History of Naval Ships Wireless Systems I

1890's to the 1920's

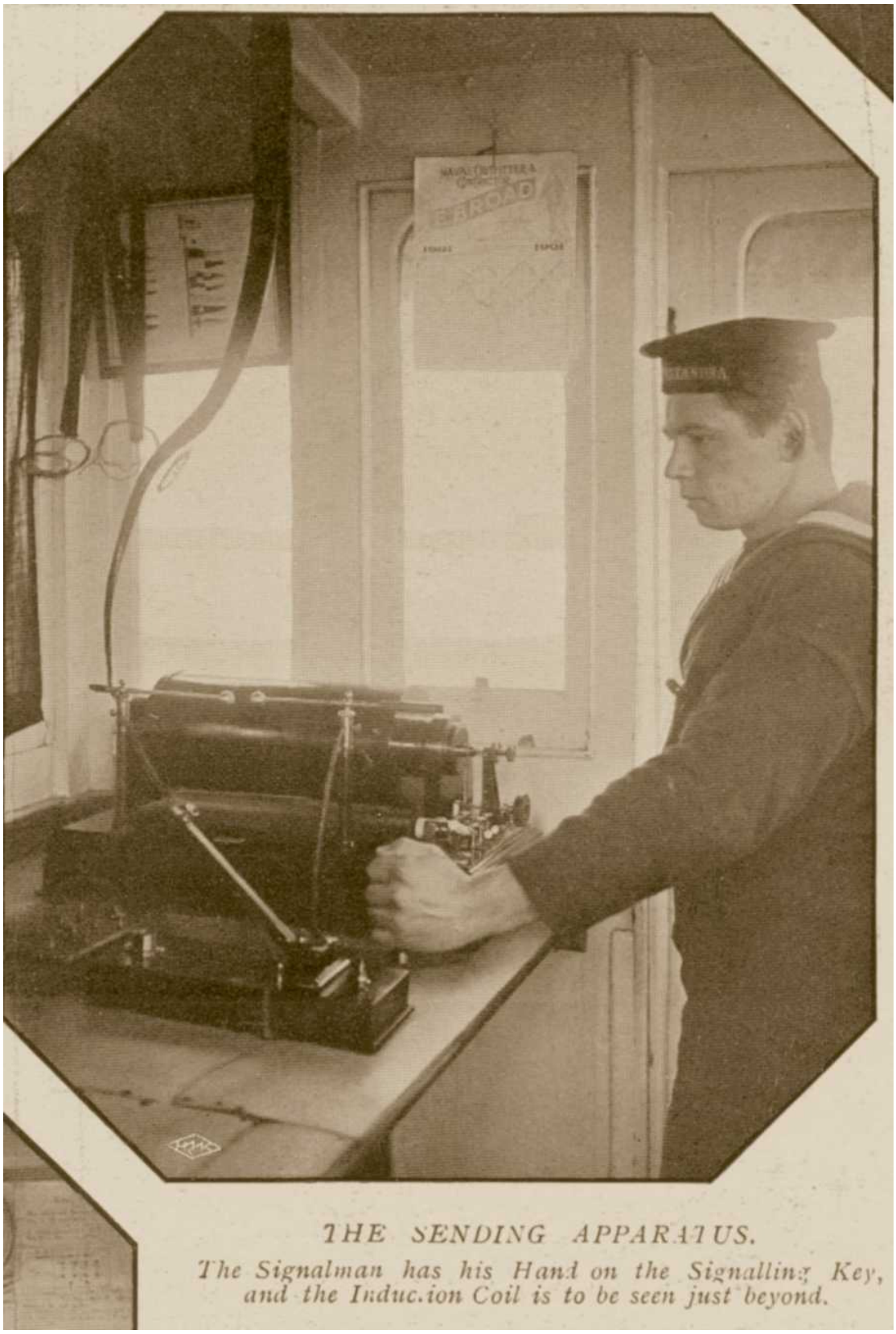
Wireless telegraphy was introduced in to the RN in 1897 by Marconi and Captain HB Jackson, a Torpedo specialist.

