THE LETTER S -- Whispers in the Air

An investigation of Guglielmo Marconi and the first trans-Atlantic wireless transmission December 12, 1901.
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SOUND: Electric noise

SOUND: Air/wings

VOICE: Are we on the air?

SOUND: Air/waves

VOICE: Are we on the air now?

BROOKES: Can you hear me?

VOICE: On the air.

BROOKES: Can you hear me now?

MARCONI: Can you hear anything?

SOUND: Air/waves

VOICE: What is “on the air”?

WRITER: Well you see, the first actual communication was when one person spoke to another person and they understood what they were saying, and then it goes on for thousands if not hundreds of thousands of years.

VOICE: Call. Response. Transmit

BROOKES: Hello.

VOICE: Can you hear?

BROOKES: Hello.

VOICE: Can you hear me?

BROOKES: Can you hear me?

MARCONI: Can you hear anything?

BROOKES: I can hear you.

SOUND: *(Woman’s voice reciting “Jabberwocky” in the distance)*

BROOKES: What happens if we whisper? *(whispering)* Can you hear me now?

VOICE: “s”

BROOKES: Why did they choose that?

GORDON BUSSEY: Well, they used the letter "s" because they thought if they used anything with dashes in, they thought that the dots and the dashes would run into each other. And therefore the easiest letter to distinguish was "s", which is in Morse Code three dots.

MARCONI: The letter "s".

VOICE: Sssssssss. S for silence.

SOUND: Electric noise stops.

VOICE: Silence. S for sound.

SOUND: Cellphone rings. Radio static.

VOICE: Ssssssound.

SOUND: Radio tunes through stations.
Airwave sound

VOICE: But what was it like then?

BROOKES: What was it like then?

WRITER: From the beginning of long-distance communications, with fires on mountain tops and so on, we moved to a number of different things throughout history.

SOUND: Flapping of wings.

VOICE: In the siege of Paris…

BROOKES: They sent messages by carrier pigeon.

VOICE: On the air… waves.

SOUND: Flapping of wings.

BROOKES: What was it like?

VOICE: Can you hear me?

MARCONI: Can you hear anything?

VOICE: Call. Response.

SOUND: Church bell.

WRITER: We get into modern times with Christianity, for instance bells. People were summoned to church by bells. That was the message being sent. And the bells rang over the hills and the dales and people heard them and answered the call. In fact, John Betchman I think called his biography "Summoned by Bells."

BROOKES: Before the car, the plane, the radio, the telephone, the telegraph. What was the world like? Was it larger?

BROOKES IN INTERVIEW: Did the world feel like a larger place to live in?

HISTORIAN: I think the world felt enormous. Turn of the century – and I'm talking about 1800, not 1900 – large parts of Africa completely unknown. The Far East, very mysterious. A message to any foreign country took weeks. Or maybe it didn't get there at all. Ships, once they had left port and sailed out into the blue, you had no idea where they were or how they

had fared until they arrived at their distant destination. And if that was miles away, somewhere like the Far East, then you had to wait months and months before you knew whether your voyage had been successful or not if you were a shipping merchant.

VOICE: Larger. Was there more space between things? Between continents? Between words? Between people?

MUSIC: from Edward Macdowell's *New England Idylls (composed 1901)*

WRITER: Well I think people when they, for instance a lot of Newfoundlanders left and went to the United States, Boston area and so on. Including some of my mother's and father's brothers and sisters. And once they left, they were gone. It wasn't a matter of "we'll be home next year, we'll fly home and see you" or anything. They left, and they never saw them again. Eventually, the lines disappeared between the families as people died out and their children didn't keep up the contacts. My grandfather's sister went off to the States in 1898 and we never heard of them afterwards.

BROOKES: Was there more homesickness in the world? More loneliness?

VOICE: Larger. What was in all the space? Imagination?

BROOKES: Dreams.

MUSIC: *(finishes)*

SOUND: Seagulls, waves

BROOKES: If this were a drama, this story about communication and the wireless, then this could be a really good place to watch it from. An outdoor theatre cut into the cliff on the Southwest tip of England, a place called Porthcurno. The Minac Theatre serves up Shakespeare and light opera here all summer for the tourist trade, but at this time of the year you might think the stage is empty. Except it isn't, really. There's the backdrop: wind and ocean And the ghosts of the communications drama that played out along these same cliffs more than a century ago. And people like John Packer, honorary curator of the cable telegraph museum next door.

PACKER: Well, we're looking down Porthcurno valley to a little sandy beach at the bottom where the cable was landed. The right hand side of the valley, this white building we can see was the original cable station, plus staff quarters, plus administration, everything in fact. It's about an eight minute walk from the Minac Theatre at the top of the hill.

BROOKES: Okay, so if the trans-Atlantic cable industry is one of the characters in this story, where was the other one? Where was Marconi?

