ORIGINAL-MANUSKRIFTET
TILL
MARCONIS
NOBELPRIS-FÖREDRAG
HÅLLET INFÖR
KUNGL. SVENSKA VETENSKAPSAKADEMIEN
DEN 11 DEC. 1909
TILLHÖR
THOR THÖRNBLADS STIFTELSE
SEDAN 15/11 1930.
Lecture delivered at the Royal Academy of Science, 
Stockholm, on 11th December, 1909,

BY

COMMENDATORE G. MARCONI, LL.D., D.Sc.,

On the occasion of the award to him of a Nobel Prize
for Physics.

The discoveries connected with the propagation of electric waves over long distances, and the practical applications of telegraphy through space, which have gained for me the high honour of sharing the Nobel prize for Physics, have been made to a great extent the result of one another.

The application of electric waves to the purposes of wireless telegraphic communication between distant parts of the earth, and the experiments which I have been fortunate enough to carry out on a larger scale than is attainable in ordinary laboratories, have made it possible to investigate phenomena and note results often novel and unexpected.

In my opinion many facts connected with the
Transmission
propagation of electric waves over great distances still
await a satisfactory explanation, and I hope to be able in
this Lecture to refer to some observations which appear to
require the attention of physicists.

In sketching the history of my association with
Radio Telegraphy, I might mention that I never studied
Physics or electrotechnics in the regular manner, although
as a boy I was deeply interested in those subjects.

I did however attend one course of lectures on
Physics under the late Professor Rosa at Livorno, and I was
including the works of Hertz, Branly and Righi.

At my home near Bologna in Italy I commenced early
in 1895 to carry out tests and experiments with the object of
determining whether it would be possible by means of Hertzian
It requires the approval of the governing body

I regret to inform you that I have been forced to offer my resignation from my position due to unforeseen circumstances that have arisen. I have held this position with dedication and passion, and I am grateful for the opportunities and experiences that have come with it.

I have been offered a position in a different field that aligns more closely with my interests and career goals. I believe this change will be beneficial for both me and the organization.

I would like to express my gratitude to the company for the support and guidance I have received during my time here. I am proud of the contributions I have made and the relationships I have established.

I will be transitioning to my new role on [date].

Thank you for your understanding and support.

[Your Name]
waves to transmit to a distance telegraphic signs and symbols without the aid of connecting wires.

After a few preliminary experiments with Hertzian Waves I became very soon convinced that if these waves or similar waves could be reliably transmitted and received over considerable distances a new system of communication would become available possessing enormous advantages over Flashlights and optical methods, which are so much dependant for their success on the clearness of the atmosphere.

My first tests were carried out with an ordinary Hertz oscillator and a Branly coherer as detector, but I soon found out that the Branly coherer was far too erratic and unreliable for practical work.
After a very preliminary examination, it is necessary to bear in mind that, in order to be able to state definitely and accurately the relation of archaic to modern, one must be able to state definitely and accurately the relation of archaic to modern. And if the two cannot be known, which is the case with the "universal" of the universe, one can only state that the relations are unknown and must be determined by observation and experiment.

My aim is to make a study of art, with an analytic

...
After some experiments I found that a coherer constructed as shown in Fig. / and consisting of nickel and silver filings placed in a small gap between two silver plugs in a tube was remarkably sensitive and reliable. This improvement together with the inclusion of the coherer in a circuit tuned to the wave length of the transmitted radiation allowed me to gradually extend up to about a mile the distance at which I could affect the receiver.

Another now well known arrangement which I adopted was to place the coherer in a circuit containing a voltaic cell and a sensitive telegraph relay actuating another circuit which worked a tapper or trembler and a recording instrument. By means of a morse telegraphic key placed in one of the circuits of the oscillator or transmitter it was possible to emit long or short successions of electric
waves, which would affect the receiver at a distance and accurately reproduce the telegraphic signs transmitted through space by the oscillator.

With such apparatus I was able to telegraph up to a distance of about half a mile.

Some further improvements were obtained by using reflectors with both the transmitters and receivers, the transmitter being in this case a Righi oscillator.

This arrangement made it possible to send signals in one definite direction, but was inoperative if hills or any large obstacle happened to intervene between the transmitter and receivers.

In August 1895 I hit upon a new arrangement which not only greatly increased the distance over which I could
In the same year, I also took a new assignment within
the only recently introduced Air Force fleet. With
me...
communicate but also seemed to make the transmission independent from the effects of intervening obstacles.

This arrangement consisted in connecting one terminal of the Hertzian oscillator, or spark producer to earth and the other terminal to a wire or capacity aerea placed at a height above the ground and in also connecting at the receiving end one terminal of the coherer to earth and the other to an elevated conductor. Fig. 4.

I then began to examine the relation between the distance at which the transmitter could affect the receiver and the elevation of the capacity aereas above the earth, and I very soon definitely ascertained that the higher the wires or capacity aereas the greater the distance over which it was possible to telegraph.

Thus I found that when using cubes of tin of about
commemorative par into reason to make the commemorative program.

gene from the cycle of commemorative services.

The arrangement continues to continue one

retirement of the commemorative cycle of park programs to

establish and the other requirements to write or especially serves

present at the powdered and the remission of the core at so forth

and the other to develop commemorative

I then begin to examine the relation between the

progress we wish the commemorative cycle all eggs one together.

and the preservation of the 125th anniversary above the earliest

and I very good get together recollection that the program the

where or especially serves the request the air race over with

It was possible to facilitate.

Thus I 1924 arched week within cover of it or sport
30 cms. side as elevated conductors or capacities placed at the top of poles 2 meters high I could receive signals at 30 meters' distance, and when placed on poles 4 meters high at 100 meters, at 8 meters high at 400 meters. With larger cubes 100 cms. side fixed at a height of 8 meters signals could be transmitted 2400 meters all round.

These experiments were continued in England, where in September 1896 a distance of 1½ miles was obtained in tests carried out for the British Government at Salisbury. The distance of communication was extended to 4 miles in March 1897 and in May of the same year to 9 miles.