There was no way to measure wavelength and tuning was in its infancy. Transmission was achieved by use of a spark gap transmitter and the frequency was dependent upon the size and configuration of the aerial. As a result, there was only one wireless channel as the electromagnetic energy leaving the antenna would cover an extremely wide frequency band.

The receiver consisted of a similar aerial and the use of a "coherer" which detected EM waves. A battery operated circuit then operated a telegraph "inker" which displayed the signal visually on tape. There was no means of tuning the receiver except to make the aerial the same size as that of the transmitter. It could not distinguish between atmospherics and signals and if two stations transmitted at once, the result was a jumble of unintelligible marks on the tape.

There was a notable characteristic about the spark gap transmitter. On reception, each signal sounded just a little bit different than the rest. This signal characteristic was usually determined by electrode gap spacings, electrode shapes, and power levels inherent to each transmitter. With a little practice, one could attach an identity to the transmitting station based on the sound in the headphones. From a security viewpoint, this was not good for any navy, as a ship could eventually be identified by the tone of its transmitted signal. On the other hand, this signal trait was a blessing, otherwise, there would have been no hope of communication as 'spark' produced signals were extremely wide. By 1924, frequency and power limitations were applied to spark gap transmitters and they were totally banned in the United States by 1927. Many amateur radio operators actually gave up their licence, rather than convert to the new method of producing CW by employing a vacuum tube. For commercial and military usage, the arrival of newer technology was a godsend.

The first naval use was to communicate from ship to ship with special emphasis on scouting and reporting on the position of the enemy. During the annual manoeuvres of 1899 and 1900, the value of wireless in this role was clearly demonstrated. As more and more equipment was installed aboard ships, the problem of mutual interference became critical as the sets lacked selectivity. The problem posed by the interception of messages by other than the intended addressee was soon recognized with the attendant requirement to use some form of secret code. These problems still exist today even with the proliferation of radio channels and the adoption of high speed fully automatic encryption systems.



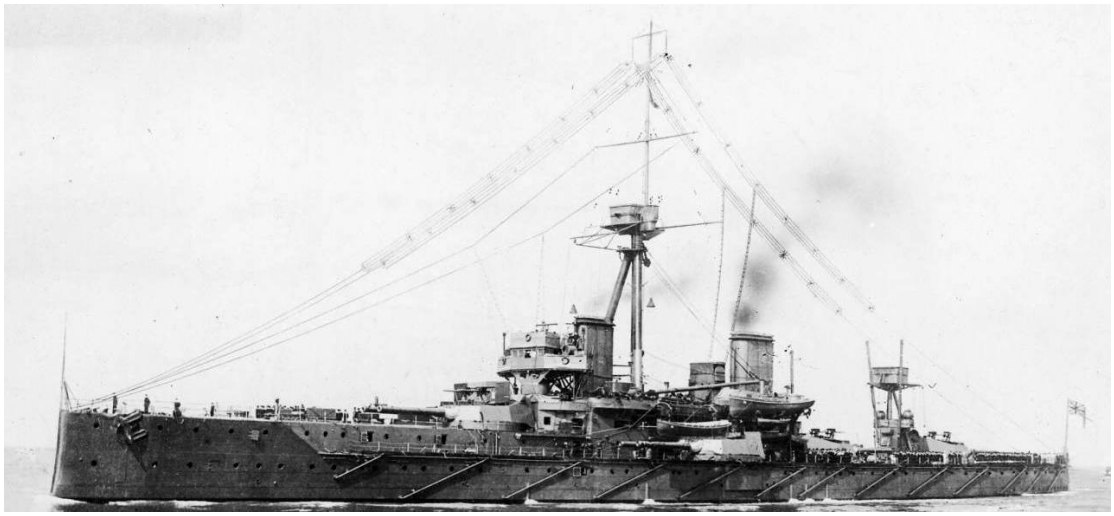
Wireless Office 1901 (note the ham-fisted Signalman!)

The second use was to send and receive messages to a ship when it was within range of a land based station. Messages to and from the ship would be relayed to the telegraph network and then to their ultimate destination. A third use for wireless was to broadcast messages to ships at sea within a 1000 mile range of Poldhu, England.

