MARCONI

THE MAN AND HIS WIRELESS

by

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“Who says Italia holds a dying race
And all the glory of her line is spent?”
One of the first of the immortals in the Italian Royal Academy instituted by Mussolini in April, 1926, in the Farnesina Palace at Rome, is Guglielmo Marconi, inventor of wireless, President of the Academy, and Italian plenipotentiary of science and peace.

He has drawn "the most distant places and many forgotten lives into the orbit of civilization"; annihilated space, shriveled a planet and girded its earthly sphere ere the pulse beat twice!

To whom has been granted the almost superhuman power to give wings to words, music and pictures that they may fly to the uttermost parts of the earth bearing messages from and to the heart of man, and whose name has already become a common noun.
PREFACE

Books have long been one of the strongest allies of civilization; so is communication. Both liberate ideas, spread knowledge and knit human kinship. It is pleasing to me that Mr. Dunlap, an editor possessing a wide background of practical experience in radio, has authored this story of Marconi wireless, recording the historic steps of science, and the part that I have had the honor to play in it.

In revealing to the world the significance of wireless and its influence on the lives of the people, I hope that this book in English will further cement the friendship of Italy and the Anglo-speaking nations, and that this story of wireless will be an inspiration to youth in science. The achievements of wireless illustrate the truth that where there is a will there is a way. There are no limits in science; each advance widens the sphere of exploration. It was that way in 1895; it is that way now. Radio is a symbol of progress.

GUGLIELMO MARCONI.
APPRECIATION

It has been the good fortune of the author to have had Guglielmo Marconi's friendly interest in the writing of this story. For his kindness in thoroughly reading the final proofs that the book would be accurate in facts about wireless and historically correct in personal detail, the author is deeply indebted.

Trails of research have led far, from the nooks of old magazine shops to the time-yellowed newspaper files now tucked away in dark chambers. Recognition must be given to the observers and reporters, especially those of The New York Times, McClure's Magazine and the Scientific American, who at the turn of the century reported the drama of Marconi and his wireless. Those interviewed directly and by correspondence have been many, and to all who have been so helpful, sincere appreciation is expressed.

The author is grateful to Dr. Max Jordan for the interesting information relative to Senatore Marconi's early life, which, with his facility to converse in Italian, he uncovered among several old residents of Bologna.
INTRODUCTION

Several meetings with Senatore Marconi inspired the idea to write a “profile” of him—an impression of his personality. But the portraiture lengthened into a book. Face to face he is radically different from the world’s general picture of him as a scientist. He is more English than Italian; shy and mysterious, punctual but not easy to meet.

Marconi the man and Marconi the inventor are two individuals with the outstanding characteristic of simplicity linking the two into one personality. Simplicity is the keynote of his everyday life and of his scientific triumphs; it is the secret of his wizardry. The simplicity of his mind protected him from complex technical ideas quite as Edison’s deafness shut off noises and chatter which would have disturbed him by contamination of clear thinking. Marconi’s simplicity of thought enabled him to accomplish what skilled mathematicians and theorists had failed to do because they became entangled in deep technical approaches.

“Nothing is more simple than greatness; indeed, to be simple is to be great,” observed Emerson. Marconi stands with Edison in testifying to this truth.

Jotting down impressions of the man is comparatively easy, but almost before the author realizes, wireless has crept into the fabric of the personal story; Marconi and wireless are synonymous and inseparable. One cannot be told without the other. His life is a chapter in the history of civilization. What he has achieved—what he has said—all interwoven with his inspiring personality and the genius of his soul, make an impressive, almost incredible, story of accomplishment within the span of a lifetime.
INTRODUCTION

Marconi sowed electric sparks to the winds. He ploughed electrically beyond the frontiers of science in search of elusive waves and reaped a wondrous system of lightning-like communication. He discovered new truths.

The very simplicity of Marconi's nature makes it possible for wireless to overshadow everything else in his life. The man is dwarfed by his own scientific creation. The human-interest yarns and lively anecdotes of his career have vanished as shadows in the brilliant glare of the wireless legend.

Even Marconi completely absorbed in wireless seems to have forgotten interesting little happenings of his boyhood and manhood. In all the records of his career, wireless predominates—always it is wireless, wireless, wireless! And that may explain why those who have talked with him along the march of life have generally overlooked the traditional fables usually recorded about great men. Nine times out of ten those who met him encountered him in hours of wireless triumphs and they naturally covered the big news of the day which eclipsed the man who made it possible. Marconi the inventor, of course, figured in the news but Marconi the man modestly stepped aside.

The unfathomed, unlimited wireless teases him in the sixties as it did in his teens to penetrate and to solve the ever-present riddles of the infinite. So steeped is he in the lore and craftsmanship of wireless—those who know him are aware—its enchantment will follow him to the gates of the Great Beyond. Indefatigable is the energy of this dynamic Italian, never content to rest on his laurels. Within sixty-three years he has crossed the Atlantic eighty-nine times on voyages of scientific research and good will. Once the ocean was his boldest challenger. It defied his magic.

Thoroughly familiar with the scientific aspects of wireless the author has endeavored to present impartially, with
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thoroughness and befitting brevity, the significant facts as he has seen and understood them; to interpret Marconi's role as revealed by a study of scientific and historical evidence much of which has been related to the author by veterans in wireless who have been with the inventor in hours of disappointment and triumph.

