Sayville
Bring a friend
Bring equipment, artifacts, photos, articles, or anything of interest to the membership

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MEMBERSHIP FEES:

Student/Sr. Citizen $15.00
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ARC (Amateur Radio Club) $50.00
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Business $250.00
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Marconi's Transatlantic Wireless Work In Canada

By Henry M. Bradford
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In 1895 Guglielmo Marconi began experimenting with wireless signaling by means of radio waves. His "spark transmitter" was a modification of Heinrich Hertz's 1880's laboratory apparatus for generating and detecting electromagnetic waves. He replaced Hertz's dipole antennas by vertical wires and ground connections, and he used a sensitive detector called a "coherer" in his receiver. With this simple apparatus he transmitted wireless signals about a mile on his family estate near Bologna, Italy. In 1896 he moved his experiments to England, and in 1897 he opened a company there for the sale and lease of wireless equipment. His principal business was equipping ships and shore stations with wireless apparatus. When his most powerful station began achieving ranges of over two hundred miles, he felt it might be possible to bridge the Atlantic Ocean and link the New World and Old World by wireless.

With this object in mind he built a high powered spark transmitting station at Poldhu, Cornwall in 1901, aided by the engineering expertise of Ambrose Fleming. Instead of the usual batteries, this station was powered by a motor driven alternator with an output of about twenty kilowatts. The antenna was an inverted cone of wires supported by a circle of twenty 200-foot wooden masts. A similar station was built at South Wellfleet on Cape Cod, Massachusetts. Skeptical Cape Cod observers and even Marconi's chief engineer worried about the stability of the antenna design. Their concerns were justified when autumn gales in 1901 blew down the antennas at both stations.

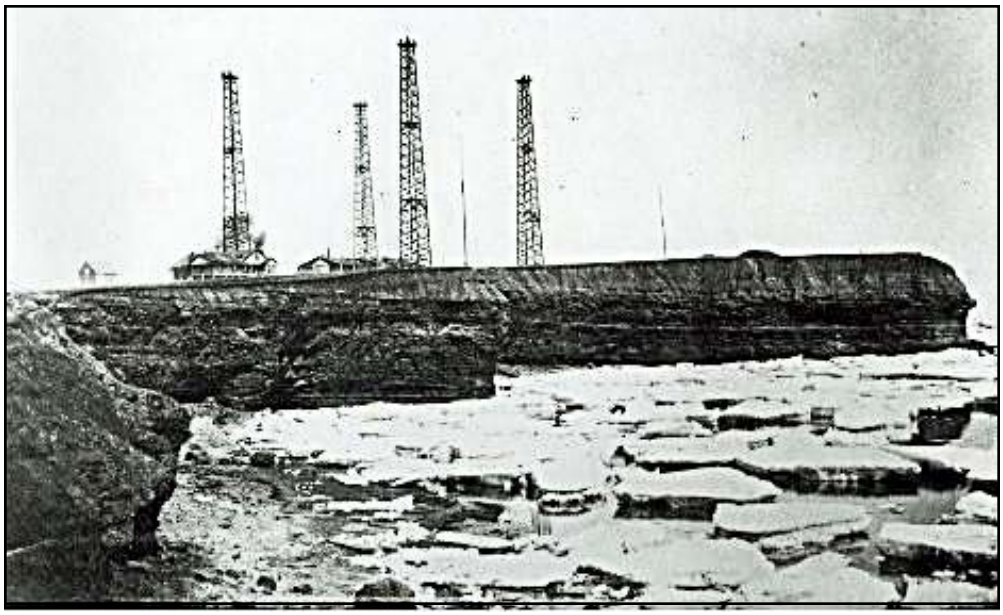
A temporary vertical fan antenna was erected at Poldhu, and Marconi decided to reduce the distance for his transatlantic experiment by receiving signals from Poldhu at St. John's, Newfoundland rather than at Cape Cod. Portable receiving apparatus was taken to Newfoundland in December, along with balloons and kites to support a 500 foot receiving aerial wire. The receiver employed a coherer detector connected via a relay to a "Morse inker" paper chart recorder. The test signal was the letter "S" in Morse code, three dots, transmitted repeatedly by Poldhu from 3PM to 6PM Poldhu time, beginning on December 11. The nominal wavelength was 366 metres (about 850 kilohertz); i. e., in the middle of the present AM broadcast band.