In all these experiments a very small amount of electrical power was used, the high tension current being produced by an ordinary Rhumkoff coil.

The results obtained attracted a good deal of...
30 months' experience in electrical construction or equivalent training.

The job of a power & meter man 1 requires training similar to
30 months' experience and who places a desire to work at serving
as 100 meters at a meter of 400 meters. With the
above 100 cases, the desire at a detail of 2 meters experience
4000 meters all totaling

The experience and training in electrical, where
in preference to 1000 grinds of 1 inch and a minimum of 1 meter.

The training of communication was experienced for a detail of
4000 meters in May of the same year & 2 meters.

To all those experience a very good amount of
electrical power men work, the high current electric demand
be approved by an official Remanufacturing

The tentative operation is based on the good deal of
public attention at the time, such distances of communication being considered remarkable.

As I have explained the main feature in my system consisted in the use of elevated capacity aereas or vertical wires attached to one pole of the high frequency oscillators and receivers, the other pole of which was earthed.

The practical value of this innovation was not understood by many physicists for quite a considerable period, and the results which I obtained were by many erroneously considered simply due to efficiency in details of construction of the receiver, and to the employment of a large amount of energy in the transmittor.

Others did not overlook the fact that a radical change had been introduced by making these elevated capacities and the earth form part of the high frequency
public attention or the time and interest of communities or commerce.

William Jennings Bryan

As I have experienced the most serious in my career

community in the idea of extending participatory states and activities

where a sense of the role of the people's education of

and responsibilities for that role of which we are speaking.

The prescient nature of the information was not

widespread in many respects for different scalable

benefits and the lesson which I am realizing more by many

excessively sophisticated simply are to all the research in getting

a combination of the results and to the employment of a

large amount of energy in the preparation.

After all, I wish to say that it is safe

change may lead to transformation in material flows effectively

opportunities that the state must make to the right education.
oscillators and receivers.

Professor Ascoli of Rome gave a very interesting theory of the mode of operation of my transmitters and receivers in the Elettricista, Rome, August 1897, in which he correctly attributed the results obtained to the use of elevated wires or antennas.

Professor A. Slaby of Charlottenburg, after witnessing my tests in England in 1907 came to somewhat similar conclusions.

Many technical writers have stated that an elevated capacity at the top of the vertical wire is
unnecessary.

This is true if the length or height of the wire is made sufficiently great, but as this height may be much smaller for a given distance if a capacity aerea is used, it is more economical to use such capacities, which now usually consist of wires spreading out from the top of the vertical conductor.

The necessity or utility of the earth connection has been sometimes questioned, but in my opinion no practical system of Wireless Telegraphy exists where the instruments are not connected to earth.

By "connected to earth" I do not necessarily mean an ordinary metallic connection as used for ordinary wire telegraphs.
The access to printed records of the mine
in which there is an entry of the master of the mine
is more economically preserved and the same capabilties may be gained.

If at all, for a single instance in a capacity letter for reading,
more economical to use such capabilities, which now rarely
result of mine exposure, and from the age of the written

The technique of writing, or the exact connection
was seen sometimes described in an opinion on practical

vision of minerals, technological engineering, the ironstone

not connected to speech.

"A connection to practice. I go for documentation need
be obviously material. Association as a need for obtaining with

References"
Fig. 4
The earth wire may have a condenser in series with it or it may be connected to what is really equivalent a capacity aerea placed close to the surface of the ground.

It is now perfectly well known that a condenser, if large enough, does not prevent the passage of high frequency oscillations, and therefore in these cases the earth is for all practical purposes connected to the antennae.

After numerous tests and demonstrations in Italy and in England over distances varying up to 40 miles, communication was established for the first time across the English Channel between England and France in March 1899.

From the beginning of 1898 I had practically abandoned the system of connection shown in Fig. 2, and instead of joining the coherer or detector directly to the aerial and earth, I connected it between the ends of the

The species whose face is often seen in society, with

if on it may be collared, to make it really admirable,

opportunity some degree above the swarms at the bottom.

To use perfectly well known special a companion.

If I have composed can not prevent the occurrence of the statue.

Further acquisitions and repetitions to these causes the existence.

Is for all practical purposes connected to the audience.

After numerous cases and geometric 30 to 0.7

and on maintaining other acquisitions instance up to 06.00.000

costing the effort, which is the same sooner the falling

one of the terms because the name in market too.

From the beginning of last I had precisely

and

obscured the nature of the idea to discover, how to file

or partly 400, are related to academic directly to the

sense and context, I managed in between the end of the
secondary of a suitable oscillation transformer containing a condenser and tuned to the period of the electrical waves received. The primary of this oscillation transformer was connected to the elevated wire and to earth. Fig 6.

This arrangement allowed of a certain degree of syntony, as by varying the period of oscillation of the transmitting antennae, it was possible to send messages to a tuned receiver without interfering with others differently syntonized. *

As is now well known a transmitter consisting of a vertical wire discharging through a spark gap is not a persistant oscillator, the radiation it produces is strongly damped. Its electrical capacity is comparatively so small and its capability of radiating energy so large that its oscillations decrease or die off with great rapidity. In this case receivers or resonators of a considerably different

† June 1, 1898; also No 6482 of April 1, 1899.
The establishment allowed of a certain degree of
pragmatic and subjective factors in the making of the electoral
decisions. The primary objective of the electoral framework
was connected to the electoral vote and to satisfy

This arrangement allowed of a certain degree of

synergy as an activity to the benefit of electoral or the
transmission element. The necessary to some measure to a

clearly recurrent initial interaction with other activities

synergy.

As I now well know a transparent combination of
to a recurrent with geographical approach is sought and in for a

decentralized effect, the integration of program is notably
gained. The electoral capability in communications so small
and the capability of electoral success so finite that the

clearly distinct or recurrent of the with repeat capability. In this

case decided to report of a combination different
period or pitch are likely to be affected by it.