This is the life story of Marconi; a story of ingenuity. The emphasis is on the man's work and on his personality; on his life full of romance and historic interest quite as human, even humanitarian, as it is scientific. This is the story of Marconi as he came into the news. And once he came into it he remained, for Marconi crowned by wireless, is always news, generally front page. Today broadcasting bespeaks his genius; television illustrates it.

O. E. D., Jr.

New York, 1937.
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ELETTA—A FLOATING LABORATORY

Marconi bought a yacht, named it Elettra and fitted it for wireless experiments and pleasure trips. Along with wireless he had discovered that work and play can be happily combined. The Elettra afforded an ideal combination; as pleasant as it was practical. Proudly he would carry the banner of Italy into some foreign ports where seldom the Italian colors fluttered.

It was 1919. The Elettra before the war was the Rowanski, so named by its owner the Archduke Stefan of Austria. But when the conflict broke out, she was quickly commandeered by the British Government to serve as a ship flying the flag of the Admiral commanding mine sweepers in the North Sea. Seven hundred and thirty tons burden, with an average speed of twelve knots, she had been built by Ramage and Ferguson of Leith. She had beautiful lines, spacious decks; drew fifteen feet of water, and her eighty-nine-foot masts designed specially to carry the wireless aerials, gave her an appearance of greater speed than she possessed. From stem to stern she measured 220 feet.

Marconi never was a laboratory hugging genius as were Edison and Steinmetz. This yacht gave him the opportunity he had long cherished, to roam the sea in the endless conquest of radio's invisible empire in the sky, and at the same time win relief from the land's constant humdrum and demands on his time.

Once a man turns his back on the coast, however, he is hemmed in by the narrow hull of a ship, and if he is a
dynamic, restless individual his patience may be sorely taxed. The man anxious to get things done often becomes impatient when away from his tools. It appeased Marconi’s mind while on a pleasure cruise to know his laboratory was just a few steps down the deck from his parlor. Should leisure annoy him—yet he was always asking, “When will I get some leisure?”—he could find plenty of work in his sea-going laboratory. By tapping the aerial wires between the masts he could hear a constant flow of human thoughts wafted across the hemispheres. He could experiment with novel devices; try mystic ideas and hear strange sounds, which to his ears might prove to be a symphony of science drumming away at the mind of man to heed some secret of nature.

He delighted, while at sea, in astronomical calculations and in study of the winds and stars, which were a great attraction to him—freedom from too much buzz of the wireless.

“I like the isolation of the sea,” he once remarked, “because I can work better when removed from the land and its interruptions.”

Yet it has been said, “in solitude one is least alone.” It is then that thoughts run through the mind of a scientist as blissfully as electricity flows through a new-fangled circuit. On the ocean the inventor dreams new dreams. Away from the clamor of the throbbing cities with their blasting motor horns, telephone bells, industrial whistles and business appointments, the mind of the inventor may be renewed to catch a magic vision—the mirage of a novel idea. The change of scene is restful; the talk of people different. Some of the cares and worries of life never leave the land. Obtrusions on the briny deep are likely to be more pleasant than irksome.

Once while coming up the Irish Channel on an ocean liner,
Marconi was talking about wireless and its possibilities when a small, shrill voice interrupted him:

“Oh! Mr. Marconi, come up and see the big ship!”

An electrical diagram under discussion was thrown aside hastily, and the inventor with one youngster on his shoulder and three others clutching at his coat, hurried on deck to look at a disreputable schooner.

Marconi loves little children and delights in their companionship. On another occasion when reporters sought him on the steamer at Queenstown, he was too busy mending a broken doll for a young lady, age six.

Play is one of the best tonics Marconi ever found for work; success was always the spur to further achievements. He had great hopes of finding out new things about wireless once he put to sea.

Fascinating news about radio progress continued to reach him from the United States. Americans called it “broadcasting,” and as a new method of mass communication it was spreading like wildfire. Amateur wireless experimenters thrilled friends and neighbors in plucking music and voices from the air by running a tiny slider across a coil of wire wound on a cereal box or on a rolling pin. Here was something that greatly appealed to the American mind; the radio “craze” swept from coast to coast.

Overnight broadcasting stations sprang up, while quickly assembled “factories” in lofts and electrical plants rushed to build receiving sets to meet the tremendous demand. All America, so it seemed, wanted to eavesdrop on what was flashing through the air. The number of transmitters increased from three to 595 between January 1, 1922 and January 1, 1923.

A new industry was born, offering employment to thou-
sands of persons. A warning was heard that this thing called broadcasting was but a fad, the fancy of which would soon pass as the novelty of listening-in wore off. But it did not; radio deeply embedded itself in the imaginations of the American populace. The ethereal “gold rush” was on; here was a new epoch in American enterprise.

Suddenly there came a realization among those who had rushed to build broadcasting stations that some way had to be found to finance the business. How could so many stations make money in the air? There was no revenue. Would the listeners pay? Could they be taxed? Could each receiver be designed as sort of a coin-box pay-as-you-listen instrument? Hundreds of fantastic ideas were suggested, but it was a most difficult problem to discover a plan of collecting for music cast to the winds and wafted through a medium as free as the air.