On December 11 the balloons blew away, and the replacement kite kept swooping up and down in the gusty wind. This spoiled the tuning of the receiver, which depended on the resonant frequency of the aerial. No signals were recorded that day.

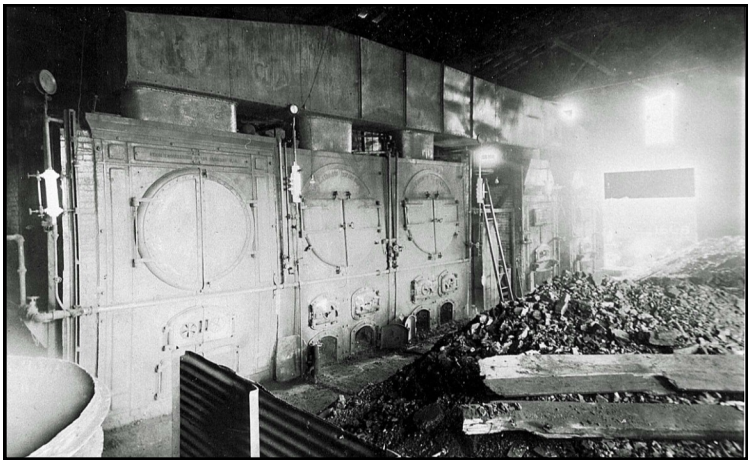
Marconi and helpers at St. John's, Newfoundland launching a kite to support a long receiving aerial wire in December, 1901.

On December 12, Marconi dispensed with the recorder because it required a fairly strong signal to operate, and used an untuned receiver with an earphone instead. With this crude apparatus he claimed to have heard sequences of S's several times during the test period, and again briefly on December 13 before bad weather forced an end to the experiment. Marconi's announcement of success brought both congratulations and doubts. Unfortunately, the world had to take Marconi's word for it because he had no chart record. The company that operated the transatlantic telegraph cable believed it enough to demand an end to the experiments. They held a monopoly on telegraph operations in Newfoundland which they conveniently interpreted to include wireless.

Marconi packed up and sailed to Cape Breton, Nova Scotia, where he was welcomed by Canadian officials and encouraged to set up shop there. After a survey of coastal sites for a permanent station, he chose Table Head, a promontory overlooking the Atlantic in the town of Glace Bay. Construction began in 1902, this time with a sturdy antenna consisting of an inverted cone of wires supported by four 200 foot wooden latticework towers made of heavy timbers. Similar antennas were now erected at Poldhu and Cape Cod.



Marconi's transatlantic wireless station on Table Head in Glace Bay, Nova Scotia, circa 1902. The four wooden latticework towers supported an inverted cone of antenna wires.