PACKER: He was to the left. We can't see from here, but if you went up onto the headland you could look across Mounce Bay, beyond St. Michael's Mount, you can actually see the site of his masts. The masts aren't there anymore but you can see the site at Poldhu from the cliffs either side here if you look out across the bay.

BROOKES: It's kind of nice. You had the established champion of international communications and the challenger in the same...

PACKER: Facing, glaring at each other from one side and the other of the same bay, yes.

BROOKES: Of course that glaring, the confrontation scene, won't happen until the third act. Because if this were a drama, that's how it would be: in three acts. And Act One would begin like this.

VOICE: Act One. S. S for signal.. Sssssssss....

SOUND: Steam hissing. Locomotive starting up.

PACKER: Well really it started with the railways. Britain had the world's first railway. Stockton to Darlington. And the great Victorian engineer Brunel built the Great Western Railway which goes from London all the way down to here, near the museum, to Penzance in the far west of Cornwall. And he had a problem. And the problem was that the train could travel faster than a galloping horse. So how could you get a message ahead of a train to stop it in case of a derailment, or a

bridge swept away in a flood, or whatever? There were urgent safety reasons why Brunel wanted communications faster than horseback. And it was actually he who put up the money, who sponsored another man named Wheatstone t take some early electrical experiments that had been going on in colleges and university labs and to produce something that they could use in the railways.

This actually is a railway telegraph, a genuine railway telegraph And rather than having a key like that, there's a handle here and when you move it to the left and the right the needle does the same thing.

SOUND: Telegraph needle clicking

PACKER: But if you look over there, you'll see the needle on the other one is following. But of course we've got to learn a code. *(spelling out on the telegraph as he speaks)* Left-left-right-left: F. R. I. E.N. D. S. Friends, Romans, Countrymen. You had to, you know, spell messages out letter by letter. And of course other entrepreneurs said well, you don't actually have to have a railway line to lay a telegraph line. Because, they said, we think that the public will be willing to pay to send messages. Why leave it to the railways? And by 1850, British businessmen said "why don't we link our telegraph networks with those in France?" So they looked at the map and they chose the narrowest bit of the English Channel, and they laid a cable. And it worked for an hour or two, and then it stopped working in the middle of a message. And so the story goes, a French fisherman had pulled it up and thought it was the stem of some strange new type of seaweed and chopped a piece out to take home to show his wife. So that was the end of the world's first submarine cable.

VOICE: So the story goes.

PACKER: However, it had worked long enough to prove that if only you could prevent French fishermen from doing that, the technology was okay. So having spanned the channel, they then said "Let's lay a cable across the North Atlantic." So it was a tremendous endeavor, I mean there's a very big difference between 26 miles across the Channel and well over 2000 miles across the North Atlantic.

SOUND: Electric noise

BALSOM: My name is Bob Balsom, I'm the site supervisor here at the Heart's Content Cable station Provincial historic site.

BROOKES: It was 1857. On the east coast of Newfoundland the little town of Heart's Content, about to become the center of 19th-century high-tech communications.

BALSOM: It was a big, big deal. I mean, 2000 miles of ocean, two and a half miles deep in places. Today, I mean, like compared with landing on the moon. Such a great impact it had on the communications industry.

MARCONI: Can you hear anything?

BROOKES: In the concert halls, the music of Louis Moreau Gottschalk.

VOICE: Can you hear?

MUSIC: *Manchega (Gottschalk/LeGrande)*

BROOKES: In British factories, the manufacture of 2000 miles of submarine cable.

(Music stops)

VOICE: Can you hear?

MARCONI: Can you hear anything?

SOUND: Man shouts *"On the cradle Joe!"*. Machinery sound. MUSIC starts again.

BROOKES: In London, the inventor of a brand-new signaling method called "Morse Code."

MORSE'S LETTER: Dear Mister Field, as the electrician of the New York, Newfoundland and London telegraph company I am most happy to inform you that our experiments have resolved all doubts of the practicality of operating a telegraph from Newfoundland to Ireland. You obedient servant, Samuel Morse.

BROOKES: In New York, an American millionaire named Cyrus Field opened the letter and bankrolled the project.

BALSOM: And they said he was a lunatic. People from his board resigned, they said "Are you nuts? This will never be done. It's just impossible!"

PACKER: The problem of course, was that if you were laying the cable and you run into a storm you can't, sort of, forget the cable and say "Oh, we'll come back when the storm's over." You're stuck, you have to stay there. And there were times when it was really quite dangerous and quite difficult, because the weight of a submarine cable in the deep ocean is a number of tons. And of course as the ship keeps pitching and tossing in rough weather it keeps jerking the cable, and this is when you're likely to have a cable damaged and snapped.

BALSOM: They came across the Atlantic with two ships, met in mid-ocean and went in opposite directions. That failed. The cables broke. And in 1858 there were two attempts. The last attempt, on August 5th, worked, and it worked for approximately three weeks. But they used too much voltage, and they burned it up, and it failed.

