WHISPER IN THE AIR

MARCONI

THE CANADA YEARS, 1902-1946

By Mary K. MacLeod

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Dedication

To Allison and Melanie

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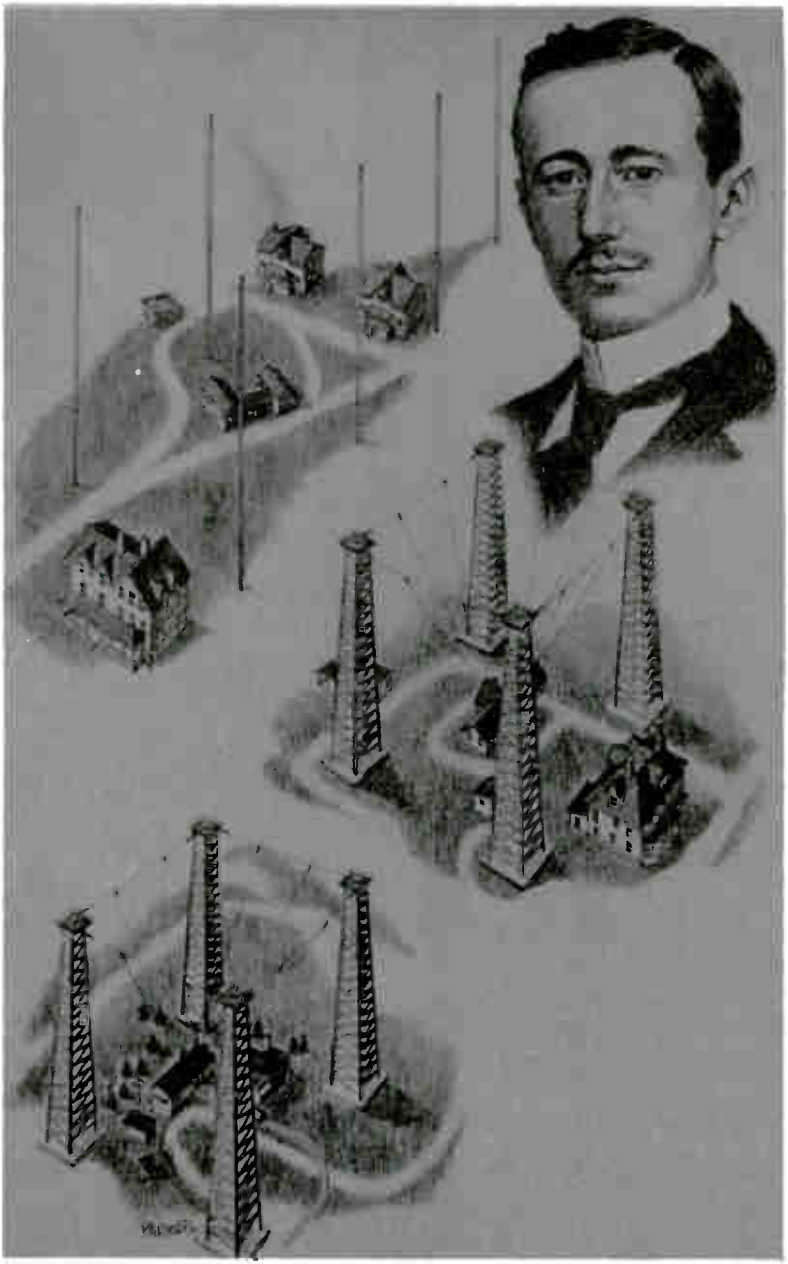


The historical artist Lewis Parker's conception of Marconi and the three Cape Breton stations. Beaton Institute photo.

Introduction

In 1902 Guglielmo Marconi astounded the world with a wireless telegraph system that transmitted signals and messages between Europe and North America. Later, Marconi was to develop an international wireless system and a network of companies that would transform the state of world communications. The use of radio waves and antennas to carry signals through space is known today as "radio," but the systems in use in the early twentieth century were referred to as "wireless telegraphy."

Marconi's fascination with radio waves began when he was a young adult living with his parents on the family estate in Bologna, Italy. After reading that these waves were generated by electric spark and could be identified metres away by simple detectors, Marconi wondered if they could be used to transmit signals through space across long distances. He began experimenting and soon devised an apparatus that transmitted and received signals over several kilometres.

Marconi was convinced that his apparatus was of major importance, but it required more funds for development than his family could afford. He was unable to convince the Italian government of the significance of his apparatus, so he turned

to his mother's Anglo-Irish family, the Jamesons of Irish whiskey fame and wealth. They agreed to help and suggested that he come to Great Britain, the world's foremost maritime nation.

In England the Jamesons helped Marconi to patent his apparatus and establish the first of his companies. Because overland communication was already serviced by the telegraph and telephone, Marconi aimed his invention at marine communications, specifically at service to shipping. Despite many successful demonstrations, orders were slow and criticism plentiful. Nevertheless, Marconi persevered and within three years was operating a small number of coastal stations in Britain and had equipped a few commercial vessels with his device.

While the young company was struggling to maintain solvency and attract new orders, Marconi announced his intention to link the continents of Europe and North America with his apparatus. This linkage would be the first step in his dream to unite the British Empire and then the world via wireless telegraphy. Poldhu, England, would serve as the European terminus, and Cape Breton would house the North American station.

Cape Breton was not Marconi's first choice as the location for the western terminus of his transatlantic service. Newfoundland and Cape Cod were earlier preferences but circumstances dictated otherwise. A combination of factors — finances, geography and politics — caused Marconi to select Cape Breton as the location for his North American station. Cape Breton was close enough to Poldhu and free of any major interference from landfall to make it an ideal setting for the station. Cape Breton businessmen and all three levels of government presented a package of incentives favourable to the station's location. For example, George Murray, the premier of Nova Scotia and a Cape Bretoner, gave Marconi a provincial monopoly on wireless telegraphy.

Three Cape Breton stations served as terminuses for

transmission and reception signals. The first station was located at Table Head, Glace Bay, on the eastern tip of Cape Breton Island. In 1902 this station, in conjunction with Poldhu, established the world's first radio link between Europe and North America. In 1904 the Table Head station was dismantled and relocated a few miles outside the town of Glace Bay to an area now known as Marconi Towers. In 1907 it linked with Clifden, Ireland, to establish the world's first commercial service. In 1919, Louisbourg, the third Cape Breton station, linked with Letterfrack, Ireland, to receive the first voice transmission from across the Atlantic.

The historic nature of the stations declined with the onset of war and the development of new technologies in the post war years. The development of the short wave, or beam, technology in 1926 ended the international significance of the stations, for with this development long-distance communications transferred westward closer to company headquarters in Montreal and the Cape Breton station was closed to transatlantic traffic. The stations were relegated to coastal operations that serviced marine interests with a considerable reduction in revenue.

In 1927 the Louisbourg station was ordered closed, but before this could happen it was destroyed by fire. The Glace Bay station continued to service fishing and shipping traffic until World War II, when it once again serviced the Canadian government. The onset of war prolonged but did not secure the station's survival. In 1946 the station was closed and the property was sold to a private citizen. Thus ended an historic period in Canadian and world communications.

Marconi with the Black Box's transmitter which he invented in 1895 at the age of 22. Beaton Institute photo.

1
Marconi the Man

For generations, Cape Bretoners of Celtic and Acadian origins have asked strangers and visitors to Cape Breton's shores three questions: Where are you from? What's your father's name? and Who was your mother? During his many visits to Cape Breton, Marconi must have heard these questions, and because of his mother and first wife's Irish lineage, he must have understood the need for the question and the need to respond, for the asking and the answer places questioner and respondent in the same global or human context that identifies a rootedness to place, family and home.

All three — place, family and home — were important to Marconi and his success. Family was especially important because it was his mother's relatives who secured the financial resources that enabled Marconi to patent his inventions and to develop the electronic and radio companies that eventually led to his name becoming synonymous with radio.

Guglielmo Marconi was born in 1874 to Annie Jameson and Giuseppe Marconi, wealthy owners of a vineyard near the medieval city of Bologna in the north of Italy.[1] They had married against the wishes of her parents, who believed the cultural, age and experiential divide of the couple was too great

Marconi, seated in centre, with his mother, father and brother in the park at Villa Grifone.

to ensure a contented and happy marriage. At the time of their marriage, Giuseppe, a dry, quick-witted, charming, hardworking and proud man, was seventeen years older than Annie, a widower and the father of a child, Luigi. When Annie, a beautiful woman with auburn hair, fair skin and an Irish lilt to her voice, first met Giuseppe she was studying bel canto, a consolation prize from her parents, who had forbade her to accept a singing engagement at Covent Garden Opera House. Such a career for a woman of her social standing was not considered respectable. Annie had met Giuseppe through his deceased wife's parents, the de Renolis, with whom Annie was staying because of their friendship with the Jameson family. Annie's father, Andrew Jameson, and his brothers had made money in the whisky trade, through which they had come in contact with the banking family, the de Renolis. The Jamesons had migrated from Scotland to County Wexford, where they established the famous Dublin brewery which produced the equally famous Jameson's Irish Whisky. Andrew's family lived amidst great wealth and comfort, residing in Daphne Castle, Enniscorthy, which had both park and moat.

While Annie's father was busy building his brewing empire, Giuseppe and his father were establishing their vineyard. They were formerly landed gentry, living without opulence in the mountain country of Italy. Through hard work and determination, Giuseppe and his father bought and built their own estate, Villa Grifone, eleven miles outside of Bologna, which in time allowed them to live in affluence and wealth. Villa Grifone did not suffer by comparison to Daphne Castle.

Villa Grifone was ancient and beautiful — a large, plain and nobly proportioned, square, four-storied, green-shuttered white stone building with large rooms, wide halls, stone stairs and stone floors. This lovely house, shaded with lemon trees and a chestnut tree-lined roadway, was situated among rolling fertile fields and vineyards at the base of several mountains.

It was to Villa Grifone that Annie and Giuseppe returned to live after their elopement when Annie became of age in 1864.

Here they raised Luigi, Guglielmo and another son, Alfonso. The slight, fair-complexioned, blue-eyed and blonde-haired Guglielmo inherited most of his physical traits from his mother, who was also undoubtedly the dominant influence in his life. From her he also inherited his love of poetry and music, especially the piano and operatic tunes and scores. Because of his slender build and susceptibility to colds, he was considered delicate as a child, an opinion his mother carried with her throughout her life, continually advising him to dress warmly and to eat properly when in later life he was living in the cold and damp climates of Cornwall, Ireland, and Cape Breton. Even after he became a married man, she packed his bags to include blankets, cloth caps with ear flaps, and fur-lined coats.

At his mother's insistence, Guglielmo grew up fluent and literate in Italian and English, speaking English without a trace of Italian accent. A devout Anglican whose husband had no objection to the children being raised in that faith, even though they had been baptized Roman Catholics, Annie brought her offspring to English-speaking Anglican services and read to them from the King James Bible. The family vacationed annually among the English colony at Leghorn, a seaport and naval base on the west coast of Italy. Here the Marconi family was in daily contact with one of Annie's sisters and her family. It was the ideal environment in which to practice a second language.

Although facile in languages and music, Marconi was no scholar. Indeed, he hated school, probably because of his mother's over-protectiveness. He had been privately tutored at home by his mother and Professor Bologni, who taught him Italian, until the age of twelve, when he entered the Instituto Cavallero in Florence. There the shy and solitary Guglielmo had difficulty in adjusting to the demands of teachers and students, especially because he had been living in an environment where there were no boys his own age with whom he could become friends. School life was not made any easier by his mother's insistence on waiting outside the school for

him. Fortunately, Guglielmo had to spend only one year at that Institute. The next year he was enrolled at the Technical Institute in Leghorn, where his family was spending the winter. At Leghorn he met new male and female friends who continued to remain a part of his well-travelled life.

At Leghorn he learned telegraphy skills and the Morse Code from Nello Marchetti, an elderly telegraphist who was going blind.[2] In gratitude for Marconi reading aloud to him, Marchetti taught him the code. Several years later on the windswept coast of Newfoundland, Guglielmo Marconi would receive a Morse Code signal from England, thus beginning the age of transatlantic wireless, the precursor to voice radio. Little did this kindly old gentleman know of the future use to which Marconi would put his teachings.

Marconi did well at the Technical Institute, where he enjoyed the physics and electrophysics courses, but he was not student enough to gain entrance to either the naval academy or to matriculate at the University of Bologna, much to the displeasure of his father, who feared Marconi was turning into a dilettante. Guglielmo certainly gave the impression that he was. From the earliest age he loved gadgets and machines and

Villa Grifone, the family home, with Marconi's burial site in foreground.

equally loved taking them apart and putting them back together. He also loved to build things, and when only thirteen, true to his heritage, built a still in the back woods of the family estate. But most of all he was fascinated by electricity, referring to it as "my electricity." At the age of ten, he often could be found emulating some electrical mechanism he had read about. Even during this youthful period he exhibited intense, almost fanatical concentration.

His mother was perfectly content to "let him be," but his father became impatient and exasperated with the young, solitary dreamer. As Guglielmo grew older and more interested in electricity and scientific experimentation, the father grew more intolerant, believing Guglielmo was wasting his youth. Giuseppe saw the scientific experiments with electricity as extravagant, and after one incident when Guglielmo smashed a good set of dinner plates by shooting an electric current through them, Giuseppe took every opportunity to destroy his son's mechanical devices. From this point on, Guglielmo's experimentation had to be hidden from his father, and his mother aided the boy in this.

But the father did not give up on the son. When Guglielmo showed signs of socializing, of enjoying the cultural and social life of Leghorn, Giuseppe encouraged him. Giuseppe bought Marconi a sailboat and paid for his lessons in music, which the young man learned to read and transpose at sight. These two pursuits were to become loves of Guglielmo's life. He loved the sea and was fascinated by the challenge it presented to seamen, and he was also grieved by the toll it took upon their lives. On more than one occasion in his adult life he declared his hopes and intentions that wireless telegraphy would minimize the tragedies at sea. As an adult he seemed never happier than when aboard ship and clearly relished those weeks and months, which mounted into years, if counted, when he sailed the seas, testing his wireless apparatus.

The piano was one of his chief forms of relaxation. Whether in a salon of London or a house on Cape Breton Island, Marconi liked nothing better than a sing song around

the piano, with him leading in the singing of his favourite operatic tunes. Giuseppe was resolute in the years immediately after the plate-breaking incident, but in 1894, after much pleading from Annie, he allowed Guglielmo to use the top floor of the house as he pleased. The young man immediately converted it into a laboratory. By now Guglielmo had become fascinated with the concept of Hertzian, or electromagnetic, waves, wondering if the waves could be used to transmit signals through space and across long distances. He began experimenting, and one night in 1894 he awakened his mother to come and witness his accomplishment — he had succeeded in sending a signal through the air without wires that caused a bell to ring.

The achievement encouraged Giuseppe to believe in his son's scientific experimentation and the father now gave Guglielmo the money he needed to carry out more demonstrations. Marconi soon devised an apparatus which transmitted and received signals over several kilometres. Delighted with his results and convinced of their importance to world communications, Marconi appealed to the Italian government for assistance but his plea was rejected. His near total dejection at the news caused his mother to turn to her family for help.

Within four years of establishing the Wireless Telegraph and Signal Company, in England, Marconi shocked his board of directors with the announcement of his intention to span the Atlantic Ocean with his apparatus. His unspoken dream had always been to span the Atlantic and then the British Empire with his apparatus, but he was fearful that competitors would beat him to it. Thus the completely unexpected announcement in 1901.

Many obstacles had to be overcome before Marconi's dream could be achieved, especially the location of his North American terminus. When his first two choices, Newfoundland and Cape Cod, were eliminated, Marconi selected Cape Breton as his site. His new and financially weak company would have to struggle heroically to raise the huge

sums necessary to re-equip the European terminus at Poldhu and build the Cape Breton station. It was a task he and the company were up for — and so was Cape Breton.

Marconi was twenty-seven years old when he first visited Cape Breton in 1901, and he last came in 1923. In the intervening years, his practical application of the principles of wireless telegraphy brought him great wealth, the status of an international celebrity, the Nobel Prize for Physics in 1909, and many other awards. By the time of his death at the age of sixty-three in 1937, his name was a household word in most countries of the industrialized world.

His rise to fame was not without difficulties and frustrations. The years 1901-08 were particularly trying, the most hectic and the most demanding. During this period he was a one-man enterprise, the driving force behind a worldwide network of companies established to produce and market his apparatus. Eventually this network, which included the Canadian Marconi Company, developed into one of the world's great electronic corporations. In the early years Marconi determined company policy, picked his staff and relentlessly pursued his vision.

During the years of the transatlantic venture, Marconi developed the lifestyle of a long-distance commuter, travelling regularly by ship across the Atlantic. Whatever ship he called home was turned into a floating laboratory, equipped with a myriad of apparatus which allowed him to maintain contact and conduct experiments with the long-distance shore stations located on both sides of the Atlantic.

To keep abreast of developments at each station, Marconi relied heavily upon detailed weekly reports which described various aspects of station operations, such as the working conditions of the boilers and the aerials, the recording and reproduction quality of the dictaphones, the quality and quantity of the water supply, daily accounts of interruptions to signals, and charts which diagrammed the readability of signals.

Through telegraph, cable and letter correspondence with

his station managers and other company personnel, innumerable problems and possible solutions were discussed: delays incurred when the wrong size nails arrived at a station; shipping arrangements for timber and the price the company could afford to pay for the land; personality clashes amongst his staff; the impact of the harsh Canadian winters upon his equipment; demands from his personnel for regular meals and clean linen at Marconi Towers.

Conditions in the transatlantic stations were far from idyllic because of a combination of factors, but primarily as a result of the pressure to succeed, the close proximity in which staff lived and the remoteness of the locales. All stations were far from urban centres and situated on coastlines susceptible to winter storms and gale force winds. The weather was always a worrying factor, and one which often cost the company huge sums of money and much inconvenience. Both the Cape Cod and Poldhu aerials were smashed by severe storms and bad weather often interfered with the clarity of transmissions.

In Cape Breton the dampness and snow could be contended with, but the silver thaw was a continual source of apprehension, as the huge and vulnerable aerials had to be guarded against the possibility of being brought down in a tangled mass and buried deep in the snow. On several occasions, despite preventative steps to secure the aerials, they crashed to earth under the weight of the ice, interrupting service and costing the company valuable time and money. Sometimes the aerials collapsed at the most critical times, as if to test the patience and endurance of all, especially Marconi. He was particularly frustrated when the Louisbourg aerial gave way immediately after construction in 1913.

Life was not easy at the transatlantic stations and staff conflicts arose periodically. On occasion, the staff complained directly to Marconi. In 1901 the Poldhu staff was outraged over R.N. Vyvyan's appointment as engineer in charge of the North American terminus at Cape Cod. Dr. C.S. Franklin and F. Flood Page were particularly enraged. Page, a company director, wrote to Marconi:

> I think that Vyvyan is capable of carrying out what we desire, but it is clear to us that unless he is made to understand that his position is not one of authority, but one of subordination, one in which he is bound to carry out instructions, and not to express his views but to do what he is told, I am afraid we shall arrive at some disaster.[3]

Vyvyan's independent ways, such as smoking in non-smoking areas, annoyed senior staff members. Marconi, whose judgement was sound in the selection and placement of personnel, overlooked these objections and retained Vyvyan in the appointed capacity. Vyvyan was one of Marconi's most astute choices. He was invaluable, especially in the early years when he supervised the construction and management of the Cape Breton stations. Vyvyan was appointed managing engineer of the Canadian Company and in 1908 made the superintendent engineer of the Marconi Company, with worldwide responsibilities.

Before this latter appointment, Vyvyan was criticized by L.R. Johnstone, the senior wireless operator at Marconi Towers, who wrote Marconi: "We could all receive a little better treatment at the hands of your chief engineer-in-charge."[4] Johnstone was particularly upset by Vyvyan's insinuations that his work was sloppy and not up to mark. Johnstone's grievance against Vyvyan was included in a long memorandum wherein he addressed a number of issues that were contributing to a degeneration in domestic standards and morale at Marconi Towers. The operators coming on shift at 4 a.m. often had to work through without food because the kitchen had been locked up. The meals were served and cooked in a sloppy way and often were not fit to eat. The odour from the kitchen was "something unbearable." Only one small face towel was allowed the operators during the whole week and it had taken seven months to secure a water jug for the operators. Johnstone concluded the memorandum with his resignation.

Marconi replied in a hand written memo:

> I am sorry to learn from your letter that things have become so uncomfortable for you at Glace Bay and regret you are going to leave long distance work for the present. It is needless for me to say how I thoroughly appreciated your zeal and ability last winter in overcoming the difficulties encountered at the commencement of the trans-Atlantic wireless work.
>
> I hope you will have a better time at the smaller stations, and that when we have put in the new machinery at Glace Bay you will come there again to assist me in establishing a thoroughly efficient service.[5]

Johnstone left the transatlantic stations to work at smaller coastal stations, but after a few years he took a posting at Louisbourg.

Marconi also had to deal with the bureaucracy that developed as his company grew. Sometimes the needs of the company conflicted with his personal preferences. The need for security clashed with Marconi's liking for people and his wish to have them about. The contracts negotiated with the British government, especially the Admiralty, demanded security. Security was also essential because he was in a race with others to establish his venture on a commercial basis. Any leaks could have been financially damaging. But Marconi at times put all this aside and invited anyone he liked and thought trustworthy to the stations.

When he visited Mrs. Vyvyan at St. Joseph's Hospital, Glace Bay, he took a fancy to the matron and invited her to the station. Such incidents caused H. Cuthbart-Hall, managing director of Marconi's English company, to write him:

> I shall be much obliged if you will take what I am now saying into your most serious consideration — not only with regard to Poldhu, but with regard to other long distance stations — for certainly you have been the principal sinner in admitting people to Poldhu.[6]

In the eyes of the security-conscious officials, such visitations counteracted their efforts to secure the physical presence of the stations, which were enclosed with high barbed-wire fencing.

A few months earlier, in July, concerns over security reached a critical point with the visit of the Prince and Princess of Wales to the Poldhu station. An exasperated Cuthbart-Hall pleaded with Marconi to issue the most rigid instructions to staff regarding their replies to questions concerning transmissions between Cape Breton and Poldhu. Technical press was not to be admitted inside the station and all others were to produce their identity cards to ensure that no one with technical knowledge could pose as a reporter and gain admission.

Cuthbart-Hall also became impatient with Marconi for his failure to put instructions through the proper channels:

> I should be much obliged, when you want anything, if you will send a requisition to the company, with some such endorsement, if necessary, as to the person to whom you may have given verbal orders.[7]

He was particularly worried about Marconi giving verbal instructions to staff to save time, and the staff in turn not putting the requisition through the proper channels. Once in the improper channel it was "sometimes difficult to get out again, or at any rate, to arrive at a clean sheet."[8] Sometimes this cost the company money, as when the company had to pay a five-year royalty on blue printing apparatus because the inquiry went through the wrong channel.

Although Marconi was often impatient with the demands of the bureaucratic structure, he realized that without it his enterprise could never take form. It was a price paid for success and growth.