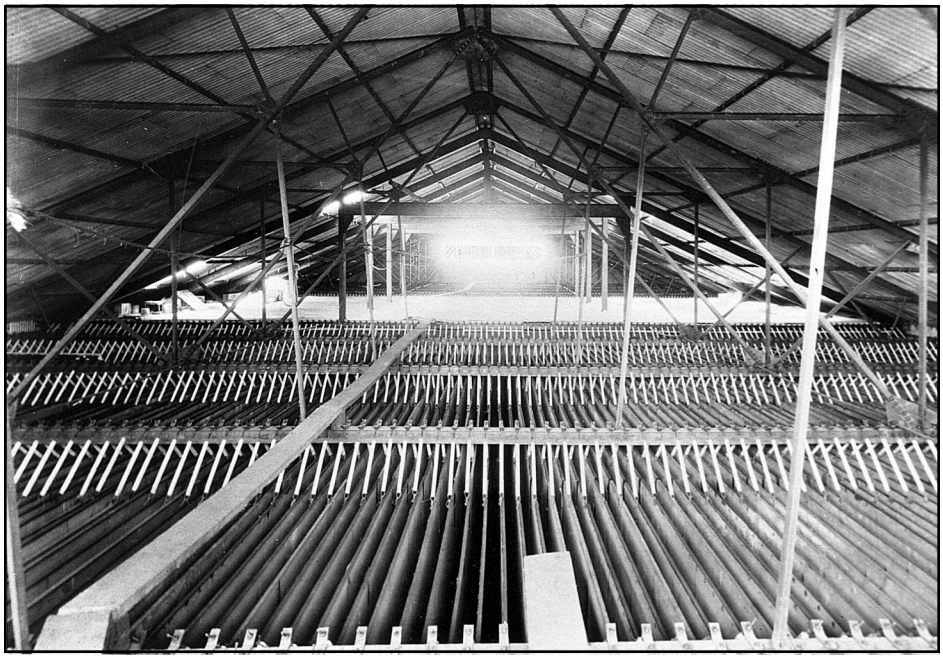


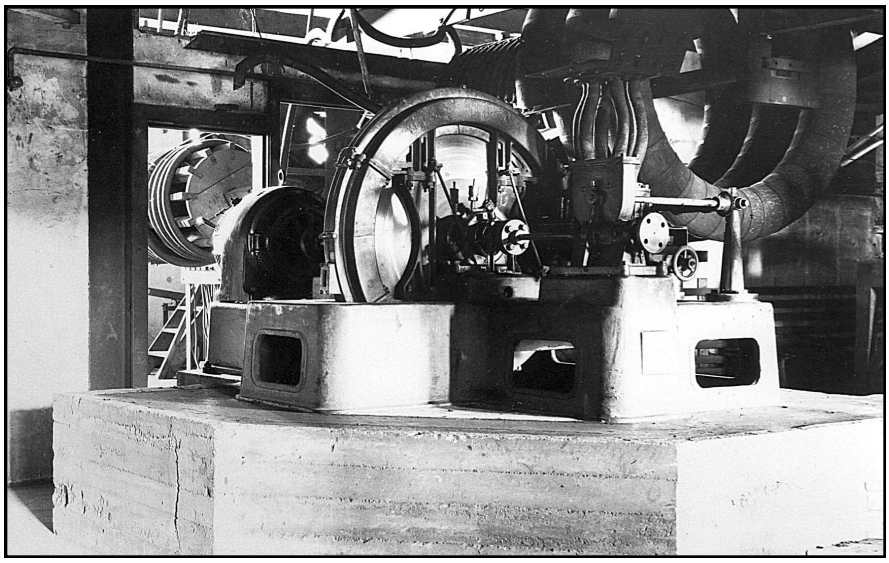
Boilers in the power station at the "Marconi Towers" Glace Bay station produced steam for the engine that drove the main alternator.

Three 5000 volt DC generators at Marconi Towers generated 15,000 volts for the transmitter spark. The fourth was a spare.

The standby battery at Marconi Towers contained 6000 two volt cells connected in series to produce 12,000 volts. It could power the transmitter for several hours if the DC generators broke down.

These were the tops of the condenser (capacitor) plates. They were metal sheets hanging down nearly to ground level.





This was the rotary spark discharger at Marconi Towers. The spark is hidden in this view. The three large toroidal rings in the upper right background were the three turns of the primary coil of the antenna transformer.
The secondary coil is mostly hidden, but a similar one on a standby transmitter is visible through the doorway.

While construction continued, Marconi sailed from Britain to New York on the passenger liner Philadelphia, which was specially equipped with a receiving aerial strung between extensions to its masts. A receiver in a cabin was tuned to the Poldhu transmitter's wavelength, and the received signal was recorded with a Morse inker and initialed by the captain each night to forestall any later doubts. The results contained good news and bad. The good news was that signals could be received at a distance about equal to that from Poldhu to Newfoundland at night, but the bad news was that they could be received at only about one-third of that distance in the daytime. This experiment turned out to be a good predictor of what would happen in the next few years; i. e., weak transatlantic signals at night and none during the day. The day/night effect is familiar to AM broadcast band listeners, but it was unknown to Marconi and his contemporaries. Actually, Marconi could hardly have picked a worse part of the radio spectrum for attempting a transatlantic service.

The S. S. Philadelphia experiment also cast doubts on Marconi's claim of daylight success at Newfoundland. Personally I believe that Marconi did receive the signals there, but at a much shorter wavelength than the nominal transmitter wavelength of 366 metres. Spark transmitters were notorious for splattering their transmissions across the radio spectrum, and Marconi had only claimed to receive signals when he was using an untuned receiver. We will never know for sure what really happened, but subsequent successes made the question academic.