(MUSIC stops)

BROOKES: *(laughs)* This must have cost a lot of money.

PACKER: A vast amount. Now don't ask me how many millions in today's terms, I don't know. But some years later, in 1865-66 they had another go.

MUSIC: *Manchega (Gottschalk)*

BALSOM: So Cyrus Field and his people went raising more money. Companies were saying "you're taking everybody down with you. All the money, we'll never get it back!" And it's a fact that millions of dollars lay at the bottom of the ocean. But anyway, he was determined as I say, and in 1866 loaded another new cable.

PACKER: They hired the world's biggest boat at that time, the "Great Eastern", which could carry almost the entire length in her holds all in one go.

BALSOM: They left Valencia, Ireland, on July 13th. July 27th they arrived here in Heart's Content. And great celebrations, because they hooked up the cable and it worked perfectly!

(MUSIC finishes. SOUND of seagulls, waves)

BROOKES: So on the Cornwall cliffs here in the front row of the Minac theatre, it's pretty obvious that one of our main characters has just strolled onstage. If this were a melodrama he'd be wearing a top hat and smoking a big cigar. It isn't a melodrama, but there is a cigar and a hat. Because even though it's revolutionary – I mean now people can send a message across the ocean in seconds, not weeks – you wouldn't exactly want to wish your aunt Effie "happy birthday" with a trans-Atlantic telegram. Not in 1866 you wouldn't, at the rate of £1 a word. For the next few decades the main customers for this service are going to be business and commerce. But the world has now become smaller.

SOUND: Telegraph key

BROOKES: The boy who's going to become the Russian playwright Anton Chekhov is six years old in 1866. When he grows up, he'll give us some advice about watching dramas like this.

VOICE: If there is a pistol on the wall in the first act, it will be fired by the third act.

BROOKES: Take a good look at the set decorations for this drama. Notice anything?

BALSOM: Oh, the cable companies, they ruled. They were the people in charge, and well they knew it. Because when the first cable company set up business here, Cyrus Field, he made an agreement with the Newfoundland government that nobody could come in and set up communication for fifty years. They had a fifty-year monopoly on communications. So they had it all in their own hands and they could call the shots when and wherever they pleased.

BROOKES: The cable company monopoly.

VOICE: The pistol on the wall.

SOUND: Telegraph key

WRITER: And of course nobody ever dreamed there'd be a thing called "wireless". Like when I was a boy listening to radio, we never dreamed there'd be a thing called television. But it came.

VOICE: Act Two

BROOKES: If I could go back there, was the air empty?

MARCONI HISTORIAN: Oh, the ether was completely empty before Marconi started.

VOICE: The ether.

BROOKES: And what would I have heard, if I could have had a radio and turned it on, before he started?

MARCONI HISTORIAN: You would have heard – if you get a radio now and you turn it to a blank section of the dial where nothing is transmitting, you would hear that, exactly the same.

BROOKES: Just static.

MARCONI HISTORIAN: Just static, yes.

SOUND: radio static

VOICE: Small voice. The still, small voice… of the air.

SOUND: radio static crackle

VOICE: Can you hear? Can you hear anything?

BROOKES: The place I grew up in, St. John's. The place he came to later.

HISTORIAN: It was a wooden city.

VOICE: What did it sound like?

SOUND: St. John's harbour ambience, distant hammering, ship's horn.

BROOKES: A city of wood, really. Not like him. He grew up in a city of stone.

VOICE: What did it sound like?

SOUND: Traffic, voices, bells. *(cuts off)*

BROOKES: This is what the city of Bologna sounds like today.

SOUND: *(continues)*

BROOKES: In fact, it's the way it sounds on the Piazza Maggiore, right in the center of Bologna. And near the corner, on 14th November Street, outside number seven there's a stone plaque over the portico that reads, in Italian: "Here was born Guglielmo Marconi who with electric waves first communicated without cables or wires from hemisphere to the other, for the benefit of humanity."

VOICE: But what was it like then? What did it sound like then?

BROOKES: In 1874.

SOUND: Baby cry.

BROOKES: Introducing our central character. As they would describe him years later in Vanity Fair magazine:

MAGAZINE: The true inventor labours in an attic, lives chiefly upon buns, sells his watch to obtain materials, and finally after desperate privation succeeds in making a gigantic fortune for other people. Guglielmo Marconi invented in comfort, retained any small articles of jewelry in his possession, and never starved for more than five hours at a time. He is quiet, with a slow deliberate manner of speech, and the shape of his head suggests an unusual brain. He has Irish blood in his veins. His maternal grandfather Andrew Jamiesion, of the Jamieson whisky distillery, married a daughter to a Marconi of Bologna, from which union was born Guglielmo. Guglielmo, I may mention, is Italian for "Bill." Being half a Irishman, Bill's lack of more humour is prodigious.

BROOKES: But at this age, his only distinguishing feature is unusually large ears. At least, according to family legend.