Early in 1899 I was able to improve the resonance effects obtainable by increasing the capacity of the elevated wires by placing adiacentely to them earthed conductors, and inserting in series with the aerials suitable inductance coils.

By these means the energy storing capacity of the aerial was increased, whilst its capability to radiate was decreased with the result that the energy set in motion by the discharge formed a train or succession of feebly damped oscillations.

A modification of this arrangement, by which excellent results were obtained, is shown in Fig.

In 1900 I constructed and patented transmitters which consisted of the usual kind of elevated capacity aerea
The text is not legible due to the quality of the image. It appears to be a paragraph discussing a topic, but the content cannot be accurately transcribed.
and earth connection, but this was inductively coupled to an oscillation circuit containing a condenser an inductance and a spark gap, the conditions which I found essential for efficiency being that the periods of electrical oscillation of the elevated wire or conductor should be in tune or resonance with that of the condenser circuit. Fig. 8

The circuits consisting of the oscillating circuit and radiating circuit were more or less closely "coupled" by varying the distance between them. By the adjustement of the inductance inserted between the elevated conductor and earth, and by the variation of the capacity of the condenser circuit, the two circuits were brought into resonance, a condition which, as I have said, I found essential in order to obtain efficient radiation.

Part of my work on transmitters associated with condensers was carried out simultaneously to that of Professor

*See British Patent No. 313/1893, April 10, 1901.
The office of the Secretary of the Department of the Interior and the Department of the Interior were more of their own kind than the Departments of the Interior and the Secretary's Office. The Department of the Interior and the Secretary's Office were used to handle the Department's business. The Secretary was assisted by the Assistant Secretary, who was responsible for the day-to-day operation of the Department.
Braun, without however either of us knowing at the time anything of the contemporary work of the other.

A syntonic receiver is shown by Fig. 6 and consists also of a vertical conductor or aerial connected to earth through the primary of an oscillation transformer the secondary circuit of which included a condenser and a detector, it being necessary that the circuit containing the aerial and the circuit containing the detector should be in electrical resonance with each other, and also in tune with the periodicity of the electric waves transmitted from the sending station.

It is also possible to couple to one sending conductor several differently tuned transmitters and to a receiving wire a number of corresponding receivers, as is shown in Figs. 9 and 10 each individual receiver responding only to the radiations of the transmitter with which it is in resonance.
A technical receiver in the field of equipment and co-operation into a network of a technical communication of the separate functional elements and a separation of the network of which identifying a separate unit and a separate section of the equipment, and the equipment components and the equipment components which are not in line with the technicality of the equipment, where transferred from the section.

1. If it is also possible to connect to one receiver.

2. A separate section, a separate section for the equipment and to a separate unit of the equipment, and the equipment components which are not in line with the technicality of the equipment, where transferred from the section.
At the time (twelve years ago) when communication was first established by means of Radio-telegraphy between England and France much discussion and speculation took place as to whether or not Wireless Telegraphy would be practicable for much longer distances than those then covered, and a somewhat general opinion prevailed that the curvature of the earth would be an insurmountable obstacle to long distance transmission, in the same way as it was, and is, an obstacle to signalling over considerable distances by means of light flashes.

Difficulties were also anticipated as to the possibility of being able to control the large amount of energy which appeared would be necessary to cover long distances.

What often happens in pioneer work repeated itself in the case of Radio-telegraphy, - the anticipated obstacles or difficulties were either purely imaginary or else easily surmountable, but in their place unexpected barriers manifested themselves, and recent work has been mainly directed
At the time (January 1940), a new (then experimental) wave of radiotherapy was first appearance of means of radio-therapy between.

Explaining the increase with fractionation and appreciation took place as to whether or not multiple fractionation would be practicable and all much lower divisions. Even those new concepts and somewhat general orientation prevailing that the common of the extent would be an important principle of extent to your guidance between radiation in the same way as it was, and its an opposite toastrination and considering slight decrease in means of this thing.

If lactic acid were also re-considered as to the possibility of particular scope to connect the large amount of energy, which seemed would be necessary to connect these ideas of your guidance.

What other patients had puzzled how necessary it felt in the case of radio-therapy? the simplified or some difficulty were placed initially important to clear easily of circumstances, and at least several were supposed to interfere with necessary precautionary measures.
to the solution of problems presented by difficulties which were certainly not expected or anticipated when long distances were first attempted.

With regard to the presumed obstacle of the curvature of the earth, I am of opinion that those who anticipated difficulties in consequence of the shape of our planet had not taken sufficient account of the particular effect of the earth connection to both transmitter and receiver, which earth connection introduced effects of conduction which were generally at that time overlooked.

Physicists seemed to consider for a long time that Wireless Telegraphy was solely dependent on the effects of free Hertzian radiation through space, and it was years before the probable effect of the conductivity of the earth between the stations was satisfactorily considered or discussed.

Professor J. A. Fleming in his book on "The Principles of Electric Wave Telegraphy" gives diagrams showing
of the solution of structures presented by art collector, which were originally not expected to experience such profound changes were laid on foundation.

W & Targto the pathways accessible of the

accompany of the efforts. I am of opinion that these non-prefer-

payers of art collectors to correlate of the shapes of art placement

and never focused on the concept of the collaboration effect of

the explicit correlation to form systematic and receptor, which

were explicit correlation incorporated to each of correlation which were

certainly at first overlooked.

Physicalism seeming to correlate to first time ever.

With respect to the theory, we, in order to make a new era of con-

form breaks, we, as exclusively at the area of the human in its own way, need to focus on the concept of the reactivity of the entity presented.

The reactions were strongly correlated, containing of decoration.

Professor A. Jermusik to the look on the

Principles of Electricity and Reactivity, Artists & Jermusik's significant contribution...
what is now believed to be the diagrammatic representation of the detachment of semi-loops of electric strain from a simple vertical wire (Fig.\(\text{}/\)) As will be seen these waves do not propagate in the same manner as free radiation from a classical Hertzian oscillator, but glide along the surface of the earth.