By the time 1922 arrived the Western Electric Company had requests to build more than 200 more broadcast transmitters. So foreseeing the high costs of broadcasting, coupled with the eventual necessity of paying the talent and the limited program material available in some communities, the American Telephone and Telegraph Company finally said in effect to those who wanted to own broadcasting stations:

We wonder if you realize how much it costs to operate a broadcasting station? After all you desire to advertise your organization. Why not share some of our broadcasting time? Why not buy from us and sponsor a program of entertainment over station WEAF, in New York?

That solved the problem. Advertising was the keynote. A nominal charge of $100 was placed on a ten-minute talk, and a realtor was the first to take advantage of the offer. Broadcasters were no longer philanthropists; broadcasting became a big business.

The crystal detector set priced at $25.50 was heralded as
“Radio for Everybody: any member of the family can learn how to use it in a few minutes; it is no bigger than an average hand camera and tuning is as simple as focusing a pair of field glasses.”

Then came the magic vacuum tube, the Aladdin’s lamp of radio. It fanned the little spark kindled by the pioneer broadcasters into an international flame. The world itself was cartooned wearing earphones, and the broad smile was evidence that something pleasant was being heard, something that entertained and lifted the cares of the day.

No wonder Marconi wanted to visit America; and Americans were anxious to see him, for he started it all.

Proudly the Elettra, with Marconi on board, sailed away from the coast of England with her bow pointed westward toward America on her maiden transatlantic voyage. It was 1922 and out of the June air, three hundred miles at sea, Marconi and his Italian crew picked up their first sample of American broadcasting. A barrage of words and melody waved out from the shore to extend a hearty welcome and to entertain for the remainder of the cruise to the port of New York. As he listened to the lively jazz from the metropolis, Marconi remarked with a smile:

“The wireless tells me that New York is a lively place. There is evidence in the development of the radio telephone, in the methods of broadcasting and in the public interest in radio, that the United States is far ahead of Europe.”

But what was this thing called broadcasting doing to the solitude and isolation of the sea?

Marconi was still the master of the situation. He could snap a switch and shut it all off. That is one blessing of his invention. Nevertheless, it often adds to the joy and comfort of an ocean voyage to know that overhead there is a flow of Bach, Beethoven and jazz as well as channels cleared for an SOS should occasion arise. Marconi enjoyed tuning
in the melodies, for as a boy he had learned to play the piano with agility and perfect tempo; he always liked music.

Life on board the Elettra, which the poet D'Annunzio called “the snow-white miracle ship,” always proceeded with that clock-like regularity dear to the heart of the wireless wizard, one of whose chief virtues is punctuality. On the voyage from Southampton, via the Azores and Bermuda to New York, breakfast was served precisely at eight o'clock. That did not mean a few minutes before or a few minutes after the ship’s bell struck the hour. For Marconi breakfast is invariably a cup of tea, two soft-boiled eggs, bread, butter and marmalade!

To Marconi time is precious. He believes in beginning the day with activity, and punctually; that is the time of day he is usually in the most serious frame of mind. And those long sensitive fingers of his begin to fidget when there is delay.

Meals for the officers and crew are usually served in Italian fashion on the yacht, because the majority of the crew of thirty-one are from Italy.

A breakfast for the crew on the Elettra has all the simplicity that legend, tradition and reputation have attributed to the first meal of the people who live along the shores of the Mediterranean. It consists of coffee and bread, the latter crumbled and dropped into the coffee.

Breakfast over, Marconi is free to get on with his work. Off he hurries to the wireless room, his sanctum sanctorum. No one dares disturb anything in that realm. It belongs to Marconi. Every coil, every piece of wire means something to him. In that wireless cabin is up-to-the-minute apparatus, and if it fails to pluck anything from space there is nothing else in the world that can.

The transmitter talks direct to London, no matter where the Elettra may be on the Atlantic. It is a fragile-looking ship compared to an ocean liner. However, on the voyage
to America it is not so far away from the paths of the grey-
hounds of the sea should King Neptune become too fero-
cious. She can carry fifteen days' supply of coal. Refueling
is done at the Azores and Bermuda, if necessary.

One of the rooms in which Marconi works is a smoking
room or study, equipped with a serviceable desk. On a table
behind him is a large autograph album containing a remark-
able collection of signatures of persons who have been his
guests on board the yacht. These include in huge, dashing,
flourishing writing, the signature of Gabriele d'Annunzio,
the Italian poet who, in 1920, also signed the picture of him-
self that finds a place upon the piano in the same room. Five
royal guests, the King and Queen of Italy, the King and
Queen of England, and Alfonso, as King of Spain, have
autographed pictures in this room. Also Premier Mussolini,
who inscribed: "al Senatore Marconi, mago degli spazi,
dominatore dell' etere." (To Senatore Marconi, wizard of
space, master of the ether.)

Sunset is often the signal for radio men, especially experi-
menters, to go to work; the end of the evening repast often
sends them back to the apparatus. All wireless men like the
witching hours of the night. Darkness helps the waves to go
further. Erebus brings surprises through the air to Marconi,
just as to the amateur tinkering in his workshop. But he sel-
dom followed Edison's example of incessant labor to the
extent of ignoring meals.

"My stomach always makes a fuss," he explained with
the usual diffidence, "and I find that I can work better if
I eat regularly."