VOICE: The story they tell in the family.

BROOKES: Apparently, the family servants were all gathered around Annie Jamieson Marconi to have a good gawk at her newborn, and one of the less tactful of them exclaimed:

VOICE: What big ears he has! Hee hee!

BROOKES: Annie replied in a huff:

VOICE: Then he will be able to hear the still, small voice of the air.

SOUND: Radio static click on

BROOKES: And did he hear it?

SCIENTIST: He thought he heard it.

BROOKES: Now why do you say that?

SCIENTIST: Well, from a radio scientist's point of view, he couldn't possibly have heard it. No.

VOICE: There are lots of stories. Is this one true?

SOUND: Radio static clicks off.

VALOTTI: So, we are in his laboratory. This is the most famous window of the Villa. I open it.

SOUND: Opening window

CURATOR: And so, this was as I said, Guglielmo Marconi's first laboratory.

BROOKES: The attic of the Villa Griffone, an estate on the outskirts of Bologna where his family spent their summers in the 1890's. Today it's the private museum of the Marconi Foundation, and historian Barbara Valotti is the curator.

VALOTTI: Marconi did not attend public schools in a regular way. He had private tutors, he read a lot, in particular the best books and magazines of the time relating to electricity. He spent many days and nights locked up here, and probably Guiseppe his father, I mean, there were moments when Guiseppe was not very happy with this strange son who spent so much time, so many hours here.

BROOKES: He must have had other friends his age, did he? What did they think of him?

VALOTTI: Not that many, not that many. He didn't have so many friends. He really didn't have close friends.

BROOKES: That's unusual, you know, for a teenager to lock himself in the attic and make experiments all day and half the night.

VALOTTI: This is certainly a very good picture. He was certainly not a very regular boy, I mean he didn't do what many people of his age were doing. He was a bit special, and maybe a bit crazy, I don't know.

BROOKES: If it had been a hundred years later he might have been a computer nerd hunched over a computer here and only coming out for meals?

VALOTTI: This is probably true, yes.

BROOKES: Except back then, computers didn't exist. He was a spark nerd.

SOUND: Spark transmitter

BROOKES: In 1894 he read about the experiments of the German scientist Heinrich Hertz.

SOUND: Electric noise.

BROOKES: Hertz had built a spark-gap transmitter – basically a machine to generate an electric spark between two brass electrodes. And he demonstrated that this could radiate electromagnetic waves.

SOUND: Air/waves.

BROOKES: In the Marconi attic the shy teenager was fascinated, and he started tinkering with his own home-built spark transmitter.

SOUND: Spark transmitter.

BROOKES: Hertz's experiment in Germany was a laboratory curiosity. In Bologna, how was it that Marconi was able to hear something else in that spark?

VOICE: In the air… waves.

SOUND: air/waves. Basilica interior, bells, prayers.

BROOKES: Just up the street from Marconi's parents' place on 14th November Street: the Basilica di San Paulo Maggiore.

VOICE: Was he here?

BROOKES: What did it sound like to him?

VOICE: Are we on the air now?

SOUND: Praying

VOICE: Call. Response. Transmit. Receive.

SOUND: Air/waves. Woman's voice laughing

BROOKES: Three blocks away. A stone corner off the Piazza Maggiore. It has a domed roof, and the acoustics are unusual. If you hang around, pretty soon you notice that lots of passers-by tend to stop. Well, this couple here is typical. They walk to opposite corners of the little square, and turn their backs on each other. He speaks into his corner, she listens in hers. The acoustics bounce his voice off the roof right into the opposite corner.

BROOKES: What are you doing?

MAN: Yeah, I.. if you talk slowly here, from this side and the other side, just slowly, you can hear very well on the other side.

BROOKES: Can you?

MAN: Yeah, yeah. It's like a radio because there is a sort of echo that is working very well, and you can talk just subtle. If you want to try?

BROOKES: Sure. Can you hear me?

VOICE: Was he here?

BROOKES: What happens when we whisper? *(whispering)* Can you hear me now?

VOICE: The still, small voice.

BROOKES: Can…You…Hear…Me?

SOUND: Four spark bursts. Electrical noise.

MARCONI'S DIARY: I conceived the idea that by means of the invention of efficient telegraphic transmitters and receivers, it would be possible to transmit and receive messages over great distances without the necessity of using connecting wires. A short emission of the transmitted waves would signify the dot of the Morse alphabet. A long emission, a dash. And thus words might be spelled out in the sparks of the distant receiver. The idea was so real for me that I did not realize that for others the theory might appear quite fantastic.

SOUND: Three sparks.

VOICE: "S" for signal.

BROOKES: "S" for shot.

SOUND: Gunshot.

VALOTTI: The birth of radio communications is often associated to a gunshot.