One of the major reasons for the growth was Marconi's ability to select the right people for positions of authority within his company. He chose competent and highly qualified people who complemented himself. He gathered a close group of associates who worked long hours inventing, designing,

altering and improving equipment. They travelled a well-worn path among the stations in Poldhu, Clifden and Cape Breton. As greater success was achieved, the paths reached out across the continents of Europe and Latin America and to South Africa. These pioneers — J. Fleming, C.S.Franklin, W.Entwistle, P. Paget, S. Kemp and R. Vyvyan — were men eminent in their chosen fields. They advanced the technologies of their crafts and raised the science of electrical engineering to heights previously unknown and otherwise perhaps undreamt of.

Marconi was proud of his staff and recognized their contributions. In 1902 he told his London board of directors about the excellent services rendered by the staff at the Cape Breton and Poldhu stations during the successful transatlantic transmission. The board then sent a memorandum to the staff, thanking them for the manner in which they had assisted Marconi.[9]

With Marconi here are Kemp, on his right, and Paget, who were the inventor's colleagues throughout his career.

This generosity, perhaps more than any other factor, accounted for the loyalty extended to Marconi by his colleagues and workers. Most of the personnel who joined his company in the early years remained with him throughout their careers. Marconi's magnanimity was extended to those other inventors and scientists whose genius had allowed him to design, develop and advance his apparatus. He never claimed to have invented radio, only to have devised a practical use for it. In an address to the American Institute of Electrical Engineers in 1902, he declared that he had "built very largely on the work of others"[10] and gave a particular mention to Clark Maxwell, Lord Kelvin, Professor Henry, Professor Hertz and Professor Alexander Graham Bell. Bell's instrument, the telephone, had been used to receive the very first signal that flashed across the Atlantic from Poldhu to St. John's in 1901. Many years later Marconi's daughter wrote:

> All his life Marconi's work was to be a fine balance between theory and practicality. He succeeded in translating his aim and other men's concepts into workable terms, building prototype machines himself if none existed that would serve his purpose.[11]

Despite his accomplishments, and eventual wealth, Marconi, especially in the early years of his scientific achievements, remained accessible to the press and affable to his colleagues and workers. Unlike other scientists of the period (and now), Marconi did not surround himself with either an entourage or spokesman. He remained his own man, always being his own best advocate. He was neither reclusive nor morose, although he did tend to be a bit shy. He seemed to enjoy the company of others, especially women. He was often featured in the social columns of local and international newspapers and journals, and was a great favourite of *Vanity Fair*. He seemed happiest when conducting experiments and testing theories, in his own company or with others who understood what he was about. During these early years there seemed to be few, if any indications of him slipping into a

reclusive "world of his own," which did happen in the later years of his life.

Marconi's willingness to share in the rough life and work of the transatlantic stations, and his ability to operate any machine or instrument just as well as its inventor, attracted the admiration of his workers. So too did his manner. Although a prominent figure in high society, he never flaunted his fame to the less famous. He was courteous, polite and considerate, a young man seemingly well liked by all who met him.

> He is frank and open, believing that straight forward dealing is best for himself and best for the cause at heart; he appears to take the world in his confidence, but of course at the same time, he knows there are times when it is best not to speak.[12]

He lacked affectations and mannerisms:

> In response his face is thoughtful, grave and kind. In conversation his greyish-blue eyes brighten up wonderfully, and his smile is cordial and unaffected. His face and manner would become a judge. There is an expression of candour and fairness about the man that indicates he is just; while his smile betokens a great patience and forbearance with the failings of others.[13]

Since his early youth his blonde hair had darkened and his face had matured with lines of strength, suffering and self-restraint. By the time of his thirty-second birthday, his face conveyed an age far beyond his years.

Although there are assuredly some today, in an age that seems at times to be dominated by cynicism, who would declare this portrait of Marconi to be romantic and unrealistic, comments in other press reports do not contradict the picture, and neither do stories from his former colleagues and workers. Their comments unfailingly testify to the friendly, considerate and unassuming manner of the man. Former workers at Cape Breton state that one would never have guessed his position by his casual dress and easy ways. They note that though usually

preoccupied, he mixed well with the men and often worked through shifts with the telegraph operators. The shifts were long, with one beginning at 4 a.m. and ending at midnight. Before its commencement, Marconi would join the men in their traditional lunch — coffee, eggs, bacon, toast or whatever was available.

Alexander Dooley, who was a schoolboy in 1905 earned pocket money by carrying lunches to the engineers in the wireless station, said of Marconi:

> To see him around at Glace Bay on his visits in 1905 and 1908, you'd think he was a regular labourer; he wore a slouch hat, a fisherman's sweater, and boots like a lumber jack's with the trousers tucked in.[14]

When Dooley became a little older, Marconi gave him a job in the station's machine shop. William Appleton, also a machinist at Glace Bay, recalled that during the rebuilding in 1909-10, Marconi worked side by side with the men, doing messy and dangerous tasks such as pouring hundreds of gallons of acid into the many large batteries required to operate the new equipment.[15] Dooley also remembered an incident when Marconi laughed hysterically at seeing a worker's trousers disappear from acid burns before his eyes. Appleton also commented upon Marconi's humour, noting that both his mirth and enthusiasm kept the men going during that long and arduous winter and spring leading up to the successful reopening at Glace Bay. But Marconi was no angel. According to Appleton, Marconi swore as well as any construction worker, albeit in Italian.

Marconi's eldest daughter, Degna, described his temperament as mercurial, flashing from delight to despair:

> His despair came either from the complications of this life, social or commercial, or from failures in his work; the delight from business and scientific successes and from the long hours when he probed the mysteries of universal space.[16]

She also noted other, less pleasant characteristics which surfaced as he grew older. He became more intolerant of those around him, demonstrating a surprising "thoughtlessness towards many who loved him."[17] He also became harsh and uncontrollably angry when things did not go his way. But these traits did not seem to predominate his early years, and most of his colleagues, friends and employees usually speak of his graciousness and kindness in both adverse and amicable situations.

Marconi's popularity with his men was matched by his popularity with the Sydney "social set." His charm and fame placed him at the top of guest lists and he was not negligent in his response. He attended many soirees and social functions, was a member of the Sydney Yacht Club and contributed to the Sebastian Cabot Society, and his eye for a pretty girl did not go unnoticed. Both local and international newspapers were continually matching him up with members of the Cape Breton "scene." Local papers — the *Sydney Record*, the *Daily Post* and the *Halifax Herald* — reported upon an alleged romance between Marconi and Miss Nine MacGillivary of Sydney. Their "engagement" was headline news despite the denials and protestations of both parties. Reporters even followed Miss MacGillivary to Dorchester, Massachusetts, in pursuit of their story.

Marconi's engineers and ship's company were no less popular. While docked in Sydney, the *Carlo Alberto* was a beehive of social activity. On one occasioin, 150 of the Island's most distinguished socialites attended a dinner and dance. At this and other occasions, Marconi danced, sang, and played on the piano his favourite operettas and popular North American tunes.

Marconi's socializing in Cape Breton seemed to end rather abruptly after his marriage to the twenty-year-old Beatrice O'Brien, eleven years his junior. Although Beatrice, the daughter of the thirteenth Baron Inchiquin of County Clare, Ireland, accompanied Marconi to Cape Breton on several occasions after this marriage, no mention is made in the

local press of their attendance at social functions. Though some excuse for this might be found in the amount of work Marconi had to undertake, the more likely reason was jealousy — a Marconi trait that seemed to surface after his marriage.

Almost from the very beginning of their marriage, Marconi sought to enclose his wife, confining her physical environment and restricting her contacts with other people, especially men. Solitary travels along the gravelled roads of Glace Bay and the newly broken pathways of Marconi Towers were as frowned upon as lone walks through the streets of London.[18] This was especially so after she got lost one day on her travels outside the station. She became disoriented while walking along the railroad track, and Marconi, beside himself with rage and fear, sent a party to find her.

Beatrice found life especially trying in Cape Breton. She was not part of a social set and was not permitted to mix freely with the staff and station personnel. While Marconi was usually content to spend most of his time conducting experiments, Beatrice had to be satisfied with her own company and that of Jane Vyvyan, the wife of the station manager. Only occasionally, "when important work was going forward," did Marconi allow his wife to be present as an observer during testing. Her misery was intensified because she did not have a house of her own, rather she had to share with the Vyvyans, and it took the two women a long and difficult time to resolve their roles and duties.[19]

By Cape Breton standards the house was large and gracious, but it was small in comparison to her houses in Ireland and London. At Inchiquin castle, two governesses, a tutor, and an assortment of domestic servants, maids, cooks and liveried servants were required to conduct the daily routine of the dimunitive kingdom. The daily regime included the trimming of the wicks of ninety lamps each morning. At Inchiquin Beatrice had been accustomed to great physical freedom. The estate encompassed not only the large castle but extensive grounds with orchards, stock and a dairy farm. At "Marconi House" as it was called, her freedom was severely

Marconi's first wife, Beatrice O'Brien.

restricted and her endurance sorely tested.

The eighteen-room, two-and-one-half-storied house in Cape Breton was Victorian with a gabled attic and a bay window on either side of the verandah. A solarium adjoined the left side of the house, and to the left of it was the tennis court. At the turn of the century, tennis was a very popular sport in Cape Breton as well as in its birthplace, England. White, graceful birches lent a note of beauty to the lawns located on either side of the straight front path where a geometrical flower garden was later graced by a magnificent waterfall. The house and the station complex, which together totalled twenty-two buildings, were located in the midst of deep woods and joined to the outside world by a branch line of the Dominion Coal Company — the Sydney and Louisbourg Railway, known in Cape Breton as the "old S and L." The station was self-sufficient with its own supply of water and electricity, even though neighbouring houses — the closest was one mile away — did without. The station also had its own livery stable and blacksmith, and eventually its own school. The complex was so independent and so self-contained that the need for visits to town were not many and were usually restricted to shopping and a "night out."

To alleviate Beatrice's loneliness, her sister Eileen and brother Harry sometimes accompanied the Marconis on their voyages to different parts of the world. On at least one very auspicious occasion they stayed for several weeks at the station. These were the nerve-wracking days when Marconi was driven to near despair in his attempt to establish a permanent commercial service.

While Beatrice suffered from the isolation and loneliness, Marconi seemed oblivious, content to spend his time with the men and machinery of the station. Yet even he needed to relax, and as the station was located in a rural setting, recreational activities revolved around the outdoor life. Walking, fishing and hunting were the main forms of relaxation for the Marconis and the staff at the station. Sometimes the Marconis would have as their guide the young Alexander Dooley, who

seemed to know every creek, nook and cranny in the vicinity. The fishing, according to Vyvyan, who loved to fish, was superlatively "good" and they did not have to travel far to catch it. Sand Lake, about one hundred yards from the station, contained plenty of brown trout, and there was a good trout brook running past the house where the Vyvyans and Marconis lived.

Even greater enjoyment was found at the Mira River, seventeen miles away, "where the sea trout came in vast quantities and running to large weights." Salmon, although not as plentiful, could also be caught there. The fisherman's paradise was:

> Tidal for about two miles, flowing between two steep and wooded banks, and only about 50 yards wide but very deep. Further up it widened out and from some of the sand banks in the wider water, when a fresh run of sea trout had just come up, very heavy baskets of fish could be caught.[21]

Vyvyan, who lived to fish, declared: "No more delightful holiday could be imagined than to camp out for two or three days in the early summer on the banks of this glorious but little known river."[22]

Unlike Beatrice, Vyvyan found life at the Cape Breton stations "on the whole quite pleasant," but there were more things for the men to do. Riding, tennis, canoeing, swimming and shooting were pursuits enjoyed by both men and women, but Marconi's daughter Degna maintains that though her parents fished and hunted, Marconi did not like either one, nor did he appreciate his wife's interest in them:

> Marconi had an un-English, un-American disinterest in fishing and shooting as ends in themselves, and Bea loved the bloodsports only for the fun of going along with the men. Her husband decided it was unsuitable, in Canada, for her to accompany them on outings.[23]

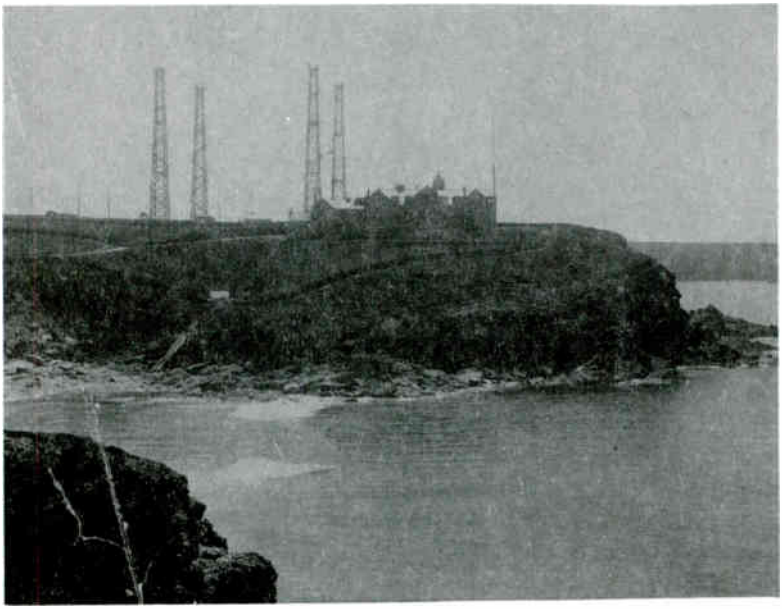
Everyone at the station, even Vyvyan, found the winters trying, especially when the country was covered with snow

several feet deep for months on end. Sleighing, skating and ice hockey helped to relieve the monotony of the long winter. The station entered an ice hockey team in the local league, and its progress was duly reported in the pages of the press. Evenings were spent indoors. While Marconi was in residence he would often provide the piano accompaniment to the household's singing.

Though it was a lifestyle quite foreign to Beatrice, others seem to have adjusted to it well. Everyone who has written anecdotes and memories of those days spent at the Cape Breton stations — Vyvyan, Dooley, Appleton, Woodward and even Johnstone — reflect fondly upon their days there. And whereas reporters from away could never quite grasp the beauties of the countryside, we know from Vyvyan that Marconi had a great sentimental attachment to the old Glace Bay station which burned to the ground in 1909. But we also know that Marconi never brought his second wife to live in Cape Breton.

After the successful installation and official opening of the receiving complex at Louisbourg in 1913, Marconi seldom visited Cape Breton. Although at least one source insists that he came here on several occasions, we have only one documented visit — his last, in 1922, when he took his yacht *Elettra* to Cape Breton to conduct tests regarding what he believed to be the reception of wireless waves from Mars. At the time Marconi denied the Mars story as reported in the Cape Breton press, but he admitted to its accuracy several years later. His excuse for the denial was the belief that people would think he had "gone mad" for entertaining such concepts.

From the time of his last known visit to Cape Breton until his death, Marconi remained mentally active, even though physically weakened by the persistent heart troubles that finally took his life on a summer day in 1937. The final years and days of his life were spent as he had lived his earlier ones, in pursuit of new lines of research which would turn a dream into reality — the practical application of microwaves, for which he believed there to be all manners of purpose!



Old Poldhu showing wooden towers and masts taken about 1907. Beaton Institute

2

The Early Days of Wireless Telegraphy

Ever since the Elizabethan age, when Gilbert first discovered the basic principle of electricity, scientists, engineers and backyard inventors have theorized and experimented with its practical applications. Experimentation reached its zenith in the nineteenth century when great innovations in communications technology were derived from electricity.

In 1822 G.S. Ohm established the mathematical relationship between voltage, current and resistance. In 1831 Michael Faraday discovered electromagnetic induction and laid the foundation for experimentation with many forms of induction telegraphy over a short distance. In 1837 two British inventors, Sir William Cooke and Sir Charles Wheatstone, patented the electric telegraph. Shortly thereafter, the American inventor Samuel Morse devised the signalling code that was subsequently adapted all over the world. In the next quarter century, the continents of the world were linked telegraphically by transoceanic cables, and the main political and commercial centres were brought into instantaneous communication. In 1876 Alexander Graham Bell invented the telephone, which substituted the human voice for Morse Code.

These inventors were joined in their electrical experiments by others, most notably the American scientist Thomas

Edison, Sir William Preece of the British post office, the Scottish mathematician and physicist James Clerk Maxwell and the German physicist Heinrich Hertz. Their theoretical work on the electromagnetic properties of light and other radiation produced astonishing experimental results. Soon scientists began to explore the possibilities of wireless telegraphy — the use of electromagnetic waves and antennas to convey signals through space. No one explored the possibilities with greater determination and dedication than Guglielmo Marconi.

Marconi's interest in wireless telegraphy began in 1894 at the age of twenty when he read a paper discussing the experiments of Heinrich Hertz, who had verified James Clerk Maxwell's theory that all changes in electric and magnetic fields cause electromagnetic waves in space. Out of this reading was born the idea to use the waves as a means of communication. Marconi believed it incredible that no one had thought of putting the idea into practice. "The idea was so real to me that I did not realize that to others the theory might appear quite fantastic."[1] Bursting with enthusiasm, Marconi began experimenting in a makeshift laboratory in a spare attic room at his family's country residence near Bologna. He seemed inadequately and hopelessly ill-qualified to conduct such experiments because he had neither post-secondary technical nor university qualifications. But he did have some training that coincided with his liking and aptitude for physics. The noted Italian physicist and neighbour, Professor Auguste Righi of the University of Bologna had been persuaded by Marconi's mother to act as his advisor and could obtain certain university privileges for Marconi, allowing him to borrow university library books. Righi was aghast at Marconi's presumption to tackle a project in the realm of trained scientists.

Throughout the winter of 1894-95, Marconi spent his time reading, conducting experiments, devising new apparatus and improving upon the old. He began by repeating Hertz's experiments, in which waves radiated by action on an electric

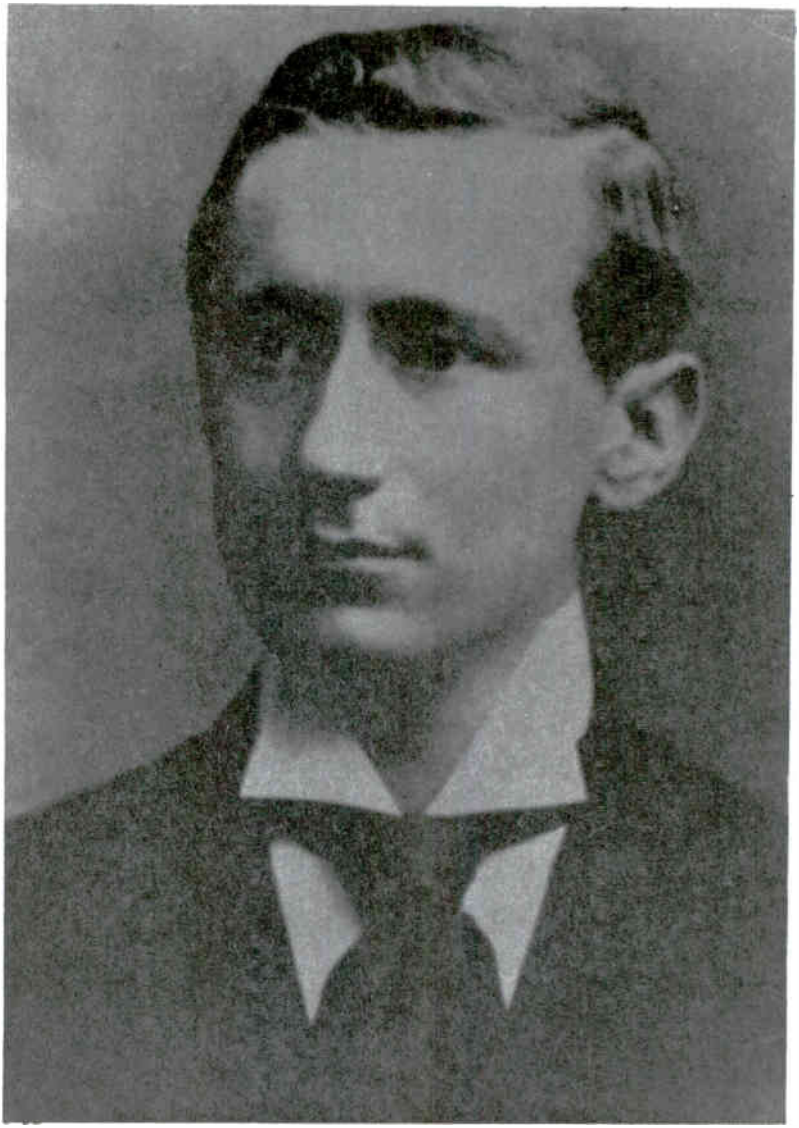
spark were detected by their ability to induce a further, very feeble, spark across a tiny gap in a receiving circuit. Like Hertz, he achieved ranges of only a few metres. During the early days of these experiments, Marconi used the apparatus that all other researchers were using, but he soon realized their inadequacy and began to make adjustments and alterations. For instance, to form a signalling device employing waves, Marconi used the Edouand Branly-Oliver Lodge type coherer (or detector), the Righi stop-gap, and other components invented by others but never before assembled into a radio-telegraphic instrument. With this occurred the birth of radio. Marconi was not satisfied with the performance of the coherer, a small and sealed glass tube of metallic filings which clung together when a radio signal current passed through it, so he decided to modify it. Through trial and error the persistent Marconi succeeded in adapting the coherer to a degree which significantly increased the range achieved. While experimenting with the apparatus he accidently discovered the principle of the aerial and ground, "the combination of a vertical conductor and earth connection that has remained the basic aerial configuration for the lower end of the radio frequency spectrum."[2]

Up to this time, the transmitter's spark had always been arranged to stimulate small circuits of low capacity, giving wave lengths that were typically a metre or less. Marconi started experimenting with slabs of sheet iron connected to each side of the spark gap. He did this to obtain longer waves that would pass around obstacles more easily. Then, purely by chance, he set one slab on the ground and held the other high in the air, whereupon he was surprised to find a large increase in the strength of the received signal. By using this arrangement at the receiver too, he increased the range dramatically to about one kilometre. Marconi then substituted copper wires for the slab held in the air and separated the wires from one another by wooden spokes. The slab in the ground was replaced with a piece of copper buried in the earth. "The invention of the antenna-terra had been made."[3]

While experimenting with the coherer, Marconi developed the idea of using Morse Code, employing a Morse telegraphic tapper or key as a means to send messages. Thus dots and dashes could be transmitted through space, without wires, from one point to another. Marconi tested his new apparatus among the hills of his father's country estate and transmitted over two kilometres. This was a crucial juncture. His apparatus had great potential for long-distance communication, but funds beyond his family's means were required. Until this point Marconi's skeptical father had financed the experiments.

To secure new and additional funding, Marconi approached the branch of the Italian government responsible for communication, the Ministry of post and telegraphs. The response was negative and many years would pass before the family could state that the ministry was "understandably indifferent to a technique that for their purposes, offered no advantages over the well-established technology of conventional telegraphy."[4] Too late the family realized their mistake. They should have contacted the Italian navy, which was expanding its fleet. Marine men might have been more aware of the possible applications of wireless communications at sea. The shocked Marconi family had to try other sources. Marconi's mother's family, advised Marconi to come to England, "since marine applications would obviously be important, it made good sense to develop and promote wireless telegraphy in the world's leading maritime country."[5] In February 1896, Marconi and his mother arrived in London where Guglielmo immediately drew up a patent specification to protect his invention; in June he filed his application for what was to be the world's first radio patent, which was granted in July 1897.