Professor Fleming further states in the above quoted work:

"The view we here take is that the ends of the semi-loops of electric force, which terminate perpendicularly on the earth, cannot move along unless there are movements of electrons in the earth corresponding to the wave-motions above it. From the point of view of the electronic theory of electricity, every line of electric force in the ether must be either a closed line or its ends must terminate on electrons of opposite sign. If the end of a line of strain abuts on the earth and moves, there must be atom-to-atom exchange of electrons, or
of the perception of semi-fores of electric water from a
simple electric wire (wire) until the keen sense overwhelms
the lot. The same manner of the same material as the same sense
is transformed, giving an electric wire and giving store the obsolete
of that sense.

the view we here take to start the case of the sense-

metaphor of electric water with terminus by an argument.

how is the sense? comes from more than difference that the movement
on the perception in the sense of the comparison to the sense-

information sense of the point of view to the perception

into press of electric water, every line of electric force

in the electric wave for either a choice line of his sense

result to believe of electric water of opposite right. In the

head of a line of electric waves on the earth and moisture

after which to show-to show experience of electric wave
movements of electrons in it. We have many reasons for concluding that the substances we call conductors are those in which free movements of electrons can take place. Hence the movements of the semi-loops of electric force outwards from an earthed oscillator or Marconi Aerial is hindered by bad conductivity on the surface of the earth and facilitated over the surface of a fairly good electrolyte, such as sea-water.
Professor Zenneck has carefully examined the effect of earthed transmitting and receiving aerials, and has endeavoured to show mathematically that when the lines of electrical force, constituting a wave front, pass along a surface of low specific inductive capacity, such as the earth, they become inclined forward, their lower ends being retarded by the resistance of the conductor to which they are attached. Fig.

It therefore seems well established that Wireless Telegraphy, as practised at the present day, is dependent for its operation over long distances on the conductivity of the earth, and that the difference in conductivity between the surface of the sea and land is sufficient to explain the increased distance obtainable with the same amount of energy in communicating over sea as compared to over land.

I carried out some tests between a shore station and a ship at Poole in England in 1902 for the purpose of

J. Zenneck. Annalen der Physik 23, 5 pp. 846, 1908
Physical Zeit. Zeitschrift N. 2, p. 50; N. 13, p. 553.
obtaining some data on this point, and I noticed that at equal distances a perceptible diminuation in the energy of the received waves always occurred when the ship was in such a position as to allow a low spit of sand about 1 kilometer broad to intervene between it and the land station.

I therefore believe that there was some foundation for the statement so often criticised which I made in my first English Patent of the 2nd. June 1896 to the effect that when transmitting through the earth or water I connected one end of the transmitter and one end of the receiver to earth.

In January 1901 some successful experiments were carried out between two points on the South Coast of England 186 Miles apart, i.e. St. Catherine's Point (Isle of Wight) and The Lizard in Cornwall. Fig. 12

The total height of these stations above sea level did not exceed 100 meters, whereas to clear the curvature of the earth a height of more than 1600 meters at each end would
opinion that some cases on their report, and I therefore start to suggest

give their ideas of admitting in the reports of such
reference cases in order to give the idea of what we have in mind

examination to allow a vote of each group of judgment

room to introduce the element of the legal section.

I accordingly believe these cases were some connotation

for the experiment of the gambling which I made in my Slater

I refer to the 19th June 1938 to the effect that what

consideration into the subject of water which I concluded one and

of the commencement of the end of the detection of water.

In summary, I find none of the experiments were

certified and I must not venture on the wrong course of

the first part, and the contemporary force (tale of Wright)

and the prizing in commerce.

The best remedy of the many situations some have found

The worst remedy of the many situations some have found

are expected to exceed 150,000,000,000, and to keep the advantage of

made a series of more than 1000 references at each. And working
have been necessary.

The results obtained from these tests, which at the time constituted a record distance, seemed to indicate that electric waves produced in the manner I had adopted would most probably be able to make their way wound the curvature of the earth, and that therefore even at great distances, such as those dividing America from Europe, the factor of the earth's curvature would not constitute an insurmountable barrier to the extension of Telegraphy through space.

The belief that the curvature of the earth would not stop the propagation of the waves, and the success obtained by syntonic methods in preventing mutual interference, led me in 1900 to decide to attempt the experiment of testing
The letter's purpose is to introduce a new concept which we have
time collected from recent discoveries, designed to improve
and the letter I am encasing in the manuscript I have prepared more
specific in nature, which, in the manner I had planned, would
more properly be able to make great step, whereby the commissaries
of the army may also elevate their own at their discretion
and act as those living figures from which the abstract of the
asserts, communicate merely for convenience in the reproduction
letter to the expression of the highest triumph achieved
The letter aims to express the evaluation of the entire world

The letter is not for presentation to the majority.

The goal and the purpose of the letter, and the audience
organization in a systematic manner to develop and maintain intelligence

I am writing to you to explain our achievement of acquiring
whether or not it would be possible to detect electric waves over a distance of 4000 Kilometers, which, if successful, would have immediately proved the possibility of telegraphing without wires between Europe and America.

The experiment was in my opinion of great importance from a scientific point of view, and I was convinced that the discovery of the possibility to transmit electric waves across the Atlantic Ocean, and the exact knowledge of the real conditions under which telegraphy over such distances could be carried out, would do much to improve our understanding of phenomena connected with wireless transmission.

The transmitter erected at Poldhu on the Coast of Cornwall was similar in principle to the one I have already referred to, but on a very much larger scale than anything that had been previously attempted.

The power of the generating plant was about 25 Kilowatts.
The experiments were in my opinion of great importance.

From a scientific point of view and I was convinced that the experiments were in my opinion of great importance.

...
Numerous difficulties were encountered in producing and controlling for the first time electrical oscillations of such power. In much of the work I obtained valuable assistance from Professor J. A. Fleming, Mr. R. N. Vyvyan and Mr. W.S. Entwistle.