MUSIC: *John Cage: Baccanale for prepared piano(LeGrande)*

BROOKES: The gun was on the other side of a hill on his parents' estate. The kid in the attic had developed an antenna and ground system to send his spark signals further and further. At the time, scientists had no idea whether radio waves could pass through obstacles or not. Marconi was about to find out. He sent his brother Alfonso over the hill with a receiver and a shotgun. He stayed in the attic to operate his transmitter. If Alfonso received the signal, he was to fire the gun. It was 1895. Marconi was 21.

MARCONI'S DIARY: After some minutes I started to send, manipulating the Morse key. In the distance, a shot echoed down the valley. I saw then for the first time a great new way open before me. Not yet a triumph, triumph was far distant. But I understood in that moment that I was on the right road. My invention was born.

VALOTTI: This was certainly a very important moment, and this happened here in 1895, probably during the summer, at Villa Griffone. At that point, there was probably a family decision to be made, and they finally decided to move to London. I would say mainly for two reasons. That is, in England Marconi was aware that he could count on the help of some of his

relatives in London. And second, they certainly knew that England had the most powerful commercial fleet of the time, so England could appreciate the potential of Marconi's invention, that is the use of wireless telegraphy for ships. So Guglielmo and his mother Annie Jamieson moved to London at the very beginning of 1896

SOUND: Train station

BUSSEY: There's two pictures of him, or rather one picture of him in 1896 when he arrived in England with his equipment.

BROOKES: So here's this, this young, very young man...

BUSSEY: Twenty-two.

BROOKES: Getting off a train with a box under his arm. What would he look like to a sophisticated British society, and to the British scientific establishment?

BUSSEY: Oh, I imagine he would look a typical Continental! No one could possibly have foreseen at that time, that this boy was going to change the world forever. Which of course he did.

BROOKES: Gordon Bussey is the historical consultant for Marconi company in England.

BUSSEY: The first thing he did, with the help of his cousin, Henry Jamieson Davis -- who was a very competent man -- got busy filing for his patent of June 1896 which was to form the first patent in the world for wireless telegraphy. But of course Sir Oliver Lodge -- as he later became -- he developed the coherer, a means of detecting Hertzian waves long before Marconi started developing the system, in 1894. But although Lodge developed the coherer, he really saw no future for wireless telegraphy. And of course Lodge never filed any patents. So when Marconi came along and filed the first patent in the world for wireless telegraphy in June of 1896, Lodge got very uptight. Saying you know, thinking that this young man in his early twenties should steal all the glory that he himself had recognised some years earlier. I can understand that Lodge was a very bitter man.

BROOKES: Why the big rush to establish a patent? Did he feel he was...

BUSSEY: Well he had to, he had to file a patent. Because he was in a rush. And quite rightly, too.

BROOKES: He was a businessman.

BUSSEY: Oh, no question about it, he was a businessman, yes.

BROOKES: As different from...

BUSSEY: Completely different to a typical scientist such as Sir Oliver Lodge. But certainly he was a businessman, yes. And he was a showman to a certain extent. He would have never have gotten as far as he did had he not given a series of demonstrations. And all the things that happened from 1896 to 1901, these things wouldn't have happened unless he had given all these demonstrations.

BROOKS: Interesting. Despite being a shy, withdrawn kind of young man...

BUSSEY: Well he was certainly dynamic. But as course someone, somewhere, once said: you have to be... it's the shy quiet ones that you have to be cautious of.

VOICE: S for shrewd. S.

SOUND: Three short bell rings.

BROOKES: His first public demonstration, December 1896.

VOICE: Can you hear?

SOUND: Bell rings

BUSSEY: This is a replica. It's a replica of the receiver that Marconi used for the first public demonstration at Toynbee Hall in London. Marconi walked around with this black box with the bell on top. And you had all the people assembled in the sort of theatre at Toynbee Hall. And you had a stage, and on the stage was Sir William Preece, the Chief Engineer of the

Post Office. And he had a similar black box, and coming from it were two wires which were attached to a Morse key. Every time he touched the Morse key the coherer in Marconi's receiver...

BROOKES: In his black box.

BUSSEY: In his black box. Would initiate the bell on his receiver to ring. So he was in fact holding this large, fairly heavy black box and walking around the audience. *(he walks about demonstrating)* Though the audience like this. He was going from one end to the other, and then turning around and going down, down, down. And every time Sir William Preece on the stage pressed the Morse key the bell would ring. And of course the public found this absolutely fascinating. They found it unbelievable. How was this possible that a bell could ring without any physical linkage? And of curse it got tremendous coverage in the newspapers the following day.

SOUND: Bell rings.

BROOKES: 1897. On the piano rolls: the Harlem Rag.

MUSIC: *Harlem Rag (Turpin/Blais) starts, then stops.*

BROOKES: In the newspaper *La Tribuna*: an interview with Guglielmo Marconi.

INTERVIEWER: What is the nature and aim of your discovery, and how did it come about?