Through Jameson family contacts, Marconi met with Sir William Preece, who was also experimenting with wireless telegraphy, although he was not using radio waves. He was attempting to achieve wireless telegraphy by means of inductive coupling between long parallel circuits with no



Marconi, soon after his arrival in England, 1896.

thought given to Hertzian, or radio, waves. Preece was an important contact because of his interest in wireless telegraphy and because of his position within the post office where he was responsible for all major forms of communication — mail, telegraph and cable.

The two men immediately established a rapport that quickly developed into a friendship. The sixty-three-year-old Welshman gave the twenty-year-old Marconi the use of his own laboratory where he had been searching for the answer that Marconi had found. He also gave Marconi the services of one of his most valuable assistants, George S. Kemp, an expetty naval officer who later became Marconi's personal assistant and an integral figure in Marconi's transatlantic operation. From Preece, Marconi also secured the full cooperation and assistance of the post office department. During the months of July through December, Marconi conducted a series of successful demonstrations for post office, army and naval personnel, wherein he transmitted signals at distances ranging from a few hundred metres to seven kilometres. These astonishing achievements were widely reported in the press, and the impression was conveyed that Marconi was responsible for every discovery related to wireless telegraphy. This offended many within the scientific community, particularly Professor Oliver Lodge, who was close on the heels of Hertz in the discovery of radio waves.

Lodge had been the first to develop the coherer as a practical detector and had demonstrated the transmission of Morse signals over a distance of sixty metres before Marconi had begun his experiments. Although Lodge had not followed up this feat because he thought it superficial, his demonstrations with high frequency phenomena were relevant to a major problem facing Marconi — tuning. Marconi's equipment was devoid of any form of tuning: "The oscillation in the transmitting circuit died away too rapidly to acquire a well-defined frequency, whilst the receiving circuit responded indiscriminately to a wide range of frequencies."[6]

Mutual interference made it impractical for two

transmitters to operate simultaneously in the same area. Lodge, with the sound theoretical knowledge lacked by Marconi, was able to devise simple circuits in which a useful balance was struck between the conflicting demands of efficient aerials and effective tuning.

Lodge was only one of several prominent scientists in a race with Marconi to develop the wireless. Though Lodge understood the practicality of the concept, others doubted the possibilities of Marconi's wireless invention, and still others alleged that Marconi had not invented anything but had stolen the inventions of others.

Although annoyed by the criticism, Marconi seemed resigned to it, and it was just as well, for throughout the remaining days of his scientific career, particularly during the years when he was struggling to establish a commercial transatlantic network, critics were unrelenting in their condemnation of his system. Rather than discourage him the criticism galvanized him to prove his detractors wrong. Because his work could not proceed without increasing his theoretical knowledge of science, particularly physics, he spent the winter of 1896-97 studying, and by summer he was prepared to demonstrate the capability of wireless across water. Wireless telegraphy seemed an obvious substitute for submarine cables, which were much more vulnerable to damage from shipping than wireless.

In May, Marconi and Preece, who was working with induction, both successfully tested their devices across the Bristol channel, but Marconi's apparatus was less cumbersome, able to transmit over a greater range and had doubled the distance of seven kilometres previously spanned. Success turned into near disaster, because the tests were observed by A.K. Slaby of Germany, a scientist of international repute who was also experimenting with wireless telegraphy. Slaby, present at the request of the German emperor, wanted his company, the General Electric of Berlin, to manufacture and sell the Marconi apparatus, but he and Marconi failed to agree to terms. Slaby then adapted and

modified Marconi's apparatus to incorporate ideas and improvements of his own. This "new" arrangement was successful, and Slaby, in association with another German scientist, Count Van Arco, followed it with other variants. In 1903 they joined forces with Professor E. Braun of Siemens and Halske and gave birth to a new electronics company, Gesellschaft fur Drahtlose Telegraphie, which marketed the Telefunken system and rivalled Marconi's. This whole episode was doubly affronting to Marconi, because Slaby was legally permitted to build, operate and promote a wireless system in Germany based upon Marconi's own invention, which held a German patent.

The appearance of rival systems forced Marconi to establish his own system on a sound business footing. To date the post office had given Marconi the equipment and facilities to conduct his experiments, but had not offered any financial remuneration or any long-term commitment to assist in the development and promotion of his invention. The war office had paid only out-of-pocket expenses for the demonstrations in which it had participated. Most of Marconi's expenses had been borne by the Jamesons, and "as the pit was not bottomless it was essential to offset expenditure to some degree with at least a token income."[7]

London financiers offered to acquire Marconi's patents, but he wished to establish his own company. His well-connected cousin and friend, Henry Jameson Davis, secured the necessary financial backing for the company and on July 20, 1897, the Wireless Telegraph and Signal Company Limited was registered. In return for exclusive rights to all patents, Marconi received £15,000, less expenses, in cash, along with 60,000 of the company's 100,000 one-pound sterling shares.[8] Marconi was paid from the proceeds of the remaining 40,000 public shares and given £25,000 as working capital. Henry Jameson Davis became the company's first president, but Marconi then and always determined company policy.

The company gave Marconi the financial freedom he so desperately needed. He could now operate independently of

government and the precarious whims of financiers. The company also enabled Marconi to assemble a staff and establish permanent premises for his work.

Because of the nature of the company's work, its business operational headquarters were situated in different locales. London housed the commercial aspect of the operation, while transmitting stations and laboratories were established along the British coastline. The location of two coastal transmitting stations within range of one another on the Isle of Wight in 1897 allowed the stations to transmit between themselves and to ships at sea.

At a station located near Poole, Marconi established a laboratory that served as his field headquarters for twenty-eight years. Located in an eighteen-foot-square room of the Haven Hotel, the laboratory resembled a monk's cell in its simplicity and decor. The sparsely furnished room had only a few chairs, a small table and some benches. The few tools were small and simple: a tiny worker's plate, a homemade winder for coils, a paraffin-wax melting pot for brewing insulated varish. Two small windows admitted fresh air and provided a view of the weather on the coast. Marconi deliberately cultivated this atmosphere, which permitted few distractions. The mood of the workroom and the remoteness of Poole were reproduced in other stations on other coasts in other countries throughout Marconi's years of experimentation.

Almost one year later, in 1898, Marconi opened the world's first wireless factory in a converted warehouse in Chelmsford, England. Chelmsford was an ideal location because of reasonable real estate prices and proximity to London, capital of the British Empire, which was critical to the company's development. London's vast port, a mecca for worldwide shipping interests, had great potential for revenue. And the company could not afford to be far from the headquarters of the post office or Whitehall, the financial centre of the Empire.

The company gave Marconi the resources to develop his inventions, and from their sale he would prosper. He saw

money as the unit of reward for his work and had no intention of becoming an inventor who had nothing to show for his efforts. Marconi immensely enjoyed the dual roles of the entrepreneur and scientist: the two would conflict at times, but that lay in the future. Now he had to concentrate on the matter at hand, developing his apparatus and building his company.

Marconi's one great fear in establishing his own company was that it would jeopardize the privileged position he enjoyed with the post office because of his friendship with Preece. His fears were well founded. The post office viewed his company as a potential competitor that would eventually challenge its monopoly over British telegraph services. He was excluded from a series of tests in Dover wherein his apparatus was adapted to the specifications of the department's engineers. Although the department had to invite Marconi to help when the tests were failing, it was still unwilling to grant him concessions.

In 1897 and 1898 Marconi embarked upon a series of public demonstrations to garner publicity for his company and demonstrate the applications of wireless telegraphy. In 1897 Marconi travelled to Italy and conducted a series of tests for the Italian navy, during which, for the first time, signals were transmitted from shore to ships at sea. During this trip the young man who had left Italy as an unknown, rejected by his government, dined with the king and queen of his country.

Even greater publicity was garnered when the Dublin *Daily Express* employed wireless telegraphy to report on the 1898 Kingstown Regatta. Marconi was in his element, operating a transmitter in a tug following the races, and relaying events to shore so the *Express* could publish them in late editions. The *Express* and other European papers acclaimed the coverage a great success and Marconi was delighted with their praise.

In 1898 Marconi scored his greatest publicity coup when he linked Osborne House, Queen Victoria's residence on the Isle of Wight, with the royal yacht *Osborne*, lying off nearby Cowes. During a sixteen-day period in August, while the

Prince of Wales was recovering from a knee injury on board the *Osborne,*150 messages were exchanged between the two royal locations, eliciting wide press circulation for Marconi's apparatus. The transmissions implied royal approval for this new, robust and reliable means of communication.[9]

Marconi was also delighted with the support he received from Lord Kelvin, England's most renowned scientist. Kelvin, who was keenly interested in the concept, application and promotion of wireless telegraphy, visited Marconi's station in Poole, where he challenged the post office's monopoly over inland wireless telegraphy by paying Marconi for telegrams despatched to Cambridge and Glasgow. The act also signified that wireless telegraphy had moved from laboratory experimentation to practical application.

The year 1899 was an auspicious one because it was when the Marconi apparatus first spanned the English Channel. For centuries the words "English Channel" had evoked feelings of awe and greatness because of the role the Channel had played in international commerce and British naval history. In the late years of the nineteenth century, when Britain to all outward appearances was at the height of its power, the words conjured up an enhanced sense of national and imperial pride. By spanning the channel, Marconi captured the imagination of the British public and the world's press.

On March 17th, after much preparation and nervous anticipation, Marconi sent signals back and forth between two lighthouses near Dover on either side of the Channel, inaugurating international wireless telegraphy. · The event made headlines around the world. In September, another series of tests conducted across the Channel disproved the long-held belief that radio waves could not reach beyond the horizon. If Marconi had accepted this theory, wireless would have had an extremely limited application. With forty-five-metre-high masts located on both sides of the Channel, he spanned a distance that would have required three-hundred-metre-high masts under the "line of sight" theory.

In the fall of 1899, Marconi shifted his focus to the

American market and accepted an invitation from the New York *Herald* and *Evening Telegram* to cover the America Cup races. The apparatus worked successfully and once again Marconi received enormous publicity. Upon the completion of the race, Marconi conducted demonstrations for the benefit of the U.S. navy. Although the navy congratulated Marconi on his equipment and its operation, no order was placed. It was as inimical to paying for Marconi's apparatus as was the British navy, which had recently refused to pay Marconi a £100 per set royalty he had requested for the use of his ship-to-shore communication sets, although it had been willing to buy the equipment.

Marconi and his company ended the nineteenth century in a state of uncertainty. Although the company could offer a system that was, within limits, technically proficient, its finances were in poor shape. Its £1 shares had risen to £6, but no orders were on the books. The British military authorities remained interested but had not signed a contract, and neither had any of the commercial shipping interests. Because the telegraph was servicing the post office's inland routes, it had placed no order. America and France were interested but neither had produced an agreement. Despite the failure to secure contracts and the high costs of demonstrations, Marconi could not stop. It was the only way to stimulate overseas business and raise the capital required to continue with his venture. In addition, he was beginning to feel the threat of increased competition from German and American competitors.

Because his name was so famous, Marconi and his board of directors decided to have it incorporated into the company's title, which thus became "Marconi's Wireless Telegraph Company Limited." Henceforth, any new subsidiary company would bear Marconi's name.

The Marconi International Marine Company, formed to market marine wireless equipment around the world, is one example. Before this new company could sell its equipment, however, the parent company had to dip into its capital to

finance and build a network of shore stations to serve the equipment. The financial situation brightened in 1900 when a German vessel lightship and lighthouse agreed to use the Marconi wireless apparatus. The British Admiralty finally agreed to the installation of radio-telegraphic equipment on twenty-six ships and coastal stations. Contracts with Belgium authorities followed soon afterwards.

In the midst of these happy developments, the twenty-six-year old Marconi confounded his board with the announcement that he wished to undertake a mammoth new project — the spanning of the Atlantic via wireless telegraphy. To some members of the board it must have seemed that Marconi could not stand the thought of money in the bank — not that there was much; the company was only beginning to recoup its investments. But Marconi persisted, and because the company was his, the board could do little but continue to do as it had in the past: raise funds to support his vision. The Marconi board was not a place for the faint-hearted. Marconi referred to the project as the "Big Thing."

Ever since he had first begun reading and experimenting with electromagnetic waves, Marconi had been gripped, if not obsessed,with the idea of spanning the Atlantic. Each success reinforced his conviction that electric waves could span the ocean by following the curvature of the earth. His conviction deepened with the discovery of syntonic tuning, a device that increased the range of transmission and eliminated jamming.

Despite these advances, the thought of sending electric waves across two thousand miles of water seemed beyond the imagination of most people, including Marconi's board of directors. The range was twenty times that previously achieved and there was a "mountain of water over 200 kilometers high between transmitter and receiver."[10]

Marconi argued that with transmission beyond the horizon already an accomplished feat, the range would be limited only by the power of the transmitter. Hitherto, transmitters had been modest affairs of induction coils and

accumulators,[11] barely advanced beyond the simple, battery-driven equipment of 1896. Now Marconi envisioned the building of two transmitting stations of unprecedented power, size, complexity and cost.

The need to build a station on either side of the Atlantic would add considerably to the already great cost. This huge investment would have to be borne by a company which had not yet begun to make a profit, a company that was annually dipping into its capital to finance research, inventions, demonstrations and markets. The shocked board acquiesced to Marconi's scheme and spent the next eight years scrambling to finance the venture. The support of the board was critical: without it a transatlantic network would never have been established.

As this project was an entirely new enterprise, Marconi had no precedent on which to design, build and locate his stations. Geography and not cost was to be the determining factor. They had to be located where transmissions would not be interrupted by land. Poldhu, in Cornwall, England, and Cape Cod, in Massachusetts, were selected as the sites because only the broad expanse of the Atlantic Ocean separated them. Both were on the coasts and both were frequented by severe storms which played havoc with the equipment and added to the difficulties already confronting Marconi and his staff. Marconi commissioned the world-renowned physicist Dr. J. Ambrose Fleming to design the Poldhu installation, which consisted of:

> an ingenious circuit with two spark-gaps operating in cascades at different frequencies, powered by a twenty-five kilowatt alternator which in turn was driven by a thirty-two horsepower oil engine. The aerial consisted of an inverted cone of wires, sixty-one meters high, supported by a ring of twenty masts.[12]

Construction of the Poldhu station began in October 1900, and by January 1901, preliminary tests of the power, control and high frequency circuits were in progresss.

In March 1901, Marconi, G.S. Kemp and R. N. Vyvyan travelled to Cape Cod and selected South Wellfleet as the site of the North American station. Vyvyan, in charge of the construction at Poldhu and now South Wellfleet, had grave reservations about the stations, believing they were mechanically deficient in concept and structure: "Though each mast was stayed against radial movement, its only tangential constraint came from horizontal wires tying it to his neighbors."[13] Such constraints, he believed, were insufficient to withstand the high winds and severe storms which often swept the coasts of the Atlantic.

Vyvyan's fears were realized on September 17th when a heavy gale smashed the Poldhu masts to the ground, leaving a shamble of shattered timber and tangled wire but sparing the personnel and plant. The loss shook the board of directors, but Marconi was undaunted and resilient. One week after the Poldhu crash, a temporary antenna system was erected, and testing resumed two days later.[14] Marconi then ordered the construction of a new, permanent aerial.

Because the signals emanating from the temporary antenna were strong, Marconi decided to resume transatlantic testing before the completion of the permanent antenna, with one major change in plans — he would try to receive the signals not in Cape Cod but in Newfoundland, the nearest North American landfall from Poldhu, using temporary equipment consisting of aerial wires, kites and balloons to receive the signals. He had decided not to receive at Cape Cod because he felt the power from Poldhu's temporary antenna would be too weak to accomplish the transmission over the additional six hundred miles. After receiving the signals he planned to sail to Cape Cod and transmit a signal to Poldhu, thus accomplishing a two-way transmission.

In hindsight these decisions seem fortuitous because the Cape Cod station was completely destroyed by a gale shortly before his departure for Newfoundland. The board reeled from the news; it had not yet recovered from the Poldhu setback and now had to contend with another. The

accumulated loss of £50,000 from the two disasters appalled them. There were now two stations to be rebuilt, with time and money running short.

Winter was coming on and Marconi, ever resilient and undaunted, wanted his experiments finished before its onset. To delay any further would make the operational cost of the transatlantic venture prohibitive. He had to try and succeed now, while the weather was favourable and his supply of money sufficient. He could not wait for the stations to be rebuilt. He decided to take a chance, cut his losses and use his temporary antenna and flimsy portable equipment to attempt a one-way transmission to Newfoundland. All thoughts of transmitting from the Cape were gone. He had now to concentrate all his energies on the transmission to Newfoundland. He could not afford a failure.

With two assistants, Kemp and Paget, "and a miscellany of receiving apparatus, kites, balloons, antenna wire and gas accessories," he sailed for Newfoundland.[15] Because he dreaded the consequences failure would have on his company, Marconi did not want any publicity to surround his trip. He therefore concealed the true reason for the voyage, implying to the press that he was pursuing an inquiry about ship-to-shore installations. His story was successful. Only the New York *Herald* sent a reporter to cover the mission.

In St. John's, Marconi was received by Governor Sir Cavendish Boyle, Premier Sir Robert Bond and government ministers. A building on Signal Hill was put at his disposal, where he would allegedly undertake routine observations of ship-to-shore reception. On December 9th Marconi and his men began to assemble their apparatus. The prospect for success was as dismal as the Atlantic weather.

> For in place of the mammoth antenna arrays on either side of the ocean, all that was available was a lashed up structure at Poldhu, the product of eight days' feverish activity with no time for matching the load to the antenna, and at Newfoundland, not even a solitary mast; only a small stack of kites and balloons to keep the wire aloft in

as capable a manners as ingenuity and the elements would allow.[16]

Poldhu was cabled instructions to transmit the Morse Code letter "S." This letter, three dots, was chosen "partly for ease of recognition, but also because the transmitter could not be trusted to transmit dashes without breakdown."[17] Transmissions were designated to occur on December 11th and 12th between the hours of 3 p.m. and 7 p.m. Greenwich mean time, and 11:30 a.m. and 3:30 p.m. Newfoundland time.[18]

Foul weather continually bedevilled the transmissions. On December 11th a fierce gale brought near depair when the fourteen-foot-wide balloon containing one thousand cubic foot of hydrogen gas and carrying the aerial aloft was suddenly ripped free. With only one balloon left, Marconi decided to use kites to carry the antenna. On December 12th the winds were still gale force and vicious, but Marconi decided to try his luck. Within an hour of launching, a kite carrying a 510-foot antenna was lost.

Shortly after, another launching disaster seemed imminent as a kite, lashed by rain, plunged and rose in the raging gale high above the stormy Atlantic. While Paget anxiously watched outside, Marconi and Kemp remained indoors, desperately trying to receive a signal through the howling wind. They sat in a small, dark room starkly furnished with only one table, one chair, and some packing cases upon which they alternately sat when not listening for the signal.[19] Between turns at the receiving set they sipped cocoa,probably laced with Scotch or rum to sustain their nerves and warm themselves in the frigid room.

Their tension mounted as the minutes of scheduled transmission slipped by. Then, shortly before 12:30, Marconi heard a faint but unmistakable three clicks. He immediately passed the earphone to Kemp for corroboration and Kemp concurred. Later that day additional transmissions were received, but the following day inclement weather caused

Marconi, left, watches anxiously as some of his men struggle in a gale to launch a kite, to which an aerial is attached.

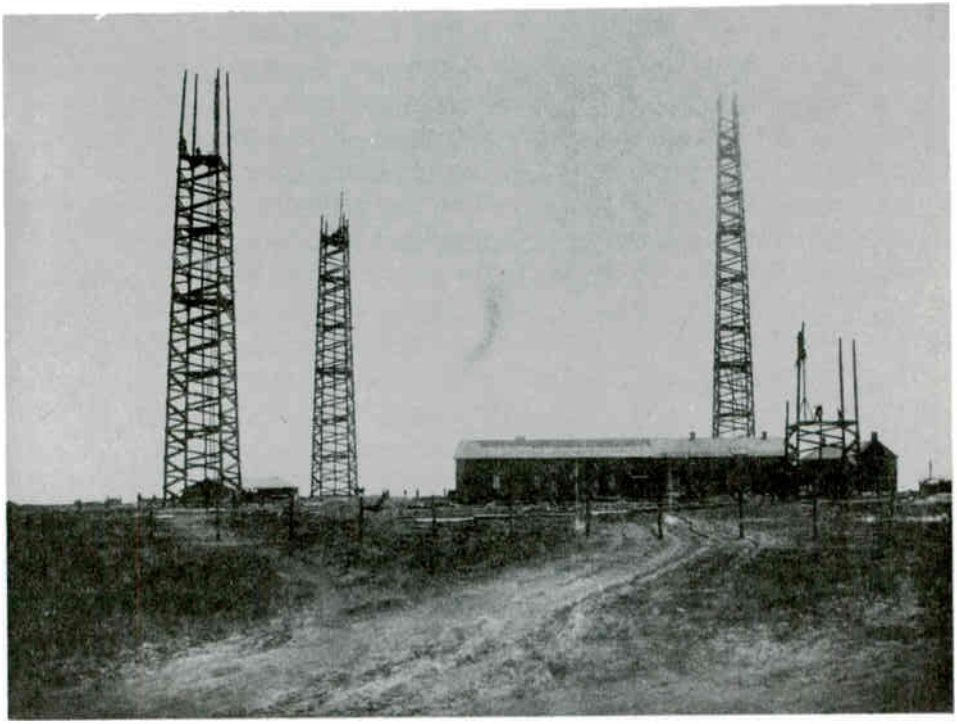
Marconi to give up hope of further results. But it did not matter. He had achieved what he had set out to do: to prove that the curvature of the earth was not an impediment to the transmission of electric waves. He now knew with certainty that one day he would transmit messages without the aid of wires or cables across the Atlantic.

It was a contented and serene Marconi who on December 14th cabled Major Flood Page, the company's managing director, with the news of the transmission and receipt of signals; that night Marconi informed the St. John's press of the event. The next day newspapers around the world variously described the event as magic, a modern mystery tale, the dawn of a new era in transoceanic telegraphy, the most significant development in modern times. With some balloons and a few kites, Marconi had latched onto a train of waves and carried signals through space. Reporters grasped for words and phrases to describe Marconi and his invention; most settled on the "wireless wizard."