After much trial and error experimentation, the first official transmission was made from Glace Bay to Poldhu on December 15, 1902. The simple message from the London Times correspondent covering the event said: "Times London. Being present at transmission in Marconi's Canadian station have honour send through Times inventor's first wireless transatlantic message of greeting to England and Italy Parkin". An indication of the reliability of these first communications was the fact that the message was first transmitted in the early morning of December 15, then again in the early evening, and finally near midnight before it was entirely received.

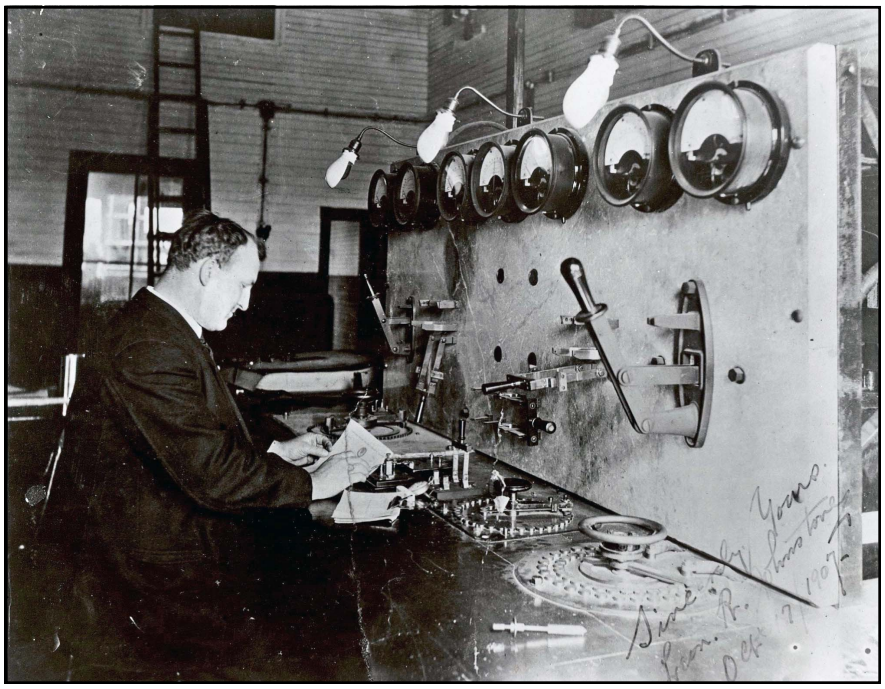
The Cape Cod station with its new antenna was completed. A message from President Roosevelt to King Edward the Seventh of England was transmitted to Glace Bay on January18, 1903, to be forwarded to Poldhu. Radio propagation conditions were good and the message was received directly at Poldhu, becoming the first transatlantic wireless message transmitted from the United States.

Efforts to make communications more reliable continued for the next couple of years, but they remained unsuccessful by day, and not adequate for a commercial service at night. Experimental results were confused by natural variations in the ionosphere, layers of ionized air high in the atmosphere. Unknown to Marconi and his contemporaries, the ionosphere reflects radio waves and was responsible for what success they were having. However, the experiments indicated that commercial success would require more power and longer wavelengths. The ever-faithful board of his company agreed to build two larger stations, one at Clifden on the west coast of Ireland, and one at a large new site just south of Glace Bay. They must have been wondering whether they were throwing good money after bad.

The antenna at the Glace Bay station was a circular umbrella of wires over two thousand feet in diameter supported in the centre by the four wooden latticework towers from Table Head, and further out by two concentric circles of one hundred 80 foot wooden masts. Local people called the station "Marconi Towers" because of the impressive array of antenna towers. The station was completed in the spring of 1905, and in June the first successful daylight transatlantic transmission was made at a wavelength of 3660 metres.

New experiments with antennas showed that a linear array of parallel wires worked better than a circular umbrella if the antenna wires extended away from the transmitter in the direction opposite to the intended recipient. Linear receiving antennas likewise worked best in this counter-intuitive sense; i. e. the wires should extend away from the receiver in the direction opposite to that of the source of the signal. Linear antenna arrays were now used at both Clifden and Marconi Towers.