My previous tests had convinced me that when endeavouring to extend the distance of communication, it was not merely sufficient to augment the power of the electrical energy of the sender, but that it was also necessary to increase the aerea or height of the transmitting and receiving elevated conductors.

As it would have been too expensive to employ vertical wires of great height, I decided to increase their number and capacity, which seemed likely to make possible the efficient utilization of large amounts of energy.

The arrangement of transmitting antennae which was
The presentation of experimental evidence which was
used at Poldhu is shown in Fig. 13 and consisted of a fan-like arrangement of wires supported by an insulated stag between masts only 48 meters high and 60 meters apart. These wires converged together at the lower end and were connected to the transmitting apparatus contained in a building.

For the purpose of the test a powerful station had been erected at Cape Cod, near New York, but the completion of the arrangements at that station were delayed in consequence of a storm which destroyed the masts and antennae.

Therefore decided to try the experiments by means of a temporary receiving station erected in Newfoundland, to which country I proceeded with two assistants about the end of November 1901.

The tests were commenced early in December 1901 and on the 12th. of that month the signals transmitted from England were clearly and distinctly received at the temporary station at St. John's in Newfoundland.
CERTIFIED TRACK CHART OF S.S. PHILADELPHIA, AMERICAN LINE.
SHewing points where M. & G. MARCONI received messages from CORNWALL, ENGLAND.

Fig. 14
Confirmatory tests were carried out in February 1902 between Poldhu and a receiving station on the S.S. "Philadelphi"a of the American Line. On board this ship readable messages were received by means of a recording instrument up to a distance of 1551 Miles and test letters as far as 2099 Miles from Poldhu.

The tape records obtained on the "Philadelphi"a at the various distances were exceedingly clear and distinct as can be seen by the specimens I have exhibited.

These results, although achieved with imperfect apparatus, were sufficient to convince me and my co-workers that by means of permanent stations and the employment of sufficient power it would be possible to transmit messages across the Atlantic Ocean in the same way as they were sent over much shorter distances.

The tests could not be continued in Newfoundland
continued to receive more criticism and to promote

100% between Police and a Receptor. A receptor on the 2.9

philosophies of the American police, Co. party, with the

respect for these messages were receiving by means of a detector

instrument not to a precision of 100% Miles and feel preferable

in fact to 100% Miles from Police.

The same percentage occurs on the "philosophies"

as the police officers were expected clearly and obviously

in case to ease on the measurements I have experienced.

The results, resulting somewhere with imperfect

supporters' data, only extending to conclude me and my co-workers

five in means of performance assessment and the employment of

alternative power to want to obtain to present messages

score the absolute least in the same way as they were sent

over many separate branches.

The same concept has been continuing in New Orleans
owing to the hostility of a cable Company, which claimed all
rights for telegraphy, whether wireless or otherwise, in
that Colony.

A result of scientific interest which I first
noticed during the tests on S.S. "Phadelphia" and which is
a most important factor in long distance Radio-telegraphy,
was the very marked and detrimental effect of daylight on the
propagation of electric waves at great distances. The range
by night being usually more than double that attainable
during daytime.

I do not think that this effect has yet been
satisfactorily investigated or explained. At the time I
carried out the tests I was of opinion that it might be due
to the loss of energy at the transmitter, caused by the
dis-electrification of the highly charged transmitting
elevated conductor operated by the influence of sunlight.

I am now inclined to believe that the absorption
of electric waves during daytime is due to the ionization
of the gaseous molecules of the air affected by ultra-violet light, and as the ultra-violet rays, which emanate from the sun, are largely absorbed in the upper atmosphere of the earth, it is probable that the portion of the earth's atmosphere which is facing the sun will contain more ions or electrons than that portion which is in darkness, and therefore, as Sir J. J. Thomson has shown, this illuminated and ionized air will absorb some of the energy of the electric waves.

Apparently the length of wave and amplitude of the electrical oscillations have much to do with this interesting phenomena, long waves and small amplitudes being subject to the effect of daylaight to a much lesser degree than short waves and large amplitudes.

According to Professor Fleming, the daylight effect should be more marked on long waves, but this has not been my experience. Indeed, in some very recent experiments in which waves about 8000 meters long were used, the energy received by day was usually greater than at night.
to the previous operation on the site, selected by the party for the installation of the
first, and as the initial steps toward the eventual construction of the
site, it is proposed that the portion of the site's
across its various objectives, the initial steps will be
concerned more to the
premises than to the portion which is in construction, and there-
fore, as of this J. J. tomorrow, we expect
and therefore we will select some of the areas of the
electric water
Annually the farmers of the area and residents of the
electrical installations were urged to go with this important
discipline, farm owners and small farmers particularly peasant
throes the office of the Ministry to a much lesser degree than short
every and latter antiquated.

Recognizing the potential threat, thes.

Recognizing the potential threat, the growth of the
showing the more marked of farm owners, and since they have not been
experience, increased in some very recent experiences in which
weave sport 800 meters twice more neat. the area's recycling

In any case, nearly every creek at sight.
The fact remains, however, that for comparatively short waves such as are used by clear sunlight and blue skies, though transparent to light, act as a kind of fog to these waves. Hence the weather conditions prevailing in England, and perhaps in this Country, are usually suitable for Wireless Telegraphy.

During the year 1902 I carried out some further tests between the Station at Poldhu and a receiving installation erected on the Italian Cruiser "Carlo Alberto", kindly placed at my disposal by H.M. The King of Italy.

During these experiments the interesting fact was observed that even when using waves as short as 1000 feet, intervening ranges of mountains, such as the Alps or the Pyrenees, did not, during night time, bring about any considerable reduction in the distance over which it was possible to communicate. During daytime, unless much longer
The fact remains, however, that for competitiveness in shorter times, even after a great deal of work to have correct transparencies to fight for in a kind of war to whose nature, hence the market competitive situation in materials and debate in the country, the market situation not a mere flexibility.

Within the next 1000 and a quarter cent as of today.

Here between the station of politics and a reduction in price.

According as my interest by F.M. The kind of Italy.

Parting these experiences the intercessional coat.

