

GUGLIELMO MARCONI: CREATING WIRELESS TELEGRAPHY

In spite of all that has been written about him, Guglielmo Marconi remains a rather remote and shadowy figure. Part of the difficulty in understanding this man lies in the fact that he lived in another time and place. It was the Victorian era — a time of heroic inventors, notable engineers, and famous scientists. It was the age of empire, sea travel, and communications technologies that included the telephone, telegraph, and submarine cables.

It was also an age when self-taught people could still achieve great things. Vision, drive, ingenuity, and determination often counted for as much as formal academic credentials. Some individuals rose from obscurity to achieve fame and fortune in that era; Marconi was one of them.

Early History

Marconi was born in 1874 in Italy. His father was a financially well off, provincial Italian landowner. He was a widower when he married a much younger Irish woman, who became Marconi's mother. She came from a wealthy family, who made their money in the distillery business. Her parents were not happy about the marriage a much older foreigner. Nevertheless, they accepted it.

Both of Marconi's parents were intelligent and fairly well educated; however, neither held university degrees. Marconi's father was an astute businessman. He was a good steward of his land holdings and financial resources. He was a serious person who did not tolerate foolishness.

Marconi's mother was a romantic person. However, she also had drive and determination, which she amply demonstrated by marrying Marconi's father against her family's wishes. She adored her son and played a large part in his education, which was eclectic, erratic, and geographically dispersed.

Marconi's primary school education was obtained through tutoring from his mother, hired tutors, and formal classroom settings in Italy and England. After finishing primary school, he enrolled in an Italian technical secondary school but

never graduated. This prevented him from pursuing a university degree or entering the Italian Naval Academy.

Marconi was interested in telegraphy, and he learned about it from an old, blind, retired, Italian telegrapher. Marconi was also good with his hands and liked to tinker with electrical devices. This would all play an important role in his later work.

In 1894, at the age of 20, Marconi was a relatively uneducated young man, who had been leading a rather privileged and undemanding life. Also, he was shy and insecure; he often thought that people greatly underestimated his intelligence. His father saw him as drifting aimlessly through life with no goals or sense of direction. But this changed suddenly when Marconi decided to turn a laboratory apparatus into a means of wireless telegraphy.

It is difficult to know exactly what motivated Marconi and fired his youthful imagination. It may have been a desire to reward his mother's faith in him. He may have also wanted to show his father that he could accomplish great things. Whatever the reasons, Marconi's decision would ultimately revolutionize the world in which we live. Nevertheless, the boy was setting out to do a man's job, and it would be a difficult task.

Existing Laboratory Apparatus

The laboratory apparatus that captured Marconi's imagination had been used by scientists to create and detect electromagnetic radiation across open space. In the middle of the 1860s, the theoretical existence of electromagnetic radiation was proposed. Scientists thought light was a visible form of this radiation. Other invisible forms of this radiation were also thought to exist.

In the late 1880s, scientists developed methods to both generate and detect invisible electromagnetic radiation. The equipment that generated this radiation utilized a battery, induction coil, two metal plates, and a spark gap. Detecting this electromagnetic radiation was originally done by means of a wire ring with a gap across which a received spark could be seen. (*Note: this ring and*

gap was the inspiration for the AWA's well-known logo—ed). Later on, detection was by a coherer, which was a small glass tube filled with metal filings. When an electromagnetic wave from the spark generator was detected, a coherer showed increased conductivity.

By the 1890s, scientists were using this laboratory apparatus to create very high frequency short waves for experimentation and research work. These waves would propagate for only a few hundred feet, which was quite suitable for laboratory work but of no value for long distance communications. Scientists thought of these waves in analogies related to light waves, which are another form of electromagnetic radiation. Their experiments with these waves involved reflection, refraction, and polarization.

Through his self-study and private tutors, Marconi learned about this laboratory apparatus. However, he saw it from a telegraphy perspective—rather than the optical (light) perspective of the scientist who used it in the laboratory.

Marconi believed that this laboratory apparatus could be the basis for long distance wireless telegraphy. At the time, there was no scientific or theoretical reason for him to believe in the possibility of long distance communications. Since he was a realist, his belief had to be based on more than just wishful thinking. In part, it may have been based on his knowledge that a coherer connected to a kite could be used to detect distant lightning storms. Perhaps he believed that this indicated the possibility for signals to travel long distances. Whatever the reason, late in 1894, Marconi became a young man on a mission.

Marconi's Creation

Marconi began his experimentation in the attic of his family home in Italy. The first thing he did was to build his own laboratory apparatus to better understand its basic capabilities. He quickly realized that existing coherer designs were problematic. The sensitivity of the device left a great deal to be desired. To deal with this problem, Marconi experimented with different metal filings until he found a combination that greatly improved the performance of his instrument.

Another problem with the coherer was the need to continually tap the device to separate the metal filings after every detection of a spark transmission. Marconi significantly improved this process by creating an electrical "tapper" that automatically restored the coherer filings for the next reception of a spark signal. Adding a Morse telegraph ink to record what was received further improved the capabilities for com-

munications work.

Throughout the ongoing days, weeks, and months, Marconi's mother totally supported his work; she thought that he would accomplish something great. His father, however, was not impressed; he thought his son was wasting time and money on a foolish dream. Probably to placate his wife and keep peace in the family, he grudgingly tolerated his son's activities and even provided some money for Marconi to buy equipment. Nevertheless, this was a tense period in the Marconi household.