When the day's work is finally finished, the inventor re-
tires to a handsome cabin, beautifully equipped in the style
of ocean liners and scrupulously clean by virtue of its white
enamel. Close to his bed is a speaking tube which communi-
cates with any part of the ship.
Regularity is a paramount factor with this genius. Even at night it is occasionally necessary for him to rise for an important wireless message or test signal. If it is three o'clock in the morning he is there on the minute attired in his dressing gown. Punctuality always!

At eight o'clock precisely another day begins!

Through the morning mist looms the skyline of New York.

The golden-white *Eletra*, the largest Italian yacht that ever crossed the Atlantic, with flags flying, while ships in the harbor tooted and whistled no end of salutes, passed the lower end of Manhattan Island following the route of Hendrik Hudson's *Half Moon* until off the Columbia Yacht Club, at the foot of Eighty-sixth Street, where the anchor splashed.

Reporters flocked to the *Eletra* in small boats. They asked the inventor all sorts of questions, as they always do when he visits America. Following an interrogative volley, Marconi remarked:

"I'm afraid in reportorial enthusiasm I have been credited with saying and doing things I never thought of saying or dreamed of doing. For instance:

"I never predicted scrapping of the submarine cable. If they are ever scrapped it will be in the distant future. Right now I know of no substitute. Wireless and the cables supplement each other. They do not supplant. They meet different needs and conditions.

"And I am not trying to communicate with Mars, or any other such distant point in the universe. Moreover, I have no plans to do so."

He, by this time, knew that New York reporters usually greeted him with visions of a front-page story. He never forgot one occasion when he told them he had nothing to report, but upon the insistence of one reporter who annoyed him, he replied, "I have invented a machine that sees through walls." Papers throughout the world printed the
yarn, and Marconi received hundreds of letters condemning such an “eye.” Female signatures predominated in the flood of mail, for they protested against the “death knell” of privacy in the home.

Can wireless be made secret? That was always a favorite query of interviewers.

“Scientists cannot employ the words ‘finite’ or ‘absolute’ to their investigations and discoveries,” replied Marconi. “What we do not know today we may know tomorrow. That is why I am not prepared to say absolute secrecy can be guaranteed with regard to wireless.

“It was twenty-five years ago that I first experimented with regard to communication between two given points without the waves being picked up elsewhere; but then there came the fascinating development of speaking to the world at large by broadcasting in all directions, and I dropped the experiments. During the war I took them up again for the benefit of the Italian navy.”

Do you think we will ever be able to hold telephone conversations across the Atlantic?

“That is quite near,” answered Marconi, “much nearer than some people think. I will not say that the conversation will be absolutely secret as between speaker and listener. It is my conviction that the human voice will cross the sea. More than that I cannot say.”

While he was speaking the Elettra’s operator picked up a weather report, followed by jazz music from a New Jersey station. It reminded a young woman reporter to ask what the sage of wireless thought of the younger generation.

“I think the younger generation is a great asset to the nation,” he replied. “I see no reason to worry about them.”

He might have added that he likes to associate with young people because they do not “talk shop,” and their spirit of gayety is a relief to him at the end of a busy day.
A reporter inquired if he agreed with the theory that broadcasting would harm newspapers. The idea seemed to amuse him.

"Radio can never take the place of the newspapers," he exclaimed. "Rather do I believe broadcasting encourages newspaper reading. For instance, I listen to some interesting news. I call my wife to share it and discover I cannot find her. She has gone out. If she wants the same news later she must get it from the newspaper and not from the loudspeaker. The newspaper has a distinct advantage; it is a record.

"When a man speaks over the radio he can deny he ever made such a statement, unless a recording is made of the speech. It is not so with the newspaper. The matter is there in black and white. Newspaper clippings can be preserved in a scrapbook. You cannot do that with broadcasting."

Those who observe the owner of the seagoing craft *Eletra* for any length of time, are soon aware that delicacy of hearing is one of his outstanding physical characteristics. Long years of practice in listening for the different notes of his wireless and strange sounds have sharpened his ears to an unbelievable extent. Uncanny is his facility in hearing conversation at a distance and in distinguishing between a multiplicity of sounds.

While in New York he invited twelve guests to dine with him on board the yacht. They were grouped at a long table with five along each side. Two or three were talking in ordinary conversational tone at the end of the table, while Marconi, apparently in abstraction, seemed to be out of earshot. Suddenly he would laugh at the joke at the foot of the table or inject some remark indicating he had heard every word.

How do you like New York? Marconi was asked after he was presented with the John Fritz Medal for engineering distinction.
“I went downtown yesterday,” he replied; “returned by way of the subway, and experienced the rather curious sensation of seeing people reading newspaper stories and looking at pictures of me. Also I could hear them discussing Marconi.”

What is the sensation?

“Well, the only way I can describe it,” he said, “is by saying that it made me hope they didn’t recognize me.”

A suggestion made by Sir Arthur Conan Doyle that radio might be used to communicate with the spirit world was referred to him.

“I think it would take too long a wave length,” he replied laughingly.

But he never casts anything aside labelled, “impossible.” He is mindful that since the beginning of wireless, whenever man perceived any queer sounds, he wondered if they were signals from Mars or some other planetary race. Marconi, unlike many other scientists, has never been content to wave the mysterious clicks aside as mere solar eruptions.

“I would not rule out the potency of this, but there is no proof that the signals come from another planet,” said Marconi. “We must investigate the matter more thoroughly before we venture a definite explanation. No one can say definitely that abnormal sounds on the wireless originate on the earth or in other worlds.