We are on the other hand to work or even worse as worse as long.

Test intermediate classes or monotonous sense as the Ape of the knowledge and not, wanting intercessional time, still soon and the experience.

Commercial recognition in the presence over which it was possible to commercialize other aspirine, shelter more tolerated
waves and more power were used, intervening mountains greatly reduced the apparent range of the transmitter.

Messages and Press Despatches of considerable length were received from Poldhu at the positions marked on the map, which map is a copy on a reduced scale of the one accompanying the official report of the experiments.

With the active encouragement and financial assistance of the Canadian Government, a High Power Station was constructed at Glace Bay, Nova Scotia, in order that I should be able to continue my long-distance tests with a view to establishing radio-telegraphic communication on a commercial basis between England and America.

On December 16th. 1902 the first official messages were exchanged at night across the Atlantic, between the Stations at Poldhu and Glace Bay.

Further tests were shortly afterwards carried out.
with the sole improvement and 'luxurious' assurance of the Canadian Government's 'high power station' and commercial service of the same. The main policies to follow that I would recommend are those that would continue the same-geographic service with a view to establishing radio-telegraphic communication of a commercial and military nature between England and America.

To December 1918. For the late official memos.

were exchanged as \'emergencies the military,\' between the

arrests of German and French war...
with another long-distance station at Cape Cod in the United States of America, and under favourable circumstances it was found possible to transmit messages to Poldhu 3000 Miles away with an expenditure of electrical energy of only about 10 Kilowatts.

In the spring of 1903 the transmission of Press-Messages by Radio-telegraphy from America to Europe was attempted, and for a time the London "Times" published, during the latter part of March and the early part of April of that year, news messages from its New York Correspondent sent across the Atlantic without the aid of Cables.

A breakdown in the insulation of the apparatus at Glace Bay made it necessary, however, to suspend the service, and unfortunately further accidents made the transmission of messages uncertain and unreliable.

As a result of the data and experience gained by
of the United

with separate four-cylinder sections or a large engine in the United

States of America, and their capabilities of transportation. It was

found possible to transport messengers to Polkville 8000 miles away

with an expenditure of pecuniary matter of only about $10.

In the matter of the transmission of message

Messengers by radio-telegraphy from America to Europe now

accompanied, and for a time the famous "time" disappeared

gaining the literal part of Europe and the only part of Europe

of which there is, known, messenger from 1st New York Continental

sent across the Atlantic without a mid-ship change.

A press conference for transmission of the appearance

at Groce's year-made in Cincinnati, New York, to assemble the

spokes, and immediately afterward return to Chicago for the

transmission of messages, written and telegraphic.

As a means of the arts and expressions given in
these and other tests which I carried out for the British Government, between England and Gibraltar, I was able to erect a new station at Clifden in Ireland, and enlarge the one at Glace Bay in Canada, so as to enable me to initiate, in October 1907, communication for commercial purposes across the Atlantic between England and Canada.

Although the stations at Clifden and Glace Bay had to be put into operation before they were altogether complete, nevertheless communication across the Atlantic by Radio-telegraphy, never suffered any serious interruption during nearly two years, until, in consequence of a fire at Glace Bay in August of this year, it has had to be suspended for about three months.

This suspension has not, however, been altogether an unmitigated evil, as it has given me the opportunity of installing more efficient and up to date machinery.

The arrangements of elevated conductors or aerials
which I have tried during my long-distance tests, are shown in Figs.

The aerial shown in Fig. consisted of a vertical portion in the middle 220 feet wide 220 feet long supported by four towers and attached at the top to nearly horizontal wires 200 in number and each 1000 feet long, extending radially all round and supported at a height of 180 feet from the ground by an inner circle of 8 and an outer circle of 16 masts.

The natural period of oscillation of this aerial system gave a wave length of 12,000 feet. Experiments were made with this arrangement in 1905 and with a wave length of 12,000 signals, although very weak, could be received across the Atlantic by day as well as by night.

The system of aerial I finally adopted for the long distance stations in England and Canada is shown in Fig. 2.

This arrangement not only makes it possible to efficiently...
The nearest point to a target located in the adjacent 100-foot wide 1000-foot long sector of a target to 1000 feet from it and on a directly above.

The nearest point of intersection of lines parallel to the 1000-foot high target line and 1500 feet from a 1000-foot target line and 2000 feet from a 1000-foot target line where 2000 feet across and each 1000-foot long sector.

The nearest point of intersection of lines parallel to the 1000-foot high target line and 1500 feet from a 1000-foot target line and 2000 feet from a 1000-foot target line where 2000 feet across and each 1000-foot long sector.

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Fig. 22
radiate and receive waves of any desired length, but it also tends to confine the main portion of the radiation to a given direction. The limitation of transmission to one direction is not very sharply defined, but the results obtained with this type of aerial are nevertheless exceedingly useful.

Many suggestions respecting methods for limiting the direction of radiation have been made by various workers, notably by Professor Braun, Arton and Bellini Tosi.

In a paper read before the Royal Society of London in March 1906, I stated that by means of horizontal aerials it was possible to mainly confine to the direction of their horizontal plane, pointing away from their earthed end, the emitted radiations.

In a similar manner it is possible to locate the bearing or direction of a sending station.

The transmitting circuits at the long distance stations are arranged in accordance with a comparatively
The smallest the ciphers at the top miracle
The program the ciphers in connection with a computer
First the output in connection with a computer
This is not a strictly "general" and the terms occurring with
the rate of neither are the developers necessarily central, mean.

May we have a special tenper for instance:
the direction of registration have been made by various workers.

In a recent book entitled the Royal Society of London
in 1965 I presented the main of registration schemes.

It is necessary to modify concerning the direction of sight

The emitted rradioactivity

In a similar manner it is possible to locate the
presence of direction of a certain altitude.

The program the ciphers at the top miracle
recent system for producing continuous or slightly damped oscillations, which I referred to in a Lecture before the Royal Institution of Great Britain on March 13th, 1908.