(*Music starts again)*

MARCONI: My discovery does not contain any new principle, but the extension of principles already known. It took shape in my mind little by little. I never thought of exploiting it immediately, and I did not expect to see it welcomed so suddenly and with such great interest by the British press.

INTERVIEWER: Would you like to say something about the consequences and practical application of your discovery?

MARCONI: It's hard to foresee them all. It is thought that my invention is applicable above all in wartime, during military operations and in the navy. However even more important will be its applications at sea. This is important in rain and fog when lighthouses are not visible.

INTERVIEWER: And is this system going to be used for everyday telegraph communications at long distances?

MARCONI: In theory there are no obstacles. But it will be necessary to overcome many practical difficulties. At the beginning of the New Year we shall start experiments in Cornwall.

Music finishes.

BROOKES: Cornwall.

VOICE: What did it sound like?

SOUND: Church bells *start, then stop*

BROOKES: Well its what it sounds like nowadays, on Tuesdays.

SOUND: *Church bells start again*

BROOKES: Tuesday night is the bell ringers' practice night on the Southwest tip of Cornwall, a small village called Mullion. The church with its bell tower dates from the fifteenth century. And Marconi was here in 1900, scouting out a transmitter site just up the road. In the previous four years he had founded the Marconi Wireless and Signal Company, captivated the British press, transmitted across the English Channel. and even convinced Queen Victoria to use his new ship-to-shore wireless system. But now he was facing a serious problem. There was no such thing as tuning. His receivers picked up everything that was on the air, and if there was more than one transmitter within a hundred miles or so the receiver picked up everything at once. If you were using one of his receivers today you'd hear something like this.

SOUND: Several radio stations at once

VOICE: But what did it sound like then?

SOUND: Bell tower door opening

BELLRINGER: Now that's on five...

BROOKES: Inside the church every bell rope has a number. And the procedure sounds almost like mathematics.

VOICE: Was it like this then?

BELLRINGER: One to two, that there is lead, you see. The lead is always taken off the number six.

BROOKES: But some bells are ringing faster and some you're ringing a bit slower.

BELLRINGER: Yes. The bigger bells, its a bigger wheel you see. The bell takes longer to go round. And the smaller bells, they're lighter and they ring faster. It's a combination of two or three things, you know. You've got to listen to the strike of your bell, and make it strike in the right place. That's the whole secret of it, is.

VOICE: Did he listen?

SOUND: Bell ringers ringing bells together. *("Three to One!...")*

MARCONI'S DIARY: It was while observing a peal of bells produced by men at the end of their respective bell ropes that I found a suggestive analogy. To ring a large bell it is necessary for the bell ringer to give a series of jerks to the rope at regular intervals until it reaches an oscillation sufficient to have the clapper hitting the side of the bell. The frequency of the jerks that makes a certain bell ring once in its swinging will never make a bell of different dimensions ring so well. The same thing can happen, in an infinitely shorter period of time, when producing electric oscillations in a good electrical resonator. Electrical resonance, like mechanical resonance, depends on the cumulative effect of a great number of small impulses transmitted with a certain rhythm. So agreement between two radio-telegraph stations can be reached if the transmitting station radiates electrical impulses in a measured rhythm. And a receiver vibrates electrically in time with the impulses.

SOUND: Bell ringers finish, and chat.

VOICE: Can you hear?

SOUND: Radio tuning through several stations.

BROOKES: That was a pretty crucial discovery then, wasn't it?

BUSSEY: Yes. That was a very great step, there's no question about that. Because that was the forerunner of today, you know, I would have turned... perhaps this morning when I was at home. I turned the radio on to Radio Four. And if I didn't like Radio Four then I'd adjust the knob and get Radio Two. Well this is the forerunner.

SOUND: Radio switches off. Music: *John Cage: Baccanale for prepared piano*

BUSSEY: So he then demonstrated to the board his system of tuning. But remember, the company was only three years old. They did have a certain amount of income from very limited ship-to-shore operations, but this was very small. People were still very skeptical about wireless. He knew in his heart that if he was to succeed he would have to do something startling. He would have to communicate by wireless across the Atlantic.

Well, he put this proposition to the board of his company, and of course I think they viewed this with some terror. You know, he proposed to build this huge station somewhere in England, and another one probably in America. And the costs were going to be probably in the region of £50,000. He was talking about a station 100 times more powerful than anything that had been done before. And there was a lot of scientists saying it was a physical impossibility, it cannot be done. "You cannot transmit across the Atlantic!" Because nobody believed at the time that wireless waves would follow the curvature of the earth. Anyway, they reluctantly agreed, and they chose a site at Cape Cod in Massachusetts, and they finally chose a site in Cornwall near Mullion, at Poldhu.

SOUND: Seagulls, waves.