But the praise was not unanimous. Because Marconi had no tangible proof of the reception (he had only heard the sounds of dots and dashes over an earphone), and because no one would question his honesty, the general response from the scientific community was that the sounds heard by Marconi were those effected by electric strays, not rays, on the delicate recording instruments. Even Marconi's old friend Sir William Preece stated that the sounds were most likely caused by natural atmospheric disturbances. Thomas Edison also thought Marconi was confused by the signals and declared: "Until the published reports are verified I shall doubt the accuracy of the account."[20] The *Electrical Review* thought someone must have played a practical joke on Marconi.[21]

These criticisms were mild compared to the vitriol Marconi endured from those who had a vested interest in the cable companies. Cable stocks had plummeted immediately upon Marconi's declaration that he bridged the Atlantic with wireless telegraphy, and the cable interests were in no mood to tolerate a further devaluation. The St. John's venture was dismissed as an experiment with an unruly kite by which Marconi had heard a few faint clicks in a telephone: "Nothing that he has said justifies the faintest expectation that his system can ever be a serious rival to the cables."[22]

Marconi was chagrined by the statements and more determined than ever to establish the credibility of his claims and to establish transatlantic communication as a commercial venture. Unfortunately, his attempts to validate his ideas were frustrated and stymied by the Anglo-American (cable) company, which threatened court action over the infringement of its monopoly on all telegraphic business within Newfoundland. Marconi later wrote: "Unfortunately, I found that the cable company whose wire landed on the ancient colony wished to assert its right to every means of communication; either by sea, or land or sky."[23] Rather than face the expense of challenging the company's monopoly, Marconi withdrew from the colony.



Marconi Wireless Station, Cape Breton, Nova Scotia 1902.
Beaton Institute

3

The Magnificent Obsession

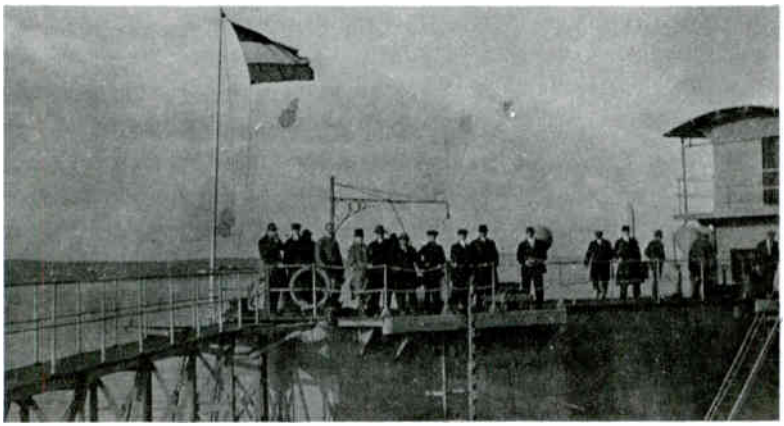
Marconi would probably have relocated to Cape Cod but for the intervention of Mr. William Smith, secretary of the Canadian post office. Smith had been in Newfoundland when Marconi announced he would quit the colony, and he persuaded Marconi to remain there while he discussed the situation with Sir William Mulock, Canada's postmaster general. Because Mulock was away from Ottawa at the time, Smith approached Minister of Finance William S. Fielding, the former premier of Nova Scotia, who immediately invited Marconi to continue his experiments in Canada.[1]

Fielding did everything possible to entice Marconi to relocate in Nova Scotia, assuring him of the Canadian government's co-operation and support. Fielding had not spoken lightly. He gave Marconi the use of the government railway between North Sydney and Montreal, and, to ensure everything went smoothly, assigned Smith to Marconi as the government's emissary. Smith would greet Marconi in North Sydney, Marconi's port of arrival in Nova Scotia, and would be at Marconi's disposal throughout his stay.[2]

Alexander Graham Bell invited Marconi to "make use of my estate in Cape Breton near Baddeck as a temporary

station."[3] In Beinn Breagh, on the shore of Bras d'Or Lake, Bell had established a "centre of activity" where he pursued his interests in flight, water transport and wireless telegraphy. Bell pondered the capacity of the telephone to act "as a receiver for Hertzian waves or Marconi signals" and thought it possible to devise an arrangement which "might pave the way for wireless telephony."[4] Although Marconi provisionally accepted the offer, Beinn Breagh was too far inland from the Atlantic Ocean to allow unrestricted transmissions across the ocean.

On December 26, 1901, Marconi arrived in North Sydney on the steamer *Bruce* from Port aux Basques, Newfoundland, to a welcome usually assigned to royalty.[5] He was met at the wharf by the Liberal Premier George Murray, a native of Grand Narrows, Nova Scotia, and MLA for Victoria County; William Smith, representing the Dominion government; Mayor MacKenzie of North Sydney; and the Honourable J.N. Armstrong. After the official greetings, the party moved to the Belmont Hotel, where Marconi held a press conference and



Marconi's arrival in North Sydney, N.S. Beaton Institute

contrasted the type of testing done in Newfoundland with what would be done in Cape Breton. The Newfoundland tests performed with kites were merely experimental, whereas the Cape Breton facilities would be permanent, requiring the construction of a station. An aerial of wire netting strung between four 150-foot poles would receive and transmit messages across the Atlantic Ocean. The station would be located 100 to 300 feet above sea level and require a clear shoreline with no intervening headlands.

After the press conference the party took the electric car "Peerless" to Sydney, where they were greeted by other prominent Cape Bretoners: D.D. MacKenzie, MLA, N.J. Gillis, MLA, and the Island's three MPs — Alexander Johnstone, the Liberal government whip and editor of the *Sydney Record*,[6] Dr. A.S. Kendall, a prominent physician and radical politician, and C.F. McIsaac. W.R. McCurdy of the *Halifax Herald* and Cornelius Shields, general manager of the Dominion Coal Company, were also present. Because Marconi was going to tour sites in Dr. Kendall's constituency of Glace Bay on the eastern tip of Cape Breton Island, he presented Kendall with a letter of introduction from Mr. Fielding.[7]

The political and financial stature of these men enabled them to assure Marconi that no company in the province would interfere with his experiments, that financial assistance could be obtained from the federal government, and that the Dominion Coal Company would also provide assistance to Marconi in any possible manner. Each promise held true. Not one company in Nova Scotia challenged Marconi's project, federal funding was obtained and the Dominion Coal Company placed its railways and tugs at Marconi's disposal and, more importantly, granted him unrestricted use of the land where he eventually erected his station. Marconi considered four sites for the station: Burying Ground Point, Louisbourg; Port Morien; Main-à-Dieu; and Table Head, Glace Bay. By rail and tug, in dark and stormy weather, Marconi toured the four sites, accompanied by Shields,

Johnstone, Kendall, Murray, Captain E.M. Dickson, Warden H.C.V. LeVatte and three veteran skippers.

The weather could not have been worse. High seas accompanied by a blinding snow and rain storm had reduced visibility to a ship's length; only the skilled seamanship of the crew averted a tragedy as the ship manoeuvred between the shore and rocks.[8] At the entrance to Louisbourg Harbour, Marconi's tug grazed and nearly collided with another tug, the *Eleanor M. Cates*, which had Mayor Lewis and the entire town council on board. Marconi and his party boarded the *Cates,* where a distraught Mayor Lewis apologized for the "unpropitiousness of the weather" and explained that Louisbourg would not be seen "at its best."[9] After the tour, Marconi and his party returned by train to Sydney, where a banquet was held in his honour. In his address he thanked the Dominion and provincial governments and the coal company for their many kindnesses; never before had he received such a general outburst of official and popular sympathy as in Nova Scotia.

The Nova Scotia press could not believe its good fortune in having the Marconi story to report. Reporters were astounded that one of the most famous inventors in the world might "set up shop" in their midst. Cape Breton and the province would be "a part of the great theatre in which this masterpiece will be shown to the world by the Ango-Italian discoverer."[10] Praise was lavished on both governments for their efforts to attract Marconi to Cape Breton. "There is nothing that we could do that was not done in receiving him, and doubtless there is nothing that will not be done to help him."[11]

When, a day or two later, Marconi left for Ottawa, he was still undecided about where to locate his station. All four sites seemed of equal merit and all four met the criteria: an ease by which machinery could be transported and landed, proximity to water, a good "position relative to Cornwall"[12] and no interference from landfall. While in Ottawa, Marconi spent hours at the Marine and Public Works Department studying maps and charts with an eye to "the location of the coast with

respect to that of England."[13]

Kendall and Johnstone accompanied Marconi on his journey to Ottawa, where a conference had been arranged with Fielding, Sir William Mulock and Prime Minister Sir Wilfred Laurier. For several very practical reasons these politicians were anxious to reach a satisfactory agreement with Marconi. Because the nation was bounded by the Atlantic and Pacific oceans, any system that could report the weather, warn vessels about severe storms and advise them to other dangers was welcome. The government also wanted to establish closer communication with England, considered the "mother country."

After a prolonged negotiation that lasted from December 1901 through March 1902, the federal government and Marconi signed an agreement which placed Canada and Cape Breton in the forefront of world communication developments. It also secured Marconi the much needed revenue and legal backing to undertake his venture. The agreement formally entered into on March 17, 1902, contained the following stipulations:[14]

1. The Canadian government would defray all the costs of erecting the Canadian station, up to a limit of $80,000.
2. The cost of ordinary wireless messages would not exceed $0.10 per word while government and press messages would cost $0.05 a word.
3. The government could erect coastal stations fitted with the Marconi system of wireless telegraphy.
4. All the equipment required by the government stations would be bought from the Marconi companies at fair and reasonable prices. Neither royalties nor patent rights were to be charged.
5. The companies had the option of installing and operating the equipment in the government stations and of retaining the tolls charged for transmissions.
6. Canadian machinery, labour and materials would be used whenever possible.

In addition, Laurier and Fielding reportedly offered Marconi free access to government-controlled telegraph lines, including cables; the use of a steamer to conduct further tests;[15] and a waving of custom duties on imported apparatus.

With or without these additional concessions, Marconi was delighted. The Canadian government's willingness to co-operate was contrary to his experience with the Italian, British and American governments — "governments as a rule do not display very keen interest in new inventions."[16] The agreement was a "godsend" to the financially beleaguered Marconi company and was the essential factor to ensure the development of long-distance wireless telegraphy and a Marconi company in Canada, "The Marconi Wireless Telegraph Company of Canada Limited," a subsidiary of the parent English company.[17]

A syndicate of wealthy and influential Maritime men that included F.L. Haszard, K.C., of Charlottetown, "a gentleman of great financial and political influence in P.E.I.," and Senator W. MacDonald of Glace Bay, "one of the wealthiest men in this section of Canada," offered to buy from the Marconi Wireless Telegraph Company "the right to operate your system between a point on the mainland in New Brunswick or Nova Scotia, Canada, and Prince Edward Island, Canada."[18] The syndicate's representative, S. McCawley, a broker from Glace Bay, hoped to meet with Marconi in Glace Bay "to discuss details and make final settlements in time to complete our plans for the necessary legislation at the next session of parliament."[19] But Marconi wanted his own Canadian company which he could direct and control through the parent company. In 1902 the Marconi Wireless Telegraph Company of Canada was registered in Ontario, and a Dominion charter was obtained in 1903.

In the view of the parent English company, the "principal and perhaps only sources of revenue contemplated for the Canadian Marconi Company were transatlantic communications."[20] In effect, the only function of the Canadian company was to manufacture parts for the

establishment of the wireless station at Glace Bay and for marine communication.

While negotiating with the Canadian government, Marconi worked at a hectic pace to develop and perfect his wireless apparatus. In February 1902 he began a series of experiments designed to extend the 250-mile distance over which messages could be received at sea. He conducted the tests on board the *Philadelphia* while en route from Cherbourg to New York. Four staterooms had been outfitted with a myriad of apparatus: a portable wireless receiver, a recording instrument, a telegraphic instrument, sensitive coherers, tuning coils and condensers. From one of the cabins in his makeshift laboratory, a lead wire was extended and affixed to the aerial which ran between the 170-foot masts of the ship. Because the length of this wire was fixed, unlike the one attached to the kite at St. John's, Marconi was able to employ a syntonic receiver and to record signals on tape with a Morse "inker" that printed blue dots and dashes.[21]

To avoid the scepticism that had surrounded his Newfoundland venture, Marconi wanted unimpeachable and technically knowledgeable witnesses to verify his experiments. He requested members of the ship's crew, including the captain and chief officer, and some passengers to observe his experiments. Each was astounded at what he heard — the reception of signals at intervening distances of 500, 1,000 and 2,099 miles, the latter eclipsing the distance of the transmission between Poldhu and St.John's.

The details of the transmissions were recorded, and the captain and chief officer verified the transmissions by signing the tapes and a chart which contained the times and distances of the messages received. An ecstatic Marconi displayed the documents to the American news media upon his arrival in New York on March 1, 1902. With this documentation, Marconi thought he had the proof required to silence his critics. "Would they now say he was mistaken at Newfoundland?" Marconi thought not. In his mind there was "no longer any question about the ability of wireless telegraphy

to transmit messages across the Atlantic."[22]

Marconi also believed he had enough evidence to convince the cable interests (who were always challenging his credibility) that the curvature of the earth did not affect radio currents, and that his messages had not been indiscriminately received. He was overly optimistic: his skeptics were not satisfied and he could not understand why they did not see things as he did. To Marconi, the process was perfectly simple and depended merely on the height of wire used and the amount of power at the transmitting ends.

Despite his frustration with his critics, Marconi still took pleasure from the successful *Philadelphia* experiments and continued to work on the problems confronting his dream of spanning the Atlantic Ocean. The one problem that most perplexed him, and would for years, was his inability to transmit over long distances during daylight hours. Though the *Philadelphia* could receive messages beyond 2,000 miles at night, 700 miles was the maximum during the day. It seemed as if the sunlight and clear skies acted as a fog upon the Hertzian waves. Marconi was at a total loss to explain this. He had more luck resolving the sensitivity of his receiving apparatus to the jars and jolts on board ship. These vibrations often resulted in erratic reception and at times knocked his receivers out of commission. In June 1902, Marconi invented a new receiving apparatus, the magnetic detector, which was immune to the movements of ships, yet sensitive enough to detect faint electrical waves. This "jewel of workmanship," made of a box, thin wire and pair of horseshoe magnets had taken Marconi less than fifteen minutes to design and build after he had spent two years thinking about the problem. He had realized the solution while cycling on the Isle of Wight.[23]

Simultaneously grappling with these problems, negotiating with the Canadian government and incorporating companies in Canada and the United States, Marconi returned in March 1902 to Cape Breton, where a fierce competition had been waged among the four communities to "land the Marconi station." The *Glace Bay Gazette* urged the

town to do everything possible to facilitate Table Head's selection because, if selected, the town's name would be on "the tongues of everybody in the civilized universe" and the town's commercial development would be enhanced.[24]

Because electric power would be needed to operate the station, the *Gazette* urged the town council to offer him power at a minimal rate, "barely sufficient to cover the actual cost of the service." The paper also urged a ten-year exemption from taxes. The newspaper stressed that these concessions would be offset by the tremendous commercial advantages the town would gain from the location of a Marconi station at Table Head. The $60,000 plant would employ one hundred men in the construction phase, and a number of men would be employed in the operational phase; in addition, "the show qualities of such an enterprise so widespread in its wonders would attract thousands of visitors yearly." Prominent members of the Glace Bay community, such as Dr. Cadegan, visited Marconi to lobby on behalf of Table Head.

Before deciding, Marconi once again toured the sites, probably more to confirm his selection than anything, because the charts and maps in Ottawa, combined with other factors such as concessions, had already led him to conclude that Table Head would be the site of the North American terminus for the transatlantic network. While touring the sites, someone threw a large rock through the window of Marconi's special car but luckily Marconi was uninjured. Most people were embarrassed and outraged by the incident. Cape Bretoners had otherwise gone out of their ways to welcome Marconi. In fact, the president of the Sebastian Cabot Society of Sydney had travelled to Mulgrave to meet and accompany Marconi on his train journey to Sydney. Upon arrival, Marconi had been greeted by 150 members of the society, who had marched him by torchlight parade to the Sydney Hotel, where he had addressed complimentary remarks to the assembly.

On March 24, 1902, Marconi announced that Table Head, one mile outside the mining town of Glace Bay on the eastern shore of Cape Breton Island, had been selected as the

site for the new station. Table Head forms the northern head of the bay and commands a view of the town. Several factors had contributed to its selection. Besides its geographic location, Table Head was easily reached by rail — a branch line of the Sydney & Louisbourg Railway ran from the station to the old Hub yard. And the town had granted concessions. To alleviate Marconi's fears that electric flashes from a trolley wire close to the towers could interfere with his system, the town had promised a five-year prohibition against electric trolleys passing within a third of a mile of the proposed station. The town also promised to install a water system.[25]

When Marconi made the announcement, Glace Bay and Cape Breton were on the threshold of dramatic change. The establishment of the steel plant in Sydney in 1900 and the proliferation of coal mines to meet the plant's demand for coal were already beginning to transform the socio-economic pattern of the Island. Within the decade, Cape Breton would change from an agrarian to an industrial economy.

Before and after Cape Breton's founding in 1785, agriculture, fishing, lumbering and shipbuilding had been the mainstays of the economy, supplemented by innumerable small, light manufacturing concerns — forges, tanneries, carriage factories, cooperages, grist mills, sawmills and woolen mills. Cape Breton traded fish with Europe, Britain, the West Indies and the United States. Cape Breton vessels returned from foreign ports with Jamaican rum, molasses, fine teas and spices. The Spanish, Portuguese, French and British had fished off her shores and visited her ports since the sixteenth century, giving Cape Breton's coastal communities an international flavour. International trade and international companies were taken for granted. The owners, brokers and other businessmen who dealt in transatlantic trade were as familiar with the cities of Europe as they were with Halifax. A spirit of adventure and success had abounded among the business and political elite.

Decline later set in with the coming of the railway and the National Policy, which directed trade and commerce to central

and western Canada and ignored the traditional trade patterns that had brought prosperity to the Maritimes and especially Cape Breton. The development of the steel and coal industries marked the end of the old era and the beginning of the new.

Cape Breton coal and steel were needed to stoke the innumerable factories rising daily in Ontario and the north eastern seaboard of the United States. A new breed of entrepreneur appeared in Cape Breton to take advantage of this demand. An international conglomerate, the Dominion Steel and Coal Company, would control and direct the Island's economy for the next fifty years, and new businesses concerned with steel and coal arose to displace the old agrarian, manufacturing and fishing enterprises. Although remnants of the old economy and its way of life remained, thousands of Cape Bretoners fled the farms, the fishing villages and lumber woods to work in the steel plant and the coal mines, where a more secure wage could be obtained for more regular work. Around the steel plant the city of Sydney expanded, and around the coal mines the towns of Glace Bay, New Waterford, Dominion, Sydney Mines, Florence and Louisbourg developed.

These towns, all within a twenty-mile radius of Sydney, became the industrial centre of the Island. Here population concentrated to such an extent that from 1891 to 1911 the population increased by 300 percent, while other parts of Cape Breton became almost deserted. [26] Part of the increase was the result of an immigration policy that allowed the Dominion Steel and Coal Company to advertise abroad for workers. Many thousands of people from around the world came to Cape Breton and stamped their own distinct marks upon the Island's culture and economy. To the English, Gaelic, French and Micmac languages already spoken on the Island, immigrants added Polish, Italian, Ukranian, Syrian, Lebanese, Welsh and dialects from the West Indies and Lowlands of Scotland.

Cape Breton housed the largest cultural mix of any Canadian centre east of Montreal, and one did not have to be

there long to notice it. Richard Vyvyan, Marconi's chief engineer and superintendent of the Table Head station, was amazed at the "curious mixture of people", — Canadians, Indians, Poles, Italians, Americans and southeastern Europeans — who helped to construct the Table Head station.[27] He could not get over how 100 to 200 men with such diverse backgrounds and languages could work together with such ease and efficiency.

The new immigrants, and the new entrepreneur borne out of the new economic thrust, engendered a feeling that all things were possible, that a great future lay before Cape Breton. The Island, home to one of the largest steel and coal conglomerates in the world, was servicing the industrial growth centres of North America. Vessels plied the waters of the St. Lawrence and the Great Lakes, conveying Cape Breton's natural resources to fire the furnaces of the great factories arising in the cities beyond. Cape Breton was the industrial hub of the nation, an important part of the trade and commercial link with Britain and the United States. These were heady times for business and political leaders, and optimistic times for penniless immigrants who believed a wage derived from coal and steel would give them a security unattainable in their native lands. They were also hopeful times for the displaced rural worker who found a new income to replace his traditional livelihood. Cape Breton's population abounded with confidence.

Glace Bay was both a product and symbol of the new industrial age. Its incorporation as a town in 1901 was a reflection of the optimism rampant among community leaders during this period. The town's first mayor, D.M. Burchell, thought the retail business was well looked after with the town having one of the largest retail stores east of Montreal, and all the stores in town well-stocked with an excellent quality of goods.[28] The purchasing power of the community was unexcelled, with jobs and good wages for everyone who wanted to work. The town's people were law-abiding, hospitable and progressive.

Because of coal mining, the population of Glace Bay rose from 2,459 to 6,945 between 1891 and 1901.[29] At incorporation, five collieries employing 2,000 men worked around the clock twelve months of the year. Glace Bay was heavily dependent upon coal company taxation for its revenue because there was only one other industry in town, a lobster cannery. The coal company dominated the economic and structural development of the town; building and streetscapes conformed to the company's needs.

The new town council struggled to keep up with the demands of its rapidly growing population.[30] A whole new infrastructure had to be developed to service the citizen's needs and those of the mining company: the installation of a water service, the construction of an electric plant, the laying of 27,000 feet of plank sidewalk, and improvements to the harbour. The school system required expansion: in 1901 there were only three schools and fourteen teachers to educate one thousand children. There was also an urgent need for a dump, milk pasteurization, and vaccination of all citizens. The provision of these services increased the town debt, which rose from $10,000 in 1901 to $237,000 in 1903. But no one seemed to mind, because the money was considered an investment in the future — better services would attract more industry and more prosperity.

Important as these matters were, they paled in significance to the housing shortage, which quickly developed into an unmanageable crisis. The armies of workers who had flooded into the town to work in the mines overwhelmed the housing supply. Although thousands of new "company houses" were built, they were not going up fast enough to accommodate the daily arrival of men "in bunches of hundreds." Dozens of "company boarding houses" holding seventy-two men each and other private boarding houses were jammed beyond capacity. In some cases the beds were never cold, because men returning from the night shift jumped into the beds vacated by the men on the day shift. Because neither company nor town could provide the required

accommodations, workers took matters into their own hands and squatted within a few hundred yards of the collieries. The shacks they built were nothing more than one-room shanties of rough boards capable of sheltering six to fifteen men.

Despite the housing shortage, bad roads, and water, health and educational problems, Stuart McCawley, a member of the Maritime syndicate that wanted to purchase the Maritime rights of the Marconi apparatus, declared: "Improvements are being accomplished every day in a sensible and businesslike manner, which will get over these difficulties."[31] Mayor D.M. Burchell agreed. And apparently they were not wrong. In 1903, within two years of their comments, Glace Bay was declared one of the leading towns in the Maritimes and its citizens were complimented for "taking advantage of the most modern methods of street improvements and the erection of beautiful buildings,"[32] one of which was the new Georgian-designed town hall. One of the street improvements was electric lighting, installed in 1902.

When Marconi left Glace Bay for Poldhu via New York in March 1902, he assigned the construction of the station to Richard Vyvyan, whom he had appointed managing engineer of Canadian Marconi. Vyvyan, an affable man with a handlebar moustache and a smoking pipe always at hand, remained in Glace Bay for eight years supervising the development of all three Cape Breton stations. Because Vyvyan had identified the weaknesses in the Cape Cod and Poldhu aerials and predicted their collapses, Marconi gave him free hand at building the Table Head station. He was given complete discretion with regard to the size of the buildings and the details of the plant to be purchased in Canada in accordance with the agreement signed with the Canadian government.

