Antennae

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The main purpose of this short communication is to report the introduction of the word *antenna* in the scientific and technical terminology, going back in time from ancient times up to Marconi's first communications.

Before the rise of radio communications the word did exist, as may be verified by looking up in old English dictionaries, dating back to before the invention of wireless telegraphy. One of them reports [1]

> ***Antenna:****...a) ancient use -- "a sail-yard;" from the Greek -- to stretch out or forth. modern use -- L. trans. of Aristotle -- "horns" of insects sensory organ, occurring in pairs on heads of insects and crustacea; popularly called horns or feelers b) figuratively "feelers" -- poetry c) botany...*

Other dictionaries add some interesting notes, such as "*...plu. -- projecting horns of iron or bronze found on some ancient helmets...*" [2], or they do not report the word at all [3].

Actually, the word *antenna* is derived from the classical Latin word *antemna*, which subsequently became, in late Latin, *antenna*, through the assimilation of the *mn* group[1]. This is a term of uncertain etymology, which, according to one hypothesis, originated from the Greek verb *ανατιθημι* = *put on*. According to other hypotheses, it derives from the Greek verb *τεμνω* = *cut* or *τεινω* = *stretch*.

In the Latin language, this term indicated the pole of the triangular (or Latin) sail, as well as that of the quadrangular sail. Most likely, the word belongs to the language of the art of navigation used in the Mediterranean Sea. The Latins, having no nautical tradition, borrowed it from the Greeks, skilled seamen, via the Etruscans[2]. Later, the word *antenna* was used to indicate [4]

> *the long wooden pole (in one or two pieces joined together) transversal to the mast which receives the upper end of the Latin sail; a high and thin pole; a long pole made of wood, metal or other materials that, if placed vertically or transversally, has different uses (as a flagpole or for banners, instruments, weights, etc.); each of the mobile appendices of various form or size existing in the front part of the head of different species of insects with a tactile and olfactory function; etc.*

Actually the word *antenna* was not known in the first years of the history of radio communications. Instead, the terms *aerial* or *elevated wire system* were used. In particular, the word aerial[3] is still sometimes used in the context of the scientific and technical terminology as a synonym for antenna, albeit rarely.

The term *antenna* seems to have been used for the first time, in the present meaning of a receiving/transmitting system, by Guglielmo Marconi (Bologna 1874, Rome 1937), in a lecture held on May 1, 1909, at the *Koninklijk Instituut van Ingeneurs*. This lecture had been requested by the Dutch Royal Institute of Engineers, and was published later on in reference [5]. That paper described the history of wireless telegraphy. In particular, on page

[1]The classical Latin language is traditionally that used by authors such as Cicero and Caesar. The late Latin language came into use from the third century AD on.

[2]The population controlling, in those times, the geographical area that now comprises Tuscany, Umbria, and Northern Latium. The Etruscans had trade contacts with the Greeks of Magna Graecia, and also exerted a great influence on the development of Rome around the sixth century BC.

[3]The term *aerial* is derived from the Latin *aereum*, which comes from *aer* (air), with a meaning of "is in the air" or "occurs in the air."

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...
The arrangement of transmitting antenna which was used at Poldhu is shown in Fig. 10 and consisted in a fan-like arrangement of wires supported by an insulated stay between masts 48 M. hight and 60 M. apart. These wires converged together at the lower end and were connected to the transmitting instruments contained in a huiding.
....

TRANSMITTING ANTENNA AT POLDHU

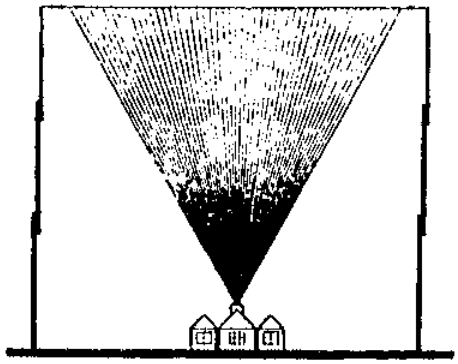


Fig. 10

Figure 1. A reproduction of a portion of what appeared on page 435 of [5].

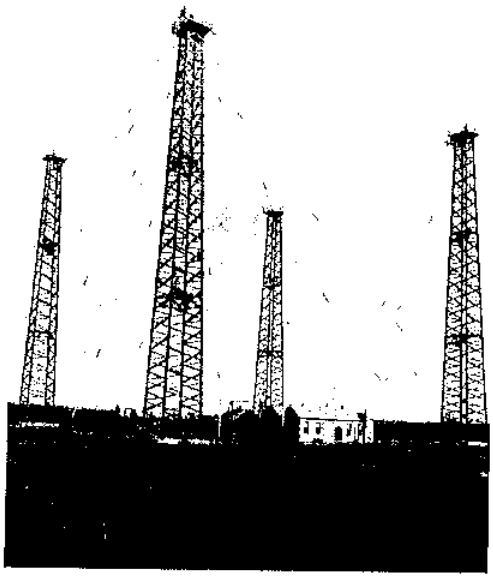


Figure 2. A photo of the Poldhu (England) antenna.

Figure 3. Guglielmo Marconi.