Marconi had two other developments during this period. The first of these was a transmitter equipped with a separate oscillator coupled by a transformer to the aerial. The resulting output was found to be on two separate wavelengths. TUNE A at 100 metres with a range to 50 to 70 miles and TUNE B on 270 metres with a range of 80 to 150 miles. It was also discovered that Poldhu, which was operating on 366 metres would not interfere on either of these tunes. In this era, the Royal Navy chose the term TUNE to express an operating wavelength.

Secondly, was the development of Marconi's Magnetic Detector or MAGGIE which replaced the coherer in the receiver and allowed the use of headphones. It was much more sensitive than the coherer and allowed CW transmission speeds to be raised from 10 to 20 wpm since the telegraph inker was no longer needed. Originally, Marconi only leased his equipment to ships and supplied his own trained operators. The Royal Navy, however, insisted on outright purchase.

In 1904 and 1905, the Royal Navy adopted transmitters fitted with alternators and accepted the use of MAGGIE and headphones. A wavemeter was developed to measure wavelength. Selectivity of receivers improved. Roof aerials or "flat tops" were introduced as well. All of these improvements permitted signalling speeds of thirty words per minute.



HMS Dreadnought circa 1910 showing her “main roof” aerials. The two down leads terminate in the Wireless Office, which is the structure just forward of the after funnel.

The main problem of the day was interference and congestion of the ether. Most countries could only transmit on one frequency and the A and B Tunes of the Royal Navy were also used by merchant ships equipped with Marconi apparatus.

In 1906, an International Radio Telegraphic Conference was held in Berlin. It established two new wavelengths for public commercial radio service, namely 300 metres (1000 Kc) and 600 metres (500 Kc). Shore stations not used for public service were allowed to use any wavelength below 600 metres or above 1600 metres (187.5 Kc).

The Royal Navy proceeded to establish TUNES as listed:

TUNE	**WAVELENGTH (meters)**	**FREQUENCY (Kc)**	**SERVICE INSTALLATION**
P	300	1000	Mark I
Q	600	500	1.5 kW (Q-U)
R	788	380	Rotary Converter
S	1000	300	Silent Cabinet
T	1273	235	MAGGIE & Headphones
U	1515	198	Mark II - 14 kW power on tunes Q to U and V,W
V	1727	174	Alternator & spark
W	1970	152	Transmitter

It was decided that a specialist operator would be needed for WT in the RN and in 1906, the Wireless Telegraphist branch was formed. Up to that point, Signalling had been carried out by Signalmen and Torpedo Operators.

In 1907, the new Destroyer Wireless radio was introduced into the Royal Navy. The associated receiver had coverage on TUNES D to W. At the same time, the first "INSTRUCTIONS FOR USE OF W/T SIGNALLING" were issued. This was standard in its day which allocated wavelengths for specific purposes such as broadcast, ship-to-shore communications, scouting net and guard.

Marconi's company was to remain dominant in the radio business for a number of years but its future was not bright. The rapid progress of CW telegraphy and the development of the vacuum tube were the main causes of decline. During the next

decade, scientists worked hard to improve the performance of radio equipment. The invention of the triode tube by Lee DeForest encouraged the development of oscillators and amplifiers in transmitter design. These advancements eventually rendered the spark gap transmitter obsolete and for the Marconi Company, this meant the loss of a leading position in the field. At the same time, receiver performance continued to improve with the adoption of the crystal detector, a device called the Poulsen Tikker, and in due course the heterodyne receiver. The main challenges remained in accurate tuning and the limitation of bandwidth. Other areas of improvement lay in antenna design and the location of antennas aboard ship - a problem that continues to challenge naval architects and naval communicators to this day. Radio had very visible impacts on the shape of warships. Before 1914, many ships were given high masts because raising antennas made for greater radio range. It also made ships visible at greater distances and long wire antennas were particularly vulnerable to gunfire. Later, they tended to foul anti-aircraft arcs of fire. During World War II, the US Navy adopted much less efficient 'whip' radio antennas since they posed fewer problems in topside arrangements.