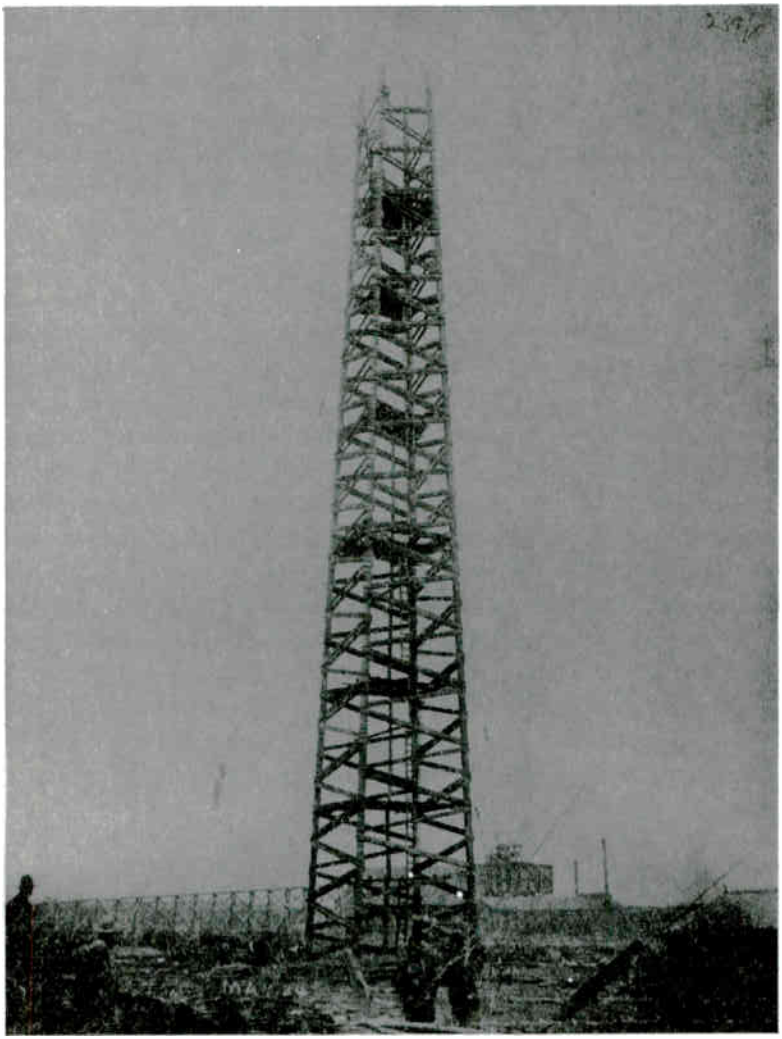
Rhodes, Curry and Company of Amherst and Sydney, a contractor famous in Cape Breton for the building of the Dominion Coal Company's company houses, received the $40,000 construction contract. Their bid was not necessarily

the lowest, because a clause had stated that the lowest bid was not automatically to receive the contract.[33] Marconi wanted only the best work done using the best materials. He was not going to lose his life's ambition over shoddy workmanship and material of poor quality. Vyvyan, by now Marconi's trusted colleague, would ensure a high standard. A sum of $30,000 was allocated for the construction of the towers and $10,000 for the powerhouse, operating house and manager's residence.[34] Work began almost immediately on the ten-acre site located about one-half mile from Dominion No. 2 colliery and near the old Hub mine.

Although Marconi and Vyvyan were delighted with the efficiency of Rhodes and Curry, they encountered many difficulties and delays which forced a prolongation in the construction period and caused Marconi to miss his first and much hoped-for deadline, Coronation Day, June 26th, on which he had envisioned sending a congratulatory message to Edward VII from Table Head. This would surely have been the publicity coup of the decade. But changes in the construction plans and labour problems arising from the men's fear of working with electricity at extreme heights had caused a delay.[35]

Table Head was a more powerful and larger station than her sister station in Poldhu. The alternator, a second-hand 75-kilowatt one, had thrice the power of Poldhu; and the building which housed the wireless plant was four times the size of the Poldhu structure.[36]

Central to both stations were the towers that supported the antenna system.[37] Table Head's four towers were constructed of hard pine, 210 feet in height and squarely situated at 200 feet on a side. The foundation of each tower was a mass of concrete formed in a hollow square, with external dimensions of 36 by 36 feet and internal ones of 24 by 24 feet. At the top of the towers were platforms from which were strung four cables, three inches in diameter. These cables supported the antenna system, which consisted of four hundred copper wires suspended in sections from triatics



Erection of Masts, 1902, Marconi Wireless Station in Cape Breton. Beaton Institute

between the four towers. The down leads were brought together into an inverted cone at the point of entry into the station building, which contained the powerful electrical plant. The antenna was constructed so either all or part of it could be used. The powerhouse was situated directly in the middle of the square formed by the four towers, with the operating house five feet to its left and connected by a single passageway. The power house was 55 by 51 feet and the operating house 70 by 51 feet; both were about twenty feet high.[38]

The only other building in the station complex was the manager's residence, located to the right of the towers as one looked out to the ocean. Vyvyan and the staff of electrical engineers shared that accommodation with Marconi while he was in Cape Breton. The 70 by 35-foot one-storey wooden structure contained twelve rooms and including several bedrooms and bathrooms, a large parlour, sitting room, dining room and kitchen. A wide hall ran end to end through the centre of the house with the rooms opening from either side of the hallway. Finished in natural wood, the house was designed to meet only the basic needs of its occupants. As in all Marconi residences, whether temporary or permanent, whether in the hinterlands of Poole or Glace Bay, or in the magnificent city of London, there was a piano which Marconi played for pleasure and relaxation.

One window afforded an unobstructed view of the broad Atlantic; from another could be seen a rugged and picturesque stretch of coastline with the wreck of a huge steel steamer sticking up out of the water not far from shore. The house and station were enclosed by a huge barbed-wire fence and zealously guarded, like Poldhu. In spring the two-thirds of a mile of mud that had to be traversed to reach the complex was a further deterrent.

Marconi was due to return to Cape Breton in May 1902, but while in Europe he was stricken with a severe case of influenza which prohibited a trip across the Atlantic. Rumourmongers attributed the postponement to mental collapse. Meanwhile the engineers and contractors were busy

solving "last minute" problems, and by mid-June most of the difficulties had been overcome. The four towers were completed and adapted with the necessary electrical apparatus. Mammoth steam engines to propel the dynamos and generators were installed and in working order. Towards the end of the month, testing began without Marconi and in great secrecy. The many reporters hovering around the station and reporting on every trivial detail they could find persistently questioned Vyvyan, but to no avail. The suave Vyvyan was "willing to talk on any subject that did not shed additional light on the Marconi system."[39]

In September Vyvyan complained to the Glace Bay town council that contrary to the agreement with the town, the tramway company was building its line much nearer to the towers than he had understood they were to be allowed. While he hoped the matter "would be adjusted without undue difficulty," Vyvyan thought that Marconi "would be very much surprised at the turn matters had taken."[40]

The council was caught in a bind between the rival interests of Marconi and the tramway company. A further complication was the belief that, because the tramway ran through the property of the Dominion Coal Company, this company should be consulted on the matter. Many of the councillors believed the tramway to be 400 feet within the minimum distance agreed upon between the town and Marconi. Councillor McKay suggested that measurements be taken to ascertain the actual distance between the tramway and the Marconi station. A committee of two was appointed to confer with Mr. Shields of the Dominion Coal Company and Mr. Creden of the tramway company.

At the next meeting of council attended by Creden and Vyvyan, Creden stated that his company had no intention of interfering in any way with Marconi's plans and wished the matter resolved "without undue disturbance."[41] He agreed to take whatever measures were necessary to obviate all interferences that might arise because of "the too close proximity of the tramway line."

Throughout this period and the ensuing months, a sense of wonder and anticipation abounded in the press, accompanied by much speculation. Newspapers on both sides of the Atlantic were carrying unsubstantiated reports that Marconi had succeeded in sending a message across the Atlantic. When a newspaper reporter waded through the mud to confront Vyvyan with the story, the exasperated engineer's only comment was that the newspapers were full of startling rumours about the Marconi system.[42]

It was a relief to everyone at the station, especially Vyvyan, when, on the morning of October 31st, the *Carlo Alberto,* with Marconi on board dropped anchor about one and a half miles from the Marconi station.[43] The ship, a vessel of the Italian navy, had been loaned to Marconi by the Italian government at the instigation of King Victor Emmanuel, and Marconi had converted it into a floating laboratory equipped with wireless apparatus to conduct experiments at sea. Marconi had spent the summer months on board the *Carlo Alberto,* experimenting and testing his apparatus in Russia and North Africa. Throughout the October voyage from England to Cape Breton, Marconi was in constant communication with Poldhu and had achieved the longest transmission and reception distance to date. He was in a buoyant mood when he arrived in Glace Bay to undertake the most crucial weeks and arduous tests of his young scientific career.

Marconi was greeted by a flotilla of small boats and hundreds of people, including Vyvyan; Major Flood Page of London, a director of the Marconi company; W. E. Brodfield of New York; Kemp and Paget; and his friend and colleague, the Marquis Solari. Marconi was accompanied by a group of experienced wireless telegraphers who allegedly were to replace Glace Bay operators transferred to South Africa.

For about an hour Marconi mingled with his friends, reporters and members of the public while fourteen boxes of apparatus for the Table Head station were unloaded. The unloading was going smoothly until customs refused to clear

two boxes. Marconi was forced to reload the boxes and take them to the international pier in Sydney where the *Carlo Alberto* was to berth. Sydney customs cleared the boxes.

At the International Pier, Marconi and his party were greeted by a large delegation including reporters and members of the Sebastian Cabot Society whom he had met on his earlier trip. In an address to the gathering, Marconi stated he did not wish to make any comments about the successful experiments conducted on his voyage until he had a chance to examine the Table Head results. He intended to stay in Glace Bay for about two weeks to install the new apparatus and to conduct more tests with Poldhu and the *Carlo Alberto*. This prediction was to prove overly optimistic — the testing would require three months of his time.

Marconi fever was sweeping the community of Glace Bay. "Excitement around town is intense and all kinds of news is going the rounds concerning events the future will unfold."[44] Despite his success in achieving constant communication between Poldhu and the *Carlo Alberto* en route to Cape Breton, Marconi refused to comment upon it until November 19th, enabling the newspapers to print contradictory stories. He also waited until the 19th to confirm that *Carlo Alberto* had received a message from Poldhu while docked in Sydney Harbour, an outstanding event because it proved wireless could span the Atlantic. Marconi was persuaded that conflicting press reports about the Newfoundland experiment had caused disbelief within the scientific community: "many of the most eminent men in the scientific news were inclined to put the whole thing down as a fake," until convinced otherwise.[45]

Further grist was added to the rumour mill on November 25th, when Marconi refused to comment on the announcement in the British Parliament that all arrangements for transmission were completed and the King and Postmaster General would shortly be receiving a message from Cape Breton.

Marconi began testing in November, at the onset of a

harsh Cape Breton winter. The bitterly cold and stormy weather added to the frustrations when throughout the following three months failure followed upon failure. November was especially depressing; from November 1st through November 29th, every test failed. The good humour and sense of camaraderie that had prevailed was strained to the breaking point as Marconi and his colleagues grappled with technical problems seemingly beyond their ingenuity. Matters were worsened by the necessity of working and living together in close proximity. No one could gripe, complain or criticize — normal human reactions amidst such disheartening conditions. To cope with the strain and prevent a complete breakdown of morale, Marconi instituted a naval ship's regimen. Formality ruled. No first names were used and all sat around the dining table according to rank.

Marconi's own frustrations intensified when he was notified that the *Carlo Alberto* had to leave in December for naval duties in Venezuela. This was a much earlier date than Marconi had anticipated and threw his plans to conduct more experiments with his magnetic detector into disarray. The change also altered his plans to visit South Wellfleet, where a new station had been constructed. Because the new station did not have enough power to transmit across the Atlantic, messages would be relayed from South Wellfleet to Table Head to Poldhu. Marconi had intended to test the relay, but these plans were put on hold. A more pressing worry was the news that his company's shares were tumbling, endangering the financial arrangements required to enable the transatlantic venture to continue. Only a proven success could entice stock market players to invest or increase their investment in his company.

The increased pressure tried the patience and ingenuity of Marconi and his colleagues. He continued to test, but after one failed test too many, he concluded that either Poldhu had an insufficient supply of power or the arrangement of the plant was unsatisfactory. Marconi decided the fault lay with the former and reversed the experiments. Table Head, with the

larger power capacity, would now transmit and Poldhu would receive. Many experiments followed with many different arrangements of plant and aerials, but the results were so inconsistent that it was difficult to know whether progress had been made. The trouble lay with the wavelengths, but at the time this was unknown:

> We knew nothing then about the effort of the length of the wave transmitted governing the distance over which communication could be affected. We did not even have means or instruments for measuring wavelengths, in fact we did not know what wavelength we were using.[46]

They were using an aerial and circuit to transmit a 2,000-metre wavelength when one of 6,000 to 8,000 metres was required. Before they discovered this error, many tests and frustrations lay ahead.

The first attempt at transmitting from Table Head occurred on November 19th with Poldhu failing to receive the signals. Day by day, various changes were made and transmissions were effected every night without success until the 28th, when Poldhu reported the reception of weak, unreadable signals. On December 5th, after further adjustments to the position of the aerial, and an increase in the length of the secondary spark, some readable signals were received over a two-hour period. "Weak readable signals for the first half-hour; nothing doing during the next three-quarters, last three-quarters readable and recordable on tape."[47]

During the following two nights, using exactly the same aerial arrangements, no signals were received. The inconsistencies made it very difficult to determine whether one transmitting arrangement was better than another and even Marconi, known for his self-restraint, lost his composure, swore and smashed his fists on the table.

Marconi persisted and changed the aerial arrangement every day until December 14th, when Poldhu reported "readable signals through the two hour programme."[48] The

men, mad with relief and excitement, "ran half-dressed into the thirty-degree cold and danced hysterically, then broke and dashed for the dining room where an enormous fire blazed."[49] But Marconi did not join in exuberance. He remained cool, analytical and detached, planning his next critical move. Everything rested on the following phase and he was determined not to make a wrong move.

The first matter to handle when his men "came down to earth" was protocol. To whom should the first messages be sent? No one must feel slighted. Financial pressures and the need to silence press criticism dictated the decision: the first message would be sent from a representative of the press to dispel any negative reaction similar to that which greeted his announcement in Newfoundland. Marconi decided the first message would be sent from Dr. Parkins, correspondent for *The Times* of London, one of the most prestigious newspapers in the British Empire.

The message was sent the following night, December 15, 1902, using the same aerial arrangement as on the 14th. Although the weather did not look promising during the day, with heavy winds lashing the station and swaying the huge aerials, conditions were near perfect as night fell. The air was cold and clear and the moon shone brightly on the snow-covered ground. On the third attempt between 10 p.m. and midnight, the message was transmitted and received. The first message despatched across the Atlantic via wireless read:

> Times, London: Being present at transmission in Marconi's Canadian station, have the honour to send through Times inventor's first transatlantic message of greetings to England and Italy.[50]

Despite the historic nature of the transmission, little celebrating was done at Table Head. Marconi's only concession to the occasion was to gather his men at the foot of one of the towers in the cold Cape Breton dawn and raise the British and Italian flags, which were soon destroyed by a fierce gale and rainstorm which swept the coast. By late morning

there was no sign of them to indicate the historic achievement of the previous night.

In reality, Marconi had little to celebrate. Although Parkin's message had been transmitted and received at Poldhu, it could not be delivered to its destination, the London *Times,* until the demands of protocol were met. Protocol demanded that messages first be sent to the kings of Britain and Italy, but Marconi failed to get the messages through. Six frustrating days passed before he overcame the obstacles, including a broken generator that forced him to temporarily discontinue attempts at transmission. Even when this was repaired, difficulties continued. Only through sheer persistence, determination and desperation were the royal messages transmitted, received and delivered on the sixth day, December 21st. Only then could Parkin's message be released to the *Times* and the world.[51]

Marconi, Vyvyan and their colleagues were almost totally disheartened by the inconsistencies, prevalent even when conditions were ideal at both stations. The signals would vary from good, readable signals to absolutely nothing within a two to three minute time span. Marconi and his men worked at a frantic pace trying to find the causes of the inconsistencies. They spent their days readjusting the apparatus, and their evenings trying to transmit, but they continually failed.

From a technical point of view, Marconi should have closed the station and used his energy to identify and isolate the problem, but he could not afford to. Parkin's message and the messages to royalty had had the desired effect. World interest had been awakened and hundreds of messages were awaiting transmission. Anyone who was anyone, including reporters, wanted to be part of history and have their messages sent. If they were not transmitted, Marconi would not be able to secure the investments required to keep his company solvent. The more favorable the publicity received, the more shares he could sell.

But the inconsistencies could not be overcome and he was

forced to transmit and receive at a painfully slow pace. From December 15th through January 20th, only thirty-eight messages were sent with varying results. According to Vyvyan: "Some were repeated twenty-four times before they were received, whereas others were repeated six times and received correctly on each occasion."[52]

On January 3rd, Marconi interrupted the flow of paid messages to send a transmission to *The Times* of London, announcing the birth of a daughter to Mr. and Mrs. R.N. Vyvyan at St. Joseph's Hospital, Glace Bay.[53] This was the first "live" news transmitted via wireless across the Atlantic. Marconi's message was followed by Vyvyan's message to his mother-in-law: "Daughter born 3rd January. Both well." The birth caused quite a stir in Glace Bay because many believed the baby was Marconi's and not Vyvyan's, a notion that persists to this day.

Marconi gave no hint to the outside world that the difficulties confronting efficient and accurate transmissions were of major importance. In remarks to the press he implied that a regular commercial service would begin shortly. The delays were attributed to the difficulty of obtaining "machinery of all kinds" in this remote part of the world: "We are all, as you can readily see, somewhat out of the world here, and often we had to send as far as Montreal for parts for our machinery."[54] The remarks were not intended to disparage Cape Breton; Marconi spoke proudly and graciously of the role Cape Breton was performing in his achievements. He was simply giving reporters a practical excuse for the delays.

Although Marconi received the favourable publicity he had hoped for from papers such as the London and New York *Times,* other publications such as *Electric World* and the *Engineer* which backed cable interests were extremely negative in their commentaries, continually questioning whether storms and ship-to-shore messages would interfere with the transmission of transatlantic signals. Marconi countered by pointing out that gales and storms had occurred often throughout November and December, but they "had not in the

least interfered" with his work.[55] His words fell upon deaf ears as his detractors warned against the dangers of messages being tapped and read by "outsiders" — secrecy could not be guaranteed. In response, Marconi promised he would pay a large sum of money to anyone who could violate the secrecy.[56]

While eminent scientists and the world's press argued over Marconi's accomplishments, Cape Breton newspapers were ecstatically reporting the tremendous significance of his work upon world communications and the Island's commercial development. The papers promoted the role the Island had played and would play "in the lives of millions of people who have never yet heard in the science of telegraphy the whir and click of the wire telegrapher's ticket."[57]

The Sydney *Record,* edited by Alex Johnstone, MP, ran a contest wherein readers were asked to suggest new names for the Marconi-gram (wireless telegraph messages). Apparently no name was received that could challenge Marconi-gram, so thus it stood. Poems celebrating Marconi's work appeared in the local papers. On Christmas Eve, 1902, the *Sydney Daily Post* ran the following:

> Won't millions remember,
> For years quite a number
> That stormy December
> You worked — not for pay;
> 'Till England would listen,
> To words from Cape Breton
> Wireless and unwritten
> She hears them today.[58]

Mac-Talla, printed in Sydney and the only newspaper in the world written completely in Gaelic, spent several issues engrossed in devising a suitable Gaelic name for wireless. It noted on January 9, 1903, how English scholars were grappling with such words as Marconi-gram and ether-gram, but in Gaelic the best word seemed to be *cogar-athair* meaning "air whisper" or "a whisper that is coming through the air." Maybe a better word would be found, but until then *Mac-Talla* would

use *cogar-athair.*[59] However, a fortnight later readers were advised that the word *athair,* which could be misunderstood to mean "father", was being changed to *adhair*, with the literal translation of *cogar-adhair* being "whisper in the air."

In the midst of this euphoria, Marconi was honoured by the city of Sydney and the town of Glace Bay. Sydney organizers spared no efforts in producing what they considered one of the best functions ever held in the Maritime Provinces. The guest list of one hundred, read like a who's who of the Maritimes. "A crowd of greater specific gravity in the financial and commercial world of eastern Canada, and of greater daily and nightly velocity in a social way, it would be difficult to find,"[60] said the *Sydney Record* on December 31, 1902. Many of the dignitaries present at the Sydney dinner also attended the Glace Bay festivities. Glace Bay organized a public reception and parade through town. At Victoria Hall, where more than a thousand crammed into every nook and cranny, the mayor declared:

> Although the honour and glory is all yours, we confess to a feeling of keen satisfaction at being identified with you, to however modest a degree, in your wonderful achievements. While the eyes of the foremost men in science and commercial industry are today turned upon the brilliant inventor, a small measure of attention is directed to the spot we love as our home, obscure and out of the world though it may appear.[61]

Marconi left Cape Breton for Cape Cod on January 10, 1903, to inaugurate the next stage of his transatlantic venture — the establishment of wireless communication between the United States and England. As the rebuilt Cape Cod station did not have enough power to transmit across the Atlantic, it would operate strictly as a relay station. Messages would be sent from Cape Cod to Table Head to Poldhu, and vice versa. Marconi was eager to begin this aspect of the transatlantic service because of the revenue it would generate. He also thought the service would silence his critics. Never again

would they have cause to say he was a failure.

The Cape Cod station was situated in a high sand dune overlooking the Atlantic Ocean. Only a pathway through a small woods and sandy expanse connected the station to the town of South Wellfleet. Marconi, who arrived at the station in the middle of a raging winter storm, had erected a system of sturdy, 210-foot towers to replace the circular system of 100-foot towers that had been demolished by a storm in 1901.

After several days of testing, Marconi succeeded, on January 19, 1903, in transmitting messages between President Roosevelt and King Edward VII. The messages, which conveyed cordial greetings to the people of the United States and British Empire, were transmitted at night because Marconi had not yet overcome the obstacles that prevented long-distance transmissions during daylight. Because Cape Cod was not designed to send directly across the Atlantic, Marconi and his colleagues were surprised to discover that Roosevelt's message had been accidentally transmitted directly to Poldhu, thus establishing the first direct transmission between these two countries.[62] The direct message had arrived well in advance of the relay message from Table Head.

The direct transmission to Poldhu, although a happy accident, was evidence of the unpredictable quality of the elements Marconi needed to understand and control. Without this understanding he could never count on a regular repetition of the accidental transmission.