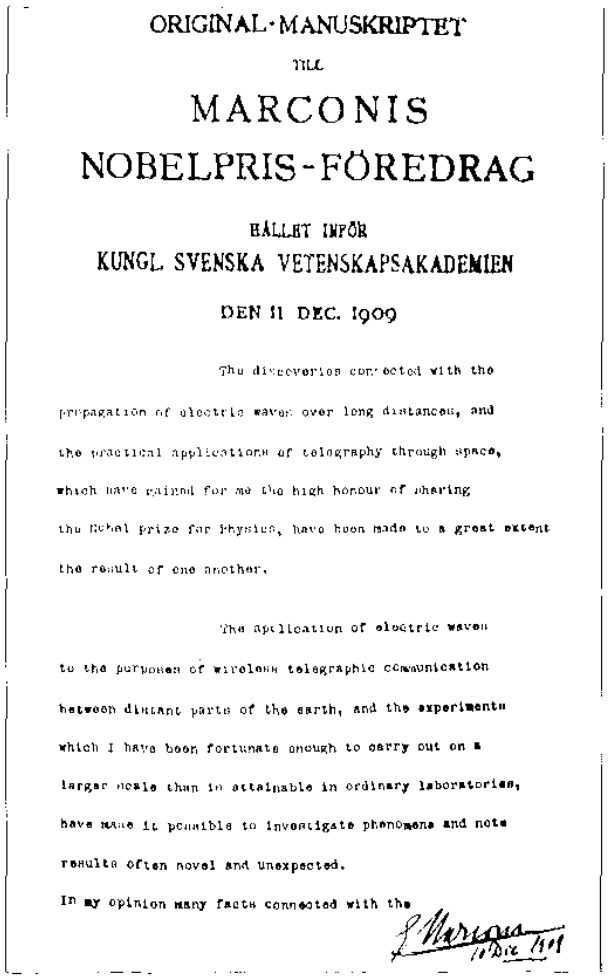
435, Marconi wrote about the Poldhu antenna (see Figure 1 for a reproduction of a portion of what appeared on page 435; see Figure 2 for a photograph of the antenna):

> *The arrangement of transmitting antenna which was used at Poldhu is shown in Fig. 10 and consisted in a fan-like arrangement of wires supported by an insulated stay between masts 48 M. hight and 60 M. apart. These wires converged together at the lower end and were connected to the transmitting instruments contained in a huiding.*

It is important to note that Marconi did use the isolated word *antenna* in reference [5], but associated it with the present participle transmitting. Indeed, as observed before, at that time the term antenna in the Italian language was essentially a synonym for a high and thin pole (in practice, a meaning similar to that of the Latin word); the term had been used with this meaning on several occasions by Marconi [6]. This aspect is confirmed by the fact that, for radiating systems with horizontal structures parallel to the ground, Marconi used the term *aerial*.

Some months later, on December 11, 1909, Marconi gave a lecture at the Royal Academy of Science (Stockholm, Sweden) when he was awarded the Nobel Prize for Physics[4]. In the original manuscript for this lecture [7, 8], which is largely based on that of reference [5], the term antenna is used many times, always in the plural, and written in a different way: *antennas* (an English-like

[4]The prize was awarded jointly to G. Marconi and K. F. Braun (1850-1918) "in recognition of their contributions to the development of wireless telegraphy."



ORIGINAL-MANUSKRIPTET

TILL

MARCONIS

NOBELPRIS-FÖREDRAG

HÅLLET INFÖR

KUNGL. SVENSKA VETENSKAPSAKADEMIEN

DEN 11 DEC. 1909

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

Figure 4. The cover and first page (with Marconi's signature) of Marconi's lecture on the occasion of the awarding of the Nobel Prize.

plural), *antennae* (the correct plural in Latin), and *antennaes* (probably a typographical error). It is clear that in the use of the word *antenna*, Marconi had the Latin term in mind.

In contrast to other scientific terms [9], the introduction of the word *antenna* into the technical literature as a synonym for a transmitting/receiving system went through many changes, since this word was used with other meanings before Marconi's scientific works.

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4. M. Pfister (ed.), *LEI. Lessico Etimologico Italiano* [Italian Etymological Lexicon], 2, Wiesbaden (Germany), Verlag, 1987, pp. 1570-1581.

5. G. Marconi, "The Most Recent Developments of Wireless Telegraphy," *De Ingenieur*, 22, May 1909, pp. 431-439.

6. G. Marconi, "Sulla Telegrafia Senza Fili [On Wireless Telegraphy]," in *Scritti*, Rome, Italy, 1941, pp. 101-131 (conference held on May, 7, 1903, in Rome).

7. G. Marconi, "Manuscript of the Lecture for the Nobel Prize," G. Marconi Foundation, personal communication.

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New FFT and Matrix Approaches

The 1999 Wilkinson Prize for Numerical Software was awarded to Matteo Frigo and Steven Johnson of MIT for development of software they call the FFTW: the "Fastest Fourier Transform in the West." The primary advantage of the FFTW is that it automatically adapts to the computing environment in which it is run, tuning itself to minimize running time by minimizing data transfers. It does this without detailed knowledge of the environment, by automatically generating a variety of different fast Fourier transform implementations and comparing their performance. This has been applied to both linear and parallel environments. The software and further information can be found at the FFTW Web site: http://www.fftw.org.

A similar approach to tuning generalized linear algebra routines, including matrix algorithms, has been developed by Jack Dongarra, Clint Whaley, and Antoine Petitet of the University of Tennessee and Oak Ridge National Laboratory. Named ATLAS (Automatically Tuned Linear Algebra Subroutines), information and the software are available at http://www.netlib.org/atlas/, the ATLAS Web site.

[Information for the above was based in part on B. A. Cipra, "Faster Than a Speeding Algorithm," *SIAM News*, 32, 9, November 1999, pp. 1, 4.]