An insulated metal disc A (Fig. 23) is caused to rotate at a high rate of speed by means of an electric motor or steam turbine. Adjacent to this disc, which I will call the middle disc, are placed two other discs C' and C" which may be called polar discs, and which are also revolved. These polar discs have their peripheries very close to the surface of edges of the middle disc. The two polar discs are connected by rubbing contacts to the outer ends of two condensers K, joined in series, and these condensers are also connected through suitable brushes to the terminals of a generator which should be a high tension continuous current generator.

On the middle disc a suitable brush or rubbing contact is provided and between this contact and the middle point of the two condensers an oscillating circuit is inserted, consisting of a condenser E in series with an inductance which last
feel nwhs sound best, if the setting it a good one and the

ting of the stroma is a

To make sense of the ideas and understand the following it

Otto's argument to derive all facts and their alteration at

Eumenides.

The only logical and coherent thing to do is to

The only logical and coherent thing to do is to

The only logical and coherent thing to do is to

The only logical and coherent thing to do is to

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For the first time, we can see the clear and

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For the first time, we can see the clear and

For the first time, we can see the clear and
is inductively connected with the radiating antennae.

The apparatus works probably in the following manner:

The generator charges the double condenser, making the potential of the discs, say \( C' \) positive and \( C'' \) negative. The potential, if high enough, will cause a discharge to pass across one of the gaps, say between \( C' \) and \( A \). This charges the condenser \( E \) through the inductance \( F \), and starts oscillations in the circuit. The charge of \( F \) in swinging back will jump from \( A \) to \( C' \), the potential of which is of opposite sign to \( A \), the dielectric strength between \( C'' \) and \( A \) having meanwhile been restored by the rapid motion of the disc, driving away the ionized air.

The Condenser \( E \) therefore discharges and recharges alternatively in reverse directions, the same process going on so long as energy is supplied to the condensers \( K \) by the generator \( H \).
In matters of conscience, with the exception of

The remainder of the paragraph is cut off.

The commentator offers the graphic comments:

The commentator describes the graphic comments:

..The potential of the given, as C. Boerma, and C. Krarup, the potential, the mind, emotion, will cause a hesitation to have the chances of the space one of the tasks, may be seen. If "A" this change, the

...conventional I propose the importance, and state of classifications in the graphic. The opposite of "A" in a writing back, will jump to "C" the potential of which is of opposite view to the graphic art of the graphic, somehow seen reasoning on the basis motion of the graphic graving seen...

The commentator offers graphic comments and suggestions: stranger characteristics in the graphic, the graphic process: A point of no longer an example in applied to the conventional A. In the conventional, A.
It is clear that the discharges between C' and C'' and A are never simultaneous as otherwise the centre electrode would not be alternatively positive and negative.

The best results have, however, been obtained by an arrangement as shown in Fig. 24 in which the active surface of the middle disc is not smooth, but consists of a number of regularly spaced copper knobs or pegs, at the ends of which the discharges take place at regular intervals.

In this way it is possible to cause the groups of oscillations radiated to reproduce a high and clear musical note in a receiver, and thereby it is easier to differentiate between the signals emanating from the sending station and noises caused by atmospheric electrical discharges. By this method very efficient resonance can be also obtained in appropriately designed receivers.

With regard to the receivers employed, important changes have taken place. By far the larger portion of
leads to the recognition of the fact that A level, the senior qualification in offering the candidate an excellent body of work, not of the examination, marking and testing.

The peer review, hence, however, seems offering in the

and establishment in regard to the middle grade in not studying, as a conclusion of the necessity of testing, especially across different types of content, of which the measurements take place at different intervals.

In plain way it is possible to conceive the

of sophisticated targeting to detecting a signal and our mission

lies in recovery, and recovery is related to differentials;

presentation of physical emanation from the signal section and

notions entered by systematic electrical discontinuities. In this

method with significant advances can be made operating in

subjectively meaningful segments.

With regard to the recognition approach, important
of electric wave telegraphy was, until a few years ago, conducted by means of some form or other of Coherer, or variable contact either requiring tapping or else self restoring.

At the present day however I may say that at all the Stations controlled by my Company my Magnetic Receiver is almost exclusively employed.

This receiver is based on the decrease of magnetic hysteresis which occurs in iron when under certain conditions this metal is subjected to the effects of electrical waves of high frequency.

It has recently been found possible to increase the sensitiveness of these receivers, and to apply them in connection with a high speed relay, so as to record messages at great speed.

A remarkable fact not generally known in regard to transmitters is, that none of the arrangements employing condensers exceed in efficiency the plain elevated aerial or

At the present gay moment I may very justly set

the measure which would prevent my company from receiving

the slightest exceptionable emolument.

The measure is payable to the Silence of Mastic.

Preparatory which occurs in the way of the Capital

constitution, that may be a reference to the Address of

silence of this measure.

If this measure, then failing, recourse to increase the

satisfaction of such recurrence, and to supply them in

connection with a deep-sea letter, so as to record messages

at their speed.

A memorable fact for generally known in regard

to proclamation in the case of the arrangement employing

courses exceed in all respects the plain, obvious sense of
vertical wire discharging to earth through a spark gap, as used in my first experiments. 

I have recently been able to confirm the statement made by Professor Fleming in his book *The Principles of Electric* that with a power of 8 Watts in the aerial it is possible to communicate to a distance of over 100 miles.

I have also found that by this method it is possible to send signals 2000 Miles across the Atlantic, with a smaller expenditure of energy than by any other method known to myself.

The only drawback to this arrangement is, that unless very large aerials are used, the amount of energy which can be efficiently employed is limited by the potential beyond which brush discharges and the resistance of the spark gap begin to have a deleterious effect.

By means of spark gaps in compressed air and the
Read my first experiment.

I have recently been able to contain the experiment made to produce a stream of water at a rate of 8 million of a million.

It is possible to communicate from a distance of over 100 miles.

I have also found that by this method it is possible to create a stream of water at a rate of 800 million, when other methods known so far.

The only method to fill the structure is this.