Marconi did not attempt to repeat the transmission because of the extraordinary costs involved in increasing the station's capacity. South Wellfleet had a maximum power of 25 kilowatts, while Glace Bay operated at 75 kilowatts, and Cape Cod was six hundred miles further from Poldhu than Glace Bay. The wireless line between Poldhu and Cape Cod passed directly over Cape Breton. Redundancy was not a factor Marconi could afford. Nor was the Cape Breton station ready to perform its relay role. When Marconi left Cape Cod on January 22nd, a small group of engineers remained behind to conduct a series of tests to determine the readiness of the

station. Frustration after frustration extended their stay throughout the long winter months.

Although Marconi was delighted with the transmission between the United States and England, he was disappointed by the need to transmit King Edward's reply by cable rather than by his own wireless system at Poldhu because it did not have the requisite power. Until the station could transmit as well as receive long distance messages, Marconi could not consider opening his commercial service.

While trying to deal with Poldhu's lack of power, Marconi had to contend with other matters that were threatening the viability of his operations. He could not convince the British post office to provide facilities for sending letters to the Poldhu station or to allow Poldhu to connect with its land lines. Neither could he persuade the British government to allow his company to establish signal stations in the United Kingdom because it feared an interruption of the Admiralty's experimental work. Marconi publicly contrasted the obstruction of British officials to the cooperation he was receiving from the Canadian government. The impasse was not easily resolved, so meanwhile he returned to Table Head for a fortnight of experimentation and tests on the malfunctioning sending apparatus — Morse keys worked by wooden levers.

While at Table Head, this practical man conducted an in-depth assessment of all his operations and assets and reluctantly decided to close the stations for a period of re-evaluation and readjustment. The three-month closure, extending from January 22 to March 20, 1903, brought the Marconi enterprise to the brink of financial disaster, but Marconi had little choice. He could not run the risk of declaring the transatlantic service open for business when it was neither ready nor perfected. Any sign of imperfections would give his powerful competitors, including the cable operators, ammunition to launch a negative publicity campaign that would drive his already financially weakened company into insolvency. It was far better to endure self-

imposed financial constraints rather than ones imposed upon the company from outside. If the closure was successful, the company would be able to recover its losses, he hoped.

The closing of the network was a major disappointment to Marconi, but his public remarks betrayed no hint of his disappointment or of the financial burden imposed upon the company. He implied the changes were minor and simply "a matter of form." Once Poldhu's apparatus was readjusted and reinforced with the latest inventions applied at South Wellfleet, wireless telegraphy would be ready to operate as a commercial venture.

Marconi spent most of the three-month closure period in Britain, where he personally supervised and conducted many of the experiments and adjustments at Poldhu. As he had feared, his critics used the delay to attack the credibility of his apparatus and his vision of a transatlantic network. Marconi argued that most of the criticism came from cable stockholders who saw the value of their shares fluctuate during 1902-03, fluctuations that were a direct result of his work. Marconi unexpectedly found an ally in the once sceptical Thomas Edison, who agreed to join Marconi's board of technical directors. Edison also transferred several of his patents relevent to wireless telegraphy to the Marconi Company in return for a large block of shares. Marconi was delighted with the arrangement, because Edison would give both credibility and genius to the struggling company.

Men of science and cable company interests were not the only sceptics — Cape Breton also had its share. A letter from Framboise in *Mac-Talla* reflects the scepticism and amazement that abounded on parts of the Island. The writer told his wife:

> There is a young man from Italy here in Cape Breton now, and he can speak to people in the old country, and not only that, but without even as much wire between the two places as would hang a lamp to a hen roost or a little pot to a peg.

And she replied:

> Do you think I will believe that a person can stand on a hill in Cape Breton, even if he would puff out his cheeks as big as that green pail, that Marcella "ban" on young Donald, my brother in Stornaway, would hear him? Nonsense! Unless I am mistaken, my hero, it takes all the power of my lungs to make you hear me calling you home from the field of hawk's nest, and I think my voice is just as loud as the voice of any Italian "bodach" that is to be found.[63]

During this period of adjustment and re-evaluation, Marconi successfully applied wireless telegraphy to the publication of daily newspapers on board ship. On February 25th, the Cunard liner *Etruria* arrived in New York from Liverpool and Queenstown with copies of the first ocean newspaper with wireless land news. The paper was a mere thumbnail edition of news items sent when the *Etruria* was seventy miles off the Marconi station at Crookhaven, Ireland. The news had been received at midnight, February 6th, and two hours later the paper was "off the press" and distributed to the passengers at breakfast. Five hundred copies had been printed. Marconi, one of the ship's passengers, was well pleased with the success of the venture because it showed another use to which wireless could be put.[64]

On March 20th, the station were reactivated and experiments resumed. With Poldhu's successful receipt of messages during four nights of transmissions, hopes rose and Marconi succumbed to requests from the London *Times* to initiate a news service from Canada. A limited service was introduced on March 28, 1903, but it came to an abrupt end on April 6th, when the Table Head antenna collapsed under the weight of a silver thaw. Although short in duration, this effort constituted the first transatlantic news service.[65]

The silver thaw was a new, annoying and perplexing problem for the Marconi engineers. Never before had they experienced this "icing of the wires." One can only imagine their consternation and horror. At a later date, Vyvyan

arranged a method of passing a warming current through the aerial wires to melt the ice before it became dangerously thick.

Despite the bad luck with the silver thaw, much valuable information had been gathered about the design of the antennas, coupling transformers, circuits, masts and towers. In addition, the syntonic tuning process had proven effective, although handicapped by the failure to devise a portable apparatus to measure the wavelength of the transmission and to aid the tuning station to resonate with it.

Other puzzles remained unsolved, notably the reason for the increase in signal strength after nightfall and the mystery of why signals followed the earth's curvature in apparent defiance of well-established laws of physics.[66] It was not until the 1920s that the theory of solar influences was proven to be correct. At a certain height above the earth's surface a layer of ionized atmosphere bent the wireless waves back to earth again.

The summer was a difficult one. Sometimes strong signals would be received at Poldhu, but Cape Cod, only one-third of the distance, would receive nothing, "conclusive evidence of the variability of the medium through which the waves passed."[67] Marconi concluded there were three possible solutions to the problems he was having: either (1) the aerials were too small for the amount of energy required, (2) the distance over which it was possible to signal during daylight increased with the length of the waves, or (3) the wavelength could only be increased by increasing the capacity and surface of the aerial more rapidly than the inductance.

To verify his conclusions, Marconi erected a large, umbrellalike aerial at Poldhu (Table Head retained a single-sided fan aerial) and conducted a series of experiments on board the *Lacania* while en route from England to New York. The experiments were extremely successful. Daylight transmission was accomplished at 1,000 miles, a 300-mile improvement, and nighttime transmissions had achieved a 1,700-mile radius. Buoyed by these successes, Marconi decided to engender further publicity by publishing an "on board" newspaper, the *Cunard Bulletin,* containing news items

received from Table Head and Poldhu.[68]

At the end of the voyage, a triumphant Marconi announced in New York that he had four inventions that would overcome the atmospheric and geographic obstacles that had to date prohibited the maximum development of wireless telegraphy. These inventions would reduce power consumption by one-half and thus reduce the cost of transmissions. The reduced power requirements also meant that the height of the towers could be decreased, allowing the stations to be established in places earlier thought impossible because of geographic and atmospheric interference. In addition, the new inventions would eliminate the possibility of a rival intercepting messages. The inventions would revolutionize the sending of wireless messages and allow the establishment of a commercial system. Marconi confidently predicted his company would now be in a competitive position with telegraph companies. Marconi also announced he would be going directly to Table Head and remain there until the modifications were completed.[69]

Two months later, in November, Marconi, contrary to his earlier statements, was adding to the height of the Table Head towers, not subtracting. Four poles, each about fifteen feet in height, were placed atop each tower. Experimentation and readjustments continued throughout the following months, and in March 1904 a more powerful plant was installed with the capacity of the alternator increased from 75 to 150 kilowatts. In May, Marconi decided to test the improved apparatus on board the *Campania* during its New York to London voyage. The results were a severe disappointment. Only a minimal increase of two hundred miles in daylight reception occurred and none during the nighttime. The nine months of experimentation between the *Lacania* and *Campania* voyages were a failure.

Marconi was nearly devastated by the lack of results. He could not believe what was happening. He was staring failure in the face and had come as close to despair as he had ever come. He quite simply could not identify the problem and

therefore was unable to find a solution. After he arrived at Table Head, a near feverish exchange of memoranda and rough, hand-drawn-to-scale sketches of designs and adjustments flowed between Marconi and his engineers in Cape Breton and Poldhu. Marconi was becoming quite desperate because of the precarious financial position the failed *Campania* tests had placed his companies in. He had developed his plans presuming successful results. Now he was forced to scramble to save his companies.

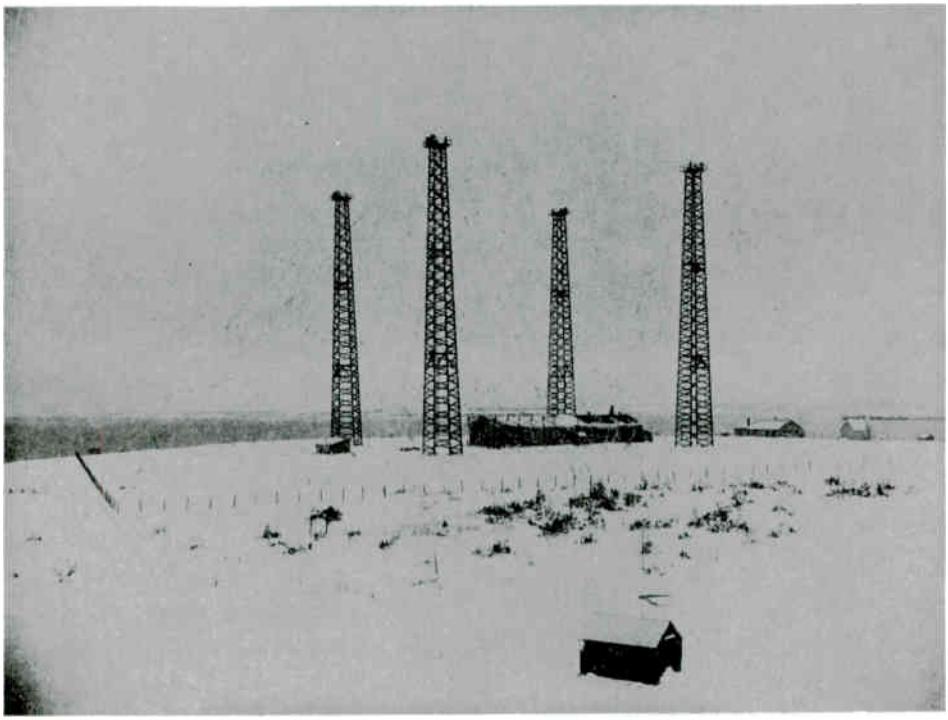
Although great progress had been made in equipping ships with wireless apparatus and establishing shore stations, the financial returns were too small to cover the huge investments the company had been making. During 1903 and 1904, respectively, the Canadian company lost $33,125 and $36,199. Both losses resulted from expenses incurred at Table Head and the company headquarters at Montreal.[70] In 1903 no revenue at all had been earned at Table Head.

The only way money could be earned was by releasing Table Head and Poldhu from transatlantic experimentation and developing a new transatlantic service to shipping. The Cunard Company agreed to pay $0.10 per one hundred words received per day. The service was an outstanding success. By 1905, ship-to-shore communication had become an indispensable way of communicating with ocean-going vessels.[71] The demand for the service was so great that several new shore stations were constructed on both sides of the Atlantic Ocean. The revenues were appreciable and helped the companies gain a degree of solvency.

Large as the revenues were, Marconi hated having to orient the stations towards profit-making. The discontinuance of the transatlantic testing was an admission of failure that Marconi was not used to making, especially in public. His critics rejoiced in the setback, while he could only "grit his teeth" and hope their joy would be short-lived. In public he again betrayed no emotion and talked as if the setback were only a temporary aberration: difficulties such as these were to be expected when attempting a revolutionary change.

The Cape Breton and mainland press had been shocked by the decision to close the stations to transatlantic communication. They had been convinced by Marconi's own statements that his sole purpose for coming to Table Head in May 1904 was to announce the beginning of commercial transmissions.[72]

During the closure, Marconi's mind wrestled with the causes that might have generated such inconsistent results throughout the past two years of testing. He finally concluded that the wavelenghts generated were far too short. He would have either to erect a mammoth, super power station at Table Head or to relocate to a larger site that could accommodate an antenna capable of radiating a much longer wavelength than Table Head. Either decision invoked staggering financial consequences. He decided to relocate, believing the better chance of success probably rested with the larger site. He could not risk the possibility of another failure at Table Head. It was better to invest the money on a new station.



The Table Head Towers before dismantlement and removal to Marconi Towers, 1904. Beaton Institute

4

The Magnificent Achievement

Marconi was nearly overwhelmed by the complexities of his endeavours but had the good sense to increasingly rely on his engineers and to delegate responsibilities. Vyvyan was entrusted with the responsibility for selecting the site of the new station and supervising its construction. He was asked to find a site inland that could contain a circular (or umbrella) antenna 3000 feet in diameter. Vyvyan chose a site about six miles from Table Head and three and a half miles inland, which locals quickly nicknamed "Marconi Towers."

Rhodes, Curry and Company again received the construction contract. Building began in October and continued throughout the depth of winter, when the ground was covered with snow and temperatures often fell below zero. More than one hundred engineers and labourers dismantled the equipment, buildings, masts and everything useful at the old station and re-erected them on the new 600-acre site. The station was completed in May 1905, at a cost exceeding $200,000.

The complex, once again, quickly nicknamed Marconi Towers, was larger than Table Head and consisted of twenty-two buildings, including a condenser building, an engine and machine shop, staff residence, livery stable, blacksmith shop,

and the manager's residence where Marconi stayed whenever he was in Cape Breton. Because the Marconi Company wanted no intruders who might inform competitors as to the latest inventions and stage of development, the complex was secured by a long and massive barbed-wire fence.

The complex, connected to Sydney by the "old S & L" and a diabolical corduroy road cut through thick woods and innumerable bogs, was situated on a black knoll topping a vast area of wild country where "half a mile away, the billows of the Atlantic may be seen lashing the rugged coastline of Cape Breton, the most easterly part of the North American continent."[1] The 280-foot towers reached a summit of 330 feet above the high water mark. The two square miles that enclosed the buildings, towers and masts could be seen from fifty miles away.

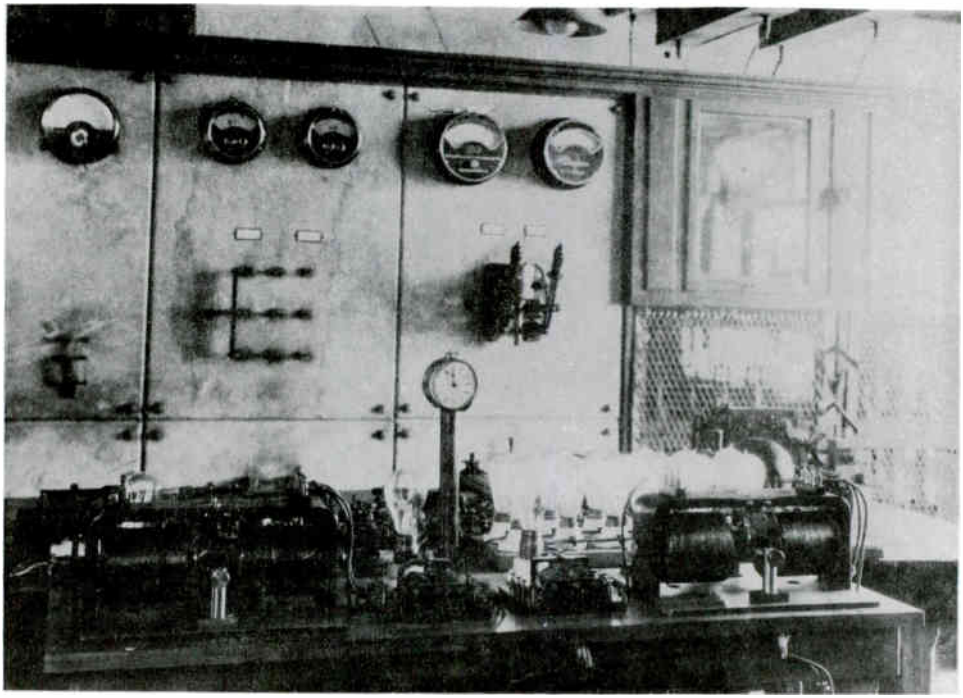
The new antenna system had a design similar if not identical to Poldhu's.[2] The four towers were in the centre of the umbrella-shaped aerial, which had two hundred wires running laterally to two concentric rings of twenty-four 180-foot masts, eight in the inner circle and sixteen in the outer. Provision was made to extend the diameter of the umbrella still further by means of an outer circle of forty-eight poles, each fifty feet high. The diameter, without the extension, was 2,220 feet and, with it, 2,900 feet. A special earthing system was also fitted. The aerials were connected to a bell-like dome at the top of the operating room located in the condenser building. The condenser building, situated in the midst of the four towers, was actually two buildings built at right angles and was shaped like a "T". Each corrugated iron building measured 200 by 60 by 30 feet.

Twenty-seven miles of ditches containing fifty-four miles of wire ran between the two rings formed by the masts.[3] Overhead an additional fifty-four miles of wires connected the two circles.

The towers were surrounded by an enclave of buildings that housed the apparatus required to transmit messages. The machine shop and the powerhouse were located one hundred

yards from the towers. The machine shop repaired and manufactured a variety of wireless apparatus, and the powerhouse contained a number of boilers, engines, electric storage batteries and a concrete floor. Coal-fired steam operated the generators that furnished the electrical energy required to transmit.

Although the station was larger than at Table Head, the



Marconi Wireless Station, Glace Bay, Nova Scotia. Relay table and switchboard, 1914. Beaton Institute

method of sending messages had not changed. When a telegrapher in the condenser house pressed the Morse key and an ether wave was sent across the Atlantic, great tongues of bluish-white flame similar to lightning shot up, while outside the aerial wires cracked like a whip. The noise inside, similar to bass organ notes, was so loud that observers had to cover their ears with cotton batting.[4]

The station was a spectacular sight whose fame quickly spread beyond the confines of Glace Bay. To satisfy the curiosity of local sightseers and tourists, the railway inaugurated a special stop to enable the folk to view the station from a close distance.

When Marconi arrived with his new wife, Beatrice, in Cape Breton in the late spring of 1905, financial pressures were threatening the collapse of his company. The pressures were so great that he had, once again, to confront the possibility of going no further with his dream despite the huge investment in the new station.

Now he had to stare into the abyss and determine once and for all whether the dream of direct wireless should be abandoned in favour of a world relay system, which in itself could be as prohibitively expensive as the transatlantic project. His other alternative was to surrender all thoughts of long-distance wireless and to concentrate on securing contracts like the one recently signed with Cunard which guaranteed ten pounds a day for every hundred words each ship received.[5]

Marconi's every instinct worked against these alternatives, but the financial situation was so bad he had to undertake an objective analysis. Only he could do this analysis and, when completed, only he could decide the direction to proceed. One can only imagine the conflicting thoughts he must have had while arriving at his decision. Could he possibly have been completely objective, or was there some little voice, some part of him, urging him to risk all for the dream? It did not take him long to decide. After only a few days of supervising the tuning process and examining the overall competency of the station, he resolved to continue the

transatlantic venture, to pursue his dream.

But the effort would require greater funding and heavier commitment from the parent company's board of directors. Marconi abruptly cut short his stay in Cape Breton and returned to England, without Beatrice, to discuss financial matters with the board and to attempt to raise additional capital. The board concurred with his decision, but there were immediate cash flow difficulties it could not meet. In desperation, Marconi invested every bit of money he had to meet the payrolls and keep the Poldhu and Cape Breton stations running.

Marconi stayed in England for three months to raise capital and conduct tests at Poldhu. Meanwhile his new, young wife was left in Cape Breton without him. The few amenities offered at Marconi Towers — riding, shooting, canoeing — were not much fun for a young bride without her husband. She found the time long and boring without him and matters worsened when she was stricken with a severe case of jaundice. Beatrice was not petulant, just lonely. People who remember her recall that she was quite prepossessing, with manners "so perfect that one never thinks to observe them."[6] Direct and lacking in affectations, everyone was at ease in her presence. She revealed no outward hint of her inner turmoil.

Marconi's decision to continue with the transatlantic venture had been reinforced by a series of successful experiments conducted on board the *Campania* while en route to England from Cape Breton. He was particularly buoyed by the experiments that improved daylight transmission by six hundred miles. Back in Poldhu, Marconi persisted until he finally achieved a Poldhu-Cape Breton transmission in daylight hours. He did not publicize his success because he wanted to perfect the experiment. This was a wise decision, because many additional experiments using aerials of different sizes failed to produce any consistency.

But these inconsistencies piqued Marconi's curiosity and he pursued the quest with renewed energy and enthusiasm. He was like a youngster close to finding a treasure, but two

Marconi house around 1912. Beaton Institute

problems needed resolution before the treasure could be found: the inconsistency of the spark as a generator of electric waves, and the aerials' transmission in all directions. He decided to concentrate on the latter problem and soon realized the possibility of transmitting more strongly in one direction than another. If a wire were erected horizontally from east to west and the western end lowered to the transmitter, signals were received more strongly from the east.[7] The aerial became more directive the nearer it was to the ground.

Favourable results were obtained when three-quarters of the Glace Bay aerial was lowered and the section furthest from Poldhu left erected. Additional tests proved long horizontal aerials could radiate waves of any length. Marconi had solved a major problem. He had been using wavelengths that were far too short for long-range daylight transmission, or if a long wave had been used, the aerial had not been efficient. Much later Marconi discovered that stronger signals could be received during daylight hours when waves of 7,500 to 8,000 metres were used. This method later became the accepted form of long-distance, or long-wave, communication.[8]

With this discovery, Marconi realized a more powerful European station was required if his dream of a commercial transatlantic network was to be realized. Because the Poldhu site was incapable of containing the contemplated extended aerial system, the station was relocated to Clifden, on the west coast of Ireland, which offered a shorter path across the Atlantic. The new station embodied every new and proven device known to the Marconi engineers, including the newly developed directional antenna with maximum radiation towards Canada and operating on a wavelength of 6,666 metres.

New and radically different transmitting equipment was installed, and the glass plate condensers were replaced by air condensers.[9] Air now replaced glass as the dielectric separating the metal plates. A large building to house the giant condenser was built and the metal plates were suspended

twelve inches apart. This condenser was much more efficient than its predecessors. Marconi also installed a completely innovative generating plant with a maximum capacity of 20,000 volts that greatly superseded the ones previously used in Poldhu and Cape Breton. Later in 1910, when the Cape Breton station was rebuilt after a major fire, it was to be rebuilt to the Chifden design. The expanded generator would allow both stations to operate for sixteen hours out of twenty-four without recourse to the main generator.