The station at Clifden was similar to Marconi Towers. At both stations, the condenser (modern name: capacitor) that stored the electric charge for the transmitter spark consisted of many sheets of metal that hung from the rafters of the building nearly down to the ground. These filled most of the building, which consequently was called the "condenser building". Both stations had their own thermal electric power stations, burning peat at Clifden and coal at Marconi Towers. The power output of the Marconi Towers station was eventually rated at three hundred kilowatts, although exactly what this figure meant is not clear.



Operator L. R. Johnstone transmits messages to Clifden, Ireland on October 17, 1907, the first official day of operations of the transatlantic service.

The transatlantic wireless telegraph service, which now operated around the clock, officially began on October 17, 1907. It is said that ten thousand words were exchanged on the first day. Of this period, Richard Vyvyan, Marconi's chief engineer, wrote: "Only those who worked with Marconi these four years can realize the wonderful courage he showed under frequent disappointments, the extraordinary fertility of his mind in inventing new methods to displace others found faulty, and his willingness to work, often sixteen hours at a time when an interesting development was being tested. At the same time the directors of the Marconi Company showed wonderful confidence in Marconi, and courage in continuing to vote the large sums necessary from year to year until final success was achieved."

In 1909 a fire destroyed the transmitter building, and the opportunity was used to update the transmitting equipment. Three 5000 volt DC generators provided 15000 volts to charge the spark capacitor. A 12000 volt standby battery was connected in parallel with the generators, consisting of 6000 two-volt porcelain cells the size of flush boxes connected in series. The capacitor (condenser) was discharged periodically by a rotary discharger that had a spinning wheel with studs on its rim. When a stud passed between two slowly revolving electrodes, a spark jumped the gap. The energetic electrical impulse of the spark was transferred to the antenna outside by a large air core transformer.

Each spark impulse produced a chain of electrical oscillations in the tuned antenna which it radiated as a gradually decaying pulse of radio waves. It was analogous to a hammer striking a bell. The type of signal it produced was referred to as a "damped wave". The pulses were produced by the discharger at a regular rate of about 360 per second. This produced dots and dashes with a musical tone in the headphones of the operator receiving the Morse code signal, and helped to distinguish them from atmospheric interference.

The receivers at both Clifden and Marconi Towers were initially located at the same site as the transmitter, so that the strong local signal drowned out the weak signal received from overseas. This meant that messages could only be sent in one direction at a time, either west to east or vice-versa. When business increased enough to justify it, the problem was remedied by building dedicated receiving stations several miles from the transmitters and operating the two transmitters on different wavelengths.

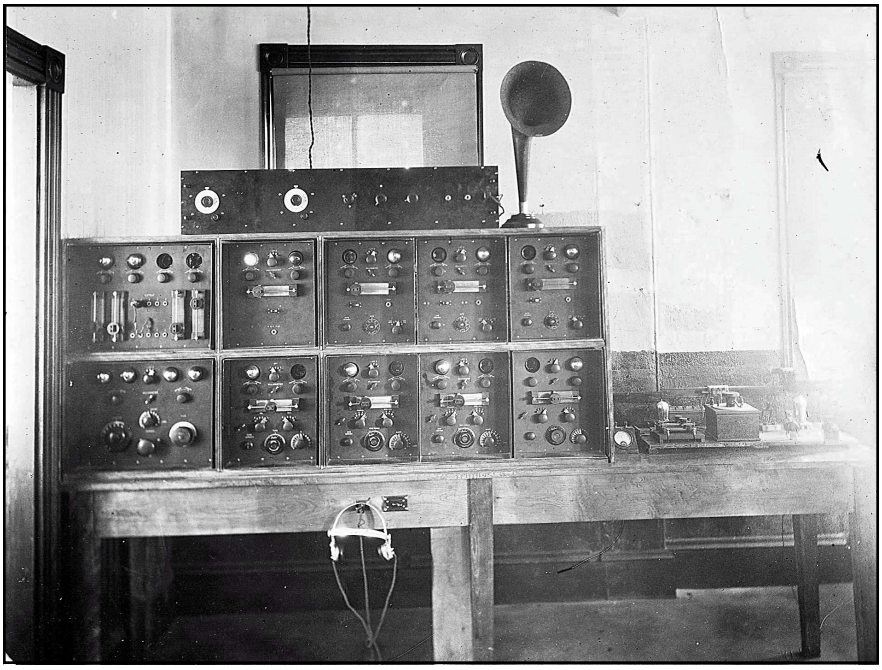
Telegraph operators receive messages in the landlines room at the Louisbourg transatlantic receiving station.