“Who can affirm signals from Mars? How can I know? How can any one know? Of course, the signals may come from space outside the earth. They may come from the upper reaches of the atmosphere. They may be caused by magnetic disturbances on the sun; they may come from Mars or Venus.

“It may some day be practical to communicate with other planets. It’s silly to say that other planets are uninhabited because they have no atmosphere or are so hot or are so
different from the earth. If there were no fish in the sea we would say life there is impossible. It is infeasible for man."

The interviewer suggested language difficulties seemed to present an insuperable obstacle.

"Well, it is an obstacle," agreed Marconi, "but I don't think it is insurmountable. You see, one might get through some such message as two plus two equals four and go on repeating it until an answer came back signifying 'yes,' which would be one word. Mathematics must be the same throughout the physical universe. By sticking to mathematics over a number of years one might arrive at speech. It is certainly not beyond the realm of reason."

Marconi then gave a concrete example of the fallibility of coded language once it falls into the clutches of clever men.

"Mark you, during the war the Germans were able within three weeks to decipher British messages and we theirs. No matter what the consonants of the code; no matter what language the dispatch was eventually decoded in, whether English, German, Arabic or Siamese, ultimately experts could interpret them.

"We can communicate by wireless; we can reproduce photographs by wireless—all this within less than a decade. It is not incredible that in the near future lantern slides can be projected by radio. Consider this possibility. Presume there is life on Mars, a language barrier must be overcome.

"By broadcasting a lantern slide showing a tree, an operator on earth, provided we can propagate the right wave lengths, could follow this picture with the word 'tree' repeated many times in international code until the same dots and dashes were repeated by the distant planet. Then following this might be flashed the picture of a man with the caption 'man' repeated. By this method language barriers
might be surmounted and intelligent communication established.

"But ask some of my material-minded friends, 'what is the practical advantage of all this; suppose communication is established?' I say the result would be the advancement of scientific knowledge by at least 200 years."
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DAWN OF THE RADIO ERA

An ovation awaited Marconi when he came on the stage of the Institute of Radio Engineers in New York, in a setting that made him appear like a real magician. It was June 11, 1922. Queer-looking, skeletonized contraptions were arranged on both sides of the stage. There was also a "baby" wireless outfit, by means of which the wizard would demonstrate how a flying shaft of radio might be hurled in a desired direction.

A crowd was there that night. As always when Marconi is the speaker, thousands were turned away at the entrance of the Engineering Societies building. Though nonplussed at first by the spontaneity of the ovation and its long duration, Marconi warmed up to the technical subject of wireless and won burst after burst of applause.

Heralded as "the master of wireless" he amazed the American engineers, who watched the miniature transmitter shoot its directional rays twenty feet across the length of the footlights. They marveled at one-meter waves in such a performance. A reflector at one side of the stage projected the wave while a horizontal metal rod at the other side caught the impulses, and instantly a clear-sounding note rang from the receiving instrument. When the semicircular reflector, a frame-like apparatus covered with wires, and resembling a bowl cut in half, was turned with its open side toward the receiver the signals were strong and clear. When the open side of the "bowl" was turned away the signals were almost inaudible, revealing the reflector's searchlight effect.
DAWN OF THE RADIO ERA

Marconi turned to his manuscript, and looking over the lectern he paused a bit before predicting a revolution in radio was coming.

Very short wave lengths, the same as he had under his control on the stage, were destined to abolish high-power stations with their expensive, cumbersome alternators, lofty towers and acres of aerial wires.

Short waves had a simplicity. Wireless had been following a blind alley for all these years by constantly adhering to the long waves. The pioneers took what looked to be the easiest path—the long waves. Had they paused to experiment thoroughly with short waves the progress of wireless from 1900 to 1920 might have cost millions of dollars less. But they lacked the vacuum tube, so had to do the best they could with existing instruments, the crystal detectors, the sparks and the long waves that would sweep across the seas.

"Short waves have been sadly neglected," said Marconi, "especially in regard to directional wireless and radiotelephony.¹ Some years ago, during the war, I could not help feeling we had perhaps got rather in a rut by confining practically all our researches and tests to long waves. I remembered that during my very early experiments as far back as 1895 and 1896, I had obtained some promising results with waves not more than a few inches long.

"The study of short waves dates from the time of the discovery of electric waves, that is, from the time of the classical experiments of Hertz and his contemporaries. Hertz used short waves. He made use of reflectors to prove their characteristics, and to show among many other things that the waves obeyed the ordinary optical laws of reflection.

"Progress made with long waves was so rapid, so comparatively easy, and so spectacular, that it distracted prac-

¹ Lecture before American Institute of Electrical Engineers and Institute of Radio Engineers, New York, June 20, 1922.
tically all attention and research from the short waves. This I think was regrettable. There are many problems that can be solved, and most useful results to be obtained by, and only by, the use of short waves.

"It may be of historical interest to recall that Sir William Preece described my early tests at a meeting of the British Association for the Advancement of Science, in September, 1896, and also at a lecture he delivered before the Royal Institution in London on June 4, 1897. I went into the matter more fully on March 3, 1899, in a paper I read before the Institution of Electrical Engineers in London.