Another significant development was the replacement, in 1907, of the old spark system by the disc discharger, which permitted more readable and understandable signals. To date, co-station interference had been a problem in the receipt of signals. Syntonization, which allowed the sending of messages exclusively to a particular station without interruption or reading by a competitor, had minimized co-station interference but was not completely effective because of "the heavily damped oscillations produced by the conventional spark gap, which produced radiations over a wide band of frequencies and thereby flattened the tuning."[10]

With the disc discharger, Marconi found a method to produce continuous oscillations instead of damped wave trains, which permitted the receivers to be tuned precisely to this frequency. In addition, a slight readjustment of the receiver-tuned circuits was sufficient to lose this transmission and to receive another on an adjacent wavelength or frequency. With transmitters "using the conventional spark-gap system the receiving station might alter its tuning very considerably yet still be unable to get rid of the transmission."[11]

The disc discharger released a discharge that was neither an oscillatory spark nor an ordinary arc; and continuous oscillations having frequencies of up to 200 kilocycles resulted. Marconi's disc, patented in 1907, was modified almost immediately "to interrupt the continuous wave periodically and so to make the signal audible when received on a magnetic detector or diode detector."[12]

In the midst of these developments, in September 1906,

Marconi, accompanied by his wife, was once again in Cape Breton to conduct and supervise more tests. Despite his categorical denial of any thoughts of opening the station to regular transatlantic business, speculation was rife that this would happen. Marconi tried to dampen the expectations:

> Perhaps we are over cautious. Perhaps we should not discontinue taking public business altogether but that is my judgement. If we were the only company, it would not be important if we failed now and then to transmit a message for a day or two at a time, but as it is, there are many submarine cables giving reliable and accurate service everyday. Our course may not be the right one but I think it is best.[13]

During this visit, Marconi accounced that $40,000 would be spent improving and enlarging the company's machine shop, the first in Canada to manufacture commercial radio equipment.[14] Until now only minor parts of equipment and machinery had been manufactured locally — all others had been imported from the parent company in England, a time-consuming and expensive process. It was more practical to have his experienced mechanics in Cape Breton design, produce and repair the equipment. In addition, Marconi had promised the Canadian government that Canadian-manufactured equipment would be used whenever possible.

Within a year of Marconi's announcement, the shop was producing high-frequency transformers and magnetic detectors for use in the Marconi coastal stations in eastern Canada that had been erected on behalf of the Canadian government. The shop also built the instruments for those vessels outfitted for the Marconi system to allow contact with the shore stations. It built a myriad of engineering apparatuses, from angle iron switchboard frames to the finest and most sensitive of instruments. The mechanics were also adept at constructing and manipulating all kinds of wiring. The shop manager, Mr. Warren, was considered somewhat of a genius for his wizardry.[15] No problem, big or small, seemed

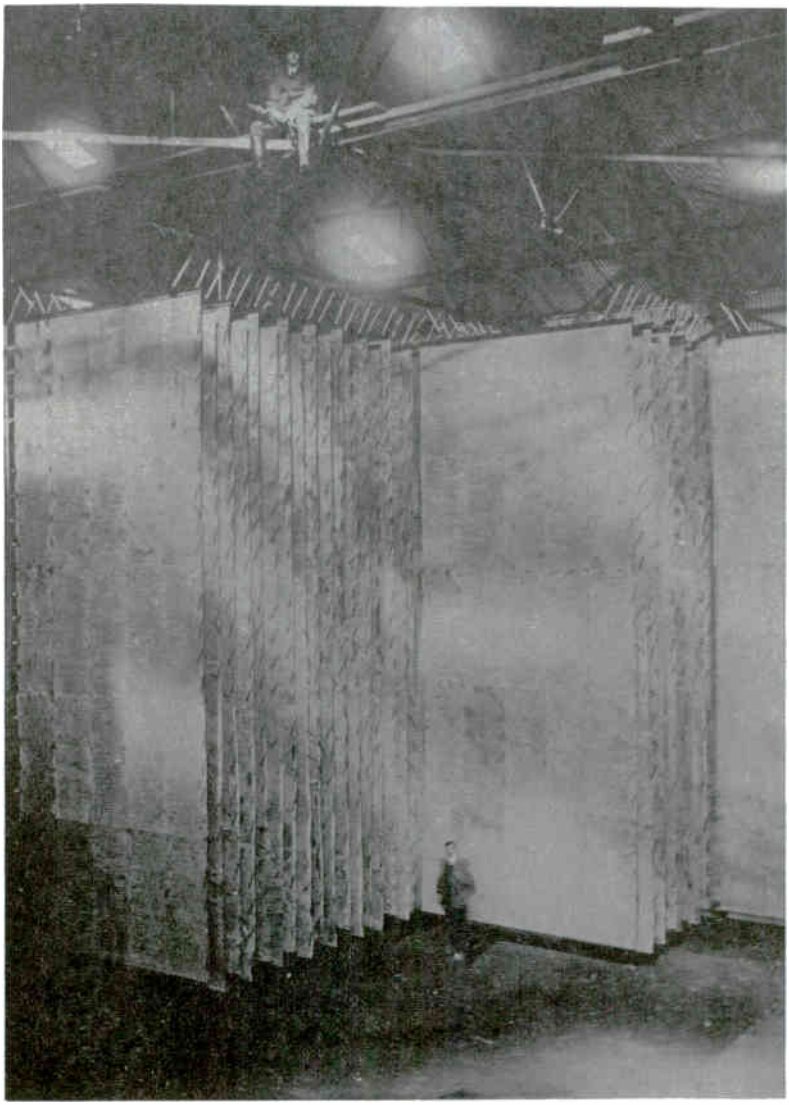
beyond his grasp. Like Marconi, he relished a challenge.

During the following three years, increased use of wireless telegraphy in navigation placed greater demands upon the shop. By 1909-10, "the little shop at Glace Bay had become too small to handle the volume of business received."[16] Rather than expand it, the shop was relocated to Montreal and a future giant in the electronics trade was lost to Cape Breton. It was a terrible blow to the proud and hard working Glace Bay mechanics who had been so successful in their craft and contributed so much to the transatlantic venture. It was also a blow to the Glace Bay economy, because forty men had been employed in the machine shop.[17]

The development of the Clifden station into a fairly big factory "dwarfing Poldhu in its size" and the installation of the new transmitting equipment in the Cape Breton station had taken two years and tested Marconi's ingenuity, patience and financial resources. "So much money had been poured into the construction of these giant stations that the effect on the company, should a satisfactory transatlantic service not materialize, could scarcely be contemplated."[18] The summer months of 1907 were especially nerve-wracking. The Clifden station had been completed by mid-year and some preliminary testing had occurred. By summer, Marconi was busily alternating between Clifden and Cape Breton to supervise the final adjustments.

In early July 1907, Marconi, his wife and two colleagues arrived in Cape Breton amidst speculation that "at no distant date important announcements will be made in connection with the operations at the Cape Breton station and the system generally."[19]

But it was not until September that Marconi felt confident enough to announce that all obstacles had been surmounted and success was certain. He stated that twenty words per minute were being regularly sent across the Atlantic and that greater speed would soon follow. He saw no difficulty in relaying overseas messages to other parts of North America as the Canadian Pacific Railway (CPR) and the Western Union



Clifden Station. Main condenser (H.F. Transmitting circuit) was exactly the same at Glace Bay. Photo gives an idea as to size of plates. Beaton Institute

had land lines running directly to the Glace Bay station. As far as he was concerned, all was ready for the commencement of commercial work in October.

The great day arrived on October 17th. Entwistle, the manager of the Clifden station, notified Marconi in Glace Bay that all was ready to transmit and receive the first transatlantic public messages over the new current. Although newspaper accounts state that not a hitch marred the efforts of the transmission, L.R. Johnstone, one of the Glace Bay telegraph officers and later superintendent of the station's operators, noted that a variety of problems had beleaguered the venture on the 16th, causing much apprehension about the next day's transmissions.[20]

The foulest possible easterly winds, fog and heavy rain off the Irish coast played havoc with the transmissions throughout the day. Signals faded out and nothing was received, but the telegraphers persisted in sending messages all day in hopes that something would get through. When darkness fell, conditions eased and "signals began to burst through."[21] Only then did they discover that all the messages had been received in Ireland.

The next day, in much improved conditions, about one hundred people gathered for the inauguration of the service. Marconi, Beatrice, Vyvyan, station engineers, telegraphers and other employees were joined by Cape Breton politicians and municipal officials from Glace Bay, Sydney and the surrounding communities. A group of journalists from Britain and the United States were also on hand to cover the event. Because no one except Marconi and the telegraph officers were allowed in the operating room, everyone had to crowd into an adjacent room and watch the transmission through a large window.

Marconi and his operators, Johnstone and Hart, sat at a table in the twenty-by-twelve-foot operating room equipped with three Morse keys and eight to ten transformers. The three men alternately received and transmitted messages while probably praying that everything would work. Everyone was

tense as Marconi despatched the first message of the day. The moment was critical for Marconi: success depended upon the quick and accurate transmission of the despatch, a message from Sir Wilfred Laurier to the British people.

While the message was being transmitted, the electricity popped like a machine gun and flashed a ghostly pallor over the faces of the waiting crowd. After the transmission, an outwardly cool Marconi stated: "It's gone, and now I'll have the operator in Clifden send it back."[22] After a few moments a smiling Marconi confirmed that the message had been received. No one else was so restrained, especially Beatrice, whose joy could not be contained. She ran into the room and hugged and kissed Marconi to the cheers of the delighted onlookers.[23]

A relaxed and delighted Marconi remained in the transmitting room, supervising the transmission and reception of some 10,000 words. He could not have been happier with the day's work. He felt satisfied that now, after all the years of frustrations, hard work and financial investment, his goal and dream had been achieved. While speaking to the onlookers, especially the press, "he took pains" to emphasize that the events of the day were but a continuation of his successful transmission five years ago: "Today we are merely throwing open our doors to the public and inaugurating the work for which our company was formed."[24] October 17th was the beginning of a regular business between Europe and America in continuation of the old service.

Because Marconi believed the press would be the major user of the transatlantic service, he declared October 17th a press day and ensured that most of the messages sent were press messages. No commercial messages and only a few private messages were transmitted. The exceptions were the exchange between Lord Grey, the Canadian Governor General, and King Edward VII. Marconi must have thought back to the time nine years ago when he had sent messages from the then Prince of Wales' yacht to Queen Victoria, then holidaying on the Isle of Wight.

As the *New York Times* had a longstanding interest in the wireless venture, Marconi selected it to receive the first press message from England. The message from Lord Avebury, its correspondent in London, read: "London; this message marks the opening of the Trans-Atlantic Wireless Service." The message was received at Glace Bay and sent to New York City via the Western Union Telegraph Company, whose Glace Bay lines were connected to the Marconi station. If Marconi had been able to make the same arrangement with the post office in England, which controlled the telegraph, his life would have been much easier.

Avebury had wanted a much wordier text but had agreed to Marconi's request to reduce it to allow more transmissions on the day. In the original text, released a few days later, Avebury referred to the transatlantic service as "one of the most remarkable achievements of modern science."[25] Marconi also sent a message congratulating the paper on having received the first westward press message.

On October 17th the *London Daily Mail* received the first newspaper despatch from the *New York Times.* And Marconi, ever aware of the good will derived from a personal touch, sent messages to the *Irish Times* and the *Dublin Evening Mail* acknowledging his happiness that the European transatlantic station was situated in Ireland, the ancestral home of his mother and wife. He paid a special compliment to the *Mail,* confirming the historic role it had played nine years earlier when it had used wireless telegraphy to cover the Kingstown Regatta — the first time a newspaper had used wireless telegraphy for news coverage.

Not to be outdone by the major North American and European papers, the *Sydney Post* had a brief message transmitted via Clifden to the *London Daily Mail.* The next day the *Post* asked to send a five hundred-word message, but because of the enormous number of other messages to be transmitted, the message was delayed. Marconi was under contract to several British, American and continental newspapers, including the *Daily Evening Mail,* to supply

news during the first ten days of transmission and these commitments had to be fulfilled.

The Cape Breton press was fulsome in its praise of Marconi's accomplishment. The *Sydney Post* noted that wireless, "the wingless carrier pigeon of the world," used the genius of commerce and the demon of news to "mark the latest milestone on the highway of progress."[26]

The Sydney *Record* stated:

> Yesterday afternoon the system of wireless trans-Atlantic communication passed from its experimental stage to a practical basis and today for the first time in the history of the world messages are being transmitted and received to and from England commercially.[27]

The *Presbyterian Witness* heralded the event and its significance for Cape Breton. It declared Marconi's contrivance "a noble triumph of science" and predicted that "the geography and topography of Cape Breton will be studied by the world in connection with this wireless wonder."[28] Despite the congratulatory tone, the newspapers noted that Marconi's prodigious activities and accomplishments were beyond the grasp and understanding of the average layman, whose perplexed mind becomes "entirely and hopelessly entangled as he in vain essays to think out the way and where of this stupendous feat."[29]

As in 1902, little was done at the Cape Breton station to celebrate the momentous achievement and mark the beginning of a new era in world communications and technology. On the afternoon of October 17th, Mrs. Marconi hosted a tea for all the guests who had attended the great event, and that night both Mrs. Marconi and Vyvyan hosted a banquet for the station staff. The British, Canadian, American and Italian flags were hung from the tops of the four towers.

Typically, Marconi spent little time celebrating. He spent most of his day and evening in the operating and receiving rooms, supervising the despatch of messages. Although he

revelled in "the termination of a season of misery that had extended over a period of several years," he more than anyone else realized the work that lay ahead.[30]

His immediate plans were to operate a limited public service that transmitted approximately one thousand words per day. Each station would operate twelve hours a day, with three shifts of five operators.[31] Business did not yet justify the full activation of the stations, and many problems prevented him from meeting the immediate demands on his service. On October 17th, when 13,000 words were transmitted and 2,000 were received, the system collapsed for a four-hour period during the night and did not resume until the next morning. To avoid a similar breakdown, the transmission was reduced to a much slower speed of ten words per minute, producing a tremendous backlog. By the 19th about 100,000 words were awaiting transmission and an equal number in Clifden.

Several factors contributed to this situation. Only two of Glace Bay's four towers were fully operational and the ad hoc land lines established by the CPR and Western Union were not as efficient as trunk lines. Breakdowns were frequent, as on the night of the 17th when one message took twelve hours to be delivered from Glace Bay to New York. Marconi looked forward to the day when business would increase, because both companies had promised to install trunk lines as business warranted. Fortunately, the Clifden station was better equipped. The resistance of the British post office authorities had been overcome and a trunk line directly connecting Clifden to London had been installed.

Marconi fervently believed that, once the problems were overcome, wireless would show its true efficiency and supersede all other means of communication, even cable:

> There is practically no limit to the capacity of our plants here [Cape Breton] and in Clifden, and when everything has settled down to routine action, we shall send messages with greater facility than cable.[32]

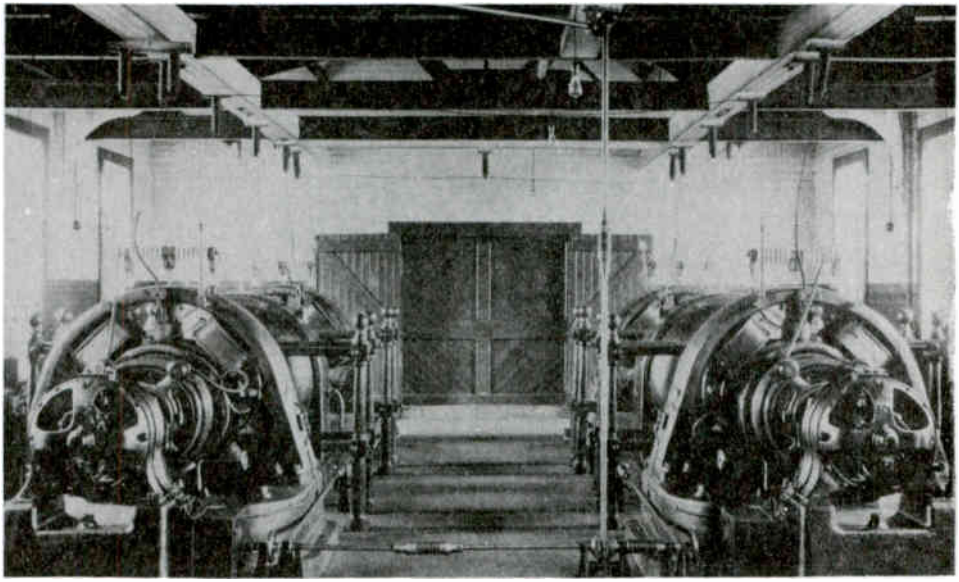
He was right. After only four months of testing, the

London and Montreal via land lines, the full commercial service began. On February 3, 1908, six years after the first messages had been sent across the Atlantic from Table Head, the continents of Europe and North America were linked on a permanent basis. This service, in effect, constituted the beginnings of the Marconi empire and marked a new phase in the development of modern communications. From this one achievement was unleashed a flood of scientific activity which revolutionized the way the world communicated.

His achievement spurred Marconi to think in other directions and to apply his apparatus to other situations and conditions. He believed it could be as successful over land as over water, and with this in mind he declared that it could be used to span the globe. "I believe there is no distance to which we may not reach, and from this beginning I look for the extension of wireless until it gives service over the globe."[33] On reading these comments his board members "must have shaken in their shoes."

Marconi's moment of triumph was also one of great relief. In bridging the Atlantic with his apparatus he had overcome the odds, defied the doubters and risked financial ruin. The moment was to be savoured, and one can appreciate the emotions of pride, relief and sheer thanks that must have been offered. Many years after the magnificent achievement, when transatlantic transmissions were a common occurrence, Richard Vyvyan, Marconi's friend and colleague, wrote that the magnificence of his achievement could only be measured by those who had worked with Marconi. Only they could

> realize the wonderful courage he showed under disappointments, the extraordinary fertility of his mind in inventing the new methods to displace others found faulty, and his willingness to work, often for sixteen hours at a time when any 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.[34]



Marconi Wireless Station, Glace Bay. Two motor generator sets 4-5000V D C generators in Series 1914. Beaton Institute

5
The End of An Era

The dawning of a new era in communications did not herald an upturn in Marconi's financial situation. The transatlantic service continued to operate at a loss. The technical triumph of spanning the Atlantic was marred by the imperfections of the land lines. Delays in transmitting on these lines from Glace Bay to Montreal and New York and from Clifden to London restricted commercial use of wireless telegraphy and thereby decreased the company's funding.[1] During the years 1906-09 the Canadian company lost $340,000.[2] Though the parent English company had started life as a "small brotherhood of engineers," it had grown into a commercial organization where shareholders wanted to see a return on their investments.[3]

In the early morning of August 21, 1909, Marconi received a severe blow when fire ravaged the Glace Bay station, completely destroying the transmitting and receiving building, the apparatus inside, and the station's logs and record books. The men asleep in the staff house and cabins only a few hundred yards away from the raging fire had been awakened by the sound of a falling building and had luckily escaped injury.[4] The fire was fed by hundreds of gallons of insulating

oil, and by the oil-filled transformers located in the transmitting room. The wooden structures, dry as tinder from lack of rain, burned like matchsticks. Although fire officials never found the cause of fire, William Appleton, a machinist on site during the fire, believed the hot weather and the continuous transmission of 200-300 kilowatts caused the conflagration.[5]

Everyone at the station fought the fire, but the water supply and extinguishers were inadequate. The Glace Bay Fire Department arrived via a special Sydney & Louisbourg train, but without there being any water nothing could be done. The only buildings left standing were the powerhouse and the machine shop, located about two hundred yards from the fire, which the firemen had taken preventative steps to save. Luckily, no lives were lost. Although the *Sydney Record* reported that all the machinery — the great dynamos, the costly electrical machinery, and everything contained in the stock building — was lost, Marconi, two months later while in Montreal and en route to Glace Bay "as fast as I can get a train to take me," minimized the damage, stating only a portion of the old machinery was destroyed, and that most of the new machinery that was to be used in the expansion of services between Canada and Great Britain was saved.[6] He feared that if the true extent of the damage were known, his company stocks would plummet and his competition would be advantaged.

Marconi arrived in Cape Breton accompanied by two directors of Canadian Marconi who stayed one day and night, just long enough to survey the damage, while Marconi, who had a "deep and sentimental attachment to the great station,"[7] remained for several months, personally supervising the redesign and reconstruction of the station.

The decision to rebuild meant "there was nothing to be done except get busy with ordering new machines and making new transmitting apparatus," and because Glace Bay "was devoid of about all materials and machinery," the workers had to be very skilled at adapting.[8] But no matter how adept they

delays ensued. Even the steel frames of the building had to be manufactured and purchased in England and then shipped by steamer to Cape Breton. The company could not afford the additional time and money, but there was no other choice, except closure, which Marconi refused to consider.

The engineers, machinist and the other staff worked eighteen to twenty hours a day, seven days a week, for several months while rebuilding the station. They caught a few hours of sleep whenever and wherever they could, often on a twenty-inch-wide engine belt in the powerhouse.[9] They worked in below-zero temperatures, laying a 30,000-volt cable and ten miles of joints in frozen trenches. Marconi was installing a new system to produce high frequency energy, replacing the old alternating current with a direct current supply. This required the installation of a massive 6,600-cell storage battery charged by a group of high-tension, 5,000-volt D.C. generators and a huge condenser. This was extremely dangerous work, especially when the 6,600 cells had to be filled with acid within a twelve-hour period. When the cells were ready to be filled, Marconi worked side by side with the engineers, staff and forty labourers, pouring 20,000 gallons of acid into every available acid-proof utensil they could find. All swore like sailors, Marconi in his native Italian, and "all suffered intensely from the irritation caused by the acid and the fumes,"[10] which spilled upon them. By day's end, most of the men had to discard their soiled, burnt clothing and shoes.

Marconi had also decided to separate the transmitting and receiving apparatuses. Formerly they had been close to each other, but now he moved the receiving apparatus to a building one-half a mile away from the transmitter. The receiver now had an antenna of its own to collect incoming signals. He also installed remote control gear in the receiver building.

While Glace Bay was being rebuilt, the Clifden station was enlarged, modernized and re-equipped. Both stations now had the latest advances in radio telegraphy, including several alternative methods of transmission, which minimized the

were, some machinery and materials had to be imported, and chance of a complete breakdown in service.

Glace Bay and Clifden were reopened for transatlantic service on April 23, 1910, eight months after the fire. The three-month closure envisioned by Marconi had been extended by delivery and construction problems. The delays and expense might have defeated another man, but Marconi, always looking for the silver lining in the cloud, found the fire "a not entirely unmitigated evil as it has given me the opportunity of installing more efficient and more up-to-date machinery whereby good speed and accuracy should be easily obtained."[11]

The new station required an expansion of personnel. Thirty people, including stokers. engineers, six technical associates and fifteen telegraphers staffed the new Glace Bay station. Four of the telegraphers were Canadian and three were English. One was kept at the wireless key every hour of the day while one or two others transmitted to the land lines.