Marconi knew that, for his ideas to be of any commercial value, he had to be able to create spark signals that could be received over long distances. To extend the range of his equipment—probably by analogy with wired telegraphy practice—he conceived of the idea of connecting one of the metal plates from his spark generator's induction coil to an earth ground. He also elevated the other metal plate from the coil to create an antenna. The result was the generation of longer electromagnetic waves that would propagate over much greater distances.

Marconi also connected one side of his coherer receiving apparatus to the earth. The other side of his coherer was connected to an elevated antenna. This arrangement provided symmetry with the spark generator. The coherer apparatus was placed outdoors and moved farther and farther away from the spark transmitter, as the inventor worked to extend the range of his equipment.

Marconi worked tirelessly to perfect his apparatus; it was not an easy task. He was not able to discuss his idea with other technical people because of concern that they might also try to create wireless telegraphy. In addition, he was under tremendous self-imposed pressure to succeed; with Marconi failure was never an option.

Gradually, through slow, painstaking work that extended over a period of many months, Marconi increased the transmission range of his equipment to nearly two miles. He was also able to receive signals on the far side of a hill. By the fall of 1895, at the age of 21, Marconi had achieved practical wireless telegraphy; the boy had succeeded at a man's job.

Conclusions

Marconi applied for an English patent on his invention in 1896 and it was awarded in 1897. The patent was for the utilization of known scientific knowledge in new ways for establishing commercial wireless communications. It was not for the basic scientific research, which had already been performed by others. It was a broad,

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of the 1960s along with some early TTL equipment from the 1970s.



FRANK J. LOTITO, K3DZ

A Collage Of Ideas Transmitter

Frank has a BS in electrical engineering, but for most of his 30-plus-year working career has primarily done mechanical engineering from a quality point of view for a large international safety equipment company. He has held the call K3DZ for over 20 years, and also possesses an FCC General Phone license with radar endorsement.

He has been a home brew enthusiast from the start of his interest in amateur radio. His projects have run the gamut from modern solid state VHF and UHF FM synthesized transceivers to designs going back to the early 20s. Frank is most definitely a strong proponent of the "file to fit—fit to file" use whatever you have in your junk box school.



RAY SOIFER, W2RS

DDH47 Commemorates 100th Anniversary of Marconi's Transatlantic Transmission (In "Below 535")

Ray Soifer has been a licensed radio amateur since 1955. Retired from a career in international investment banking, he now has his own consulting practice serving global financial services companies. A longtime officer and director of the Radio Amateur Satellite Corporation (AMSAT), he currently holds the position of Vice President for International Affairs. Ray is a member of the DXCC Honor Roll and enjoys working DX, especially on CW, on all bands from 160 meters to VHF/UHF moonbounce. He credits the late Robert Morris, W2LV (ex-2CQZ), and Brother Patrick Dowd, W2GK, with getting him interested in the history of radio and AWA, is an active participant in AWA QSO Parties and a Fellow of the Radio Club of America.

JOE STEPHANY, N2XS

Haiku Radio Station and the Alexanderson Alternators.

Joe is a retired Physicist. He joined the Navy after high school and attended college afterwards, earning an MS degree. He then worked in the research departments of Kodak, Stromberg Carlson, General Dynamics, Xerox, and Clevite (the former Brush Development Labs) where he had 24 major publications in leading physics journals and was issued 27 U. S. Patents.

Joe has held the calls KH6BDU and K2KSJ, and is now N2XS. He also holds a commercial Radiotelephone and Radar license. Since his retirement, he continues his explorations into fluctuation phenomena in semiconductors and these results have appeared in *The Journal of Physics*, *The Journal of Applied Physics*, *The Bulletin of the American Physical Society*, and *The Physical Review*.

He also is a reviewer for the *Physical Review*, the *Physical Review Letters*, and the *European Physics Journal*. This is the third time he has written for *The OTB*. Articles by his son Nolan, N2EAW, who is Assistant Chief Engineer at WXXI-TV in Rochester, have also appeared in *The OTB*.



RONALD R. THOMAS, W8QYR

Guglielmo Marconi: Creating Wireless Telegraphy

Ronald Thomas is a communications specialist who has written over 100 articles and two books on telecommunications. He holds an Extra Class Amateur Radio License, a Second Class Commercial Radiotelegraph License and a First Class Commercial Radiotelephone License. Thomas served as a Communications Electronics Officer, with rank of Captain, in the U.S. Air Force at Cape Canaveral. He received a Bachelor's degree, with honors, from Youngstown University and a diploma in Advanced Communications Engineering from the Cleveland Institute of Electronics. 

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overarching patent, which would help to ensure the commercial success of Marconi's ventures.

Several more years of hard work would be required for Marconi to extend the range of his equipment to approximately 200 miles and make it truly suitable for commercial work. Then, in 1901, his wireless signals spanned the Atlantic, from England to North America. Marconi was

on the way to fame and fortune.

In his lifetime, Marconi would receive many honors and awards, including a Nobel Prize, and achieve tremendous success. Yet, some people continue to be amazed that an obscure Italian youth could have come from out of seemingly nowhere to achieve so much and have such a great impact on the world in which we live. 