"At that lecture I showed how it was possible, by means of short waves, to project the waves in a beam in one direction only, instead of allowing them to spread all around, in such a way that they could not affect any receiver which happened to be out of the angle of the beam's propagation.

"Since these early tests of more than twenty years ago, practically no research work was carried out or published in regard to short waves, as far as I can ascertain. Research along these lines did not appear easy or promising. The use of reflectors of reasonable dimensions implied the use of waves only a few meters in length, which were difficult to produce. The power that could be utilized in them was small. The investigation of the subject was again taken up by me in 1916 in Italy for certain war purposes. I was valuably assisted by Mr. C. S. Franklin of the British Marconi Company. The work was most interesting. It was like going back to the early days of wireless, when one had a perfectly clear field.

"As the result of the success of a series of experiments with the fifteen-meter wave, tests were conducted between Hendon and Birmingham, ninety-seven miles apart. With reflectors at both ends clear speech was exchanged between
the two places. A receiver on a ship in Kingstown Harbor picked up a beam from Carnarvon, seventy-eight miles distant. This important fact was also noticed—there was no rapid diminution of signal strength after the ship had passed the horizon line from Carnarvon.”

Several days later the *Eletra* steamed up the Hudson to Albany, so that Marconi might visit “the House of Magic” at Schenectady. En route the shore was dotted with Italian flags and people gathered to catch a glimpse of the famous yacht. At one point several monks from a monastery came out on a flat boat in full regalia and waving the Italian colors. Marconi’s distinguished friends on board had quite a time inducing him to come on deck to wave a greeting. One of his associates remarked, “He just doesn’t care for that sort of thing.”

Dignitaries of science welcomed Marconi to Schenectady; there was the mathematical wizard Steinmetz, Dr. Irving Langmuir, noted for his development work on the vacuum tube; Dr. Willis R. Whitney, expert in electrical research, and Dr. W. D. Coolidge, famous for his achievements with cathode ray tubes. They demonstrated their latest wonders, including improved vacuum tubes for radio.

Marconi could see a vast change coming in his wireless as he watched the needles waver across the faces of delicate meters that spoke the electrical language in a most prophetic way. Like tiny fingers the needles beckoned the experts onward while the cherry glow of the filaments inside the “glass bottles” indicated the dawn of a new day in wireless.

Marconi agreed with the American research engineers that these tubes sounded the doom of many old devices. They solved age-old problems. It was evident that the spark and high frequency alternators were on the way out. The crystal detector would no longer be needed. These tubes would send and others would receive. They would make the Marconi
dream of ultra-short waves, transoceanic telephony, television and possibly power transmission by wireless come true—some day!

"It is difficult to estimate the enormous influences broadcasting is going to exert on humanity in a hundred directions," said Marconi. "For the first time in the history of the world man is now able to appeal by means of direct speech to a million of his fellows, and there is nothing to prevent an appeal being made to fifty millions of men and women at the same time. Until now it has rarely been possible to speak to more than five or six thousand people packed into some huge hall.

"The limits of the carrying power of the human voice, unaided, are, however, pretty sharply defined. Radiotelephony makes distances more negligible. The day may come when 'the voice of the Government' will no longer be a figure of speech, but a literal truth."

Late in July the Eletra sailed for Europe.

Marconi's first marriage, having proved unhappy, was about to terminate. This marriage was dissolved on Marconi's petition by a decision of the Court of Fiume in 1924, which decision was duly confirmed by the Appeal Court of the Kingdom of Italy. The marriage was also annulled by a decision of the "Sacra Romana Rota" (Vatican Court) in 1927. Miss O'Brien married the Marchese Liborio Marignoni immediately after the Fiume decision in 1924.

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Despite the predictions of Marconi in regard to short waves, under the impetus of war and in the unsettled aftermath, high power stations were built all around the earth. Lofty towers went skyward near Bordeaux, France; Stavanger, Norway; Mont-Grande in the Argentine; at Bolinas, Cal.; Marion, Mass.; Kahiku, Hawaii; Carnarvon, Wales;
Annapolis, Md.; Tuckerton, N. J., and at Rocky Point on Long Island. Engineers clung to their faith in long waves. They failed to sense the new power of the vacuum tube pumping energy into short waves.

"We are now entering what may be called the field of vibrations," Marconi announced. "The really great forces with which we must deal are locked up in vibrations so gentle that we cannot feel them.

"Science will transform the world within fifty years. Life on this planet will be so changed that we who are here now would have difficulty in recognizing it. Until the end of time, invention and discovery will shower benefits upon the human race at a constantly increasing speed. I see a certain danger to the world in this great progress. The conditions of life will be made so easy that if people are not careful, they will deteriorate. People work now because they are compelled to do so to earn a living—and it is good for them. But it will not much longer be necessary for a person to work more than a fraction of his time to earn a living. Then will come the danger of deterioration."

Radio continued to plunge ahead. Each day brought new wonders. The laboratories were giving to peace and industry the instruments which they had evolved for war.

Aircraft began to wing their way across the ocean, and they carried wireless, notably the United States Naval Flying NC-Boats and the British dirigible R-34 in 1919. It was clearly apparent from these flights that the Marconi invention had a vital role cut out for it in aviation.

Then, on November 2, 1920, station KDKA, Pittsburgh, went on the air with the Harding-Cox election returns.