Marconi was "thoroughly satisfied" with the smooth, accurate and efficient operations of the station on the day of its reopening, which was also two days before his birthday, a fact noted by the Sydney Century Club of businessmen in their congratulatory telegram to him. Polite as always, Marconi returned the sentiment:

> "I sincerely thank the Sydney Century Club for their kind congratulations and good wishes on the reestablishment of the trans-Atlantic wireless service."[12]

Once again the *Presbyterian Witness* heralded Marconi's achievement:

> Marvellous beyond measure is the art of man that collects and arranges symbols of human thought and commits those symbols to swift-winged rays — swift as the very rays of light — and teaches them to traverse the paths of the earth, across lofty mountains, arid plains and stormy seas. In this way England speaks instantaneously to her friends on this side of the ocean, and her friends return messages by the same ethereal pathfinder.[13]

Although the stations were successful in resuming operations, business was disappointing and threatened Marconi's still precarious finances. Marconi had estimated that the capacity of the two plants would be 10,000 words per day, increasing to 20,000 in July or August, but by October only 4,000 words per day were being transmitted. The main obstacle to success continued to be the "the unremitting inimical attitude of the land telegraph companies," which refused to grant the Marconi station press rates.[14] Although the companies had, as agreed, run lines to the Glace Bay station, the station was charged the same rate as a private individual and not granted cheaper press rates despite the fact that it handled a large volume of business for newspapers such as the *New York Times.*

Another problem was the inaccurate transmission of messages over the land lines, which negated the reputation of the wireless. Telegraph signals had very fine lines of distinction and the length of the signal was the only method of determination, but with wireless every signal was distinct and recognizable beyond doubt. G. Whitmore, who had succeeded Vyvyan as manager of the Glace Bay station, declared to the *Sydney Record*:

> I have no hesitation in saying that 90% of the mistakes which are complained of to us occur in transmission over the land telegraph lines on this side or over the postal lines on the other.

The telegraph operators were either wantonly careless or lazy in their readings and transmissions of the messages, and the Marconi Company was powerless to do anything about it.

Marconi was completely frustrated and "fed up" with the telegraph companies; at his every step since 1901 these companies had badgered and bedevilled his efforts. From Glace Bay on April 7, 1910, he wrote to the Marconi head office regarding yet another telegraph issue:

> It would be very desirable if you could manage to induce the telegraph companies to accept messages addressed to

places in the United Kingdom via Glace Bay instead of requiring messages to be treated as local ones and addressed solely to our station at Glace Bay.[15]

While the struggle with the telegraph companies ensued, Marconi embarked on other activities to broaden the appeal of wireless and enhance the financial position of his stations. In October 1910, communication was established among Argentina, Great Britain and Canada, and in November Marconi personally inaugurated the transatlantic service between Italy (Coltano), Great Britain (Clifden) and Canada (Glace Bay). Marconi's grasp of the world was growing daily more complete.[16]

To keep pace, further technological adjustments were made at the stations, including the replacement at Glace Bay of the four wooden towers by twenty steel masts 180 feet high that supported a new system of aerials. The contrast in appearance between the old and new was striking. Formerly the operating station was located in the centre of the square formed by the towers, and the wires ran down to it from the top of the towers in the shape of the ribs of an inverted umbrella. Under the new system, the towers were only supports to the inclined wires and therefore expendable.[17] The operators who had worked in the transmitting building located within the four-tower square were relocated to a little red house a quarter of a mile from the towers.

Disappointed and disbelief greeted the changes. Marconi Towers had become a familiar site to locals and tourists since its construction in 1905 and had become a regular railway stop. Cape Bretoners were proud of the Towers. "Each inhabitant has felt something of the distinction which the best of them elsewhere could not boast."[18] The dismantling of the towers was akin to the removal of a part of the Island's mystique — something which set Cape Breton apart from the rest and best of the modern world.

Even Whitmore regretted the dismantling and wished "we could turn these four tall towers over to some amusement concern which could utilize them as sight-seeing elevators or

something of the kind."[19] But such did not happen. "The towers were felled and the material sold to iconoclasts for fence pickets and firewood."[20] The great wooden towers that gave Marconi Towers its name became but a memory in the minds of Cape Bretoners.

Other dramatic changes occurred in 1913 when the duplex operation system was installed in Glace Bay and Clifden. This system revolutionized the transmission and receipt of messages by enabling the simultaneous transmission of signals in both directions. Before duplex, a message could not be sent while one was being received because of mutual interference. The procedure was both time-consuming and expensive. The duplex system doubled the traffic between the two stations and greatly enhanced the stations' revenues.

The duplex system required the relocation of the receiving apparatus to a site several miles from the transmission apparatus. Letterfrack in Ireland and Louisbourg in Cape Breton were the sites chosen.

Louisbourg, site of the eighteenth-century French fortress, was situated on an immense natural harbour about twenty-five miles from Glace Bay. The two towns were connected by the Sydeny & Louisbourg Railway. The receiving station was not situated in the "new town" of Louisbourg, incorporated in 1906, but in the "old town," where the civilian population of the fortress had lived. The old town and the new station were only a few yards from the shore of the inner harbour, La Barrachois. A thick forest had grown on the land once inhabited by French settlers.

The receiving station, with its six aerials, was much larger than Marconi Towers with its four. The main aerial was a single, thick wire more than a mile long, separated on six 320-foot steel masts. The balancing aerial was one and a half miles long, fifty feet high and supported by a number of wooden poles.[21]

Although theoretically they had been designed to withstand the pressure, the entire aerial complex and the controlling lines linking Glace Bay and Louisbourg collapsed

under the weight of a silver thaw one February night in 1913. Marconi was "beside himself" with this development. He had been assured that the warming system — devised years earlier during Vyvyan's time to prevent such catastrophe — had been in place.

Previously, an impending silver thaw would be detected when a rope could not freely pass through a pulley block mounted twenty or thirty feet atop the condenser building. When this happened the aerial wires would be electrically warmed and the ice prevented from developing.[22] But all this depended upon someone having the prescience to know that a silver thaw might be on the way and that the pulley should be tested. That "someone" was usually an "old hand" who could be relied upon to predict a thaw by the feel of the air. Apparently no old hand was around to give the advice because Woodward told Marconi: "The warming had not commenced until it was too late and a quantity of ice had already formed."[23]

Marconi was incredulous and furious. A man who had received the Nobel Prize for Physics four years earlier was being told that the success of his expensive, new wireless telegraphy installation depended upon the folkloric ability of an old hand to foretell weather conditions by the feel of the air. It was too much for Marconi.

A voluminous correspondence ensued between Marconi and Woodward over the incident, with Woodward insisting that the aerials could not have been saved even if the thaw had been detected earlier because "the temperature was lower than usual for a silver thaw and the ice continued to make during the whole of that night and the next day."[24] Woodward should have saved his energy, because Marconi refused to believe any explanation. In Marconi's mind it should not have happened and could only be the result of negligence. An exasperated Woodward sent the duty engineer's logs for that eventful night to Marconi in hopes of quelling future queries and insinuations. Apparently he succeeded, but one can only wonder whether the episode came up again when Marconi officially opened the station two months later.

Louisbourg not only received messages from Clifden but also dispersed them across the country via a network of land lines connecting the station to telegraph centres in eastern Canada. The Louisbourg and Glace Bay stations were also connected by an overland telegraph line. Messages were transmitted by hand tapping keys or by Wheatsone high-speed automatic keys. Louisbourg was thus the point of traffic or message control. It was described by a former employee as "a small, central telegraph office in the wilds, utilizing the latest innovations in radio and line telegraphy."[25] Although Louisbourg was a pleasant place to work, the climate was not hospitable.

> It would start to freeze in October and ice would form on the sea round the shore in early November. There would be continuous ice and snow until May — then melting ice and snow and slush for at least a month! July brought constant, thick, damp fog and mist which penetrated into everything, while August and September, though warm and fine, were memorable for millions of mosquitoes and almost every variety of fly and insect it is possible to imagine.[26]

He and his colleagues had lived in a large modern hotel within the complex while the manager and supervisors had lived in several "fine houses" also built on the property.

Twelve of Glace Bay's twenty-four telegraphers were transferred to Louisbourg to staff the station, and recruits were to be drafted from other stations to augment staffing in the Cape Breton stations when business increased.

Marconi had invested a great deal of money and time in modernizing the Cape Breton stations to accommodate the duplex system. At least $75,000 had been spent, and it was estimated that the overall cost of operating both stations would rise by 20 percent. The expenditure had been undertaken with the expectation that the more efficient stations would generate a greater business, which would offset the costs. Although the traffic increased, the stations were

not operating at their maximum capacity. This caused some anxiety among company directors, who hoped for increased revenue. Despite the disappointment, Marconi remained confident the traffic would improve further. But his plans and hopes were interrupted by World War I.

During the years 1914-16 the transatlantic service operated normally with a minor increase in business, but in August 1917 the British Admiralty ordered the stations closed to public service. Although the stations performed short notice and emergency service work for the government, the revenue did not offset the loss incurred through this closure.

In addition to lost revenue, the stations had to contend with a military presence. Because of their strategic importance in communicating with the British and American governments, the Canadian Government had units of the Argyll Highlanders guarding the two stations. The staff "were fitted out with rifles" and "forced to participate in daily drill and route marches."[27] Wartime restrictions were not removed until March 19,1919, despite the company's near desperate pleas for their removal. Marconi was never compensated by either the British or Canadian governments for the lost revenues during wartime.[28] Although the transatlantic stations lost revenue, Canadian Marconi had an accumulated profit of $309,120 during the war years.[29]

Business at the Cape Breton stations gradually returned to normal after the war. As in earlier years, new techniques and innovative machinery were added to the transatlantic network in the hope of expanding the stations' productivity and efficiency. At the same time, new spheres of operation and responsibilities were introduced, including Louisbourg's reception of voice or phone transmissions from Europe in 1919 and 1920.

The first voice transmission from Europe was heard in Louisbourg in 1919 when W.T. Ditchman in Ballybunion, Ireland, spoke to J.W. Picken in Louisbourg: "Hello America! Hello Picken! can you hear me? This is Ditchman of Chelmsford, England, speaking from Ballybunion, Ireland."[30]

Marconi wireless telegraph operators, Louisbourg, circa 1920. Beaton Institute

Because Louisbourg did not have phone transmitting services, the voice reception was acknowledged via wireless from Glace Bay. Experiments and demonstrations using weather reports, news items and gramophone records in other Marconi stations also took place, and what we now know as commercial radio soon followed. In 1919 Canadian Marconi opened its first radio stations, CFCF, not in Louisbourg but in Montreal, where a large listening and advertising audience resided.

In the 1920s the scope of the Glace Bay and Louisbourg stations was broadened to include service to ships at sea, including weather reports, news and press items. Fishermen became especially dependent on the weather reports. The installation of voice or phone transmissions in 1927 greatly facilitated this service.

The vast sums of money invested in the Cape Breton stations did not secure their future against the short wave, or beam, technology that rendered the long wave obsolete. This new method was as revolutionary as the old one had been. The beam stations, using a fraction of the power consumed by the old system and handling up to 400 words per minute were much cheaper to construct. This development sounded the death knell for the two Cape Breton long-wave stations, and their demise closed an historic era in Canadian communications.

The two stations were soon replaced by a short wave beam transmitting station in Drummondville and a receiving station in Yamachiche, Quebec. When the new beam stations were opened on October 25, 1926, the Cape Breton stations were closed to transatlantic traffic. This closure occurred twenty-four years after Marconi had bridged the Atlantic. None of the Cape Breton newspapers commented on the closure. The only recognition of the event was the *Halifax Herald's* reprint of a news item in the *New York Herald* which read:

> Yet so rapid has been the march of wireless development, that after having been renewed and brought up-to-date a

half dozen times, the first stations at Glace Bay and Louisbourg have been practically put out of business and will soon close down altogether."[31]

It is rather ironic that it was left to an American newspaper to comment on the demise. The Cape Breton papers had lost their fascination with the stations. The glory years and the magnificent achievements in world communications and the new technology were now taking place far away from Cape Breton's shores. Marconi and his wireless stations were to become a footnote in Cape Breton history.

Epilogue

Although both Cape Breton stations were closed to their traditional transatlantic role, they continued to service ships at sea. The greatly reduced role and functions of the stations necessitated the transfer of redundant operators and other employees to the new beam station in Quebec or to other stations in the Marconi network. Phone was added to the Cape Breton stations in 1927 and in 1930, short-wave facilities were installed. Few other major developments occurred at the Cape Breton stations.

Louisbourg survived as an adjunct to Marconi Towers until 1927, when the company decided to close it down in favour of two additional stations in Quebec. But before this could happen, the station was destroyed by a fire caused by an overheated stovepipe. All instruments, charts and other station records were lost.[1] The buildings that survived the fire were removed from the site and sold or given to citizens of the town. Today the property contains few visible signs of the station: a few embedded foundations are the only indication of the station's location. The property is now owned by Parks Canada and is part of the Fortress Louisbourg complex.

From 1930 through 1937, Marconi Towers functioned as a service to shipping. From 1937 until the outbreak of the Second World War, Canadian Marconi undertook services on behalf of the federal department of transport in exchange for maintenance and operational costs. During the war Canadian Marconi operated the station on behalf of the department's naval services. As during the First World War, the station was guarded by the military. At times the soldiers were an unruly group. Mrs. Rita Johnston, daughter of the station manager, W. Kingham, remembers one soldier who had been in a fight bursting into the house demanding Kingham "somehow rescue the situation" by resolving the conflict.[2]

Throughout the war years the station made a profit from its government contracts, but after the war, with government revenue withdrawn and no prospect for additional revenue, the station was closed, and the land and buildings were sold to the highest bidder. In 1946 the entire property — eight hundred acres of land, all buildings, machinery, artifacts, records, logs and charts — were sold to Russel L. Cunningham for the sum of $6,000.[3] To this day the Cunningham family retains ownership of the historic site.

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Endnotes

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1. Degna Marconi, *My Father, Marconi,* 2nd. ed. (Ottawa: Balmuir, 1982). This is the best source of information on Marconi's family background and early life. I have relied heavily upon it and am indebted to Degna Marconi.
2. Marconi 17.
3. Page to Marconi, 31 July 1901, HIS-250, MC.
4. Johnstone to Marconi, 10 July 1908, HIS-250, MC.
5. Marconi to Johnstone, 3 August 1908, HIS-250, MC.
6. Cuthbart-Hall to Marconi, 25 November 1903, HIS-88, MC.
7. Cuthbart-Hall to Marconi 17 July 1903.
8. Cuthbart-Hall to Marconi 27 January 1906.
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11. Marconi 16.
12. *Halifax-Herald* 30 December 1901.
13. *Sydney-Record* 21 October 1906.
14. "Marconi, the Man," ms., MG 28/111/72, NAC.
15. W. Appleton, "The Marconi Company in Canada," ms., HIS-92 MC.
16. Marconi 44.
17. Marconi 8.
18. Marconi 151.
19. Marconi 150-151.
20. R.N. Vyvyan, *Wireless Over Thirty Years,* (London: Routledge, 1933) 48.
21. Vyvyan 48.
22. Vyvyan 48.
23. Marconi 154.

Chapter 2

1. Marconi 21.
2. K.Geddes, *Guglielmo Marconi: 1874-1937,* (London: Science Museum, 1974) 5.
3. Marconi 26.
4. Geddes 6.
5. Geddes 6.
6. Geddes 8.
7. W. Baker, *A History of the Marconi Company,* (London: Methuen, 1979) 34.
8. Baker 35.
9. Baker 39-40.
10. Geddes 16.
11. Geddes 16.
12. Geddes 16. Fleming, a leading authority on heavy electrical engineering had been appointed scientific advisor to the Marconi Company in 1899.
13. Geddes 18.
14. Baker 66.
15. Baker 66.

16. Baker 67.
17. Geddes 19.
18. Baker 67.
19. Marconi 92.
20. *Sydney Daily Post* 18 December 1901.
21. *Electrical Review* 20 December 1901.
22. *The Electrician* 28 February 1902.
23. *Sydney Record* 31 December 1902.

Chapter 3

1. Fielding to Marconi, 20 December 1901, HIS-79, MC Several sources including Degna Marconi in *My Father, Marconi,* state that Alexander Johnstone was the crucial figure in convincing Marconi to locate in Cape Breton. But Canadian government telegrams (such as the above) and other memoranda clearly indicate that government officials were in contact with Marconi prior to his arrival in North Sydney on December 24th or 26th. The press notes his arrival as December 26th, 1901 while Baker states it was December 24th and that he had spent Christmas in Cape Breton (see below, footnote 5).
2. Fielding to Marconi, 25 December 1901, HIS-79, MC.
3. Bell to Marconi, 22 December 1901, HIS-261, MC.
4. "Thoughts dictated to W.M. Mitchell," 25 March 1903, Bell Archives, Baddeck, Cape Breton.
5. For details on Marconi's arrival see the *Sydney Daily Post,* the *Sydney Record* and the *Halifax-Herald* 27-31 December 1901.
6. Alexander Johnstone, the M.P., and editor of the Sydney Record who claimed to have been the individual responsible for convincing Marconi to come to Cape Breton. See Marconi 98-100.
7. Unidentified newspaper article contained in E. Andrews, MG 12/121/2, Beaton Institute.
8. Andrews, MG/121/2.
9. *Sydney Daily Post* 28 December 1901.

10. *Halifax-Herald* 30 December 1901.
11. *Halifax-Herald* 30 December 1901.
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14. For details of the agreement see W.R. Green Agreements, Vol. 6, 1902-1903 and "History of the Canadain Marconi Company, 1901-1960," (hereafter CMC History), ms., 2 MG 28/111/72, NAC.
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26. See Statistics, Census Canada 1891, 1901.
27. Vyvyan 34.
28. This description and most of the following description of Glace Bay are taken from *Glace Bay: Fifty Years* (1951) Pam. 112, Beaton Institute. 61.
29. See Statistics: Census Canada 1891, 1901.
30. See *Glace Bay: Fifty Years;* Minutes of Glace Bay Town Council, 1901-1903 and Sydney Record 19 November 1903.
31. See *Glace Bay: Fifty Years,* 63-64 for the reprint of McCawley's comments.
32. *Sydney Record* 19 November 1903.
33. "Glace Bay Towers" 11 February 1902, HIS-92, MC. Complete details of the Towers can be found in this document.
34. *Halifax-Herald* 25 March 1902.

35. *Sydney Record* 10 May 1902.
36. Vyvyan 34.
37. "Glace Bay Towers"
38. The description of the power and operating houses and the manager's residence (below) is taken from the *Sydney Daily Post* 9 April 1902.
39. *Sydney Record* 16 July 1902.
40. *Sydney Record* 16 September 1902.
41. Glace Bay Town Council Minutes and the *Sydney Record* 17 September 1902.
42. *Sydney Record* 2 October 1902.
43. See the local papers the *Sydney Daily Post* and the *Sydney Record* for extensive details of Marconi's arrival.
44. *Sydney Record* 1 November 1902.
45. *Sydney Record 10 November 1902.*
45. *Sydney Record* 10 November 1902.
46. Vyvyan 37.
47. Vyvyan 37.
48. Vyvyan 38.
49. Marconi 120.
50. Vyvyan 38.
51. Vyvyan 38.
52. Vyvyan 40.
53. Vyvyan 40.
54. *Halifax-Herald* 23 December 1902.
55. *Sydney Record* 26 December 1902.
56. *Halifax-Herald* 23 December 1902.
57. *Sydney Record* 31 December 1902.
58. *Sydney Daily Post* 24 December 1902.
59. *Mac-Talla* 9 January 1903.
60. *Sydney Record* 31 December 1902.
61. *Sydney Record* 3 January 1903.
62. Baker 80.
63. *Mac-Talla* 9 January 1903.
64. *Sydney Record* 27 February 1903.

65. Geddes 21.
Baker 81, 82.
66. Baker 82.
67. Vyvyan 41.
68. Vyvyan 41.
69. *Sydney Record* 3 September 1902.
70. See "CMC History," and Canadian Marconi Company annual reports, 31 January 1904, 1905, MG 28/111/72. NAC.
71. Vyvyan 48.
72. *Halifax-Herald* 16 May 1904.

Chapter 4

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2. Baker 111-112.
3. *Sydney Record* 10 January 1905.
4. The *Sydney Record* and the *Sydney Post* during the years 1906-1907 provide excellent and vivid descriptions of the process.
5. Marconi 148.
6. *Sydney Record* 21 September 1906.
7. Vyvyan 44.
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9. Baker 116-117.
10. Baker 116-117.
11. Baker 117
12. Baker 117-118.
13. *Sydney Record* 21 September 1906.
14. *Sydney Record* 5 September 1906.
15. W. Appleton, "The Marconi Company in Canada," HIS-92, MC.

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19. *Sydney Record* 4 July 1907.
20. L.R. Johnstone, "Professional Wireless Telegraph Pioneer," ms., HIS-250, MC.
21. Johnstone. For further descriptions see the *Sydney Record* 18 October 1907 and the *Sydney Daily Post* 18 October 1907.
22. *Sydney Record* 28 October 1907.
23. *Sydney Record* 28 October 1907.
24. *Sydney Daily Post* 19 October 1907.
25. Danna 157.
26. *Sydney Daily Post* 18 October 1907.
27. *Sydney Record* 18 October 1907.
28. *Presbyterian Witness* 26 October 1907.
29. *Sydney Daily Post* 18 December 1908.
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31. *Sydney Record* 18 December 1907, 18 October 1907.
32. *Sydney Record* 18 October 1907.
33. *Sydney Record* 28 October 1907.
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12. *Sydney Record* 24 and 26 April 1910.
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14. *Sydney Record* 29 October 1910.
15. Marconi to Matthews, 7 April 1910, MG 111/72 NAC.
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17. *Sydney Record* 29 October 1910.
18. *Sydney Record* 29 October 1910.
19. *Sydney Record* 29 October 1910.
20. *Sydney Record* 29 October 1910.
21. "Looking Backward: Early Trans-Atlantic Reception," 18 May 1934, MG 12/214/D (b) 14, Beaton Institute.
22. "Looking Backward," 27 April 1934, MG 12/214 D (b) 13, Beaton Institute.
23. Woodward to Marconi 26 February 1918, 13 March 1013, HIS-261, MC.
24. Woodward to Marconi 13 March 1913.
25. "Looking Backward" 18 May 1934.
26. "Looking Backward" 18 May 1934.
27. Johnstone.
28. Allan to Secretary of State, 16 July 1918, MG 14/31, NAC.
29. Annual Directors Minutes, 1914-1918.
30. Quoted in the *Essex-Chronicle Herald* 24 January 1946.
31. *Halifax-Herald* 7 December 1926.

Epilogue

1. *Sydney Daily Post* 12 February 1927.
2. Rita Johnstone, personal interview, 27 July 1985.
3. Annual Directors Minutes, 1946, 28/111/72, NAC.

WHISPER IN THE AIR

MARCONI

THE CANADA YEARS, 1902-1946

Mary K. MacLeod tells the exciting story of Marconi's work, particularly in Newfoundland and Cape Breton, and of the formidable obstacles he encountered. As a boy of ten, he experimented with various electrical mechanisms and exhibited "intense almost fanatical concentration." Later, as a young man, he dreamed of uniting the world with radio.

His tenacity, as well as his genius, enabled him to overcome many problems throughout his career. Lack of finances, government indifference and at times obstruction, caused delays and disappointments. Fierce gales toppled his huge towers and fire detroyed his 22-building complex, but these were mere temporary set-backs for Marconi.

Mary K. MacLeod's text gives us a picture of Marconi the man and his relationship with others, while gripping us with the story of his magnificent obsession.

Dr. MacLeod is a graduate of Edinburgh University. She is an economic historian and the Assistant Director of the Beaton Institute, University College of Cape Breton.

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