The new receiving stations at Louisbourg, Nova Scotia and Letterfrack, Ireland were opened in 1913. Marconi Towers transmitted to Letterfrack on a wavelength of 8000 metres (37.5 kilohertz), and Clifden transmitted to Louisbourg on a wavelength of 5500 metres (54.5 kilohertz). This simultaneous two-way transatlantic link was called a "duplex" system, and the former one-way link a "simplex" system; terms borrowed from landline telegraphy. Interference from the local transmitter was further reduced by receiving its signal on a separate aerial and using that to cancel out the local signal received on the main receiving aerial. At Louisbourg the main aerial was a wire one kilometer long, supported by six steel towers about 300 feet high.

The first receivers employed crystal detectors like the popular "crystal sets" that were used to listen to early radio broadcasts. Although the signal amplifying "triode" vacuum tube had been invented by Lee DeForest in 1906, its development was slow. Audio amplification of the signal from the detector was achieved by an ingenious electromechanical device called a "Brown Relay". It worked on a principle analogous to feeding the signal to an earphone that was coupled to a carbon microphone via a common diaphragm. Up to three Brown relays could be cascaded, making the audio signal strong enough to be recorded on "Dictaphone" style wax cylinders. Outgoing messages were punched on paper tape that was automatically converted to high speed Morse code by a "Wheatstone Transmitter" to make optimum use of the transatlantic wireless link. At the receiving station the recorded messages were later played back slowly enough to allow a receiving operator to write them down or type them.

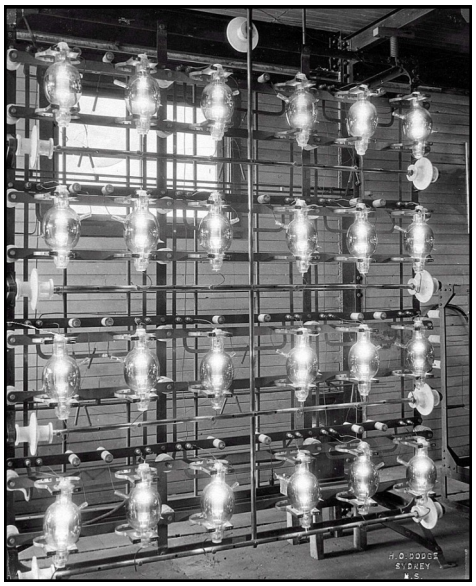
The Louisbourg station became the North American communications centre of the transatlantic service. Here operators relayed wireless messages received from Clifden to North American telegraph networks, and relayed messages from the telegraph networks to Marconi Towers by landline for wireless transmission to Letterfrack. A former worker at the station wrote: "It was in fact, a small central telegraph office in the wilds, utilizing the latest innovations in radio and landline telegraphy".

After World War l, vacuum tube receivers replaced crystal detectors, and professional style rack mounting replaced the casual layout of receiver components on benches



By the end of World War l (1914-1918), the triode vacuum tube had become a popular device. Vacuum tubes made receivers thousands of times more sensitive, so that transatlantic receiving antennas no longer had to be giants. Vacuum tubes in transmitters replaced the crashing spark, and silently generated continuous radio waves. The building-size condenser that powered the spark was no longer needed, and the Marconi Towers transmitter building was shortened from about 160 feet to its present length of about 60 feet, perhaps to reduce taxes.