The description of a prize fight was broadcast in 1921. That indicated possibilities. Woodrow Wilson and Warren G. Harding made the first Presidential use of radio and the microphone. A football game was broadcast in 1922, and
by November of that year radio was bold enough to attempt to handle the New York Philharmonic Orchestra.

Wireless was on its way, under the name of broadcasting, and moving rapidly in a direction that Marconi never dreamed of in the '90's.

Donald B. MacMillan, exploring in the Arctic, listened-in on music from Chicago, New York and other centers of life. Cape Town and Calcutta heard Pittsburgh. Marconi, using a thirty-two-meter wave, talked in daylight by voice from his yacht to Syria, 2,100 miles away. From Poldhu, in England, on the 92-meter wave, Marconi was able to transmit his voice to Sydney, Australia, for the first time on May 30, 1924. Big Ben ringing midnight in London boomed through the air of America.

Old principles and practices in wireless were collapsing under the sweeping nature of new short-wave discoveries; the whole technique of long distance communication was changing.

England's sixteen-year-old dream of establishing an Imperial wireless chain came true in 1924 with the Marconi Company's sensational announcement to the Government that it was ready to guarantee a high-speed, all-Empire beam system of communication. Marconi's distinguished research engineer C. S. Franklin had solved numerous short-wave riddles; he had perfected directional aerials and adequate reflectors.

To prove the globe-girdling circuit possible, Poldhu, in October, 1924, using 12-kilowatts of power conducted 32-meter wave length tests with New York, Montreal, Rio de Janeiro, Buenos Aires and Australia. The signals were clear even when daylight covered the entire Atlantic.

"The employment of the Elettra for the important experiment, which demonstrated the practicability of short waves working over long distances, reduced the period of
preliminary research very substantially," said R. N. Vyvyan, engineer in charge of construction of the beam transmitters. "A moving station for purpose of observation and measurement possesses great advantages over a fixed station where problems of range, directional effects, and other propagation questions require solution. The Elettra was able to sail across the path of the beam to ascertain if the signals from Poldhu still traveled in the form of a beam at great distances, and also to measure the intensity of the signals both by night and day over varying distances and with different wave lengths. Many months' investigation were undoubtedly saved by the use of Marconi's yacht for this purpose.

"Mr. C. S. Franklin himself designed the beam aerials and the actual transmitters used. It was due to his careful attention to detail, and profound technical knowledge and experience on short-wave working, that the stations when erected were successful from the start and fulfilled the very severe guarantee that they were called upon to perform." (The stations had to be capable of communication at a speed of 100 words a minute in each direction exclusive of any repetition to ensure accuracy and the aerial system had to be so designed as to concentrate the emitted waves within an angle of 30 degrees.)

Under the spur of American enterprise, radio had made its greatest strides. Just when the broadcasters were boasting of the high popularity of their art as an entertainment factor, already revolutionizing the social aspects of the country, an amusing cable item came under the ocean from Britain.

Marconi was in a London hospital for a slight operation in April, 1926, and it was announced that while recuperating he had complained of being "fed up" with broadcasting. For one day the human race smiled at Marconi. American
industrial magnates were shocked with the news that the father of the art was vexed at the activity of the bedside earphones and loudspeakers. It was reported that friends of the inventor, in the American radio circles, asked him to temper the statement lest it have a bad influence on prospective buyers of receivers.

The next day Marconi quickly notified the grinning public that the report was grossly exaggerated; in fact, false in every particular. He had not asked for a phonograph instead of radio. He had not rebelled against music in the air. Perhaps he was weary and merely asked the nurse to turn off the machine so he might slumber.

The march of progress continued.

Facsimile messages, maps and pictures were flashed from New York to Hawaii, 5,136 miles. The picturegram of a check was tossed across the sea from London to be honored and cashed in New York. Byrd and Bennett flew over the North Pole carrying a forty-four-meter transmitter. The dirigible Norge followed them into the northern wilderness and sent messages direct from the Pole. All the world tuned in the Dempsey-Tunney fight and the World Series was described on the air for the first time. It was 1926.

Wireless in accomplishing all this did not neglect the mariners.

Disabled in a hurricane 1,724 miles out of New York on January 24, 1926, the British freighter Antinoc flashed the SOS from masts that wavered in a vicious sea. The S.S. President Roosevelt, one hundred miles away, veered in her course. It was 5:40 o'clock on a cold winter morning.

Mountainous seas were running day after day, waves climbed to a peak of seventy feet, driven by a wind that blew ninety to one hundred miles an hour. Behind the swirling curtain of sleet, snow and fog was the disabled hull of a doomed ship.
Marconi visited with Charles Proteus Steinmetz, electrical wizard, in 1922 at "the House of Magic" in Schenectady. It was Steinmetz who declared, "there are no ether waves; they are electromagnetic."
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The Roosevelt reached the position given by the Antinoe, but there was no ship; yet the sputter of her wireless was still in the air. The wireless men trained their direction finders on the signals while the skipper followed the bearings. The Antinoe’s position had been incorrectly reported and she had drifted fifty-eight miles in the wintry blasts of the storm. She was listing thirty-five degrees to starboard.

All lifeboats on the starboard side had been swept away. The port-side boats were stove in and useless. The engine room was flooded. The steering gear was disabled and her navigating bridge crashed by the heavy seas. It was noon, that Sunday, when the Roosevelt rode up to the scene, while four hundred and forty persons along her decks watched the hulk roll helpless in the defying waves. Gallant sailors were ready to go over the side, but it meant certain death in such a storm. They could do nothing but stand by.