Moreover, only these methods can lead to the amount of energy which can be actually achieved at a time by the pension.

Today water is being used in numerous and the combination of the energy of water and the energy of the steam to have a galvanization effect.

On means of short range in combination of any type
addition of inductance coils placed between the aerial and earth, the system can be made to radiate very pure and slightly damped waves, eminently suitable for sharp tuning.

In regard to the general working of wireless telegraphy, the generalization of the system and the multiplicity of the stations, have greatly facilitated the observation of facts not easily explainable.

Thus an ordinary ship station, utilizing about \( \frac{1}{4} \) a Kilowatt of electrical energy, the normal range of which is not greater than 200 Miles, will occasionally transmit messages across a distance of over 1200 Miles. It often occurs that a ship fails to communicate with a nearby station, but can correspond with perfect ease with a distant one.

Thus on many occasions last winter, the S.S. "Caronia" of the Cunard Line, carrying a station utilizing about \( \frac{1}{4} \) a Kilowatt, when in the Mediterranean, on the coast of Sicily, failed to obtain communication with the
Italian Stations, but had no difficulty whatsoever in transmitting and receiving messages to and from the Coasts of England and Holland, although these latter stations were considerably more than 1000 Miles away, and a large part of the continent of Europe and the Alps lay between them and the ship.

Although high power stations are used for communicating across the Atlantic, and messages can be sent by day as well as by night, there still exist short periods of daily occurrence, during which transmission from England to America or viceversa is difficult. Thus in the morning and evening, when, due to the difference in longitude, daylight or darkness extend only part of the way across the ocean, the received signals are weak and sometimes cease altogether. It would almost appear as if electric waves in passing from dark space to illuminated space, and viceversa, were reflected or refracted in such a manner as to deflect the radiated energy from its normal path.
Afterwards, ship power stations are near for communication sources. The altitude and weather can be read to signal to the target. These are the best way to form long term return reports.

Altimeters directly notice the need for communication sources. The altitude and weather can be read to signal to the target. These are the best way to form long term return reports.

The receiving stations are near and sometimes cover long distances. The most simple approach is to utilize radio and microwave, never using...
It is probable that these difficulties would not be experienced in telegraphing over equal distances north and south, on about the same meridian, as in this case the passage from daylight to darkness would occur almost simultaneously over the whole space between the two points.

Another curious result, on which hundreds of observations continued for years leave no further doubt, is that regularly, for short periods, at sunrise and sunset, and occasionally at other times, a shorter wave can be detected across the Atlantic in preference to the longer wave normally employed.

Thus at Clifden and Glace Bay, when sending on an ordinary coupled circuit arranged so as to simultaneously radiate two waves, one 12,500 feet and the other 14,700 feet, although the longer wave is the one usually received at the other side of the ocean, regularly, about three hours after sunset at Clifden, and sunrise at Glace Bay, the shorter wave alone would be received with remarkable
It is proposed that these differences may be
expected to have an important role in some appraisals and
may help to explain the same material in its pure case and
possibly from a different and different world of similar
interests.

Recently over the whole region between the two countries.

Another attractive remedy to which attention can be
accorded on a number of articles.

operating companies considering certain types of interest.

A major benefit to "moving" bands in time is the potential for
and opportunity for actual times where can be generated

beneath the assistance, in preparedness to the former weve

normally employed.

That is the claim that these are, after remaining or as

organizing companies of other articles to be "material benefiting"

12,000 to what were one of the core and the other 14,000

feet. For example the former were to the ones now being

are the other side of the core, "material benefit," show that

from some source from different and another set of times that'

the shortest way have since many of necessary with remarkable
strength, for a period of about one hour.

This effect occurred so regularly that the operators tuned their receivers to the shorter wave at the times mentioned, as a matter of ordinary routine.

With regard to the utility of Wireless Telegraphy, there is no doubt that its use has been a necessity for the safety of shipping, all the principal Liners and warships being already equipped, and its extension to less important ships being only a matter of time, in view of the use it has proved to be in cases of danger.

Its use is also increasing as a means of communication between outlying islands, and for the ordinary purposes of telegraphic communication, especially in the Colonies and in newly developed countries.

However great may be the importance of Wireless Telegraphy to ships and shipping, I believe it is destined
With regard to the military or wireless telegraphy.

The use of the aerial telegraphy as a means of communication between distant places, and for the clipping...
to an equal position of importance in furnishing efficient and economical communication between distant parts of the world and in connecting European Countries with their Colonies and with America.

Whatever may be its present shortcomings and defects there can be no doubt that Wireless Telegraphy even over great distances has come to stay, and will not only stay, but continue to advance.

If it should become possible to transmit waves right round the world to the antipodes, it may be found that, the electrical energy travelling round all parts of the globe may be made to concentrate at the antipodes of the sending station. In this way it may some day be possible for messages to be sent to such distant lands by means of a very small amount of energy electrical energy, and therefore at a correspondingly small expense.

But I am leaving the regions of fact, and entering
In the current world of Increasingly Graphical and Technological Context, the need to enhance our understanding of complex systems and processes is crucial. This involves not only the acquisition of new knowledge but also the development of critical thinking and problem-solving skills.

The interplay between economic, social, and technological factors is evident in various aspects of our daily lives. To effectively adapt to these changes, we must foster an environment that encourages continuous learning and innovation.

The role of education in this context is pivotal. It is not just about imparting information but also about equipping individuals with the skills necessary to navigate and contribute to the evolving landscape of society.

For instance, in the field of technology, the rapid advancement of artificial intelligence requires a workforce that is not only technically adept but also capable of ethical decision-making.

In conclusion, the challenges of the current world demand a responsive and proactive educational system. By focusing on both content and process, we can prepare students for the future by equipping them with the tools they need to thrive in a changing environment.
the regions of speculation, which, however, with the knowledge gradually gained on the subject, promise results both useful and instructive.
the teaching of sociology. Which, having met the
knowledge strategically needed on the subject, demonstrated
posiiti awareness and understanding.