BROOKES: Poldhu. Sitting here in the outdoor theatre in Porthcurno you can actually see the place, just down there a few miles to the South along the cliffs. Certainly in the summer of 1901 the cable companies could see it, and they could watch Marconi's giant aerials slowly rise 200 feet into the air at the edge of the cliff. In the summer of 1901 their submarine cables were still the only way to send a message across the Atlantic. But in the communications drama we're watching, the challenger has just walked onstage. And as that Russian playwright predicted, the pistol on the wall -- the cable company monopoly in Newfoundland -- is about to be fired.

Act Three.

VOICE: Can you hear?

SOUND: Foghorn at Lizard Point, Poldhu.

KEEPER: I'm Eddie Matthews, 43 years a lighthouse keeper.

BROOKES: So when Marconi was here, that is the foghorn he would have heard?

KEEPER: Oh yes, in Marconi's time oh yes. That's compressed air. Not like the new things today.

BROOKES: So if you'd been around in 1901 and seen Marconi putting up 200-foot high towers, what would you have said to him?

KEEPER: Well, I would have thought he was mad, personally. Because we get terrific gales here. 60 to 80 mile-an-hour gales are regular for this. That would be gone the first storm.

SOUND: Foghorn blows, cuts off.

VOICE: Are we on the air?

BROOKES: No.

BUSSEY: On the 17th of September 1901, the aerials at Poldhu were virtually destroyed by a storm. And of course the board were horrified when they learned this.

BROOKES: They'd just thrown their money away.

BUSSEY: Yes. But he had a temporary aerial erected, and he knew then he did not have enough power to go to Cape Cod. So he decided to go for the nearest landfall, which was Newfoundland.

BROOKES: Another storm blows down his antennas in Cape Cod. It means the company now has a small fortune riding on the Newfoundland gamble.

VOICE: S for Desssperate. S for ssssssignal.

SOUND: Ship's horn blowing in St. John's harbour.

READER: St. John's Evening Telegram, December 6th 1901: The S.S. Sardinian, nine days from Liverpool, arrived this morning with 450 tons of general cargo to Shea and Company. Her saloon passengers are: Mrs. C. Steer, Mrs. R.G. Green and two children, Miss Ledingham, Messrs. Marconi, Kemp, and Paget.

VOICE: S for secret. Secretive.

SOUND: Pages turning.

WRITER: That's the way Duckworth Street would have looked when Marconi was here. That's Prescott Street going down there.

BROOKES: Was there any big fuss when Marconi came off the boat? Was there any special delegation to meet him or...

WRITER: I think it was all very secret. From what I know of it, it was all hush-hush. He didn't even want anyone to know that he was conducting these experiments. He said he'd been invited over by the Ministry of Fisheries to get in touch with ships at sea because so many ships had been lost off the Newfoundland coast. So.

BROOKES: Newfoundland writer Paul O'Neill.

SOUND: Page turns

BROOKES: Why was he so secretive then? Was it competition he was afraid of?

WRITER: I think he was a very proud man, and I don't think -- if he'd failed -- he wanted have to say "This experiment was a failure" . Because he'd made such a fuss over in England. He built this big sending thing over in Poldhu, and then he built the big one down in Cape Cod, and they both blew down in storms and everybody was laughing at him. And he was determined he was going to do this. So he just came over here and looked for a hill where he could fly a kite and a balloon. So I'd say if it was a failure, nobody would have ever known.

VOICE: S for St. John's.

WRITER: It was a wooden city.

BROOKES: A city of wood, really.

VOICE: What did it sound like?

SOUND: Hammering, harbour sound.

VOICE: But what was it like then?

SOUND: Piano picking out *Face to Face*

ALASTAIR COLLIS: Well, according to my father, from a small boy, when we'd go to Signal Hill, Dad would always reflect on the memory that his father had when he met Marconi.

VOICE: There are lots of stories. Is this one true?

COLLIS: But anyhow, Marconi could play the piano. And my grandfather could sing quite well, you see? And he was a known baritone and he sang in a great many concerts in St. John's and around Newfoundland. And Marconi just said "Oh, and I play the piano" and introduced himself, and they talked about one thing and another. And he said "We should do a concert!" Because Marconi was explaining how he needed some funds to try to get the kite up in the air and try to get this thing on the go. And he said "Sure, I'd be happy to." So apparently they arranged a concert in St. John's. This is 1901 now, this is a long time ago. And they raised forty dollars. And Marconi played the piano and grandfather sang.

VOICE: So the story goes. There are lots of stories.

COLLIS: *(finishes playing piano)* That's one old one, anyway. That's "*Face to Face*" by Herbert Johnston.

VOICE: Is this one true?

SOUND: Piano begins to play another tune

PAGET (*Marconi's assistant- archival recording*:) We selected as a site for our receiving station Signal Hill, a headland at the entrance to St. John's harbour. It was a desolate scene. Not a shrub or a tree, only a deserted military hospital in one room of which Mr. Marconi set up his apparatus. We had brought two fifteen-foot balloons and six kites for the purpose of elevating the aerial, but the weather was terrible, and for a couple of days we battled with the elements, one of the balloons being carried away by the gale which snapped the heavy mooring rope like a piece of cotton. So Mr. Marconi suggested that for his crucial test of the third day we should use kites. And on that morning we managed to fly a kite up to 400 feet. The icy rain splashed my face as I watched anxiously. It is now my great privilege to introduce my distinguished chief, his excellency the Marchese Marconi.