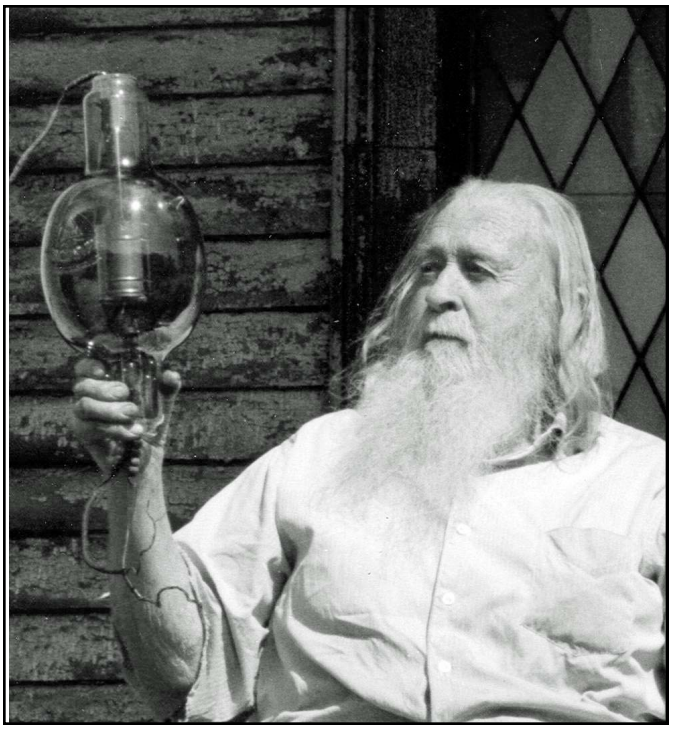
Just as the long wavelength transatlantic service was reaching its peak performance, a new discovery made it obsolete. Amateur radio operators with their low powered transmitters had been reporting occasional long distance transmissions at short wavelengths, in what is now called the high frequency (HF) band. As the professionals investigated, they found that short wave was much more efficient than long wave for several reasons. The antennas were much more efficient at high frequencies, they could be made directional, further increasing their effectiveness, and the level of natural interference ("static") was much lower. This discovery prompted a rapid changeover from long wave to short wave for commercial wireless communications, and plans for long wave stations of tremendous power and size were abandoned. Construction of an RCA long wave super station at Rocky Point, Long Island was halted, and Marconi's proposal for a British Empire network of giant long wave stations was changed to short wave.



The Marconi Towers transmitter switched from spark to vacuum tubes after World War l. The triodes shown in this photo generated a continuous wave radio signal. Racks of similar looking rectifier tubes provided the direct current power for the transmitter

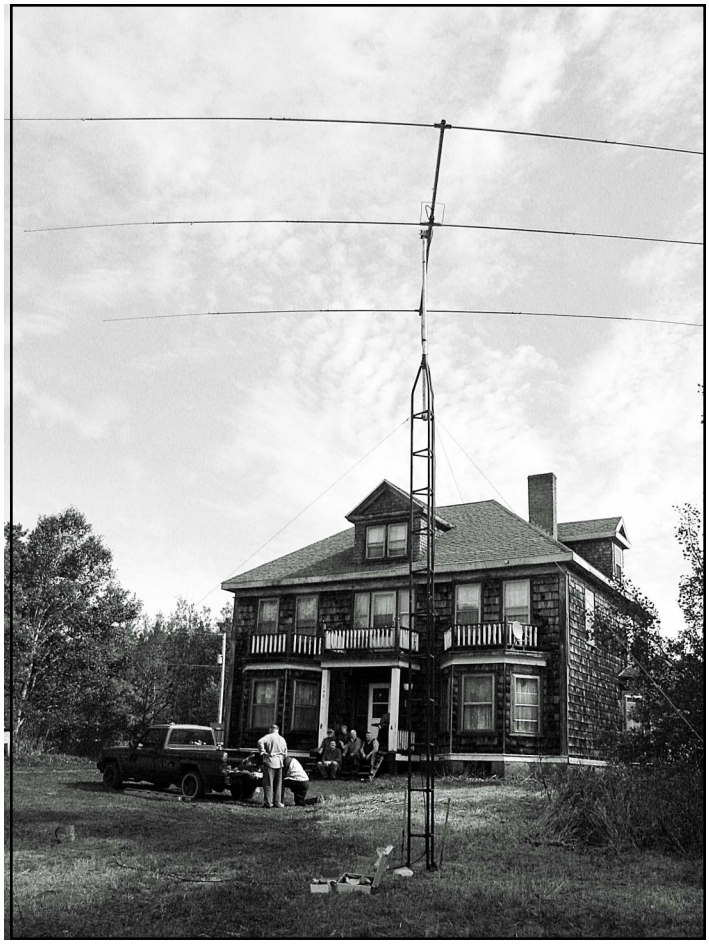
The first link of the British Empire short wave "beam" system was opened between London, England and Montreal, Canada in 1926. The Louisbourg receiving station was closed, and the Marconi Towers station was relegated to other purposes until it too was closed at the end of World war ll in 1945. The Louisbourg station site is now in the Fortress of Louisbourg National Historic Site operated by Parks Canada. An exhibit at Signal Hill in St. John's, Newfoundland tells the story of receiving the first transatlantic wireless signals there. The location of the Table Head station is now the Marconi National Historic Site, and contains an interpretive centre operated by Parks Canada. The Marconi Towers station site was purchased in 1946 by Russell Cunningham, a local citizen, and most of the site still belongs to the Cunningham family.