And that they did for several days, expecting any moment that the distressed vessel would plunge under the waves that pounded and flooded her from stem to stern. At midnight on Wednesday, the sea moderated and a small boat quickly pulled away from the Roosevelt. It was a spectacular rescue in the moonlight as the men jumped overboard, one by one, into the lifeboat that carried the entire crew of twenty-five to safety.

That was another triumph for Marconi wireless, and for the radio compass designed to peer through the most blinding snow storm or treacherous squall.

Each achievement at sea brought new honors to the inventor of the humanitarian instruments, and this time it was Spain, which on March 29, 1926, conferred the Plus Ultra Order Gold Medal for “extraordinary service in behalf of mankind.”

Bologna was a gay place on June 13, 1926. It was Marconi Day and he had the key to the city.
It seemed from the size of the crowd that all the townsfolk had gathered at the University of Bologna for the grand climax of the festivities—a talk on wireless by Guglielmo Marconi. Never had the old halls echoed with such an ovation as that which greeted the distinguished native son as he appeared in the uniform of an Italian naval officer.

"Since February, 1896, the date of my departure from Bologna, after my first experiment in wireless telegraphy carried out at the Villa Grifone, my life has been spent far from my beloved Bologna," said Marconi. "The force of events has been greater than my will.

"Bologna, the city which gave birth to Galvani and Righi, is always the home of him who has a reverence for study and progress. If in my work I have been carrying on for the last thirty years I have been carried far from Bologna, I hope it has made me no less a worthy son of that city. No greater prize could be conferred upon one who feels the pride of having been born among you in our beloved Bologna. During my eighty-six crossings of the Atlantic, from farthest outposts in Canada, my thoughts have often been carried back here.

"I remember how in both my boyhood and youth I was fascinated by the mathematical hypothesis of Maxwell regarding the electromagnetic theory of light and the brilliant pursuit of such researches made by our great Bolognese physicist, Augusto Righi. For many years I had to face adverse criticisms, and the assurance from many distinguished, as well as ordinary people, that radio-telegraphy would never be in a position to compete seriously with other methods of communication. We Bolognese smile in the face of most difficulties. I was determined that success should crown my efforts eventually.

"In time, by means of the use of thermionic valves, a bril-
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Brilliant conception of Dr. Fleming, perfected by De Forest, Langmuir, and Armstrong in the United States, by Meisner in Germany, and Round and Franklin in England; and by means of the use of balanced tuned circuits, of electric filters, of powerful amplifiers and finally directional radiators, I succeeded in obtaining results such as to ensure regular wireless telegraphy service by day and night between Europe and America. Thus in 1918 I could for the first time in history communicate from England to Australia. To obtain such a result, expensive installation is necessary, yet it was first at the Villa Grifone that I experimented with what has since come to be called beam wireless.

Marconi recalled that in the early days at Bologna it was his intention to develop this method of concentrating the radiation of electric waves in a beam, by means of suitable reflectors. He said that in 1916 he used the first beam system or “fascio” apparatus, utilizing short waves two or three meters in length, and added, “perhaps I may be allowed to claim for this that I was the first fascist in Italy.” It was explained that Marconi chose the fascio or Roman bundle to symbolize the concentration of electric waves. The beam was called “the Marconi Fascio system.”

With the dawn of 1927 came fulfillment of a prophecy made by Marconi in 1915. The transatlantic radiophone circuit was opened between New York and London. He had declared it would be easy some day, and the press reports indicated he was right:

Scattering words and phrases have been wirelessly telephoned across the Atlantic before, but thousands of words were shot over the distance of 3,000 miles last night and heard apparently with the distinctness of messages over a wire from Times Square to Herald Square. The deluge of words crossed the sea so steadily that the group of auditors on the other side began to complain that it was something of a bore.
Marconi always hit the target of the future with his cautious predictions. He never linked a future possibility with a definite date.

Some one inquired regarding the popularity of a device to permit two persons at opposite ends of a telephone line or radio "see-talk" circuit to view each other as they conversed.

"That seems to be of doubtful utility," replied Marconi. "I can imagine many circumstances, indeed, in which it would be embarrassing to one or both parties."

"This man Marconi could never be accused of talking 'shop,'" remarked an interviewer. "He is not an easy person to lead into conversational lanes of one's own choosing. Quietly, deftly and politely he assumes command of the conversation, and the subject may be changed before one is aware of it. If one would get an idea of Marconi's vision of the future, it must be by piecing together little glimpses which he permits one to have from time to time of that vision—bits of conversation and snatchés of pictures which he shows en passant.

"But he leaves a distinct imaginary picture of a future world run by wireless. The impression of that future state may be entirely unwarranted by the remarks of the inventor, but an hour or two of conversation with him leaves an indelible impression of a changed world. The outstanding feature of that changed world is its cleanliness; the second, its compactness.

"Marconi's admonition, when discussing the innumerable potentialities, seems most appropriate; 'I must leave to your imagination the uses which can be made of these new powers.'"

"'The more a man bends the phenomena of the universe to his will and the more he discovers, the more he will find to discover,'" Marconi once remarked. "'Because of this he will realize more and more the infinity of the Infinite.'"