MARCONI: It was shortly after midday on December the 12th, 1901, when I placed the single earphone to my ear and started listening. The xperiment had involved risking at least £50.000 to achieve a result which had been declared to be impossible by some of the principal mathematicians of the time. The chief question was: whether wireless waves would be stopped by the curvature of the earth. The first and final answer to that question came at 12.30 when I heard:

SOUND: Radio static signal

MARCONI: Listen to this, Kemp. Take the headphone. Can you hear anything?

VOICE: Can you hear?

KEMP: Yes, there it is.

MARCONI: The letter "s"?

KEMP: Distinctly, Mr. Marconi.

VOICE: So the story goes.

BROOKES: Now, four things happen at once.

SOUND: Four voices speak at once.

BROOKES: The first:

VOICE: S for success!

BROOKES: Wireless makes world headlines.

VOICE: The New York Times: Gugielmo Marconi announced tonight the most wonderful scientific development in modern times...

MALE VOICE: ...the fall in securities of cable companies...

BROOKES: Second:

VOICE: S for shot.

BROOKES: That pistol on the wall gets fired.

LAWYER VOICE: On behalf of the Anglo-Newfoundland Telegraph Company..

BROOKES: The cable company's fifty-year communications monopoly in Newfoundland still has three years left to run. Their St. John's lawyers run Marconi out of town.

LAWYER VOICE: ...legal proceedings will be instituted to restrain you from further prosecution of your work....

BROOKES: So Marconi leaves Newfoundland for Nova Scotia, where there is no cable company monopoly. He builds a wireless station in Glace Bay for commercial trans-Atlantic message transmission, but it takes him six years to get it working reliably. Third:

VOICE: S for skeptics. Skepticism.

BROOKES: Marconi and his assistant swore they heard the signal. But some scientists were dubious. Initially, in 1901, the skeptics included people like Thomas Edison. A hundred years later, they include the Senior Radio Scientist at Ottawa's Communications Research Centre, Dr. John Belrose.

BELROSE: From a radio scientist's point of view, he couldn't possibly have heard it, no. Ground-wave propagation would not go across the Atlantic, so he'd have to be receiving a sky-wave signal, sort of like a short-wave signal or a signal reflected from the ionosphere. But he wasn't using a short-wave signal. He was using a signal at the lower end of the medium-frequency broadcast band, about 500 kilohertz. But after all, he had a tremendous investment, his company had a tremendous investment in this experiment. He simply had to hear something. And if you listen hard enough, you can believe that you heard something. Let's put yourself in Marconi's position. He had never really listened to the signal with a pair of earphones before, and so he had to learn the new sounds that he was hearing, with clicks and atmospheric noise and so on. So he was learning as he was doing his experiments on Signal Hill. Put yourself in his position. Listening very intently, he would occasionally hear three clicks, and that's what he was listening for.

BROOKES: But you don't believe he heard the letter "s" in St. John's that day?

BELROSE: I think he heard just naturally occurring atmospherics.

BROOKES: He was lucky then, wasn't he? Because he turned out ultimately to be right in a way. Because otherwise I wouldn't be hearing you on the radio now, so it must exist.

BELROSE: That's right, yes. But whether he heard the three clicks or not, I think is really unimportant from today's standpoint. It certainly stimulated a tremendous amount of scientific discussion, and a race to achieve reliable trans-Atlantic communication. So it stimulated the radio communications world into trying to achieve trans-Atlantic communication. So he did accomplish something by his experiments. Marconi is really the father of long-distance communications.

MUSIC: from Edward McDowell's *New England Idylls (1901) LeGrande*

BROOKES: And the fourth thing that happens is: the world gets very small indeed.

WRITER: It was the beginning of a new century and the beginning of a new era. Which, as we found out, so many things happened in it. Incredible things. Nothing ever dreamed of way back in 1901 when Marconi was doing this kind of thing. But now, to let you see how small the world is: a friend in Australia who was trying to find out if he was related to me -- he's not a friend, he's a correspondent on the internet -- wrote and said "I've just seen an enquiry here in Sydney on the internet which says: anybody related to Edward Flynn of St. John's, Newfoundland, get in touch." He said "would that be anyone related to you?" Well, that was my grandfather. So this woman lived in Wisconsin. I got in touch with her and she was my grandfather's sister's grand-daughter.

VOICE: Can you hear? Can you hear anything?

MUSIC: *(finishes)*

SOUND: Cellphone rings.
Radio turns on and tunes through various stations.
Airwave sound
Radio static turns off.

END