Russell Cunningham, who purchased the Marconi Towers property in 1946, examines a tube from the transmitter.



The Sydney Amateur Radio Club sends and receives commemorative transatlantic messages on October 17, 2007 inside a tent on the lawn of the Cunningham home (former Marconi residence).

. The Yagi antenna used by the Sydney Amateur Radio Club at Marconi Towers for the exchange of commemorative messages between heads of state in Canada and Ireland on October 17, 2007, one hundred years after the opening of the transatlantic wireless service. The house is the Cunningham home and former residence of Marconi and subsequent station managers. The original station was in the fields and woods behind the house. The fact that such a compact setup could do in 2007 what a huge station did in 1907 is due mainly to the use of short wavelengths and receivers that greatly amplify the received signal.



Useful Out Of Print References:

Wireless Over Thirty Years, or Marconi And His Wireless, by R. N. Vyvyan
A History Of The Marconi Company, by W. J. Baker
Whisper In The Air; Marconi The Canada Years, by Mary K. MacLeod

Biographical Notes on Henry M. Bradford

I became interested in radio in high school in Nova Scotia in the 1940's when I received an old Atwater Kent radio to tinker with. My interest in radio theory led to studying physics in university, culminating with a PhD thesis on solar radio bursts. This research brought together my interests in radio waves, receivers, and antennas. I taught physics and mathematics at the Canadian Coast Guard College in Sydney, Nova Scotia, just a few miles from the site of the Marconi Towers station in Glace Bay that is featured in this article. I was fortunate to meet the owner of that property, Russell Cunningham, before he passed away. He lived in the house that once was Marconi's residence, and raised his family there. Most of the site still belongs to the Cunningham family.

Although little remains of the station, there are many excellent photographs of it, and over the years I have enjoyed trying to figure out what went on at the station and how it all worked. I belong to a small group called the Cape Breton Wireless Heritage Society. We naturally would like to see the site preserved, perhaps as a museum commemorating the first regular transatlantic wireless service and the days when transmitters were electromechanical and long wave was king. See http://www.cbwireless.ednet.ns.ca .

PRESIDENT'S MESSAGE

The Long Island Radio and Television Historical Society continues to move ahead in its mission of bringing the history of Long Island Radio and Television to Long Islanders. We continue to exhibit in Riverhead at the LI Children's Science Museum. We completed a successful stay at the Islip Art's Center at Brookwood Hall, and we just enjoyed a great program, The Major Armstrong Story, as presented by Richard Brewster, along with a Documentary from the Antique Wireless Association at the Sayville Library. There we greeted new people. We hope to visit other libraries in the future.

Another very positive event was the donation of a BEN radio, manufactured in Freeport, on the south shore of Long Island, by Warren Greene in honor of his grandaughter, Gabrielle. This a truly super radio, and we are delighted to be able to exhibit it when we find our home.

As time has raced past us, we are moving Radio/TV Day to April 2013. This is a great event with wonderful workshops, speakers, performers and exhibits. It covers all aspects of Long Island radio. It's fun. Join us and participate in this event. Meet the people who are making radio and TV what it is today.

Connie Currie, President LIRTVHS

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LONG ISLAND RADIO & TELEVISION HISTORICAL SOCIETY
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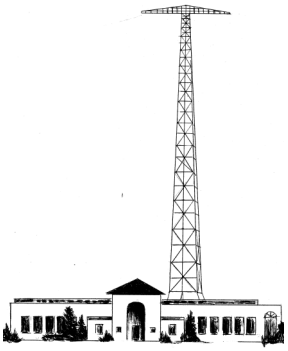

To: