First World War Wireless Stations in England

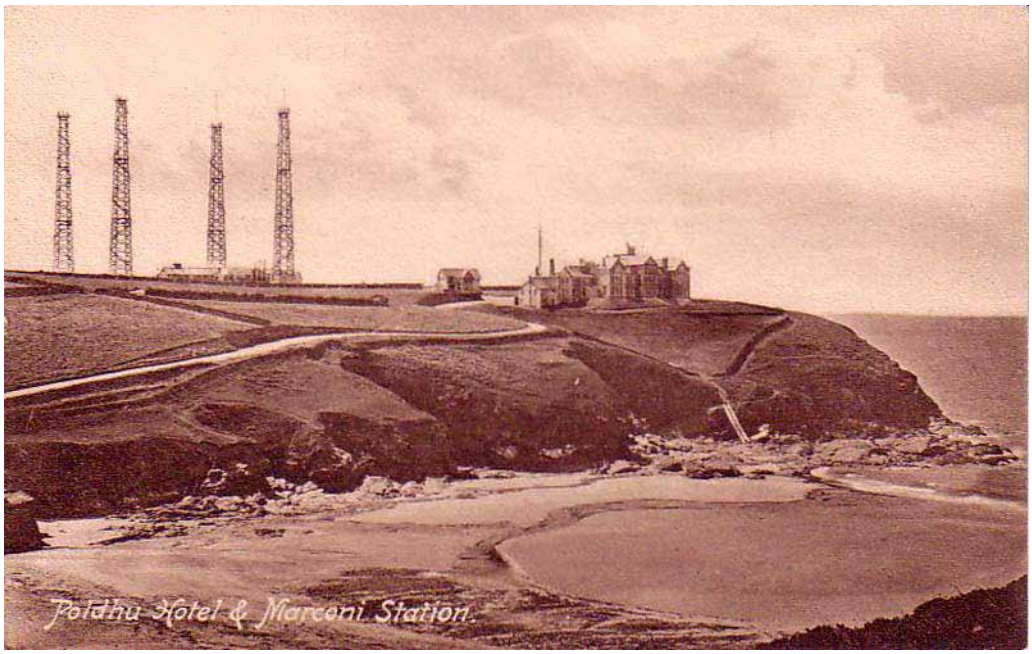

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Plate 4 courtesy of Lizzie Ridout ©
http://sketchbook.lizzieridout.com/2011/05/days-out-vol-i-shed.html

Designed and typeset by Hannah Kennedy, Oxford Archaeology

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Glossary

CBA – Council for British Archaeology

D/F – Direction Finding

EH – English Heritage

HER – Historic Environment Record

TNA – Public Record Office of the National Archives

RNAS – Royal Naval Air Service

RCHME – Royal Commission on the Historic Monuments of England

NGR – National Grid Reference

NHPP – National Heritage Protection Plan

OS – Ordnance Survey

IET – Institution of Engineering and Technology

IWC – Imperial Wireless Chain

RFC – Royal Flying Corps

W/T – wireless

First World War Wireless Stations In England

National Heritage Protection Plan for English Heritage

Summary

This report on First World War Wireless Stations has been commissioned by English Heritage as part of the National Heritage Protection Plan, specifically to provide improved information for the understanding of wireless stations in England during the First World War. Through archive research, 215 sites were identified. The largest category within this were coastal and intercept sites (87 sites), which form the focus of this study. Most of these sites are new to the record, and played an important role in the conflict when wireless technology became one of the 'transformational technologies of the 20th century' (Cocroft 2013). Through wireless direction-finding, stations had the capability to use intelligence gained from the enemy; messages were decoded, positions triangulated and targets predicted. These techniques became sophisticated during the First World War, and played a significant role in Britain's success.

Through assessment of historic maps and aerial photography the report establishes the location and survival of the coastal wireless and intercept sites, and assesses the potential for survival of above and below-ground archaeological evidence. It also places the stations in a broader, national perspective by considering their historic context and development, and discusses the typography and character of the sites. This found that while there was some standardisation in buildings and layout, particularly those stations established by the Marconi Company for military use, the size, layout and architecture of the wireless stations varied according to the role and location of stations. The vast majority of sites are located along the south and east coasts of England, which were ideally situated for intercepting messages and transmissions from Zeppelins over the North Sea, U-boats and surface vessels on the so-called 'German Ocean'. Whilst stations were established during the war on new sites, others were installed within existing structures which were ideally located; pre-war stations also continued in use under military control.

The often remote location of many of the stations means that there is considerable potential for the survival of below-ground archaeological evidence at many sites. There are several locations where evidence such as concrete foundations for buildings, or stays for masts survive, and where a programme of archaeological investigation would enhance understanding. The above-ground survival of stations is less common, some structures were identified, the best examples of which have been the subject of previous research or are protected under heritage mechanisms. Pre-war stations at Cullercoats and The Lizard are Listed Grade II, and the Port War Signal Station is Scheduled as part of Dover Castle. A possible surviving wireless station is also included within the scheduling of the Garrison Point Fort at Sheerness. There are surviving structures, particularly at Stockton-on-Tees, but also at Devizes which have been the subject of previous research (Sockett 1992 and Newland 2012). The study also identified a further group of sites which potentially retain surviving structures but further investigation is required. These are at Malvern, Neston, Bolt Head, Seaham and Cawood.

The study of First World War wireless stations has considerable potential for further research, continued archive research would enhance understanding of the roles of the stations and their inter-

relationships, as well as the changing relationship between commercial companies such as the Marconi Company and the military. This report has focused on coastal and intercept stations only, but identified five other types of stations that are worthy of further research. Local investigation of individual stations at HERs and libraries would provide information about the form and function of buildings, and may confirm analysis of the survival of stations. Whilst satellite imagery on Google Earth is an incredible tool in assessing the survival of sites, it has its limitations. A programme of targeted archaeological investigation of the most historical significant stations would add further information about the form, layout and date of sites. The topic of wireless stations in the First World War has in the past been examined from a technological and engineering perspective, but less consideration has been given to the topic from a historical and archaeological perspective. This report has made an initial step at reconciling these two realms, but there is clearly a considerable body of information available to further understand and interpret the role, character and archaeological potential of wireless stations in the First World War.

1 Introduction

1.1.1 This report on First World War Wireless Stations was commissioned by English Heritage (EH) as part of the National Heritage Protection Plan (NHPP), specifically to provide improved information for the understanding of wireless stations in England during the First World War. The project identifies through archival research those stations operated by the Admiralty, War Office, the General Post Office, and other government departments. Those stations operated by commercial companies, such as Marconi, which later came under government control, are also included in the study. The report considers the historic context of the stations, as well as their topography and character. Through assessment of historic maps and aerial photography the report establishes the survival of above and below-ground archaeological remains of sites, to identify the best surviving examples to inform strategies for their protection by EH. Information about the survival of sites is recorded in the Council for British Archaeology's (CBA) First World War database, to ensure the information gathered in this study is disseminated.

2 Aims and objectives

2.1.1 The brief (English Heritage 2013) broadly sets out the following aims; the methodology for meeting these is described in Section 3.

Aim 1 – To identify the locations of the most significant wireless stations in operation in England up to 1919

Aim 2 – To understand the role of the stations

Aim 3 – To understand the physical character of the First World War wireless stations

Aim 4 – To understand the archaeological potential of these sites

Aim 5 – To trial a First World War recording form.

3 Methodology

3.1 Previous Work

3.1.1 The study of wireless stations is an area which has been afforded little research from an archaeological and historical perspective, with past work predominantly considering the topic from a technological and engineering perspective. The lack of research may be attributed to the technical complexity of the topic, and a confusing wartime history where it is difficult to understand the changing relationships between commercial enterprises such as the Marconi Company, and the military bodies who used the technology.

3.1.2 A recent project 'Innovating in Combat: Telecommunications and Intellectual Property in the First World War', funded by the Arts and Humanities Research Council (AHRC), considered the topic of telecommunications with a series of public events and conferences. This project was led by Elizabeth Bruton and Graeme Goody at the University of Leeds, who have also improved understanding of the link between profit and patriotism in the First World War. Information assimilated from this project is available at the *Innovating in Combat* website.

3.1.3 There have been various papers and books published on 20th-century wireless communications, some of which are listed in the bibliography on this report (Appendix 1). These in general discuss wireless communications in relation to a particular body or organisation such as the Army, Navy, Air Force or Marconi. A more holistic and archaeological approach to understanding the topic was taken in a recent article published

by Wayne Cocroft in 2013 entitled 'The Archaeology of Military Communications'. This paper also identified the need for further understanding of First World War wireless stations. Three previous papers which considered individual sites from an archaeological and historical perspective, were of particular use in this study. These papers, listed below, discuss the form, function and layout of surviving remains at Stockton-on-Tees, Bishops Canning (Devizes) and Hunstanton:

- Sockett, E W, 1992 'Stockton-on-Tees 'Y' Station' *Fortress: The Castles and Fortifications Quarterly*, 8, 51–60
- Lewis, J and Mackie, C, 2008 '"Take Air-Raid Action": the Early Warning System' in Faulkner, K & Durrani, N *In Search of the Zeppelin War: The Archaeology of the First Blitz* (2008)
- Newland, C, 2012 'Mr Hopgood's Shed: an archaeology of Bishop's Canning wireless station' in Saunders, N, *Beyond the Dead Horizon: Studies in Conflict Archaeology,* 116–129

3.1.4 There has been some references to wireless stations within archaeological reports of particular areas, such as the Tyne and Wear and Chelmsford (Whaley *et al.* 2008 and Cocroft and Menuge 2000), but these have not been in-depth studies. Information available on the internet has been useful in determining the survival of sites, where odd references on military forums or local studies have provided clues to the location and survival of sites. The English Heritage website *PastScape*, a national historic environment database, also provided useful information on individual sites.

3.2 Stage 1: Communication with relevant individuals/ Organisations

3.2.1 The first stage of the project was to ascertain the level of research on the topic, and whether previous research had been undertaken in assimilating the number of First World War wireless stations in England. As discussed above, research has been undertaken by Burton and Goody at the University of Leeds. In particular Elizabeth Burton has published several papers concerning wireless communications up to and including the First World War. Dr Philip Judkins, of the University of Buckingham Centre for Security and Intelligence Studies, was particularly helpful in providing information and references relating to the number of wireless stations. A complete list of First World War wireless stations was not identified at this initial stage of the project, and therefore archive research to identify stations of the period was undertaken.

3.3 Stage 2: Collection of Data

Archive Research

3.3.1 The Marconi Archive held at the Bodleian Library in Oxford, which includes papers on the Admiralty and other stations, formed and initial focus of study. The information was useful in understanding the layout and topography of sites, and included several historic plans and photographs of sites. Records at The National Archives (TNA) provided lists of sites in use during the First World War, as well as further information about the layout of sites. The Institution of Engineering and Technology (IET) archives held information giving historic context to the topic, but held little information identifying or describing sites. The lack of previous research on First World War Wireless stations meant that historic documents were of considerable use in this study, and references are included throughout this report.

Secondary sources

3.3.2 Relevant books and journals were assessed firstly to identify any references to individual stations, and these were cross-referenced with the archive based list. The English Heritage website *PastScape* was used to identify any sites recorded on the historic record both protected for example by listing, or as important local assets. Information was also assimilated to understand the roles of the stations and their physical character, and also to provide historic context to the stations to elucidate their development up to and including the First World War. Relevant sources are listed below in the Bibliography (Appendix 2).

3.4 Stage 3: Assimilating Data

3.4.1 Data were gathered and catalogued to produce a list of wireless stations in England which were in use during the First World War. As the list was assimilated from a number of different sources repetition of sites sometimes occurred. For example, the place names of Devizes and Bishops Canning were both detailed, but are the same locations. Further analysis was therefore aimed at eliminating such repetition, and also categorising stations into types to enhance understanding. The types and numbers of sites in each category are detailed below:

- Coastal Wireless (W/T) and/or Intercept – 87 sites
- Royal Flying Corps (RFC) Home Defence – 22 sites
- Royal Naval Air Service (RNAS) Aerodromes – 41 sites
- RFC Aerodromes – 52 sites
- Lightships – 7 sites
- Experimental/Portable – 6 sites

3.4.2 The final total number of wireless stations identified is 215. This number was more than anticipated and because it was not possible to assertain the survival of such a large number of sites within the confines of this project, it was decided following consultation with EH to focus on the coastal and W/T and/or intercept sites. The rationale beyond this approach was that many of the Historic Environment Records (HERs) have records for most RFC airfields and RNAS stations, so the general locations, if not the specific building, are known. Most of the free-standing coastal wireless stations operated by the Admiralty and other agencies are largely new to the record, and therefore more worthy of further study.

3.5 Stage 4: Identifying the location, survival and archaeological potential of sites

3.5.1 The coastal and/or intercept stations, which form the focus of the study, were further analysed to determine their location, survival and archaeological potential of each site. The results of this work are recorded in Table 1 of this report and their national distribution illustrated in Figure 1; Tables 2–6 which tabulate the remaining types of sites (described above), are included in Appendix 2 of this report.

3.5.2 Historic mapping was used to help identify the exact location of the W/T coastal and/or intercept sites. This was necessary as many of the locations of sites identified were quite broad, and with a few exceptions archive sources did not provide detailed locations. A typical location reference was 'Cirencester'. In some examples this was complicated by several places with the same or similar names existing, such as 'Berwick'. Historic grid references, where identified in archive references, were converted via web resources into modern national grid references (NGR). The absence of the exact locations of sites in most historic records is noteworthy; one National Archives file included numerous letters relating to individual sites which referenced attached plans that had subsequently been removed.

3.5.3 Ordnance Survey (OS) mapping predominantly from the 1920s, but also some later mapping, was used to determine the exact location of sites. Various scales of mapping were used, predominantly 1:2,500, but also 1:10,560 and 1:1250. The broad location references meant that it was often necessary to search for sites within a town or area, therefore historic maps were accessed digitally to facilitate this. Once a site was located on historic mapping, modern mapping was used to produce an NGR. It was often the case that a site could not be found on historic mapping. This was probably because of the sensitive function of wireless sites, or because they were too short-lived to be mapped. Some wireless stations utilised existing structures, with only a mast indicating the secondary function of a structure, the footprint of which may have been unmapped. If a site was not identified, a probable NGR of a site was given. For example in Cirencester the NGR of a wartime barracks is given, as this was considered to be the most probable location of the site.

3.5.4 To determine the archaeological potential of sites, aerial images on the websites 'Google Earth' and 'Grid Reference Finder' were used to ascertain if any surviving evidence could be identified. Whilst standing structures are visible on these resources, less substantial remains such as concrete mast pads are often less readily identifiable.

3.5.5 Internet resources were also used to establish the survival and archaeological potential of sites. For each site identified a 'Google' search was completed under the search terms of the wireless location and 'First World War Wireless'. This was a successful process in finding information relating to sites and their history. Some sites were included on the *PastScape* website, information was utilised relating to their survival and archaeological potential. Historic aerial photography from the website '*Britain from Above*', was used to find images of wireless stations. Searches were undertaken using the search criteria of the place name and 'wireless station'. A small number of sites were identified. This information was useful in confirming locations but also in providing information about the layout and form of sites and buildings.

3.6 Stage 5: Understanding wireless equipment

3.6.1 Information relating to the type of wireless equipment in use during the First World War was gathered from archive resources, secondary sources and the internet. Bruton provided a list of museums thought to hold First World War wireless equipment, these museums were contacted (predominantly via email), to ascertain the extent of their collections.

3.7 Stage 6: Trial of 'First World War Report Form'

3.7.1 As part of the centenary celebration of the First World War the Council for British Archaeology (CBA) have launched a 'Home Front Legacy 1914–1918' project, which includes an online toolkit to enter information of surviving First World War sites (*Home Front Legacy* website). Those sites identified as having surviving archaeological evidence are recorded on this resource to ensure that the results of this project are disseminated.

4 Report Format

4.1.1 The format of this report is as follows:

- Section 6 – A List of Coastal Wireless and/or Intercept Stations
- Section 7 – Historic Context
- Section 8 – Topographic Locations
- Section 9 – The Role of Wireless Stations
- Section 10 – The Character of Wireless Stations
- Section 11 – The Archaeological Potential of Wireless Stations

- Section 12 – Wireless Equipment
- Section 13 – Potential for Further Research
- Section 14 – Appendix 1: Bibiliography and other sources consulted
- Section 15 – Appendix 2: Further Types of Wireless Stations
- Section 16 – Appendix 3: Contemporary List of Wireless Equipment
- Section 17 – Appendix 4: Wireless Equipment Held Within English Museums

4.1.2 Table 1 (Section 6) lists identified coastal and/or Intercept Stations, and details the survival, archaeological potential and typography/layout of each site. Tables 2–6 are included in Appendix 2, which lists but does not describe the other types of sites identified through archive research (as described above in Section 3.5.1). Tables 7–11 list within Appendix 4 wireless equipment held within museums in England.

5 Acknowledgements

5.1.1 The author would like to thank Elizabeth Bruton of Leeds University and author of 'Beyond Marconi: the role of the Admiralty, the Post Office and the Institute of Electrical Engineers in the invention and development of wireless communications up to 1908' (2012). Elizabeth was very helpful in providing information and commenting on aspects of the report, in addition to providing a list of the wireless collection held at the Science Museum in Oxford. Phil Judkins of the University of Buckingham Centre for Security and Intelligence Studies, was also very helpful in providing information and archive references for First World War wireless stations.

5.1.2 At English Heritage, Wayne Cocroft, Dan Miles, Helen Winton, Peter Kendall and Victor Smith were helpful in providing information about the broader subject of wireless stations and information about specific sites. At Oxford Archaeology South, Kirsty Smith provided valuable input into this project, particularly in helping to assimilate the list of wireless stations and providing understanding of other types of stations (sections 9.2–9.6).

5.1.3 Several museums kindly provided information relating to their collection of First World War wireless equipment. These include: James Taylor at the Imperial War Museum, Elizabeth Bruton at the Museum of the History of Science (University of Oxford), Rory Cook at the Science Museum, David Barlow at the Lizard Wireless Museum, Bill Legg at the HMS Collingwood/Royal Navy Museum of Radar and Communications, Trevor Cass at the Museum of Technology, Andrew Renick and the Royal Air Force Museum (London), Nick Kendall-Carpenter of the Royal Signals Museum (Blandford Camp) and Danielle Sellers of the Royal Engineers Museum.

6 First World War Coastal and W/T Stations

6.1.1 Table 1 lists and provides information about the Coastal and/or W/T sites in the format detailed below. The national distribution of these sites is illustrated in Figure 1. The methodology for assimilating this information is discussed in Section 3.2.

- OA number – these numbers are referred to throughout the report, when discussing individual stations
- Station Name – this name is as given in the archive sources
- 'Type' – including Admiralty, General Post Office (GPO), Garrison/Army, Railway Company, Marconi/Lloyds
- NGR – in examples where the NGR is taken from historic documents and converted to a modern NGR this is indicated by a *, where the site is not identified a probable NGR is given in brackets, for example: 'Not found (NU186135)'
- Survival – this details above-ground archaeological evidence.
- Archaeological Potential – this is determined for both above and below-ground archaeology. A discussion of the archaeological potential of sites is given in Section 11
- Archive Ref.
- Typology and Layout – this information is taken from archive and secondary sources including historic documents, mapping, historic photography and published papers
- Historic Context – information relating to the historic development of an individual site identified primarily through secondary sources
- References – these are secondary source references and *PastScape* numbers

6.1.2 Tables 2–6 are included in Appendix 2, which list but do not describe the other types of sites identified through archive research. These are:

- Royal Flying Corps (R.F.C) Home Defence
- Naval Air Service (N.A.S) Aerodromes
- R.F.C Aerodromes
- Lightships
- Experimental/Portable

6.1.3 In general, the following sections of this report focus on the Coastal and/or W/T sites. However, some discussion of these types of sites is included in Section 9.

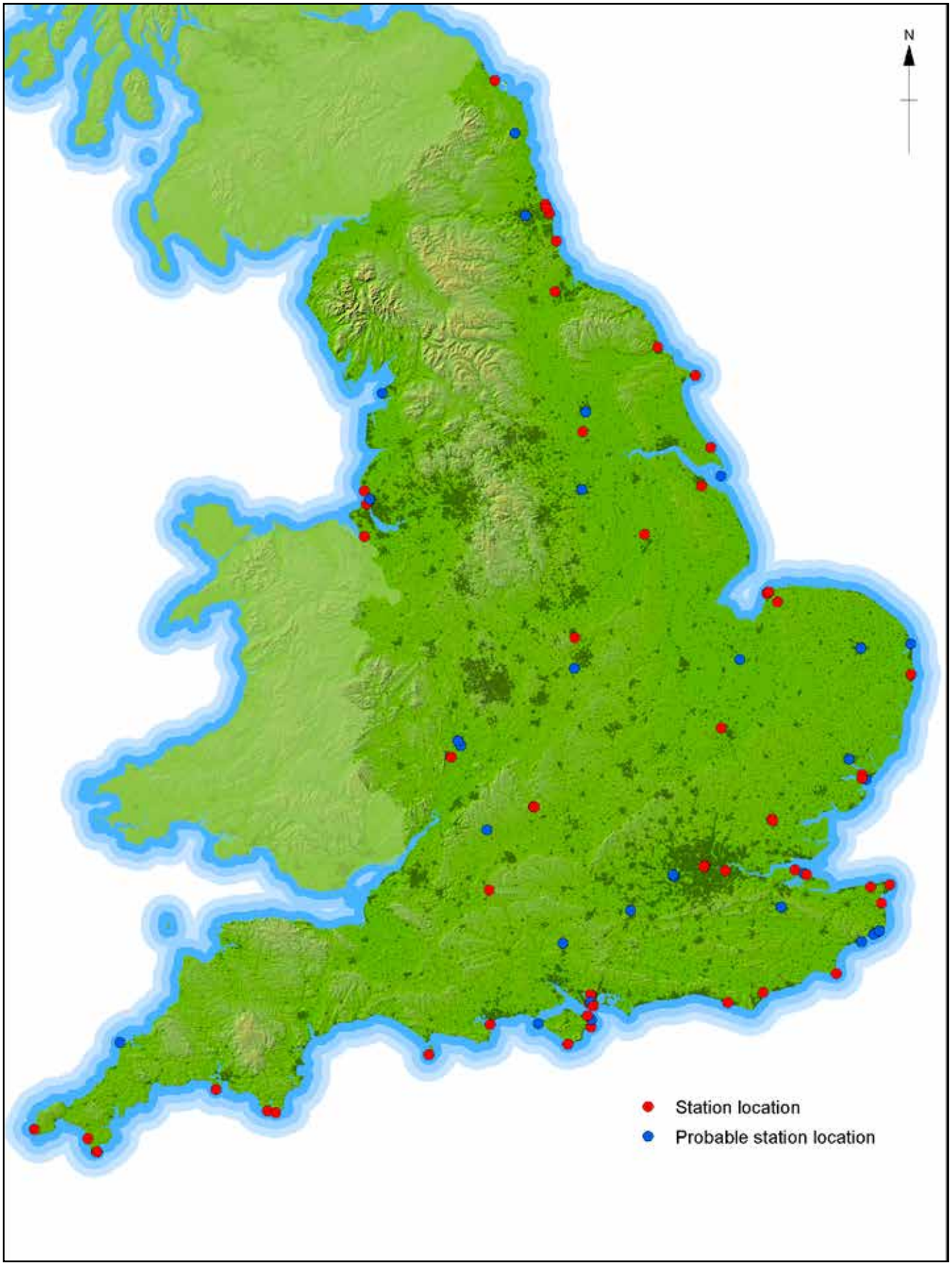

Figure 1: National Distribution of First World War Wireless Stations (Contains Ordnance Survey data © Crown copyright and database right 2014)

Table 1: Coastal W/T and Intercept Sites

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
1	ALNWICK (NORTHUMBERLAND)	Admiralty	Not found. (NU 186 135)		
2	BEAUMANOR HALL (LEICESTERSHIRE)	Admiralty	SK 538 157	PastScape states there are 'remains' of the station at the Hall.	It is not possible to identify specific features within the numerous buildings relating to the Hall. There is potential for above and below-ground archaeology to survive.
3	BERWICK (NORTHUMBERLAND)	Admiralty	NU 065 448	The road running to the wireless station survives, but there is no apparent evidence for surviving buildings or footprints.	This is a remote undeveloped coastal site, where evidence such as concrete foundations for masts have greater potential to survive. There is also potential for below-ground archaeology.
4	BIRCHINGTON / ST NICHOLAS AT WADE (KENT)	Admiralty	*TR 28645 68184	No evidence visible.	The site is in an open field, where evidence such as concrete foundations for masts have greater potential to survive. There is also potential for below-ground archaeology.
5	BOLT HEAD (DEVON)	GPO	SX 724 361	No evidence visible.	This is a remote undeveloped coastal site, where evidence such as concrete foundations for masts have greater potential to survive. There is also potential for below-ground archaeology.
6	BROOMFIELD (CHELMSFORD)	Admiralty	TL 7017 0844	The site was demolished in the 1960s, to make way for a housing estate.	None
7	CAISTER ON SEA (NORFOLK)	GPO	TG 52349 11908 (High Street centred on)	It is uncertain whether Pretoria Villa survives within the High Street. The Villa was later converted to a Police Station, and it is unlikely that evidence of the former wireless station survives.	The building may survive but fixtures and fittings relating to its use as a wireless station are unlikely to survive.
8	CAMBRIDGE (CAMBRIDGESHIRE)		*TL 405 622	No evidence visible.	Catch Farm on Huntington Road appears to survive as a working farm, located very close to the M11. It is possible that some evidence survives such as concrete pads for masts but it was not possible to distinguish these on aerial photography.
9	CAWOOD (YORKSHIRE)	Admiralty	*SE 58423 37171	There appears to be fairly large areas of hard standing and some minor buildings immediately to the south-west of the NGR. It is possible however that features relate to the use of the nearby house/ farmhouse.	The landscape is open and largely undeveloped, there is potential for the survival of below-ground archaeology, in addition to possible above-ground remains.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
ADM137/4680 (D/F Station, book U.K. S.441)	Not identified on OS mapping.		
	Not identified on OS mapping.	PastScape states there is a box of photos and a site plan (presumably in local library). Parts of the Second World War station are listed.	Pastscape No. - 1412077
ADM137/4680 (D/F Station, book U.K. S.44)	This is a remote coastal site close to a Coastguard Station, the nearest habitation is at the small hamlet of Goswick. Historic OS mapping shows an Admiralty Wireless Station, with a mast and possibly two small structures within a rectangular plot of land.		
Bod MS 335 & ADM137/4699		A 'Captain Round Station'	
ADM 137/4699		The Post Office opened its first ship-to-shore wireless radio coast station at Bolt Head.	
ADM137/4680 (Admiralty book C.B.1284 A) & ADM186/737	A Marconi station is identified on historic mapping, next to the disused Broomfield Pottery. The site is enclosed in a rectangular plot with mast identified and buildings. An image of the site (undated) from the Bodleian Marconi archives shows the mast and several pitched roof structures to the rear. It was located to the north of Chelmsford, and at the time of use would have commanded good views in all directions.	In 1903 Marconi built a wireless receiver station on the site of Broomfield Pottery, by 1911 it was a research station and part of the Marconi training school. It continued in use until the early 1960s, but was cleared shortly afterwards to make way for a housing estate.	Cocroft W. and Menuge A. (1992)
ADM137/4680 (Admiralty book C.B.1284)	A postcard of the High Street (undated), shows a two large masts to the rear of the building along the High Street.	The original Marconi Wireless Station in Caister was established in the village High Street in 1900 and set up to communicate with ships in the North Sea and the Cross Sand lightship. It closed in 1929 and became the village police station.	
ADM 137/4699	Not identified on historic OS mapping.		Location of site at Catch Farm identified through archived letters.
ADM 137/4699			Location of site identified through archived letters, description reads 'in a field to the east of Wistowgate Lane, south of York'. Described as 'Carwood' in historic references

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
10	CHELMSFORD, NEW STREET (ESSEX)	Marconi/Lloyds site	TL 708 073	The Marconi works survives, planning permission was converted in 2013 for conversion to homes and office buildings.	The building survives, it is unknown whether fixtures and fittings relating to its use survive, although the building's continued use means that this is unlikely.
11	CIRENCESTER GLOUCESTERSHIRE		Not found. (Barracks -SP 019 021)		
13	CLEETHORPES (LINCOLNSHIRE)	Admiralty	TA 28646 05122	Peaks Lane is now largely developed with inter- and post-war housing to each side.	It is unlikely that evidence of the station remains.
14	CROSBY BATTERY (LIVERPOOL)	Admiralty		Not identified.	This is a fairly remote, undeveloped coastal location and therefore evidence may survive.
15	CULLERCOATS (NORTH TYNESIDE)	Admiralty	NZ 3653 7161	Site mapped as part of the North East Rapid Coastal Zone Assessment Survey, and appears to be extant on the 1988 OS vertical photography. Google Earth images show a surviving wireless hut, and possible concrete platforms. The wireless hut is believed to have been converted to residential accommodation.	
16	CULVER CLIFF (ISLE OF WIGHT)	Admiralty	SZ 63447 85613	There are no structures extant, but some evidence remains. A car park now occupies where the main building was situated, the boundaries marked by RN boundary markers. The concrete pads for the masts can be seen, along with two small buildings that may have been part of the site.	This is a remote undeveloped coastal site, with some above-ground elements of the site surviving. There is also potential for below-ground archaeology. Further investigation is required.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
Bod MS 335 + ADM186/737 (C.B.1284 A)		Marconi station that was intercepting for the Admiralty Intelligence Division. The New Street works was the Marconi Headquarters in England. The original offices and factory continued in use and were much extended over the years	
ADM137/4680 (Military W/T station, book S.561)			
ADM137/4680 + ADM186/737 + (Admiralty book C.B.1284) + ADM137/4680	The location is south of Grimsby, set in from the coastline of the River Humber.		Grimsby Station is also listed in archive research, I have assumed these are the same as research suggests these are both on Peaks Lane.
A1/305/15/226/164 + ADM 137/4680 (Revised list of War Dept. and R.F.C W/T Stations 8/3/18 and book S561)	Historic OS map shows a signal station within the dunes, the site includes several buildings although the mast is not identified. It is located in a remote coastal location within the dunes, close to Sniggery Farm.	Battery constructed between 1905 and 1914, built as part of the fixed defences along the Mersey. The battery is the location of other defensive structures many of which date from the Second World War. Aerial photography from 1983 shows that the battery has been removed and the site is dunes and an estuary (*PastScape* website).	PastScape No. - 1425941
ADM137/4680 (Admiralty book C.B.1284, elements are listed)	Well populated coastal location at Browns Point. OS mapping shows a 'Wireless Station' and post within a square enclosure. It is situated in a coastal location, to the north-east of Newcastle upon Tyne. The site dates from 1906-07 consisting of a 1906 brick built structure, and a 1930 wireless station immediately to west.		
ADM137/4680 (Admiralty book C.B.1284, elements are listed)			

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
17	DEVIZES (WILTSHIRE)	Admiralty	*SU 03194 66511	Elements of the site survive such as concrete platform, some of which are thought to have been generator and transmitting room floors. It is possible that some of the surviving structures post-date the First World War. A structure (now used as a shed) also survives locally within land belong to Mr Hopgood. It is constructed from corrugated iron and is thought to have been used as for accommodation.	The site has archaeological potential for below-ground archaeological evidence, and for further investigation of the above-ground remains building on the article published by C. Newland (2012).
18	DONCASTER (SOUTH YORKSHIRE)		Not identified (Scarborough Barracks - SE 580 029)		
19	DOVER CASTLE (KENT)	Admiralty	TR 32765 41635 (Port War Signal Station).	The wireless room survives within the Port War Signal Station. Wireless equipment is also *in situ* dating from the First World War, and open to the public as part of the Dover Castle visitor experience.	The Port War Signal Station is a rare surviving example of a wireless station within a heavily fortified defence landscape. It is Scheduled as part of Dover Castle.
20	DOVER - CITADEL (KENT)	Garrison/ Army	Not identified (possibly associated with the Garrison in SW corner and Coastguard Station - TR 30437 40336)		
21	DOVER - LANGDON (KENT)	Garrison/ Army	Not identified (Current Coastguard Station and First World War battery - TR 33915 42384)		
22	FARNBOROUGH (HAMPSHIRE)		Not found (RFC base - SU 868 543)		
23	FELIXSTOWE HARBOUR, SUFFOLK	Admiralty	TM 2360 3455	Shotley Cottage survives, but there is no visible evidence visible relating to the wireless station	The cottage is surrounded by open fields, it is therefore possible that some limited above-ground evidence survives. There is also potential for below-ground archaeology.
24	FELIXSTOWE (possibly the same as above?)	Garrison/ Army	Not identified (TM 260 317)		
25	FELTHAM, MIDDLESEX		Not identified (Camp on Hounslow Heath - TQ 124 746)		

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
WO 78/4326 (T.11954)	Located within a rural area to the north-east of Devizes. OS mapping map identifies the site as 'Wireless Station G.P.O', it is a reasonably sized with six masts in a diagonal line orientated north-west to south-east. A 1936 photograph held within the EH archive, although only four of the six masts are seen, and an additional north-west mast is shown. It is therefore possible that these features post-date the First World War in part.	The Marconi wireless station was part of the Imperial Wireless scheme, later becoming part of the War Office's 'Wireless Signal Company'. It was a receiving station, used after the war as 'ship to shore station' when further buildings were likely to have been added. During the 18 years of its operation, it was passed from the Marconi company to the GPO, the War Office and Signals Corps, and back to the GPO. Built as a flagship of the Imperial Wireless Scheme, it was probably employed as a listening station, a direction finding station, a long range ship-to-shore station, and as a test bed for wireless technologies.	Newland, C (2012)/ PastScape No. - 1159409/ The station has been mapped as part of EH's National Mapping Programme, and is recorded on a 1936 Crawford Coll. aerial photograph held within the EH archives (EH pers. comm.)
ADM137/4680 (Military W/T station, book S.561)			
ADM137/4680 and ADM186.653 (Admiralty book C.B.1284 and military book S.561)		The Port War Signal Station dates from 1914, constructed above a 1905 fire command post. The Royal Navy could control the movements of all shipping in and out of the harbour using flags and wireless, keeping close liaison with the gunnery control in the room below.	Dover Castle Scheduled Monument No. 467778/ Pattison, Paul (2010)
ADM137/4680 (Dover Garrison, Military W/T station, book S.561)			
ADM137/4680 (Dover Garrison, Military W/T station, book S.561)		An Admiralty Order from 1917 confirms use of wireless equipped aircraft in a spotting capacity for coastal gun batteries. This identifies 'Langdon' as one of the ground receiving station (*Kent History Forum* website)	*Kent History Forum* website
ADM137/4680 (Dover Garrison, Military W/T station, book S.561)			
ADM137/4680 (Admiralty book C.B.1284)	The station was located at Shotley Cottage which is surrounded by fields, immediately to the south of Shotley village. It is opposite Harwich Port and to the west of Felixstowe.		PastScape No. - 1412199
ADM137/4680 (Harwich Garrison, Military W/T station, book S.561)			
ADM137/4680 (Military W/T station, book S.561)			

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
26	FLAMBOROUGH (EAST RIDING OF YORKSHIRE)	Admiralty	TA 25136 70357	No evidence visible.	The open, undeveloped landscape means that there is the possibility for below-ground archaeology.
27	FOLKESTONE HARBOUR (KENT)		Not identified, but likely to be at the harbour. (Folkestone Harbour - TR 23242 35907)		
28	FORT BLOCKHOUSE, GOSPORT (HAMPSHIRE)	Admiralty	SZ 62601 99323	Fort Blockhouse survives and remains in military use as 'Support Unit Fort Blockhouse', access is restricted. It is possible that the wireless room survives within the Fort.	There is potential that the wireless room survives, but it continued reduces the possibility of surviving fixtures and fittings relating to its First World War use.
29	FRENCHMAN'S POINT (TYNESIDE)	Garrison/ Army	NZ 387 662	Aerial photography from 1994 shows that all the military buildings have been removed from the site and the only surviving evidence are two east-facing gun emplacements covered in earth mounds. The right hand emplacement is now destroyed. There is no evidence of a wireless station.	The open, undeveloped landscape means that there is the possibility for below-ground archaeology, and limited above-ground evidence.
30	HEYSHAM HARBOUR (LANCASHIRE)	Railway Company	SD 40281 60024 (NGR of Port)	No evidence is visible, but the site is an active port and it is not possible to distinguish dates and functions of individual buildings.	This is a developed port and it is unlikely that evidence relating to the wireless station now survives.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
Bod MS 335 and ADM137/4680 (Lieut. Round Station, D/F Station, book U.K. S.441+I21)	Site located near Flamborough light house, on a coastal point to the east of Flamborough. 'Britain from Above' shows two small structures/ huts and several masts. The site appears insubstantial and temporary. The east hut appears to have a pitched roof with four masts to the rear, the west hut appears to be smaller but with a larger mast to its west.	A 'Captain Round Station'	
ADM137/4680 (Admiralty book C.B.1284)			
ADM137/4680 (Admiralty book C.B.1284 A) + ADM186/737 + AIR1.654.17.122.507+ WORK 41/487	Plan of 'proposed wireless station' found in National Archives dated 30.12.1914 (WORK 41/487). The wireless station was within Fort Blockhouse, which is surrounded by three sides by water and provides the best view of the entrance into Portsmouth Harbour. The station was above a Gatehouse in the Fort with 'REFORMED MDCCCXIII' on plaque above the gate.		*Wikipedia* website
ADM137/4680 (Tyne Garrison, Military W/T station, book S.561)	The site is on a coastal position and part of 'Frenchman's Point Battery'. It is located directly to the east of South Shields and to the rear of a Coastguard Station.	Frenchman's Point Coastal Battery opened in 1905 and was used during both the First and Second World Wars. Construction was completed in 1905, but was downgraded to a practice battery shortly afterwards. In 1913 it was restored to full use and was operational throughout the First World War until its closure in 1922. It was subsequently redeveloped as a holiday camp. During the Second World War the battery was reactivated. There are no accounts of a wireless station detailed within those sources accessed.	
ADM137/4680 (Admiralty book C.B.1284) and ADM186.653	This is a coastal position, to the west of Lancaster.		

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
31	HORSEA ISLAND (PORTSMOUTH)	Admiralty	SU 63650 04419 and SU 63261 04681	No evidenced of standing buildings relating to the wireless station were identified. Earthworks are visible in the field to the north of the former wireless station. A modern building lies on the site of the east location of the wireless station, and there is vehicular parking to the west.	This was a substantial wireless site, and there is potential that elements (concrete mast bases) may remain. Earthworks show that there is a high potential for below-ground archaeology. The site continued as a wireless station until the 1960s, analysis would be required to distinguish First World War footprints from later evidence.
32	HOUNSLOW (MIDDLESEX)		Not identified (Barracks - TQ 119 756 or Camp - TQ 125 746)		
33	HUNSTANTON (NORFOLK)	Admiralty	Four sites within Hunstanton - Site A - TF 67670 42109, Sites B - TF 67337 41634, Site C - TF 68102 42493 and Site D - TF 68545 42418.	Sites A, C & D - no evidence identified. Site A is the subject of a paper (Lewis, J & Mackie,C (2008)), which identified no surviving evidence of the station. Site C - there is a small building at the edge of the car park at the location of the NGR, but it is most likely that this is a recent public W.C. or similar.	There is potential for below-ground archaeology at sites A and B. Site C requires further investigation. Site D is on the edge of an area with post-war residential development, therefore reducing the possibility of archaeology. A hut, locally called 'Hippisley Hut' survives at NGR 6852842393. It is possible that this was removed from one of the four identified locations to its current location at Old Hunstanton.
34	IPSWICH (SUFFOLK)	Admiralty	Not identified (TM 158 437)		
35	ISLE OF GRAIN (KENT)	Garrison/ Army	Probable location (TQ 891 763).	The row of Coastguard cottages survive, including the small structure attached to the east cottage belonging to the Chief Officer. There is a possibility that this relates to the wireless station, but equally it may related to the Flagstaff or as an addition to the cottage. The plot of land at the east end of the cottages where the Flagstaff was situated is now occupied by a house.	The site requires further investigation. The cottages have remained in use thereby decreasing the possibility of surviving archaeology relating to its use as a wireless station. There is some potential for below-ground archaeology within the garden plots.
36	LAND'S END (CORNWALL)	Admiralty		There is evidence of concrete platforms in the area.	This is a remote coastal location, increasingly the likelihood of below archaeological remains, and limited above-ground evidence.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
ADM137/4680 (Admiralty book C.B.1284 and C.B.1284 A) + ADM186/737	Horsea Island is now reclaimed land, sitting in a coastal position adjacent to Portchester, on the north shore of Portsmouth Harbour. OS mapping from 1932 identifies a 'Wireless Station' to the east consisting of two large structures at the east end surrounded by several smaller buildings, a mast is identified to the rear. At the east end is a large rectangular building with a mast at each end.	The island was used as a wireless station from 1906 until the 1960s. The new station at Horsea consisted of 4 wooden aerial masts of overall height 150 feet with 8 'spreader' masts of 60 feet surrounding them. Power was delivered to the site via an underwater cable from the dockyard. For the first time security at Horsea became a serious issue and fences were erected around the masts and an extended guardroom manned 24 hours a day. The first station was out of date within 6 years and plans were made for 4 masts of an overall height of 446 feet. The first went up in 1913 to be followed by two more in 1914, the last was not finally being erected until 1921. This island is now the centre for military diving training in Britain's arm forces. An area to the south-east has been sold for housing development.	Pastscape no. - 1314370/ Newcastle HER no - 869/ Anderton (2000), Dobinson (2000), vols. 6.1 & 6.2 Pastscape states there are photographs of gun-training circa 1915 held at the English Heritage Archive (Swindon). These may show the wireless station, as may aerial photographs of the period.
ADM137/4680 (Military W/T station, book S.563)			
ADM137/4680 (Admiralty book C.B.1284) + ADM 137/4699 (use map for locations)	Coastal position on 'The Wash' situated next to a Lighthouse and to the north-west of Norwich. Hunstanton was a significant station	The Hunstanton station(s) played a significant role as an interception and D/F station during the First World War. The station(s) were established by Col. Bayntun Hippisley and Edward Clarke.	Lewis, J & Mackie,C (2008)
ADM137/4680 (Admiralty book C.B.1284)			
Sheerness Garrison, Military W/T station, book S.561			
ADM137/4680 (Admiralty book C.B.1284)	This is a coastal location to the north-west of Porthcurno. It is not identified on historic OS mapping.		PastScape No. - 1411573 Information is thought to be held at the HER, PastScape details 5 photographs and 1 aerial photograph.

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
37	LEAFIELD (OXFORDSHIRE)	Marconi/Lloyds site	SP 295 157 (to the north-east of Langley Farm), and SP 29932 15346 (to the east of Langley village)	To the north-east of Langley Farm concrete footprints of former buildings or masts are visible. A small shed is visible within a small wooded area, although it is possible this relates to the farm. To the east of Langley Village is Leafield Technical Centre occupying some of the site of the former station. Possible concrete footings are visible to the west of the Centre, which may relate to the First World War Wireless Station.	There is potential for below and above-ground archaeology. The later development of the site means that it will be necessary to distinguish First World War evidence from later phases of uses. Further investigation is required.
38	LIZARD (CORNWALL)	Admiralty	Lloyds Signal Station - SW 71473 11930. Marconi Wireless Station - * SW 71547 11894	Lloyds Signal Station survives, as does the Marconi station to the west in two wooden hut and the base of a mast to the north.	The Lloyds Signal Station is a restored monument. The Marconi station and mast base is Listed Grade II, and is now open to the public as a museum fitted with wireless equipment. The station is the oldest Marconi station to survive in its original state.
39	LONDON, THE STRAND	Admiralty	TQ 30660 80916	Marconi House, located at 336-337 The Strand, survives.	Marconi House has recently been converted into flats, any fixtures or fittings relating to its former use are unlikely to survive.
40	LONDON, WHITEHALL	Admiralty	TQ 300 802	The exact location of the wireless room within the building is uncertain.	The building survives but has continued in use, fixtures and fittings relating to its use are unlikely therefore to survive.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
Bod MS 335 and T.11954	Site identified on historic OS mapping, the station to the north-east of Langley Farm is identified as 'Marconi Signal Station'. No buildings are depicted although there are several lines of masts surrounding it, totalling 12 within the rectangular field. Within Langley is a larger site which is thought to also relate to the signal station although this is not specifically identified. It includes several small square and rectangular buildings set in two plots of land and connected by trackways, set along the Langley Road. Two pumps are identified.	Marconi station that was intercepting for the Admiralty Intelligence Division. Document sources described the site as being at Fairspear Farm (SP 30601 16302) and Langley Farm, the latter site was identified only on historic mapping. Interest in the station began in 1912 when Marconi conducted experimental wireless transmissions in Morse Code. The site was protected by the Home Guard during First World War, and a massive high powered longwave spark wireless station was installed in 1922 under the callsign GBL. During the Second World War, Leafield was an important communication station, and in the 1960s it was upgraded and modern-mainly for maritime communication, and ised, it became one of the major stations known as Portishead Radio. The receiver station for Leafield was located at Devizes in Wiltshire. The wireless station became a substantial BT station covering 600 acres of masts. In 1961 the station closed, and construction of a new wireless station commenced, and the old steel and concrete masts were demolished. This closed in 1986, most of the land used for aerial fields was returned to the Crown but in 1988 12 ½ acres, which included the site of the buildings, was purchased by B.T.	
ADM137/4680 (D/F Station, book U.K. S.441)+ ADM1.8512.28B	A map of 1907 shows the Lloyds Signal Station at the Lighthouse at Bass Point along the coastal path. To the west a 'Marconi Signal Station' is shown with two small huts and a mast to the rear enclosed within a rectangular plot of land.	In 1900 Guglielmo Marconi stayed at the Housel Bay Hotel in his quest to locate a coastal radio station to receive signals from ships equipped with his apparatus. He leased a plot "in the wheat field adjoining the hotel" where the Lizard Wireless Telegraph Station still stands today. Recently restored by the National Trust, it looks as it did in January 1901, when Marconi received the distance record signals of 186 miles (299 km) from his transmitter station at Niton, Isle of Wight.	
Bod MS335	Marconi House was the UK Headquarters for the Marconi Co during the First World War. The station was intercepting for the Admiralty Intelligence Division.		
ADM137/4680 + ADM186/737 (Admiralty book C.B.1284 and C.B.1284 A and S5.61)			

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
41	LOWESTOFT (SUFFOLK)	Admiralty	*TM 52429 93773	No evidence visible. Location identified through grid reference found in archive data. It seems more probable that the station was located near the lighthouse or cable office, but nothing could be identified on historic maps or 'Britain from Above' website.	The grid reference is located in a wooded area between modern housing, it is therefore unlikely that evidence survives.
42	LYDD, DUNGENESS (KENT)	Admiralty	TR 085 173	The Coastguard Station survives and appears to remain in use possibly as a bird observatory. There are probable concrete platforms surviving, but these are hard to distinguish amongst the sand.	The coastguard station survives, which may been used as/ or as part of the wireless station. The remote location increases the possibility of surviving evidence such as concrete footprints or structures.
43	MAIDSTONE (KENT)		Not identified. (Barracks - TQ 757 564)		
44	MALVERN (WORCESTERSHIRE)	Admiralty	SO 8093 4503	A brick-built standing wireless station survives, visible on Google Earth. There is also a small structure directly to the north visible (possibly without a roof), in addition to a minor structure/ footprint to the south.	Structure(s) relating to the wireless station survive, the site therefore has archaeological potential both above and below-ground.
45	MERSEY DOCK AND HARBOUR BOARD VESSELS X 5	Admiralty	Not identified. (Seaford Battery, now Gladstone Dock - SJ 321 960)		
46	NARBOROUGH (LEICESTERSHIRE)		Not identified. (Narborough centred on - SP 53505 97393)		
47	NESTON (CHESTER WEST AND CHESTER)		SJ 2948 7529	There is possibly some concrete platforms or a minor building visible at the edge of the field, located off Denhall Lane leading up to the farm.	There is some evidence of standing structures visible, however it is possible that this relates to the Second World War use of the site. There is potential for below-ground archaeology.
48	NEWCASTLE-UPON-TYNE (TYNE AND WEAR)		Not identified. (NZ 24773 64715)		
49	NEWHAVEN, BOLT HEAD (EAST SUSSEX)	Railway Company	TQ 444 000	Possible small rectangular structure surviving. There are 3 probable gun emplacements directly to the north-east, the evidence may therefore relate to this later phase of activity.	This is a remote coastal location, increasingly the likelihood of below-ground archaeology.
50	NITON (ISLE OF WIGHT)	Marconi/Lloyds site	SZ 498 753	In the 1920s, a farmer chopped up the now redundant mast to make ladders, but its concrete base remains in the field to the south of the farmhouse	Concrete base only thought to survive, but there is potential for below-ground archaeology

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
ADM137/4680 (Lieut. Round Station' and D/F Station, book U.K. S.441)+ Bod MS 337 + Bod MS 336		A 'Captain Round' station	
ADM137/4680 (D/F Station, book U.K. S.441) + Bod MS 337	Site identified on historic OS mapping as 'Dungeness Coastguard Station (Lloyd's Signal Station)'. There are no masts or buildings specifically identified. The Coastguard Station consists of a row of cottages, it therefore seems likely that these buildings or some of these buildings were used for the wireless station. This is a remote coastal location.		Listed Building ID No. 492330
ADM137/4680 (Military W/T station, book S.561)			
ADM137/4680 (Military W/T station, book S.561)		Identified as a First World War Telegraphy Station on PastScape, it also states that this was later a listening station and part of the Telecommunications Research Establishment.	PastScape No. - 1414854/ More information is available in the Defence of Britain Project (*ADS* website).
A1/305/15/226/164 (Revised list of War Dept. and R.F.C W/T Stations 8/3/18)			
ADM137/4680 (Military W/T station, book S.561)			
	Coastal location on the edge of a field next to the River Dee, located to the north-west of Cheshire. The site is not identified on historic OS mapping.		PastScape No. - 1414626/ PastScape info details - 4 photographs, sketch plan and 2 location plans.
ADM137/4680 (Military W/T station, book S.561)			
ADM137/4680 (Military W/T station, book S.561) + ADM186.653	Site identified as 'Coastguard Signal Station' on 1910 OS mapping, but is no longer extant on the 1920s edition. A small building is shown and a probable mast (although not specifically identified). It is a remote coastal location.	The Newhaven Marconi Radio Station was established in 1904, and started running in 1905. The station achieved ship to shore radio communications around 1912	*Wikipedia* website (Marconi)
ADM137/4680 (Military W/T station, book S.561)	Probable wireless building and mast identified on 'Britain From Above'. A small rectangular building to the front of the lighthouse is visible, to the west of which is a mast.	In 1897 Marconi established a station at Niton. Marconi moved his station here from Alum Bay. There is a stone at Knowles Farm into which is cut the inscription, "This is to commemorate that Marconi set up a wireless experimental station here in A.D. 1900".	

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
51	NODES POINT (ISLE OF WIGHT)	Garrison/ Army	Nodes Point is located at NGR - SZ 637 899, however no evidence of a wireless station was identified.		
52	NORTH FORELAND (KENT)		*TR 39916 69658	The lighthouse is extant. Minor structures are visible in the gardens along North Foreland Road, although these are unlikely to relate to the wireless station.	Post-war houses are visible along North Foreland Road, it is therefore unlikely that evidence relating to the wireless station remains. There is a low possibility that elements have been retained with gardens. There is some potential for survival of below-ground archaeology.
53	NORTON (WORCESTERSHIRE)		Not identified (Worcester Barracks - SO 867 519)		
54	NORWICH (NORFOLK)		Not identified (TG 22992 09266)		
55	PARKESTONE QUAY (ESSEX)	Railway Company	TM 236 326	No evidence visible.	This is a working international port, there is unlikely to be an evidence relating to the wireless station.
56	PERCH ROCK BATTERY (MERSEYSIDE)	Garrison/ Army	SJ 30960 94492	The battery survives, but there is no immediate evidence of the wireless station.	The battery is now a tourist attraction, it is possible that evidence remains although the battery continued in use post-World War I which may have compromised surviving evidence.
57	PETERBOROUGH (PETERBOROUGH)		Not identified.		
58	PEVENSEY, POLGATE (EAST SUSSEX)	Admiralty	TQ 651 06	No evidence visible.	This is an open undeveloped landscape, there is potential for below-ground archaeology and minor above-ground evidence.
59	POLDHU (CORNWALL)	Marconi/Lloyds site	SW 662 196	Concrete platforms survive from the masts and earthworks are evident. The masts themselves were destroyed in storms. The Poldhu Hotel survives.	There is potential for further investigation of above and below-ground archaeology.
60	POOLE (DORSET)	Marconi/Lloyds site	SZ 03827 87043	The wireless station was at the Haven Hotel which is extant. A plaque points to a small room where the 'wireless age' was born.	The hotel continues in use and therefore is unlikely to be any fixtures and fittings surviving relating to its former function as a wireless station.
61	PORTLAND BILL (DORSET)	Admiralty	SY 67777 69094	Lloyd's Cottage' appears to survive, or a structure in the footprint of the cottage (possibly an extended cottage). The structure shown as the telegraph station is not readily visible. Earthwork are visible relating to the wireless station.	The cottage probably survives but appears to continue in use. The remote coastal location means that some evidence may survive from the former wireless station. It will be necessary to distinguish between First World War and Second World War remains.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
A1/305/15/226/164 (Revised list of War Dept. and R.F.C W/T Stations 8/3/18			
ADM137/4680 (Admiralty book C.B.1284)	Masts identified on 'Britain From Above' in 1920 next to the front of the lighthouse. There is a small building adjacent to a mast which may have been a wireless station.	North Foreland station was built by Lloyds on land near the lighthouse in 1901. In 1909 it was taken over the post-office. By the mid 1920s it was decided that the site was no longer big enough and it was moved to Broadstairs.	
ADM137/4680 (Military W/T station, book S.561)			
ADM137/4680 (Admiralty book C.B.1284)			*Margate Museum* website
ADM137/4680 (Admiralty book C.B.1284)			
A1/305/15/226/164 and ADM 137/4680 (Revised list of War Dept. and R.F.C W/T Stations 8/3/18 Military W/T station, book S.561)	Coastal site in the Wirral, along the River Mersey. Battery had a wireless station.	Perch Rock Battery dates from 1829, and is a Listed building. It was built to protect the Port of Liverpool and as a fortified lighthouse to replace the old Perch Rock light.	*Perch Rock* website
ADM 1/8512/28/B			
ADM137/4680 (D/F Station, book U.K. S.441) + and Bod MS 335		RAF Polegate was an airship base from 1915-1919. Archive reference states the site is - '1/2 mile along Pevensey/Wartling Road on right side'.	
Bod MS 335	A 1900s map of Poldhu shows the wireless station to the south of the Poldhu Hotel. Five interconnecting buildings are visible with rectangular footprints, with a further rectangular building to the rear connected by paths. There are eight posts and two masts depicted on the map.	Marconi station that was intercepting for the Admiralty Intelligence Division. Poldhu was constructed by Marconi in 1900, the station was dismantled in 1933. It was a large site compared to its predecessors, and was responsible for the first transatlantic message.	
ADM137/4680 + ADM186/737 (Admiralty book C.B.1284 A + Bod MS 339 (Photos))	The hotel is marked on historic mapping, but the wireless station is not. This is a fairly developed coastal location.	Marconi established a wireless transmitter at The Haven Hotel in 1899, and carried out some of his first wireless telegraphy experiments from the hotel. The Haven Hotel housed Belgian refugees during the First World War.	*Ham Radio* website/*Marconi Calling* website
ADM137/4680 (Admiralty book C.B.1284)	Lloyd's Cottage & 'Wireless Tel Sta' are both marked on historic OS mapping. They are situated to the south of the 'Old Lighthouse' and the north of the coastguard station.	The site carried on in use during the Second World War. A 1946 image on 'Britain From Above' shows aerial masts in the location of the house.	

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
62	PORTSMOUTH SIGNAL SCHOOL (HAMPSHIRE)		Not identified. ('Navigation School' - SU 631 004)		
63	PRAWLE POINT (DEVON)	Admiralty	SX 77333 35067	The 19th century station survives. It is difficult to distinguish possible surviving platforms surrounding the station from the rocky coastline. Further investigation is required.	A remote coastal location with archaeological potential for the survival of below and above-ground archaeological evidence.
64	PUCKPOOL (ISLE OF WIGHT)	Garrison/ Army	SZ 61446 92210	The battery where the wireless station was situated survives, but there is no evidence of the wireless station. Remains relating to the wireless station are difficult to distinguish from other defensive archaeology on aerial photography.	The Scheduled Monument description does not mention the wireless station. There is a wireless museum on site although this does not appear to relate to the former wireless station.
65	RAME HEAD (CORNWALL)	Admiralty	SX 42064 48714	No evidence visible.	The earlier station used in the First World War is thought to have been replaced in 1935. The station and mast are likely to have been built on the existing foundations. This is an undeveloped landscape and there is potential for the survival of below-ground archaeology.
66	RAVELIN BATTERY, SHEERNESS	Garrison/ Army	TQ 91800 75200	The battery has been demolished.	The battery has been replaced by a supermarket, but some evidence relating to the battery has survived. An RCHME report of the battery prior to demolition does not identify a wireless station. There is low potential for surviving evidence relating to the wireless station.
67	SANDWICH (KENT)	Admiralty	*TR 35106 58699	No evidence visible.	The site is located in a golf-course, the undeveloped landscape means there is potential for survival of platforms. It is however unlikely that these would have been retained within the golf course.
68	SCARBOROUGH (NORTH YORKSHIRE)	Admiralty	TA 02577 87353	A house is thought to survive from the wireless station, although it is not known whether this dates from the First World War.	Much of the station has been replaced by modern housing. There is some potential for surviving above and below-ground archaeological evidence.
69	SEAFORTH (LIVERPOOL)	GPO	SJ 328 972	Modern housing has replaced the old barracks.	None.
70	SEAHAM (COUNTY DURHAM)		NZ 42996 49806	A building survives in the same location on the plot of land identified on historic OS mapping, however it is not possible to date this structure and it is possible that it is a later structure built on an earlier footprint.	There is archaeological potential for the survival of the wireless building, but further investigation is required.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
ADM137/4680 (Admiralty book C.B.1284)	This is part of the Royal Dockyard at Portsmouth, and a densely developed coastal location.	A signalling school had been established at HM Barracks, Portsmouth in 1904 and was transferred to Petersfield during the Second World War	
ADM137/4680 + ADM1.8512.28B (D/F Station, book U.K. S.441)	Lloyd's Signal Station' is identified on historic OS mapping. A small hut and mast are identifiable. This is a remote coastal location.	The station is thought to have been erected in the 1860s as a coastguard lookout by the Admiralty. It became a Lloyd's Signal Station in 1882. Between 1903 and 1951 it served as a Royal Navy Signal Station with both Lloyd and Admiralty signalling undertaken by Navy personnel who carried it out while undertaking lifeguarding duties. Lloyd's signalling continued until 1956.	*Prawle Point* website
A1/305/15/226/164 (Revised list of War Dept. and R.F.C W/T Stations 8/3/18)	This is a developed coastal location, the wireless station was within a a former fort although it is not specifically identified on historic mapping.	Puckpool mortar battery is a SAM (1012721), the fabric of it is largely complete and public access is possible.	
ADM137/4680 (Admiralty book C.B.1284)			*English Heritage (2012)/ Rame Head* website
ADM137/4680 (Sheerness Garrison, Military W/T station, book S.561)			Kennedy, J (1993)/ PastScape No. - 890818
ADM137/4680 (D/F Station, book U.K. S.441) + Bod MS 337		Records in the Marconi archives at the Bodleian includes plans and elevations of the Sandwich wireless station, the site plan shows that there was a Engine House, Operators Hut and a new hut is proposed which is a crew quarters hut.	
ADM137/4680 (Admiralty book C.B.1284)		The wireless station remained in use until the 1960s.	
ADM137/4680 (Admiralty book C.B.1284)	Small building identified as 'Wireless Station (G.P.O)' within Seaford Barracks, with an adjacent mast.		
	A 'Signal Station' is identified on an OS map of 1919 as a small building, there is a Flagstaff to the rear (F.S). There is a 'Rocket Apparatus Station' next to the station.		*Scarborough Heritage* website/ *Puella* website

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
71	SEDGEFORD (NORFOLK)		*TF 737 36	No evidence visible.	This is a rural, undeveloped site therefore there is potential for below-ground archaeology.
72	SHEERNESS (KENT)	Admiralty	TQ 908 755	The Garrison Point Fort survives, some of which remains in use by the Port Authority, but the majority is unused. The signal station survives and is part of the scheduled monument, but is not specifically identified within documentation. It is possible that the wireless and signal stations are the same structures.	The fort survives in a good level of preservation.
73	SHIP		Not identified		
74	SLOUGH FORT, ISLE OF GRAIN (KENT)	Garrison/ Army	TQ 840 783	The structure used as a coastguard station still exists within the Bourne Leisure property, and is currently used as sleeping accommodation (Victor Smith pers comm).	The site of the signal station on the map is roughly that of the Coastguard Station, which remains extant although it has not been possible to access the structure. There may have also been a connection between the blockhouse built on the roof of the central fort structure and the wireless station (Victor Smith pers comm).
75	SOUTH CARLTON (LINCOLN)		Not identified (South Carlton centred on - SK 95158 76479)		
76	SOUTHSEA CASTLE (PORTSMOUTH)	Garrison/ Army	SZ 646 980	The Castle survives as does the associated batteries, however the area in which the stations where located appear to have been located has been developed.	None.
77	SPURN HEAD (EAST RIDING OF YORKSHIRE)	Garrison/ Army	Not identified (Spurn Head centred on - TA 401 110)		

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
ADM137/4680 (Military W/T station, book S.561)	Site is inland from the coast, to the south-east of Hunstanton.		
ADM137/4680 (Admiralty book C.B.1284)	The station was located at the Garrison Fort which dates from the 1860s, where a coastguard station, Admiralty House and old barracks were also situated. The signal (also possible wireless station) is a white cylindrical structure on top of the main fort and forming part of a later (possibly Second World War) larger structure.	An Admiralty Order from 1917 confirms use of wireless equipped aircraft in a spotting capacity for coastal gun batteries. This identifies 'F.C Post, Sheerness' as one of the ground receiving station (*Kent History Forum* website). The area is now an important industrial area used by Thamesport, Thames Gateway and BP.	*Kent History Forum* website
ADM137/4680 (Military W/T station, book S.561)			
ADM137/4680 and ADM 137/4699 (Sheerness Garrison, Military W/T station, book S.561)	The station is identified as 'Slough War Signal Station' on historic mapping. A small rectangular building and a probable mast lie within a rectangular enclosure. The station is close to Slough Fort (a Palmerston Fort). The Signal Station is served by approach and fire trenches and within a protective enclosure of barbed wire. The site of the signal station on the map is roughly that of the Coastguard Station. This is a small structure with a bay 'observation' window (Victor Smith pers. comm.).	Slough Fort is described within the defence schemes of 1906 and 1914 as a Port War Signal Station, but the listing of vulnerable points for 1917 and 1918 lists is as 'Wireless Telegraph Station, Naval, Special'.	Much of the information relating to Slough Fort Station was supplied by Victor Smith under an English Heritage grant.
ADM137/4680 (Military W/T station, book S.561)			
A1/305/15/226/164 and ADM 137/4680.	Historic mapping shows that on the East Battery are 'Position Finding Cells Nos 1 & 2, No 6 Battery'. Masts are not specifically identified.		
ADM137/4680	Considerable military and coastal remains survives particularly relating to the batteries. It is not possible to distinguish these from possible evidence relating to a wireless station. PastScape states that a Port War Signal Station with its own wireless station was in operation during the Second World War, but it does not mention the First World War.		

Table 1 (continued)

OA No	STATION NAME (COUNTY)	TYPE	NATIONAL GRID REF. (probable location) *ref from archive data	SURVIVAL	ARCHAEOLOGICAL POTENTIAL
78	STOCKTON-ON-TEES (COUNTY DURHAM)	Admiralty	*NZ 42088 19891	Two brick buildings, and the anchor points for what are thought to have been five radio masts survive. The two brick buildings are interpreted as the operations room and the battery store and generator house, and have been converted to residential accommodation. An old garage is thought to have been reconstructed from an L-shaped timber building that may have been a policing and transport unit. Analysis of Google Earth suggest that these buildings remain extant.	The sites has high archaeological potential, as a rare example of a site with two (possibly three) surviving above-ground structures. The site is of considerable historical significance as a 'Y' station in the First World War.
79	TREVOSE, PADSTOW (CORNWALL)		Not identified (SW 85088 76548)		
80	TYNEMOUTH CASTLE (NORTH SHIELDS)	Garrison/ Army	NZ 373 693	No evidence identified. The castle ruins survive but there is no above-ground evidence of a wireless station.	There is some potential for the survival of below-ground archaeology. The site is managed by English Heritage as a tourist attraction.
81	WARDEN POINT BATTERY (ISLE OF WIGHT)	Garrison/ Army	SZ 324 875	The Victorian battery survives in reasonable condition. The location of the station within the battery is not known.	No evidence relating to the wireless station was identified.
82	WITHERNSEA, EAST RIDING OF YORKSHIRE		Not identified (TA 34170 27995)		
83	WOOLWICH COMMON, GREATER LONDON		TQ 42803 77741 (centre of Ha-ha Road)	No evidence identified.	EH research does not identify surviving First World War evidence. There is potential for below-ground archaeology.
85	WORCESTER, WORCESTERSHIRE		Not identified (SO 84944 54737)		
86	WORTHY DOWN, HAMPSHIRE	Garrison/ Army	SU 467 352	No above-ground evidence identified. There are probable cropmarks visible in the field.	There is archaeological potential for below-ground evidence.
87	YORK (YORKSHIRE)	Admiralty	*SE 60282 48968	No evidence identified.	There is potential for below-ground archaeology, and the survival of minor above-ground evidence such as concrete platforms.

ARCHIVE REF National Archives Bod[leian] Marconi Archives	**TYPOLOGY & LAYOUT**	**HISTORICAL CONTEXT**	**REFERENCES**
ADM137/4680 (Admiralty book C.B.1284)	The station is identified as 'Wireless Station' on historic OS mapping, and includes four possible small buildings and four 'posts' in a roughly rectangular enclosure.	Admiralty Radio Telegraph Station thought to have been built in 1915 or 1916. It was a `Y' station, built to intercept radio transmissions from German `U' boats and Zeppelins operating in the North Sea	Pastscape No. - 611216/ Sockett, E W (1992)
A1.305.15.226.164			*World War 2 Talk* website
ADM137/4680		An Admiralty Order from 1917 confirms use of wireless equipped aircraft in a spotting capacity for coastal gun batteries. This identifies 'Tynemouth' as one of the ground receiving station (*Kent History Forum* website)	*Kent History Forum* website
A1/305/15/226/164 and ADM 137/4680 (Revised list of War Dept. and R.F.C W/T Stations 8/3/18 book S.563)			*Warden Heights* website
ADM186.653			
ADM137/4680(Military W/T station, book S.561)		The 'Signals Experimental Establishment' was located at the northern end of Woolwich Common, adjacent to Ha-Ha Road. In 1914 the Army set up 'an experimental Wireless Telegraphy Section of the Royal Engineers' (English Heritage 2009)	
ADM137/4680 (Army Training Station - Bletchley? /Military W/T station, book S.563)			
A1/305/15/226/164 (Revised list of War Dept. and R.F.C W/T Stations 8/3/18)		A camp was located at a former racecourse, which became the location of Wireless and Observers School in 1917.	*Worthy Down* website
Bod MS 335		A 'Captain Round' station	

7 Historic Context

7.1.1 The use of wireless communications in military operations is one of the 'transformational technologies' of the 20th Century when Britain and German were locked into a technological arms-race (Cocroft 2013). The formation of the 'Wireless Telegraphy Company' was the watershed moment in the development and use of wireless technology. It was established in England in 1898 under Guglielmo Marconi. Chelmsford became the centre of the wireless industry, where Marconi built his New Street Factory in 1912 (OA.10) (Plate 1), after leaving his former factory on Hall Street. The Marconi Company became a major rival of the German 'Telefunken', and as late as 1911 formed a syndicate with a Belgian company. The military, particularly the Navy, was quick to pick up on the developments which were utilised in early 20th-century conflicts. In the years prior to the First World War the military tried many experiments in wireless communications on land, sea and in the air. A defining development in wireless history was in 1907 when Marconi inaugurated a transatlantic wireless telegram service from his station at Clifden near Galway (Ireland) to Glace Bay in Nova Scotia.

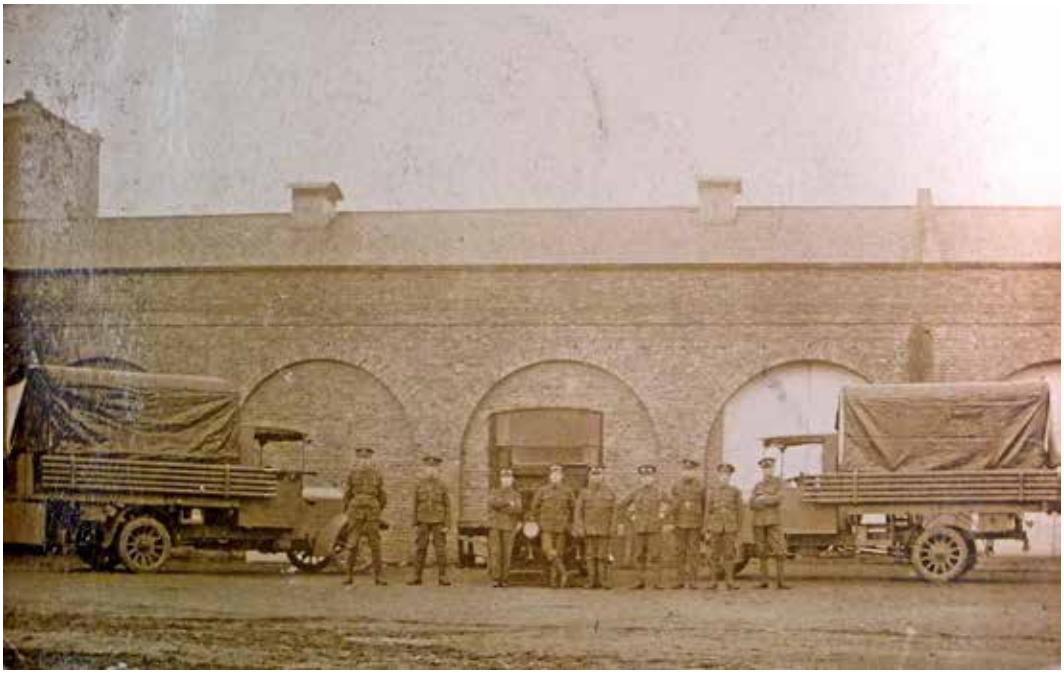

Plate 1: Direction Finding Outfits before leaving for France Nov 1914, outside Marconi works, New Street Chelmsford (MSS.Marconi 335)

7.1.2 Early wireless stations include Marconi's now iconic station at Poldhu (Cornwall) (see image on front cover) (OA.59), which since 1903 was used by the British Navy for a proportion of the time. By 1907/8 the Navy completed three new stations at Horsea Island (OA.31), Cleethorpes (OA.13) and North Front, Gibraltar. These were designed jointly by Vernon and Marconi and had 100kw spark transmitters. Their function was not only to communicate with each other, but to replace Poldhu and distribute orders and information to HM ships in European waters thereby giving more control to the Admiralty. The Admiralty also provided five new medium-power stations at Ipswich, Aberdeen and Pembroke Dock (Wales), and Malta and Gibraltar abroad. A wireless station was also established by the Admiralty in Whitehall (OA.40), which was used to communicate with the three British stations (Hezlet 1975). In 1912 the British Government signed a contract to build an Imperial Wireless chain (IWC). This was a strategic international wireless telegraphy network created to link the countries of the British Empire.

7.1.3 At the outbreak of war, the British wireless network in home waters was much the same as had been established in 1909, but it rapidly became obvious that wireless was a technology of great strategic importance. The running of the Marconi IWC and GPO ship to shore stations was passed to the War Office soon after the commencement of hostilities. British interception of enemy wireless traffic developed very rapidly from August 1914, although there had been virtually no organisation in existence for this purpose previously. The British government immediately took control of parts of the Marconi Company, including transatlantic stations in Wales and its factory in Chelmsford, and an ambitious training programme for wireless operators was instigated. Research into wireless interception was concentrated at the nearby Broomfield wireless station (OA.6). The War Office created the Wireless Signal Company as a unit on 2 January 1915, their remit was to operate wireless sets in the field and to run the British stations (Newland 2012).

7.1.4 During the first 18 months of the war the spark transmitters and crystal receivers had been used satisfactory in home waters. However, longer ranges were now needed on the oceans and this led to the development of the Poulsen arc. This could be used to obtain better results with smaller sets. Other sets were also being developed so that by the end of 1915 there were 35 different types of transmitters listed as in use by the Royal Navy and 28 receivers (Baker 1970). In 1915 the Navy established 16 new 'Auxiliary' wireless stations round the coast, from Fair Isle and St Kilda in the north to Newhaven (OA.49) and the Scilly Isles in the south, as well as Ireland (AIR1/616/16/15/328). These stations were to communicate with the vast armada of yachts, trawlers and drifters that compromised the Auxiliary patrol and the minesweeping service (Hezlet 1975).

7.1.5 Prior to the war, the Marconi Company developed a system of wireless detection finding (D/F), the principle of which was commonly known as a modification of the Bellini-Tosi system and was used by the Army in France from the beginning of the war. The D/F equipment, which used soft 'C' valves, was developed by H J Round, who was seconded from the Marconi Company to Intelligence and ordered to provide an initial two stations for service in France. Following this a large network covering the entire Western Front evolved (Baker 1970). The wireless stations therefore had the capability (in addition to transmitting messages), to gather intelligence gained from the enemy. It was this use of signals intelligence which was of major significance in Britain's success in the First World War.

7.1.6 Signals intelligence involved the interception of messages, traffic analysis, or the interference derived from the observation of the procedures and patterns of communications circuits and the resolutions of codes and ciphers. Signals could be intercepted, for example, and D/F techniques could locate the positions of enemy transmitters. Each D/F station was represented as a point with lines and scales radiating from it, if the readings from several stations coincided, then it was possible to locate trench wireless sets, and enemy troop positions could also be known, as well as Zeppelins and other hostile aircraft. Messages were decoded, and positions were triangulated, movements calculated and targets predicted. Most of these techniques became sophisticated only during the Great War itself, which was the dawn of modern signals intelligence (Hezlet 1975).

7.1.7 Navy war signals were under the control of the Director of Naval Intelligence who established the highly successful 'Room 40' code-breaking operation. The survival of documents from Room 40 provides a clear impression of the contribution of signals intelligence to the naval conflict. The Navy adopted the new technology more quickly. An early example of an intercept and D/F station was set up at Hunstanton, Norfolk (OA.33) (Plate 2). The wireless sets were heavy, bulky and fragile, which was less of an issue for the Navy than the

Plate 2: Hunstanton Wireless Station and Lighthouse, June 1920 (http://www.britainfromabove.org.uk/image/EPW001849 © English Heritage)

Army. Less is known about the British Army's use of wireless technology because of the destruction of their intercept records.

7.1.8 The Air Force and Army did however use wireless technology; by 1915 the use of wireless was adopted by the Royal Flying Corps. Its use by the army was handicapped by a lack of policy and by the failure to provide adequate research facilities (Hartcup 1988). The First World War was however won on land rather than sea so the significance of wireless technology to the Army should not be underestimated. Sophisticated systems were adopted on the Home Front, which shaped the land operation of Britain, France, Germany, Italy, America and probably of Russia and Austria (Ferris 1998).

7.1.9 The increasing use of wireless stations as enemy targets shows the importance of long-range wireless communications in the First World War (Cocroft 2013). Several stations identified in this study were located on existing defensive sites (for example Dover Castle (OA.19), Gosport (OA.28) and Perch Rock Battery (OA.56). This was in part because they already commanded the best strategic position, but also because they already had in place the defensive mechanisms needed to defend the sites. Those wireless stations not on defensive sites were afforded their own security. Site plans and inventories detail guard huts and show fenced enclosures. The value of signals intelligence was proved beyond doubt when Hunstanton and Room 40 were warned of the sailings of the German fleet, resulting famously in the war's major naval battle off Jutland on the 31st May/1st June 1916 (Hawker 1999).

7.1.10 It was not only the rapid adoption of wireless technology that gave the British the advantage in the war, but the early realisation of the advantage that it could give to the enemy. No secrecy was made of the D/F stations, but the British continued to convince the Germans that information received from wireless activity came from other sources. The Germans were not aware of the 'Round receivers' and continued to issue messages that were unencrypted (Newland 2012). Most operational signals were issued in writing and never sent by wireless. It was from inconsequential signals, such as those to minesweepers to sweep passages clear by a certain time that a picture was built up. The realisation of the advantage wireless could give to the enemy made the British more conscious of what it could give away by a too liberal use of wireless (Beesley 1982).

8 Topographic Locations

8.1.1 A total of 87 coastal and/or W/T and intercept stations was identified as being in use during the First World War (Table 1). Figure 1 shows the national distribution of these sites. The vast majority of stations are located close to the shoreline along the south and east coasts of England, stretching from the tip of Penzance to Berwick-upon-Tweed. This stretch of land along the English Channel was important strategically during peace and wartime with heavy maritime traffic, as was the east coast of England. In particular there are small clusters of stations in the strategically important ports of Liverpool and Portsmouth. These stations were ideally situated for intercepting messages and transmissions from Zeppelins over the North Sea, and U-boats and surface vessels on the so-called 'German Ocean'. A further cluster of wireless stations is evident on the Isle of Wight because of its clear views across the English Channel. Figure 2 shows the division of waters around the British Isles and the fixing of some stations (ADM1.8512.28B). Figure 3 shows the W/T low power shore station and ranges from wireless stations to first class ships in 1911 (*Royal Navy Museum of Radar And Communications* website).

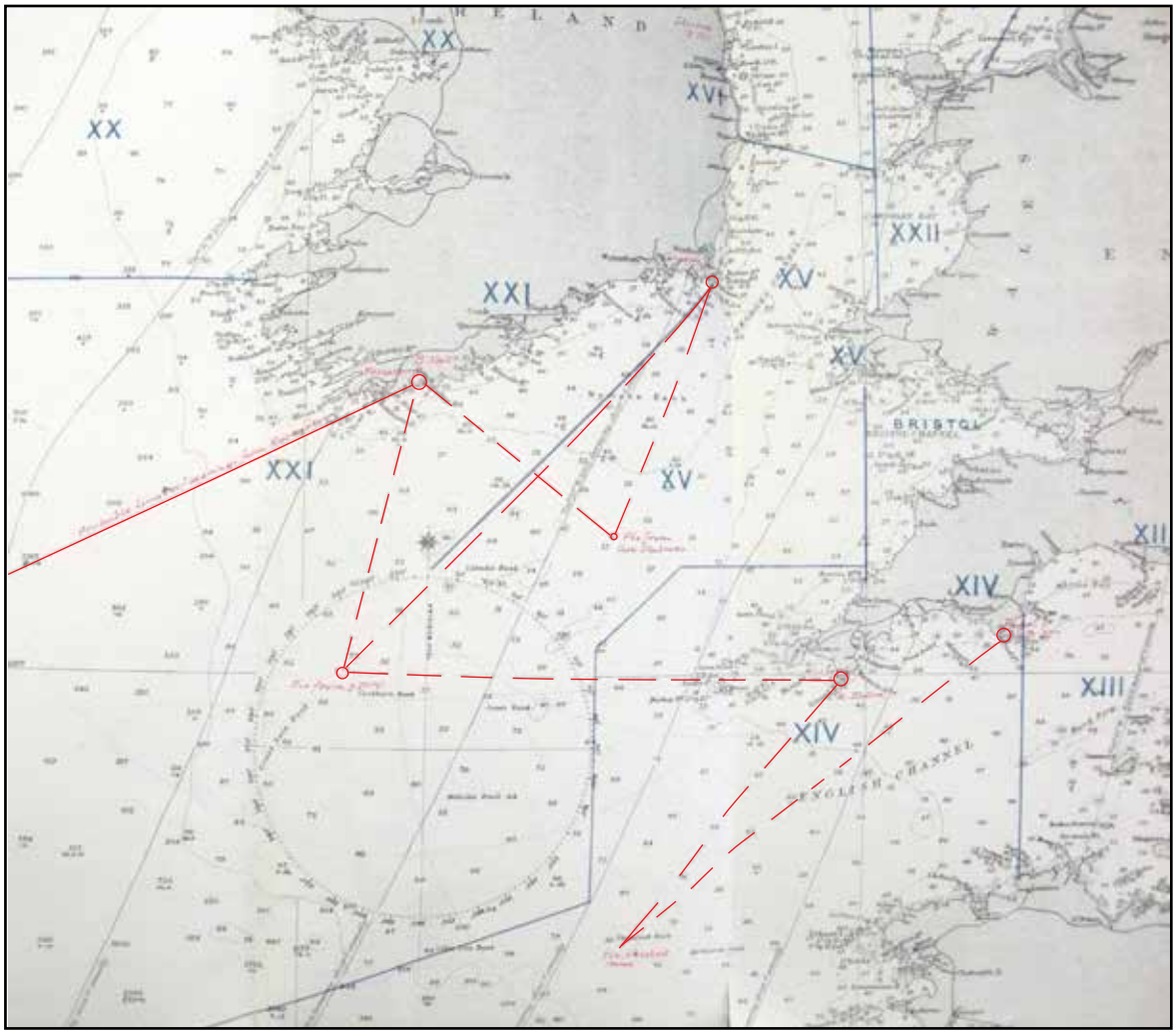

Figure 2: Map showing the English Channel and fixing of stations (ADM1.8512.28B)

8.1.2 There are a number of inland sites particularly around London (including Chelmsford) (OA.6, OA.10, OA.39, OA.40 & OA.83), Beaumanor Hall (OA.2), Cambridge (OA.8), Cawood (OA.9), Cirencester (OA.11), Cleethorpes (OA.13), Devizes (OA.17), Doncaster (OA.18), Feltham (OA.25), Hounslow (OA.32), Leafield (OA.37), Maidstone (OA.43), Malvern (OA.44),

Narborough (OA.46), Norton (OA.53), Norwich (OA.54) and Peterborough (OA.57). Most of these sites were located in elevated positions with unimpeded positions to allow good transmissions. Some inland sites had training, development or administration function, for example those at Whitehall (OA.40), Woolwich Common (OA.83), Broomfield (OA.6) and Portsmouth Signal School (OA.62).

8.1.3 A letter dated 12th September 1917 from Lieutenant W J Picken to Captain Round (MS.Marconi 335) discusses the type of conditions preferable for siting a station following a visit to the Isle of Skye. A coastal position with clear views and no obstructing mountains or hills was preferred. The absence of high and wooded surroundings lessened distortion of night signals from the seaward side. This reduced refraction which was sometimes experienced at stations high on the coast. Sandy conditions on coastal sites gave better earthings, sites slightly inland such as Stockton-on-Tees 'Y' station was chosen because it stood on a low knoll with a sandy edge (Sockett 1992).

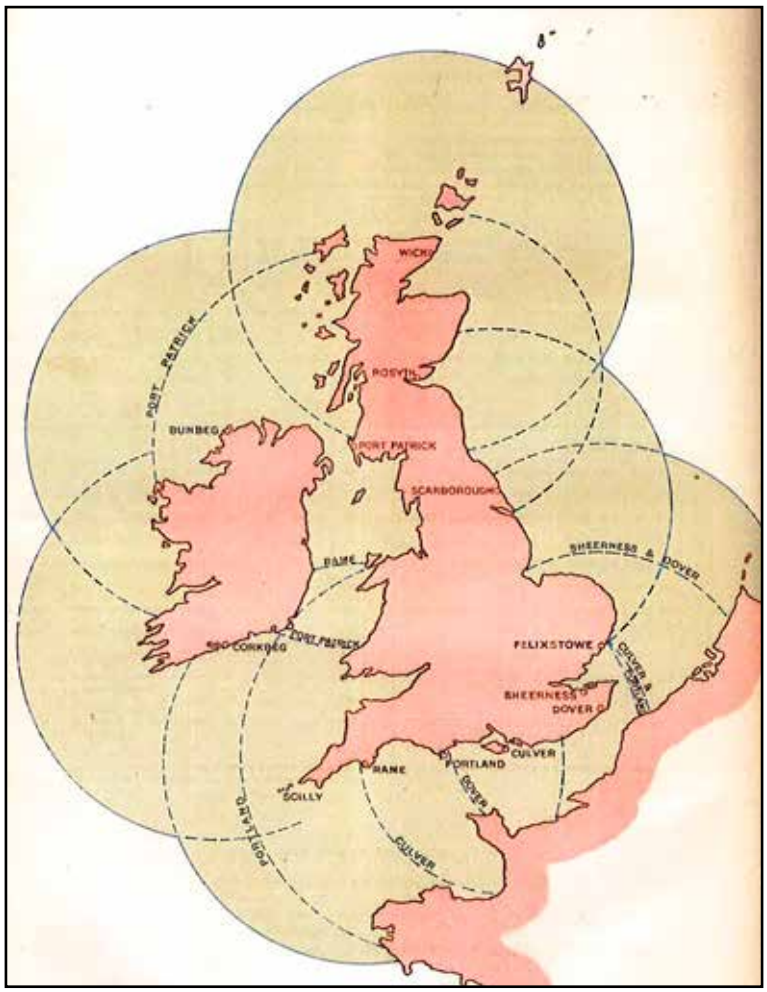

Figure 3: Map showing W/T Low Power Shore Stations, showing range with a first class ship (Royal Navy Museum of Radar and Communications website)

8.1.4 Existing infrastructure such as roads to the site was preferred, as was close proximity to a nearby town for lodgings (the need for lodgings was dependent on the size and location of the station as discussed in Section 10.6). Stations were often Sited next to Lighthouses. Examples are at Flamborough Head (OA.26) and North Foreland (OA.52). This would have enabled the Lighthouse facilities to be used, including infrastructure such as roads and water. These would have been required by those living and working on site. Lighthouses would also have been sited at the best position geographically along the stretch of coastline. Existing buildings were also utilised. For example, at Caistor on Sea (OA.7) a building on the High Street was used (Plate 3).


Plate 3: Caistor-on-Sea Wireless Station in the 1900s (Southgate Amateur Radio News website)

8.1.5 Close proximity to a telegraph line was preferable to reduce extra landline being laid. Ideally an existing (Post Office) circuit would be tapped into. Devizes (OA.17) was chosen because it was close to the main telegraph trunk line from Oorthcuron to London which passed underground through the nearby town of Calne (Newland 2012). At Stockton-on-Tees (OA.78) the western boundary of the site was formed by the former London North Eastern

Railway's Castle end branch line, thus giving easy and secure contact with the telegraph lines which ran along the railway tracks (Sockett 1992). The availability of Crown Land was also favourable; both Leafield (OA.37) and Devizes stations, which were part of the IWC, were on Crown Land, and were therefore available at virtually no cost to the government.

8.1.6 Importantly the IWC chose to select land on the basis of defensive strategy rather than technological concerns (Newland 2012). Devizes was also often part of a wider network of military infrastructure in the area which was a common characteristic in the siting of wireless stations. The Port War Signal Station at Dover (OA.19) was part of a heavily militarised landscape, as was the station within Fort Blockhouse in Gosport (OA.28). Such landscapes were often heavily fortified because of their strategic coastal position, the siting of wireless stations within them was therefore due to both their prominent geographic locations, and their existing infrastructure. A significant aspect of this was that defensive mechanisms were already in place, which was important in guarding the sensitive function of the stations. Historic maps show that those stations outside militarised areas were surrounded by a guarded fence, with a guard hut often visible on historic plans. Strategically it was preferred not to be easily visible from the sea, to reduce probability of enemy detection.

9 The Role of the Stations

9.1 Coastal W/T and/or Intercept Stations

9.1.1 The Coastal W/T and/or Intercept stations had different functional roles during the war. These were:

- Intercept stations – referred to as 'Y' stations.
- D/F stations – referred to as 'B' stations. 'Y' stations and 'B' stations sometimes occupied the same site, for example at Hunstanton (OA.33). D/F stations were often more temporary and mobile.
- Ship to shore stations – these operated two way communications.
- Experimental/Development stations – these stations had a research role, such as the sites at Chelmsford, Broomfield (OA.6) and Woolwich Common (OA.83).
- Wireless training schools – the training of wireless operator was important as it was skilled work. An example is the Portsmouth Signal School (OA.62).
- IWC – this was a strategic international wireless telegraphy network created to link the countries of the British Empire; examples at Devizes (OA.17) and Leafield (OA.37).
- Post Office inland wireless stations – around 1911, the Post Office took over inland (non-ship-to-shore) wireless stations.

9.1.2 The relationship between the types of sites during wartime requires further research, particularly between commercial and military companies. The extent to which this relationship was based on profit and patriotism has been the subject of a recent article by Bruton and Gooday (*Guardian* website). The military was reliant on the Marconi Company's technological developments, equipment and staff. At the outbreak of war the Marconi Company offered its wireless operators and training to facilitate the armed services' use of wireless communications. The close relationship is shown in the role of Captain Round during the conflict; he joined the Marconi Company in 1902 and at the outbreak of war was seconded to Military Intelligence and given the rank of Captain. Using his experience in direction finding he established a number of stations on the Western Front and England, identified as 'Captain Round Stations', which played a significant role in England's success. These stations include Birchington (OA.4), Lowestoft (OA.41), Flamborough Head (OA.26 York (OA.87) (MS. Marconi 335).

9.1.3 The ownership of sites was transferred before the war but particularly during the war, North Foreland station for example was built by Lloyds on land near the lighthouse, but then sold to the Post Office in 1909. The station at Devizes illustrates the confusing ownership of stations and their changing functional role most clearly. The station was built by Marconi as part of the IWC, and later became part of the War Office's 'Wireless Signal Company'. During the 18 years of its operation, it was passed from the Marconi company to the GPO, the War Office and Signals Corps, and back to the GPO. The station also demonstrates the changing function of stations during their use; in addition to its use as part of the IWC, it was thought to have been employed as a listening station, a D/F station, a long range ship-to-shore station, and as a test bed for wireless technologies (Newland 2012).

9.1.4 The most significant function of wireless stations during the war was in their role of interception and D/F (as discussed in Section 7), which was of established importance in Britain's wartime success. Papers in the Marconi collection (MS.Marconi 355) show that the D/F stations would have been fitted with the latest, top secret 'Round receivers', which were used to determine the position of enemy wireless stations and the movement of Zeppelin

airships. The Germans were not aware of the receivers and continued to issue messages that were unencrypted. Long range receivers were frequently used as D/F stations.

9.1.5 The D/F stations and interception stations both come under the category of 'Y' stations, which were British Signals Intelligence sites operated by a range of agencies including the military, GPO and the Marconi Company. Sometimes both functions operated at the same time with the D/F hut being a few hundred metres away from the main interception building because of the need to minimise interference. Archive research identified 'B' and 'X' directional stations located on the south-west coast of England and Ireland for the purposes of working with our aircraft and locating the positions of enemy submarines (ADM1/85/2/28B). 'B' stations are also classified as wireless D/F stations which used specially-adapted aerials and wireless apparatus.

9.1.6 An Admirality Order dating from May 1917 confirms use of wireless equipment aircraft in a spotting capacity for coastal gun batteries, stations were used for ground receiving at Spurn Head (OA.77), Tynemouth Castle (OA.80), Dover (Langdon) (OA.21), Isle of Grain (OA.35) and Nodes (OA.51) or Culver (OA.16) (*Kent History Forum* website). Again, this is an area which requires further research.

9.1.7 The archive research identified, in addition to the coastal and/or intercept sites six other types of wireless study. These do not form the focus of this study, but the following sections provide an overview of the history and role of these stations.

9.2 Home Defence (Royal Flying Corps/War Office) **(Appendix 2, Table 2)**

9.2.1 The increasing number of attacks on London during the First World War led to a need to have an integrated home defence system. The War Office with the Royal Flying Corps took an increasing role in home defence as the war progressed.

9.2.2 The London Air Defence Area (LADA) was created from 191 7–9918 by Major General Ashmore. This demanded the integrated reporting of sightings of enemy aircraft that would be collated on an operations table and then the threat dealt with using both Anti-Aircraft (AA) guns with searchlights and by calling up aircraft from local areas.

9.2.3 Wireless telegraphy had an increasingly important role to play in home defence as the war progressed. The use of W/T along with sound detectors at strategic points would have allowed an early warning system to be set up. The process of reporting sightings to a HQ and then using wireless to call upon aircraft and AA batteries would have led to a co-ordinated defence of areas.

Billericay	RFC 39 Squadron - North Weald
Burnham	RFC 37 Squadron - Woodham Mortimer
Canterbury	RFC 50 Squadron Harrietsham
Chatham	RFC 141 Squadron - Biggin Hill
Cliffsend	RFC 50 Squadron Harrietsham
Epping	RFC 39 Squadron - North Weald
Harwich	RFC 75 Squadron Elmsett
London - Parliament Hill	RFC 39 Squadron - North Weald
London - Staines	RFC 39 Squadron - North Weald
Plumstead Common	RFC 39 Squadron - North Weald

Common	RFC 39 Squadron - North Weald
Putney	RFC 39 Squadron - North Weald
Redhill	RFC 141 Squadron - Biggin Hill
Sevenoaks	RFC 141 Squadron - Biggin Hill
Shoeburyness	RFC 37 Squadron - Woodham Mortimer
St Albans	RFC 39 Squadron - North Weald

9.2.4 National Archives file A1/305/15/226/164 suggests that by 1918 a number of RFC squadrons operated the wireless sets as part of the LADA. These sites are listed as having a zone call sign system and included the following sites:

9.2.5 The development of the London Air Defence Area during the First World War led to the setting up of the Observer Corps during the 1920s and also the development of regional operations rooms to deal with future threats from aircraft.

9.3 Royal Naval Air Service (RNAS) Aerodromes **(Appendix 2, Table 3)**

9.3.1 Until 1915 the Naval Air Stations were the main providers of air defence for Britain, as most of the Royal Flying Corps aircraft were needed on the front lines. The main function of the RNAS aerodromes after this related to the defence of coastal naval bases and shipping ports. The establishment of wireless sets at RNAS led to greater communication and tactical integration of each RNAS aerodrome, with larger naval bases and with allied shipping at sea.

9.3.2 The list of wireless sites from the National Archives (ADM 137/4680) shows that the RNAS not only had wireless sets fitted with aircraft and seaplanes but also in airships. Before the widespread use of radio telephony towards the end of the war, naval bases preferred to receive wireless communications from airships. This is because they could send a steady stream of Morse code rather than patchy reports from pilots, who had to fly an aircraft at the same time as sending a message in Morse code.

9.4 Royal Flying Corps (RFC) Aerodromes **(Appendix 2, Table 4)**

9.4.1 From 1916 onwards the increasing number of air raids led to a change in tactics with the RFC becoming responsible for Home Defence as they were ordered to deal with air raids. This led to a massive expansion in the number of War Office/RFC aerodromes as more resources were focused on dealing with the threat from German airships and bombers.

9.4.2 The use of wireless telegraphy at RFC sites initially allowed the transmission of Morse code. Towards the end of the war the transmitter within the aircraft could begin to send voice signals, allowing a much quicker response to enemy aircraft, and allowed a greater integration between the airfield and the aircraft. This was particularly important where allied aircraft were operating in the same areas as anti-aircraft sites, to prevent incidents of friendly fire. By 1918 over 50 RFC sites had Wireless Telegraphy as detailed in The National Archives file A1/305/15/226/164.

9.5 Lightships (Appendix 2, Table 4)

9.5.1 In the early 20th century a number of Trinity House lightships around the coast were manned with wireless telegraphy sets and operators on board. These ships were in contact with local coastguard stations and their main role was to guide shipping into safe harbour and act as a lookout for ships in distress. Although Trinity House was impartial during the First World War it is possible they (or staff on military attachment) were involved in some

war work. The lightships with W/T sets are included on the First World War admiralty list of home wireless stations in National Archives file ADM137.4680.

9.6 EXPERIMENTAL/PORTABLE **(APPENDIX I, TABLE 5)**

9.6.1 The First World War saw a rapid development in the use of wireless telegraph for a number of purposes. Experimental and portable sites were set up to test new equipment which was being developed throughout the war. The development from Morse code signals to voice radio (radio telegraphy) was a significant breakthrough and one which allowed a more rapid response to threats from land and sea. Marconi had developed the Short Distance Telephone Transmitter and Receiver by 1914 which could carry voice messages over 70km. Although radio telephony had been developed by 1914 it was not adopted in great numbers during the war due to technological difficulties. First World War W/T test sites listed in National Archives file A1/305/15/226/164 include Biggin Hill and Aldershot.

10 The Character of Wireless Stations

10.1 Introduction

10.1.1 The layout of the First World War wireless stations, their buildings and associated infrastructure were not of a standard type but varied according to their functional role and significance, and their date of construction. Some standardisation of buildings is evident however, both before and during the war. Table 1 (Section 6) describes the 'Typology and Layout' of each site where known, from OS mapping of the period, contemporary documents, historic photography and secondary sources. The findings of this work are summarised below to describe the character of the wireless stations in use during the First World War. Some stations were constructed prior to the war, therefore this section is separated into 'Pre-War' and 'Wartime' wireless stations.

10.2 Pre-war Stations

10.2.1 Some of the sites in use during the war, pre-dated the outbreak of conflict particularly the purpose built sites constructed by commercial companies including Lloyds and Marconi, but also the Navy and GPO (who as explained in Section 6 were early adapters of wireless technology). These sites were not of a standard design but varied according to their location and role, which is shown in the example of two stations in Cornwall situated six miles apart, located at Poldhu (OA.59) and The Lizard (OA.38).

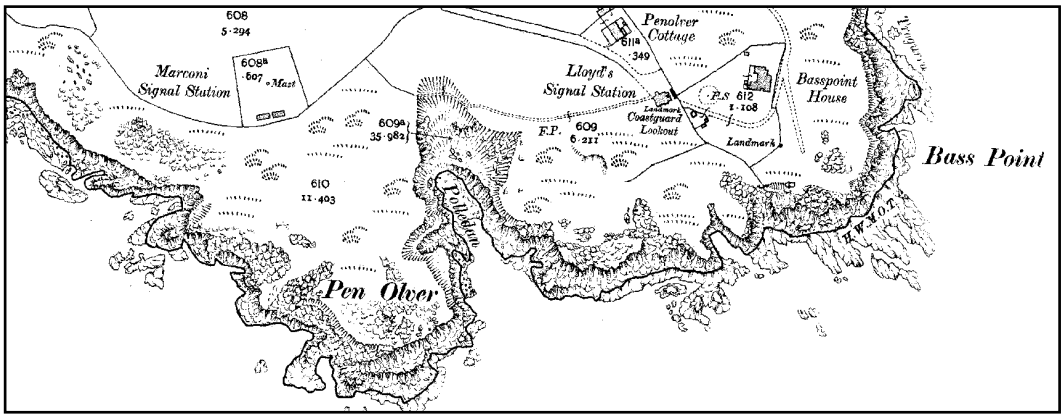

Figure 4: 1907 OS map of The Lizard (1:2,500)

10.2.2 A 1907 OS map of The Lizard shows the Lloyd's station to the east which is part of the Coastguard Lookout (and survives today as a museum), and the Marconi station to the west (Figure 4). The latter consists of two small timber-clad rectangular structures, and a mast surrounded by fence or similar means of enclosure (Plate 4). The buildings are now listed at Grade II, and are described as:

> *Weatherboarded timber-frame. Felt-clad roof with gabled ends; small wooden finials to gables of accommodation hut....Two detached huts adjacent to each other; the radio hut to the east and the accommodation hut to the west. (British Listed Buildings* website*)*

Plate 4: Pre-war Marconi station at The Lizard (© Lizzie Ridout)

10.2.3 This site made history in receiving an early signal from the Isle of Wight in 1901, 186 miles away. Marconi also constructed a station six miles away at Poldhu, which famously sent in 1901 the first transatlantic message to Marconi's station in Newfoundland. The station at Poldhu is shown on a 1910 OS map. Although both Marconi stations are of roughly the same date, the Poldhu station is significantly larger with five-interconnecting buildings, a further building to the rear, eight posts and five masts. The Poldhu station was larger to accommodate its important role in communicating across the Atlantic.

10.2.4 Existing buildings were also adapted before the war as wireless stations, including the station at Caistor-on-Sea (OA.7), a postcard from the 1900s shows an existing building on the High Street with two large masts to the rear (see Plate 3). This station was set up to communicate with ships in the North Sea and the Cross Sand lightship, it closed in 1929 and became the village police station. The size and location of this station demonstrates the limited space needed to establish a wireless station, and the importance of finding the right geographical location. At Poole (OA.60), Marconi established a station at the Haven Hotel in 1899; an image taken from archives at the Bodleian library (MS. Marconi 181) depicts the hotel and large mast with employees gathered beneath (Plate 5). Another undated image within the Marconi archives shows the adaptation of buildings and the importance of locating masts on high ground, as the flat roof of an (unidentified) building is utilised (Plate 6).

Plate 5: The Haven Hotel, Poole (MS.Photogr.b.63(2))

10.2.5 The station at Hunstanton (OA.33) is also shown on a 1920s image on '*Britain From Above*', (see Plate 2), the whitewashed Victorian lighthouse is visible, as is the tall redbrick coastguard tower to the west of the lighthouse. An aerial mast can be seen between these two structures, as depicted within a 1907 edition of the Electrical Engineering magazine. This shows the wiring connecting to the wireless receiver mast, which connects to the coastguard tower. The wireless room is therefore thought to have been located within the coastguard tower. A small rectangular structure can also be seen situated between the tower and mast, which is likely to relate to the operation of the station.

10.2.6 In Old Hunstanton, a building known as 'Hippisley Hut' is located at NGR TF6852742393, this is possibly an old wireless station probably moved from a cliff-top installation after the war. The building consists of two small single-storey structures, both with a pitch roof and large window on the front elevation, on either side of a larger central building. The latter has an overhanging first floor to the front elevation supported on posts, with a long run of windows to the upper level. The building is timber clad with a pitch roof and an ornate barge board. The building in its present form is not immediately apparent in the 1920s image described above, but it is possible that it has been relocated from one of the other four sites identified through archive research (see OA.33). Architecturally, the building is similar (although not identical) in style to the wireless station identified at Culver Cliff (see Plate 10).

Plate 6: Wireless mast on unidentified building (MS.Marconi.181)

10.2.7 Whilst the size and layout of the sites were adapted to meet the role of the station, the sheds used by the Marconi Company appear to have been of a particular and standardised design. Photographs of Clifden and Poldhu show sheds of identical construction, with timber cladding and with an asymmetrical roof (Newland 2012). The stations are functional structures, as evident in an image of the Marconi station at Broomfield

Road, Chelmsford (OA.6) (Plate 7). This station opened in 1903 as a wireless receiver station, and by 1911 was a research station and part of the Marconi training school, continuing in use until the 1960s. The image is unclear but shows several small rectangular structures at the forefront of the picture (which appear to be interconnected), and a mast. These structures have pitched roofs and are possibly brick built with windows. There are also two large pitch roofed structures to the rear, also with windows in the end gables although it is unclear whether these are part of the former Broomfield pottery works which was located next to the wireless station.

Plate 7: Broomfield Road Testing Station, Chelmsford (MS. Photogr.b.63.fols.255–263)

10.2.8 A rare surviving standing wireless station at Cullercoats (OA.15) which dates from 1906 provides material evidence of an early wireless station, and is now Listed Grade II. The following description is taken from the Listed building description:

> *Wireless telegraphy station. 1906, by the De Forest Company for Marconi. Extended c1930 with a wireless station building for HM Coastguard. 1906 building of colourwashed brick with Welsh slate roof and cusped bargeboards. Rectangular plan. Segmental arches over two horned 6/6-pane sashes to S elevation and one to N elevation, to left of later C20 door. Entry in W gable wall. (British Listed Buildings* website*).*

This description shows that early wireless stations were not only simple timber sheds, as evident at The Lizard, but brick-built structures which were afforded some architectural embellishment with segmental arches and cusped bargeboards.

10.2.9 The wireless masts varied in number according to the size and role of the station, and as technology developed different arrangements of masts were experimented with to achieve the best results. At Poldhu for example masts can be seen arranged in a circular plan (Plate 8). These, however, were later destroyed by storms, and were replaced by four large tower aerial supports with a small hut situated centrally within these (Plate 9). Information about the pre-station at Hunstanton shows that it had a 122ft high mast built of planks and bolted together in a design 'very reliable in high winds, but exceedingly strong'. The mast was stepped in concrete and stabilised by three sets of four stays tied to ground anchors formed of long bolts set in deeply buried oak beams. The receiver at the top of the mast was connected by a set of six air-wires to the telegraphic apparatus room ledged in the coastguard tower. The engine and alternator were installed in a wooden outhouse (Lewis and Mackie 2008).

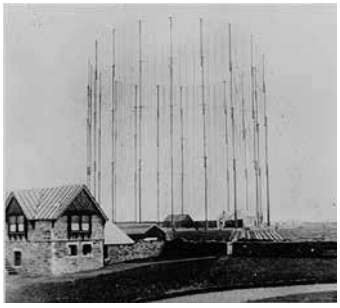

Plate 8: The original circular mast arrangement at Poldhu (Marconi Calling website)

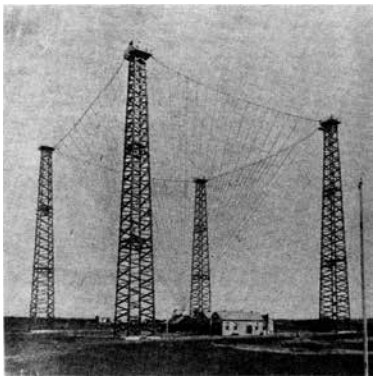

Plate 9: Poldhu dated 1905 with replacement aerials following storm (North America Astro Physical Observatory website)

10.3 Wartime Stations

Layout

10.3.1 Archive research identified several plans of Wartime Wireless sites which provide valuable information about their layout. A letter to Captain Round with specifications for a new site (not identified) asks for two collapsible wooden huts only, one to be used as the wireless hut (2.4m by 3.6m) and one to accommodate personnel (6.09m by 3.65m) (MS. Marconi 335). This shows that these sites were very functional, with basic timber huts for work and accommodation.

10.3.2 A plan of the York site (OA.87) (MS. Marconi 336) (Fig. 5) shows that it measured 120.7m by 129.8m, within this space is a cook house (6m by 3.6m), a guard hut (18.28m by 2.6m) and wireless hut (measurements not given but roughly 13m by 4m). It also shows four small masts and five stay anchors which are surrounded by a hedge. A letter from G Morgan to Captain Round (17th October 1917) (MS. Marconi 336), describes a bench in each hut and a portable stove. The Marconi archives at the Bodleian also include inventories of the 'Captain Round' sites which detail everything from the structures to stationary. These suggest that there were standard types of stations, as each inventory describes within the site an 'A1 station', 'A2 station, 'F1 station', 'BD station', 'JD station', 'J1 station' and 'AD station'. These types require further research.

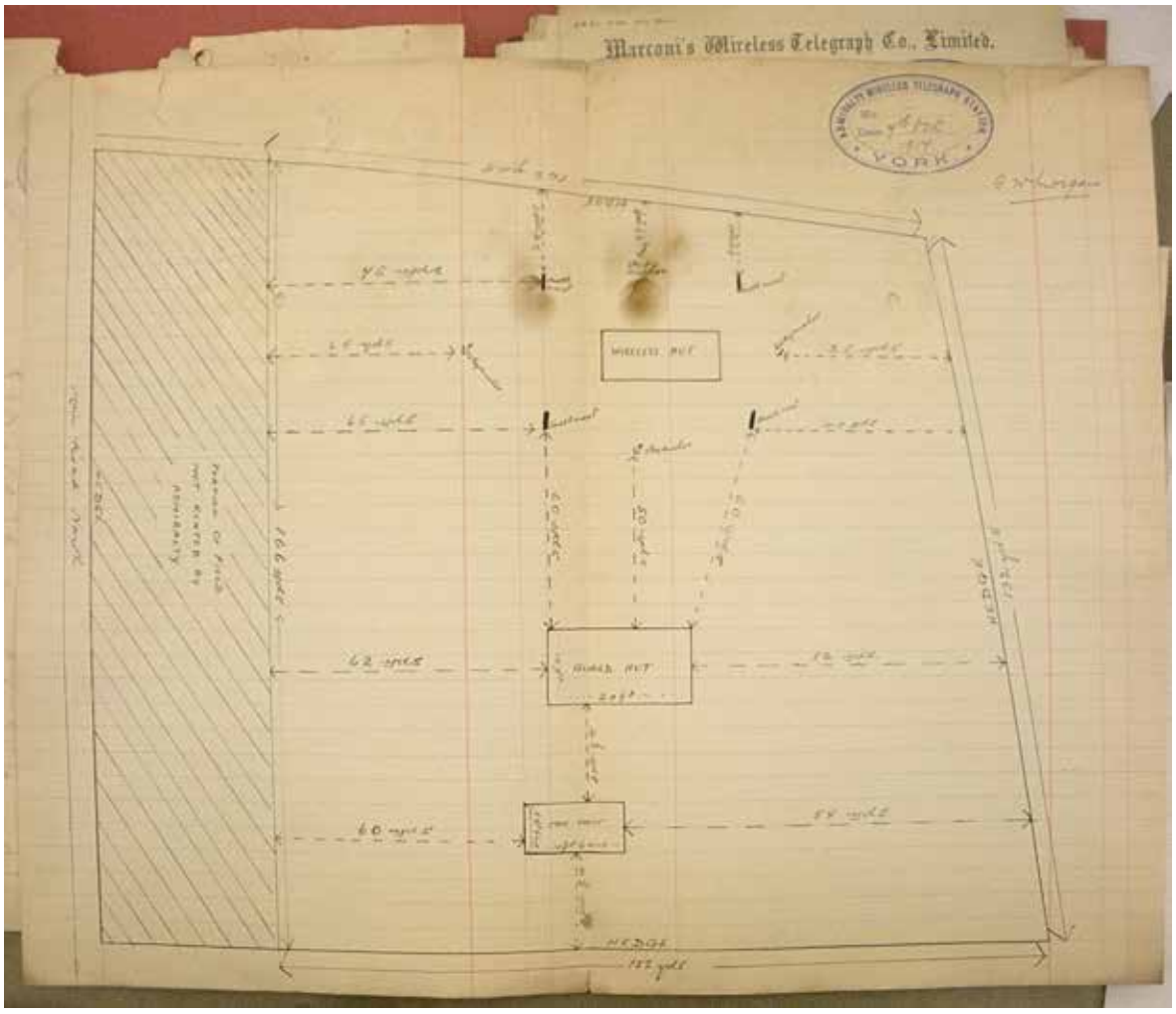

Figure 5: Plan of the York Wireless Station (MS.Marconi336)

10.3.3 The inventory of the Lowestoft (OA.41) station details the following structures (measurements changed from feet to metres):

- Station A1 – two wooden buildings (7.9m by 3.6m) with 5 windows and shutters, and 5 masts
- Station A2 – a wooden building (4.2m by 3m) with 3 windows and shutters, and 1 mast
- Station F1 – two wooden buildings (16m by 3.6m) with 3 windows and 3 shutters and 5 54.8m box masts
- Station F2 – 27.4m by 3.6m wooden cabin with 3 windows and shutters, and a 90ft mast

- Station – same accommodation as F1
- Engine house – wooden building measuring 3.3m by 2.1m, with 2 windows and shutters
- A battery house – a portable wooden building (2.4, by 1.8m)
- A guard room – a wooden building (3.0m by 3.6m, with 4 windows and 4 shutters and 10 wooden bunks)
- 2 canvas tents
- 2 dug-outs
- 4 sentry boxes
- 2 latrines

10.3.4 The York inventory includes the following structures –

- A cabin – used as a landline and 'AD' station (8.22m by 3.96m), which is weather boarded with 3 double and 3 single windows. Cabin divided into 2 rooms with 1 cooking stove and 1 open heating stove
- Cabin – used for F1 and B1 station (4.5m by 3m) with 2 double and 1 single window. It was open plan with a heating stove
- Weather boarded cabin – used for CD and J1 station (6.4m by 3.96m) with 3 double windows. Divided into 2 rooms with an open heating stove
- Cabin – used for BD station (3.65m by 3.35m) with a heating stove
- Guard hut (6.4m by 3.96m)
- Engine house (3.35m by 2.13m)
- Small hut – used as a battery house
- Cabin on 4 small wheels, originally used as a builders' office
- 4 wooden sanitary huts
- 2 old canvas huts
- 1 corrugated iron lavatory

10.3.5 This shows that the York site grew from the site plan dated October 1917 (described above), to a larger site consisting of more wireless huts and related buildings, such as a battery house, accommodation and additional sanitary facilities. In contrast the site at Birchington/St Nicholas on Wade (OA.4) is shown as being considerable smaller. The inventory describes only a 15ft hut with three windows and a stove, and a latrine (MS. Marconi 336). Records at the Bodleian also include plans and elevations of the Sandwich wireless station (OA.67), the site plan shows that there was an engine house, operators hut, and a new crew quarters hut (which is further described below) was proposed (MS. Marconi 339).

10.3.6 Security was a consideration on site. There are several references in text to sites being guarded (both from the enemy and animals that may cause damage), and sites were therefore surrounded by a hedge or fence. The site at Stockton-on-Tees was surrounded by a perimeter fence, with a bed of barbed wire and an internal patrol track (Sockett 1992). Each guard hut had a coke stove, broom, bench and oil lamp (MS. Marconi 337).

10.4 The Wireless Station

10.4.1 The archive research identified further evidence of the internal layout of the operational wireless structures. A plan of a 'Navy 'B' Station Receiving House', also found in the Bodleian dating from 1915, shows a much smaller building than the Sandwich station (Fig. 6) (MS. Marconi 339). It is a small weather boarded hut, with a single door and ventilation louvres in the roof. It has two windows in one of the gable ends, and internally there are long benches running the lengths of the gable ends, a pedestal table and a stove. The wireless

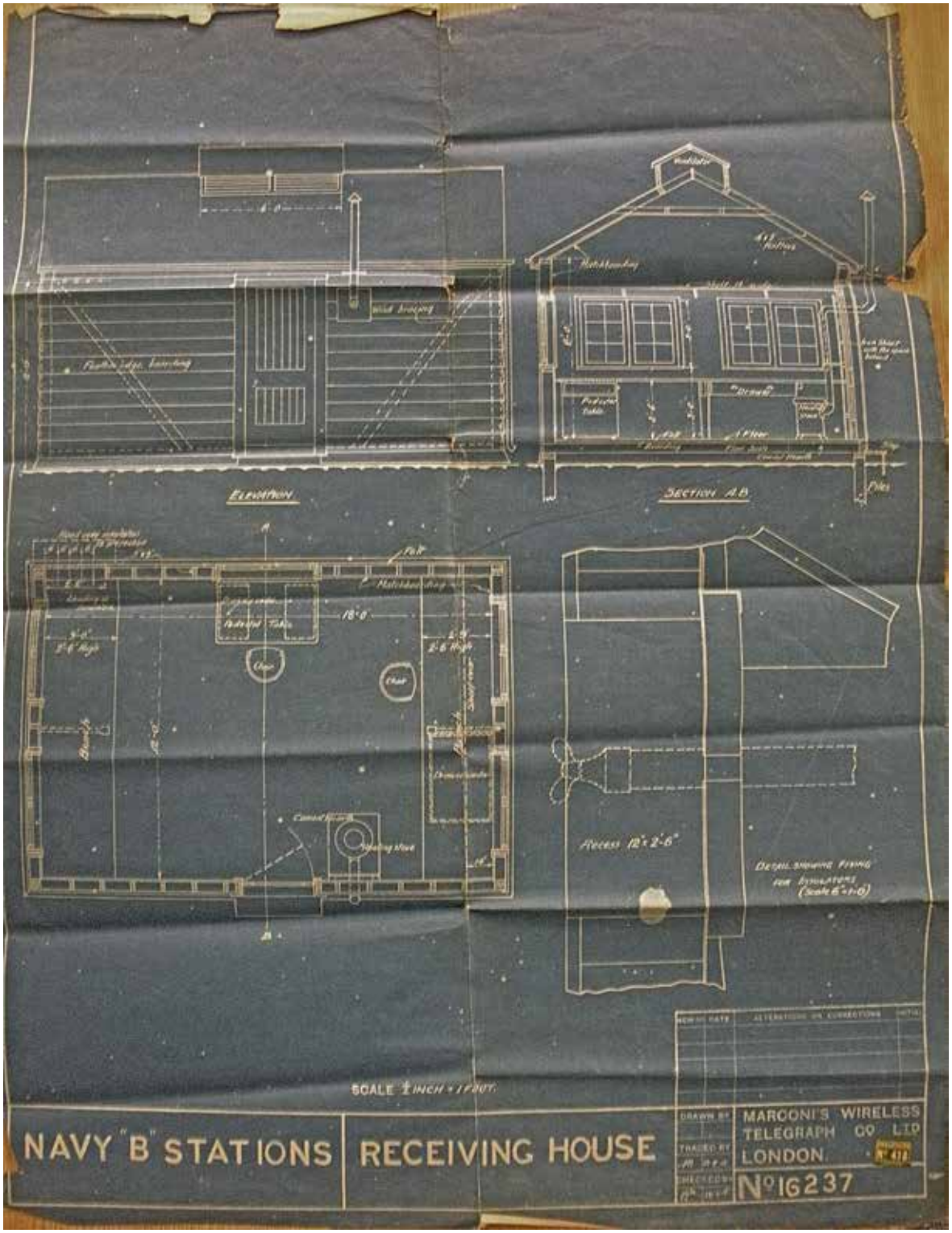

Figure 6: Navy 'B' Stations, Receiving House (MS.Marconi339)

room needed to be dry and well ventilated, and should 'have easy access via a window or bulkhead to the open air' (MS. Marconi 366). This need for ventilation is evident in the plan of the Navy 'B' Receiving House which has ventilation louvres projecting from the apex of the roof.

10.4.2 A quote from a local builder in Aberdeen to Lieutenant Robb (MS. Marconi 336) dated 4th October 1917 provides information about the fixtures and fittings of a wireless station hut proposed in Scotland. It describes the hut as weather boarded with a felt roof and barge boards on gables (MS. Marconi 336). Each hut had four windows with glazed opening parts and internal blinds. Entrance was via double doors. There was a fitted hatch for messages in the gable and a medium-sized stove with cast iron smoke pipe. A bench ran along two sides of the hut.

10.4.3 At Stockton-on-Tees (OA.78), a plan dated 1927 shows that the main accommodation was in a large 'Operations Block', and there was a smaller ancillary building (9m by 4.3m) which housed the power unit. Both buildings have a 'Dutch-Barn' shaped to their roofs, this shape allowed ventilation by expelling fumes from the power source. Above the operations and cipher rooms, the batteries were stored which were accessible by an external ladder. A window at the west end had four equally-spaced apertures of 25.4cm in diameter each below it, to allow the cables from the masts to enter the building. There was also a generator room, battery room, fuel store and storage.

Plate 10: Culver Cliff Wireless Station, 1920 (Britain From Above website, image EPW000794 © English Heritage)

10.4.4 The operations block (17.5m by 6.7m) included working and living space and was heated by three fireplaces. A reconstructed plan of the building shows that immediately opposite the entrance porch was a single bunk room, which may have been for the Duty Officer. A 3.7m square kitchen to the right of the entrance led through to a bunk room with four beds. Stockett (1992) comments that the layout is similar to large warships of the period. Half the building was dedicated to working space, with a large operations room and possible office or cipher room.

10.4.5 The wireless station at Culver Cliff (OA.16) is shown both on historic mapping, and on images from '*Britain From Above*' (Plate 10). The OS mapping shows a small structure within a roughly rectangular enclosure, with no masts identified. The aerial photography depicts quite a substantial structure with several windows, and a probable observation platform. There is a tall mast immediately adjacent to it, and a further mast between it and the coastguard station. This station is very different in character to the timber sheds identified on other sites.

10.4.6 The station at Flamborough Head (OA.26), in contrast with the Culver Cliff station, appears less substantial. Images from the '*Britain From Above*' website show two small structures/huts and several masts visible to the rear of the lighthouse (Plate 11). The east hut has a pitched roof with four masts to the rear, the west hut is smaller but with a taller mast situated adjacent

Plate 11: Flamborough Head Wireless Station, 1928 (Britain From Above website, image EPW023118 © English Heritage)

Plate 12: North Foreland Wireless Station, 1920 (Britain From Above website, image EPW000669 © English Heritage)

to it. Although the image is unclear and difficult to assess, it appears similar in form to the 'Navy 'B' Station Receiving House (described above). The station at North Foreland (OA.52), also situated to the rear of the lighthouse, is shown on '*Britain From Above*' with a single mast, and a pitched roof wireless station situated adjacent to it (Plate 12). This appears to be separated into three connected blocks, with a timber framed block to the west and two probable brick structures to the east.

10.4.7 An image of a wireless station at Holyhead shows the adaptation of existing structures for wireless station, a wireless mast is shown surrounded by a brick wall at the end of a row of terrace houses (Plate 13). A small hut can be seen with a pitched roof, and two windows within the plot which may have served as the operators hut (Bod MS. Photogr. b.63(2)). Marconi correspondence relating to a site in Murcar (Aberdeen) shows that the wireless station and apparatus was installed within rooms at the golf club. At Gosport, a plan dating from December 1914 (Fig.7), shows that a wireless station was within a small room over an arched entrance within Fort Blockhouse (WORK41/487). This provides an example of a wireless station within an established military site, and shows that a station could be accommodated within a small space. The room includes space for a bench, cabinet and hammocks for the operators; the mast was situated externally extending above the height of the roof.

Plate 13: Marconi Wireless Telegraph Station, Holyhead (undated) (MS.Photogr.b.63 (2))

10.5 The Mast

10.5.1 Surviving evidence at the Stockton-on-Tees site suggests that the five masts were probably the Bellini-Tosi type, which were commonly used by the Royal Navy at this time. The size of the mast varied between sites. References identify masts measuring 36.5m in height (MS. Marconi 335), 51.8m in height (MS. Marconi 337) and a 21.3m mast constructed in portable timber (MS. Marconi 335). It was found that a large number of aerials of moderate height were as effective as tall aerials (ScMss143.Box2).

10.5.2 Masts would require wire, stays, insulators, chains and anchors. The aerial was made from stranded copper wire, that communicated at the bottom end with the operating room (MS. Marconi 366). It was necessary for the wire to extend above any metallic objects, and in the case of high winds it was vital that the wire did not blow within 0.6m of any ropes, flags etc. as contact caused leakage with the earth. The 'lead-in' to the operations room had to be insulated to prevent the wires transferring their vibrations to the walls of the operation block, thereby creating impossible conditions for the operators. The valves used in the sets (crystal at first and later 'C' valves) had to be earthed in such a manner that the valve capacity was balanced by the aerial's capacity.

10.5.3 Surviving evidence at Devizes of a steel mast footing and base suggests that 25mm thick plates would have clamped cylindrical steel masts to a plate set into the concrete (Newland 2012).

10.6 Accommodation

10.6.1 Archive research and surviving evidence of wireless stations show that the men working in the wireless stations were accommodated either on site or in local lodgings. On-site accommodation would have been basic, at Flamborough Head (OA.26) it is described as being within bungalows, which included eight iron bedsteads and four chests of drawers, and two showers (MS. Marconi 338).

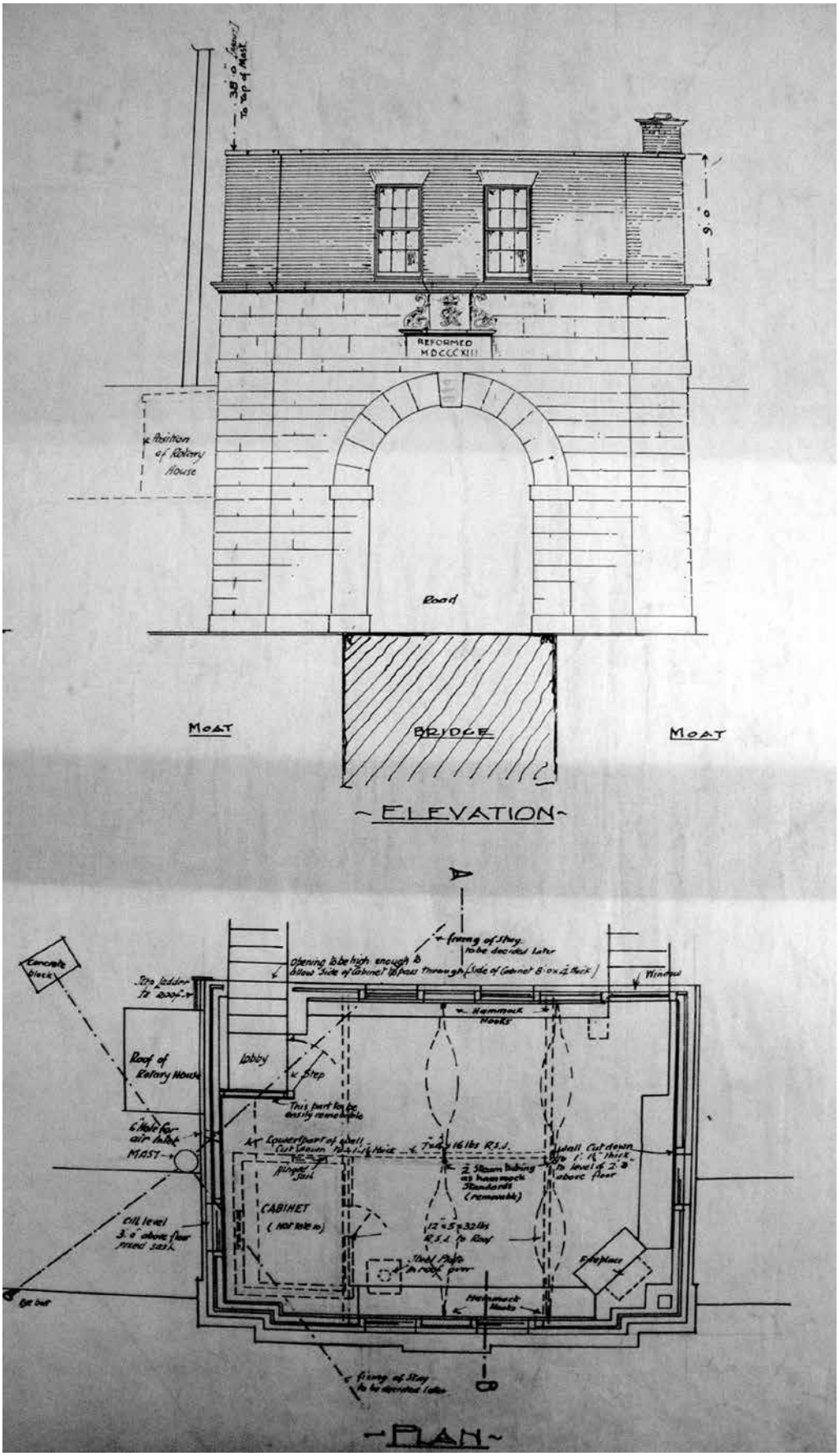

Figure 7: Plan of Gosport Wireless Station, 1914 (WORK41/487)

10.6.2 A surviving accommodation shed from the Bishops Cannings site in Devizes is now extant in Mr Hopgood's garden, whose grandfather recovered the shed prior to its demolition. The Devizes site was part of the IWC, as was the site at Leafield (Oxon) described below. The accommodation shed at Devizes is made of corrugated iron with three doors and four windows, and measures 6m in length although it is thought to have once been longer. The shed shows that it was once divided into 2 rooms with an integral raised timber floor, a stove and chimney and walls insulated with asbestos sheets. It is thought that the shed was once an army hut, and provide very basic accommodation. The buildings at Devizes appear quite temporary in design, and do not follow the architect's plans that are of grander structures (Newland 2012).

10.6.3 The station at Leafield (OA.37), identified on OS mapping (1921), was a large site apparently incorporating two areas, to the north-west of Langley Farm and within the village of Langley itself (Fig. 8). As part of the IWC it linked to Cairo, with the receiver station at Devizes in Wiltshire. A letter discussing the Leafield wireless station dated 23rd June 1915 (IET.T.11954) shows that it was not of the same type as the Devizes station. It states that the accommodation building is 'of wood framing covered with asbestos slabs, and is artificially lit with means of oil or petrol lamps and candles'. The building was occupied by Marconi employees, but was within a Post Office site. The cost of the Leafield station was £37,000, and the Devizes station was £10,000 which includes the costs of infrastructure such as roads and water supply. Leafield was a one way station with potential to convert to a two way station if necessary.

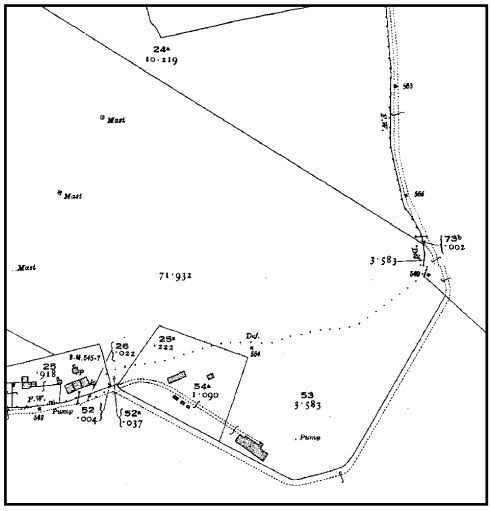

Figure 8: OS Map of Leafield Wireless Station, 1921 (1:2,500)

10.6.4 There are plans and elevations for the proposed 'Hut for Quarters for Crew' at Sandwich (OA.67) which provide further information about the accommodation blocks (MS. Marconi 339) (Fig. 9). The block is weather boarded with four windows, a single door and ventilator in each gable end. Six bunks are shown in a separate 'Sleeping Room', which also has a 'Wash Place'. A lobby provides access to the 'Mess Room' with a range, larder, table and flap table. In the 'Officers Room' is a store, bunk, stove and table.

10.7 Staff

10.7.1 The men used for wireless work were trained, often with previous experience in operating. Amateurs (hams) may also be used who often had a good knowledge of wireless operating. Hunstanton's original staff were all amateurs and were given Royal Navy Reserve titles, such men were absorbed onto the staff of their nearest station. Roles within the wireless station include an officer in charge of station, chief operator, operators in charge of watch, clerk, runners and maintenance, engineers and assisting engineers. At Birchington (OA.4), for example, there was one CPO (Chief Petty Officer), three POs (Petty Officer) and one messenger boy (MS. Marconi 335).

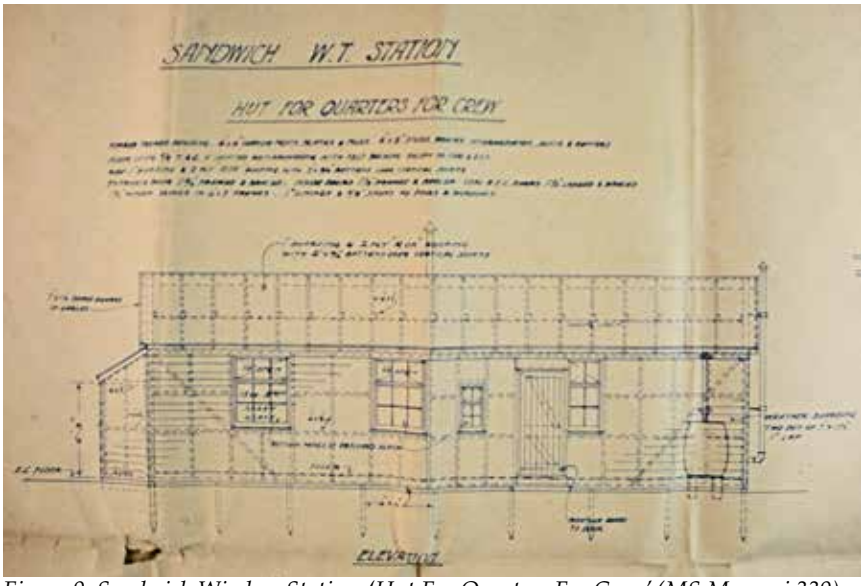

Figure 9: Sandwich Wireless Station, 'Hut For Quarters For Crew' (MS.Marconi.339)

11 The Archaeological Potential of Wireless Stations

11.1 Sites identified as retaining above-ground wireless station structures

11.1.1 The study identified several sites with standing structures, or possible standing structures, which survive from former wireless sites. The survival of above-ground evidence classifies these sites as the best surviving examples of wireless stations that were in use during the First World War. Some have previously been identified on English Heritage's online database, *PastScape*, and some are protected through Listing (Cullercoats and The Lizard), or scheduling of a larger site (Dover Castle). Three sites have already been reported on in journals and books (these are Devizes, Stockton-on-Tees and Hunstanton, as discussed in Section 3.1.3). The fact that the best surviving examples of sites identified in this study have already been reported on, or have already been afforded protection illustrates the effectiveness of our heritage protection mechanisms. The study also identified a further group of sites which have the potential for surviving above-ground evidence, but further investigation is required.

11.1.2 Stockton-on-Tees (OA.78) is an excellent example of a surviving First World War wireless station. It was constructed in 1915–66 and the site incorporates two (possibly three) surviving brick-built structures. Further features survive such as anchor points for five probable masts. The two buildings are converted to residential accommodation, No. 19 Marley Close, and are rare surviving examples within an area of medium density housing. The site is of considerable historical and functional significance as a 'Y' station in the First World. War, intercepting messages and transmissions from Zeppelins over the North Sea, U-boats and surface vessels. The Stockton station was also ideally situated to intercept communications emanating from the German Naval Airship Divisional HQ at Fulsbattel, and, later, from the new HQ at Nordholtz, near Cuxhaven, as well as from German Naval HQ at Kiel. The site has been the subject of a 1992 paper by Sockett entitled 'Stockon-on-Tees 'Y' station'. It is not protected, for example through Listing, but it is identified as being of interest on *PastScape* (No. 611216).

11.1.3 The Port War Signal Station at Dover Castle (OA.19), constructed in 1914, is an excellent example of a surviving First World War station located on a historical significant defensive site, and on a prominent location overlooking the port of Dover (and perhaps, with its large mast, originating as a flag signalling point to ships before being adapted for wireless use). The station is Scheduled as part of Dover Castle (Monument No – 467778), and is open to the public with First World War wireless equipment on display to communicate the functionality of the building to the visitor.

11.1.4 Also part of a Scheduled Monument is the Admirality Signal Station at Garrison Point Fort, Sheerness (OA.72) which is under the ownership of Peel Ports. It is possible that the signal and wireless stations were the same structures, although the station is not individual recognised or described in the scheduling documentation (which requires updating). The signal station is a white cylindrical structure on top of the main fort and forming part of the later (possibly Second World War) larger structure. This station, in addition to the Slough Fort station (detailed below), require further research to more accurately describe the structures and their significance.

11.1.5 At Slough Fort (OA.74) in Kent, it is thought that the structure used as a coastguard station may also have served as the wireless station. This still exists within the Bourne Leisure property and is used as sleeping accommodation although it has not been possible to access it. There may also have been a connection between the tower-like observation blockhouse built on the central fort structure, and the wireless station (Victor Smith pers. comm.).

11.1.6 The station at Devizes (OA.17) retains a standing structure, although this is not *in situ*, having been utilised by a local and now survives within land belonging to Mr Hopgood. The shed is a simple corrugated iron structure, which is thought to have been used for accommodation. Within the site, elements of the station survive such as concrete platforms, which (with the accommodation shed) have been the subject of archaeological interpretation and a recent article by Newland (2012). The site is also of interest in largely retaining the landscape setting of the First World War station, and there is potential for surviving below-ground archaeology to further understand the site. The station is of historical significance. It was originally constructed as part of the IWC, and survived eighteen years of operation, and was passed from the Marconi company to the GPO, the War Office and Signals Corps, and back to the GPO. It was used as a listening station, a D/F station, a long range ship-to-shore station, and as a test bed for wireless technologies (Newland 2012). The site identified as number 1159409 on English Heritage's database, *PastScape*.

11.1.7 The stations at Cullercoasts (OA.15) and The Lizard (OA.38) are excellent examples are surviving pre-war stations that were retained in use during the First World War. Both stations are Grade II Listed. The archaeological potential and historical significance of Cullercoats, which was constructed in 1906 (and added to in 1930), is described in the Listed Building Description as –

> *'an exceptionally early and well-preserved example, grouping with a later and carefully-handled radio station, of a building associated with the initial development of radio telegraphy. It dates from 1906, thus marking the first phase of wireless telegraphy's major contribution towards the twentieth century's scientific-technical revolution.' (PastScape* website*).*

11.1.8 The Marconi station at The Lizard dates from 1901, and is the oldest surviving Marconi station. The site consists of two simple timber structures and a surviving concrete platform for a mast to the north. It has recently been restored by the National Trust, to replicate its appearance in January 1901, when Marconi first received a signal 186 miles (299 km) distance from his transmitter station at Niton, Isle of Wight. As a rare surviving example of an early Marconi station, it is of considerable historical significance, and is of recognised archaeological potential.

11.1.9 The research identified five sites which require further research to determine the possible survival of structures, these are: Malvern (OA.44), Neston (OA.47), Bolt Head (OA.49), Seaham (OA.70), and Cawood (OA.9). Standing structures/features from the wireless station at Malvern may survive, a brick-built station is visible on Google Earth and there is also a small structure directly to the north visible (possibly without a roof), in addition to a minor structure/footprint to the south. The site is identified as a 'First World Telegraphy Station' on *PastScape* (No. 1414854). The site continued in use as a Telecommunications Research Establishment, and it is possible that the brick built structure identified is a listening post.

11.1.10 At Neston, possible concrete platforms or a minor building are visible at the edge of the field, although these may relate to a nearby farm. There is also potential for below-ground archaeology. At Bolt Head a possible small rectangular building survives, although this may relate to probable gun emplacements at the site location. At Seaham a building in the location of a wireless station identified on OS mapping survives, but further investigation is required to determine whether this relates to the wireless station, or whether a more recent structure has been constructed on the footprint of an earlier station. At Cawood possible areas of hard standing and some minor buildings are identifiable immediately to the south-west of the NGR. These may, however, relate to farm buildings.

11.2 Sites identified as retaining standing structures in which wireless stations were located, and which have continued in use

11.2.1 A wireless station is thought to have been located in the grounds of Beaumanor Hall (OA.2), although its exact location is not known. *PastScape* states that there is a box of photos and a site plan available (presumably at the local HER or library). At Poole, The Haven Hotel (OA.60) survives as a hotel, in which a wireless station was set up. A plaque signifies the location of the room but no fixtures and fittings relating to its communications use are thought to survive. At Caistor-on-sea (OA.7), a wireless station was located within Pretoria Villa on the High Street. It was subsequently converted to a police station. It is possible that this building survives, but there is unlikely to be any evidence relating to its use as a wireless station.

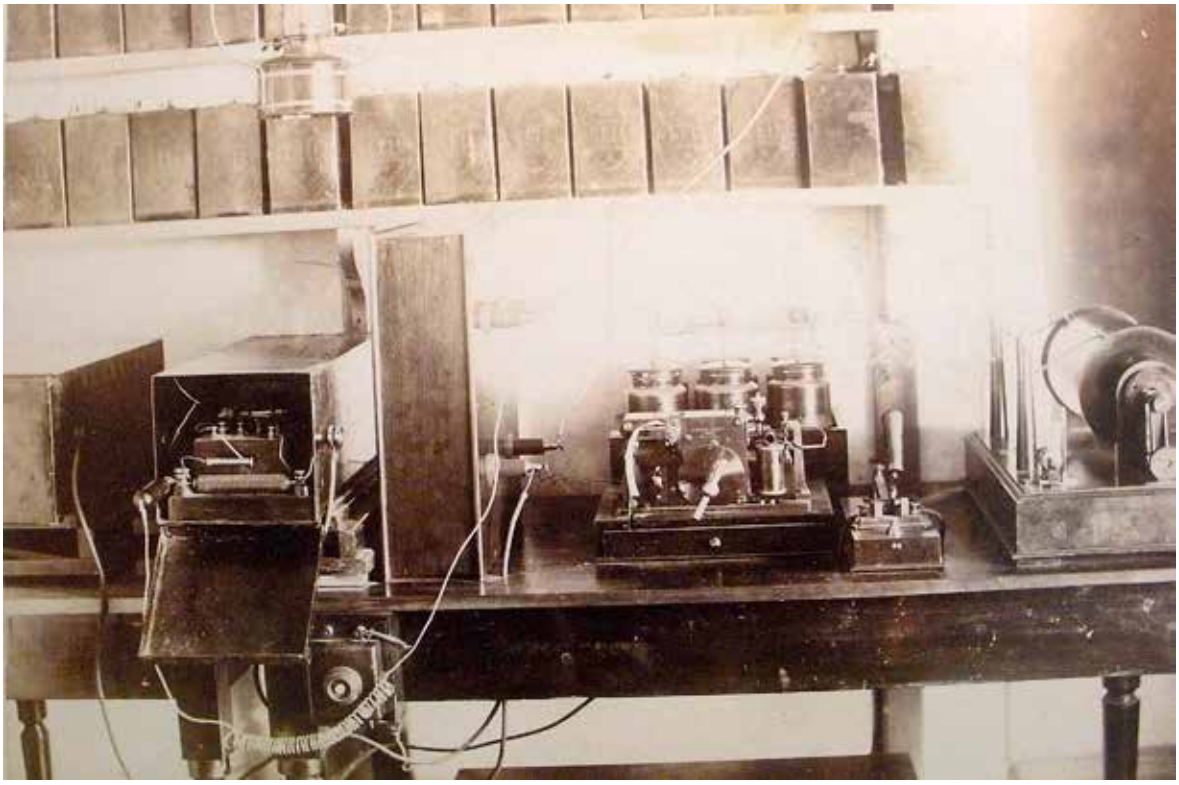

Plate 14: Instrument Room, Marconi Station, Holyhead (MS.Photogr.b.63 (2))

11.2.2 At Prawle Point the 19th-century coastguard station, which survives, is thought to have been used as a wireless station during the First World War. There is archaeological potential for the survival of evidence relating to the wireless station above and below-ground, further investigation is required. At the Isle of Grain (OA.35) a small structure attached to the coastguard cottages survives, and there is a small possibility that this relates to the use of the wireless station. This building is now in use as residential housing. At Lydd (OA.42) the coastguard station survives, which may have accommodated the wireless station. There is potential for below-ground archaeology, and the survival of evidence such as concrete footprints of masts.

11.2.3 At Felixstowe Harbour (OA.23), Shotley Cottage which was used as a wireless station survives but is thought to continue in use as residential accommodation. At Portland Bill (OA.61), 'Lloyds Cottage' is extant and remains in use. There is potential for below-ground archaeology at the site and above-ground archaeology of minor features such as platforms.

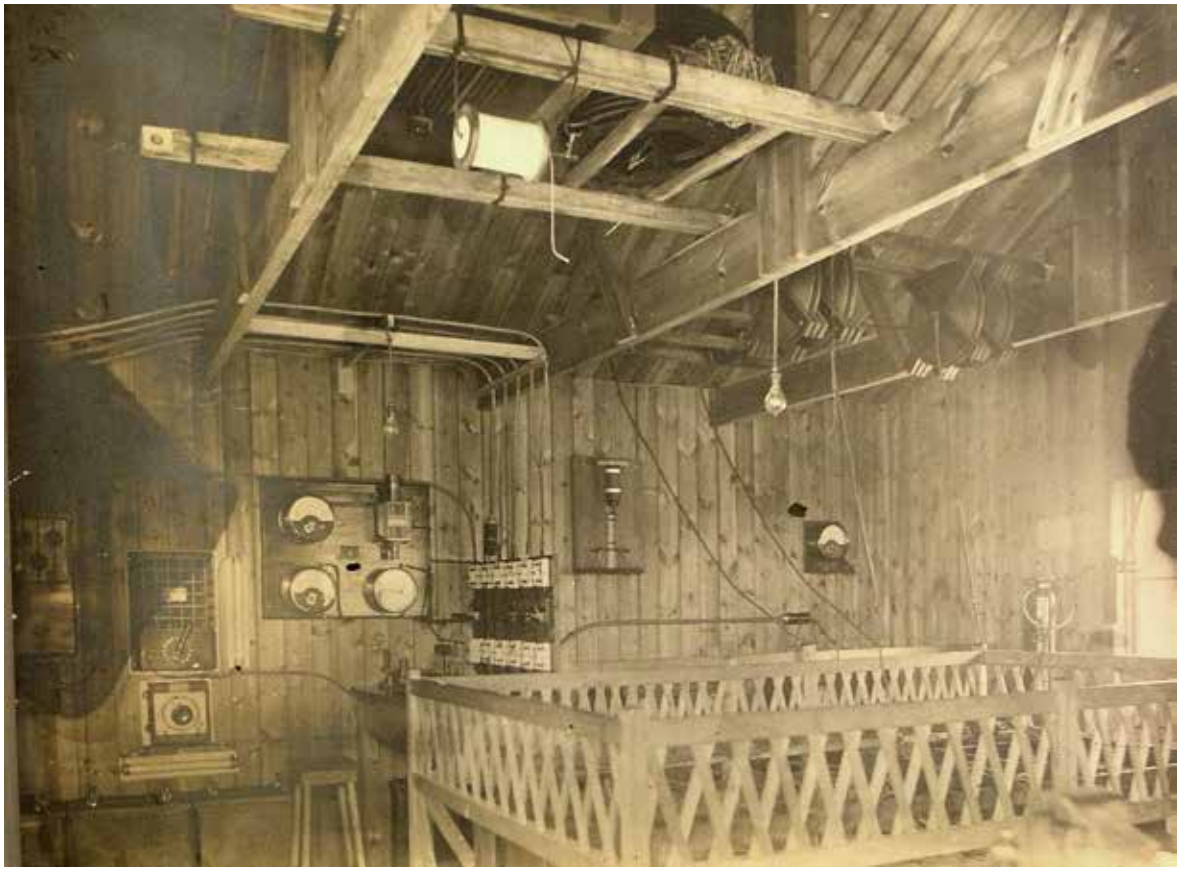

Plate 15: Interior of Marconi Station, Broomfield Road, Chelmsford (MS.Photogr.b.63 (2))

11.2.4 A group of buildings which were the headquarters of Marconi or the Admiralty survive which include Chelmsford, New Street (OA.10), London, The Strand (OA.39) and London, Whitehall (OA.40). The New Street and The Strand buildings are currently being converted (or have been converted) to residential accommodation and Whitehall continues in use. It is unlikely that any fixtures and fittings relating to these buildings operation as a wireless stations survive.

11.2.5 Wireless stations were established at a number of existing military defence sites including Fort Blockhouse, Gosport (OA.28), Perch Rock Battery (OA.56), Puckpool Battery (OA.64), Sheerness Fort (OA.72) and Warden Point Battery (OA.18). These military installations survive, but the location of the wireless station within these sites (with the exception of Gosport), requires further investigation. It is possible that evidence relating to the wireless stations survives, including external footprints for masts etc.

11.3 Sites with archaeological potential for below-ground archaeology, or minor above-ground evidence.

11.3.1 The remote locations, frequently coastal, of wireless stations means that there is considerable potential for below-ground archaeological evidence at a number of sites which are listed below. These sites also have the potential for the survival of minor above-ground evidence not identifiable on Google Earth, such as stays for masts or concrete foundations for buildings.

- Berwick (OA.2)
- Birchington/St Nicholas at Wade (OA.4)
- Bolt Head (OA.5)

- Cambridge (OA.8)
- Crosby Battery (OA.14)
- Culver Cliff (OA.16)
- Flamborough Head (OA.26)
- Frenchman's Point (OA.29)
- Horsea Island (OA.31)
- Hunstanton (OA.33) – this station, established prior to the First World War, played a significant role during the conflict.
- Land's End (OA.36)
- Leafield (OA.37) – this large station which was established as part of the IWC, it played a significant role during the First World War and continued in use through various phases of development until 1986.
- Niton (OA.50)
- North Foreland (OA.52)
- Pevensey (OA.58)
- Poldhu (OA.59) – constructed by Marconi in 1900, the station was dismantled in 1933. It was a large site of considerable significance as the location of the first transatlantic message.
- Rame Head (OA.65)
- Sandwich (OA.67)
- Scarborough (OA.68) – a house is thought to survive from the former wireless site although the site continued in use after the war, and the date of this building is not known and further research is required.
- Sedgeford (OA.71)
- Tynemouth Castle (OA.80)
- Woolwich Common (OA.83)
- Worthy Down (OA.86)

11.4 The archaeological potential of buried artefacts, and surviving artefacts

11.4.1 There is potential for the survival of artefacts at the sites of the wireless stations, particularly in more remote locations. Burial pits may for example contain remains of the wireless sets or discarded valves, that will confirm the types of sets in use and in some instances may be the only physical remains of some set types. Burial pits might also contain domestic debris giving some insight into life in the lonely outposts. Given the remote locations it is possible that wireless equipment would have been left and disposed of on site, rather than transported and disposed of elsewhere. The coastal location, however, means that it is equally possible that equipment may have been tipped over sea which would have been the quickest method of disposal.

11.4.2 As part of this study a number of museums were contacted to determine the level of survival of wireless equipment, to inform the rarity and significance of surviving artefacts. The results of this are detailed in the following Section 12 of this report.

12 Wireless Equipment

12.1 Equipment used in coastal W/T and/or Intercept Stations

12.1.1 Wireless equipment changed and developed during the war, and it is beyond the scope of this report to discuss in detail the type of equipment used. Different equipment was used at sea, in wireless stations, by the Army, and by the Air Force. For example air equipment required a transmitter to be developed which could be used above engine noise, vibration and forms of aerial disturbance (Hartcup 1988). This section provides an overview of the type of equipment used within coastal and intercept stations only, which is the focus of this study.

12.1.2 During the first 18 months of the war the spark transmitters, crystal receivers and magnetic detectors were used. These were satisfactorily used by the Royal Navy and merchant vessels in home waters, but as the war developed longer ranges were needed on the oceans and this led to the adoption of the Poulsen arc. The Poulsen arc was developed in *c.* 1902 for wireless systems and was based on the 'musical arc' developed by English electrical engineer and wireless pioneer William Duddel in the late 19th century. The Poulsen arc system could be used to obtain better results with smaller sets but was developed in parallel with other systems sets so that by the end of 1915 there were 35 different types of transmitters listed as in use by the Royal Navy and 28 receivers (Baker 1970).

12.1.3 By the end of the war, Poulsen arcs had been replaced by radio valve systems. Radio valves were also referred to as vacuum tubes. Experimental radio valve systems existed before the outbreak of the First World War with the most popular systems being developed by Marconi engineer H J Round who also developed radio valves. It was not until about 1916 that radio valves, in particular hard radio valves, began to be produced on an industrial scale. This was first achieved by the French and it is for this reason that some hard radio valves were referred to as "French valves". Marconi soft valves, the C and T, were first commercially produced in 1913. The C was a receiver valve and the T a transmitter valve. One important application of the Marconi C valve was in direction finding receivers and these continued to be used throughout the War until suitable hard valves became available from 1916 (Keith Thrower, pers. comm.).

12.1.4 Another wartime development based on pre-war civilian and scientific research as well as radio valves, was the Marconi Bellini-Tosi D/F. It was first developed by Italian electrical engineers Bellini and Tosi in Paris in 1907, and later purchased and further developed by the Marconi Wireless Telegraph Company and Marconi engineer H J Round. It was initially used as a means of ensuring private wireless communications, these D/F sets were adapted to detect the position of enemy wireless stations. First used on the Western Front in late 1914 and early 1915 to detect the position of German Army wireless stations, wireless D/F stations began to be established on the British east coast (as discussed in Section 7).

12.1.5 Research at the Bodleian Library identified inventories of the wireless stations which detailed the equipment in use for the stations at York, St Nicholas on Wade and Lowetoft. Examples from these inventories, which are lengthy, are included within Appendix 3 of this report.

12.2 First World War wireless equipment held within museums

12.2.1 The following museums were contacted to determine the extent of their First World War wireless collections:

- *Museum of the History of Science, Oxford* – Appendix 4 (Table 7) lists those objects held in the museum within the Marconi collection which are believed to be of First World War in date (those objects shown in bold are definitely considered to be First World War in date). There are probably some general

objects, such as magnetic detectors and radio valves, which date from the first decade of the 20th Century, which remained in use during the war. It is possible that there are other artefacts within other collections that survive within the museum, but these also require further research to identify

- *Science Museum, London* – a list of equipment is included in Appendix 4 (Table 8)
- *Imperial War Museum* – a list of equipment held by the Imperial War Museum is included in Appendix 4 (Table 9)
- *Lizard Wireless Museum* – 1908 Marconi Spark Generator, original Morse Inker (predates 1900 and was not used in the First World War). A spark generator dated 1908 of the sort used on board ships. A valve not directly used on site
- *Royal Engineers Museum* – a list of equipment is included in Appendix 4 (Table 10)
- *HMS Collingwood/Royal Navy Museum of Radar and Communications* – the museum holds the following equipment: Type 2 Transmitter (1914) and used with a Model C receiver (not held), HF transmitter (1918) which is similar to a Type 31, Marconi type 558M Spark Transmitter and a Crystal Receiver Type 5 (1914), a Jackson Transmitter (1896), Spark Transmitter Set Type 5 (1916)
- *The Museum of Technology* – 2 examples of aircraft wireless transmitters (nos A0137 and A0772)
- *Royal Signals Museum (Blandford Camp)* – a list of equipment is included in Appedix 4 (Table 11)

13 Potential for Further Research

13.1.1 The study of wireless technology has considerable potential for future research, it has in the past been examined from a technological and engineering perspective, but little consideration has been given to the topic from a historical and archaeological perspective. There is a considerable body of information available, and further archive research would enhance understanding of the topic both of the other five categories of stations and the coastal W/T and intercept stations.

13.1.2 It was not possible to access all available archive information within the limits of this study, and further desk-based research would greatly enhance understanding. Those documents accessed through this study would also benefit from further interpretation, particularly of the roles of stations and their inter-relationships. The documents show that there was some standardisation of types of stations, but their exact role and how the form of buildings is reflected by these roles is not clear. The interception and D/F stations clearly played a vital role during the conflict, and further understanding of this role both in relation to the topic as a whole and that of individual stations would be of benefit. The relationship between Marconi, the Admiralty, the Army and the Air Force during the war also requires further research, and the extent to which this relationship was based on profit and patriotism.

13.1.3 There is a potential to access further information about individual stations through local history research. Those stations identified on *PastScape* often noted the existence of further records, such as plans and photographs, within HERs (Lands End is one example). Local history groups and historians will also be useful sources of information. The centenary celebrations of the First World War means that the topic would make a timely and popular subject of study.

13.1.4 Wireless communications is a specialised topic, which has a body of professional, academic and amateur historians with a considerable knowledge of information. This knowledge is often of a technological and engineering perspective, and a continued exchange of information between this body and the archaeological and historical body would further enhance understanding. This report has made an initial step towards reconciling these two realms, but there is a large potential to utilise existing information and present it from a layman's perspective.

13.1.5 This report identified an additional five categories of wireless stations which did not form the focus of this study. The Historic Environment Records (HERs) have records for most RFC airfields and RNAS stations, so the general locations if not the specific building of these sites is known. Research to determine the possible survival of these buildings would be of benefit, and would enhance understanding of the role and significance of the stations. Further desk-based research of archived information and secondary sources would also be a worthwhile exercise, information within the 'Defence of Britain' project (Dobinson 2000) for example is likely to be a useful source of information.

13.1.6 This report identified a total of 87 coastal and/or intercept stations, but the locations of all these stations were not identified and requires further research. The use of 'Google Earth' in determining the survival of above-ground archaeology, whilst incredibly useful does have its limitations. Coverage of areas varies, and whilst large structures or footprints of buildings are often identifiable, less sizeable remains are not always clear and difficult to distinguish from their surrounds and from other types of buildings.

13.1.7 A programme of targeted archaeological investigation, including geophysical survey might locate the footings of buildings, masts and anchors. Targeted excavation would add further information about form, layout and date. It may also enhance information about the type of wireless equipment in use, burial pits for example may confirm what types of set were in use and in some instances may be the only physical remains of artefacts. There may also

be remains of domestic debris that would enhance our social understanding of daily life at the wireless stations.

13.1.8 Outside England, there is of course further potential. While Marconi's Cape Cod station has largely fallen over the cliff edge there are local records in the Wellfleet Historical Society Museum (*Stormfax* website). The Clifden Station (at Ballyconneelly, Co. Galway) is well recorded in the Marconi archives, and substantial ground remains of the station survived its burning by the Irish Republican Army (IRA) in July 1922 and can be seen today in a remote bogland setting.

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January 2015

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15 Appendix 2: Additional Types of Wireless Stations

Table 2: Home Defence (RFC) Sites

Station name	Type	Unit/Squadron	Location (where identified in archives)	National Archives Ref
Aldershot	Signals Experimental Establishment	Experimental Signals Establishment - Woolwich Common		A1/305/15/226/164
Basingstoke - Park Prewett	Wireless School	No.1 Wireless School		A1/305/15/226/164
Billericay	R.F.C Early Warning?	R.F.C 39 Squadron - North Weald		A1/305/15/226/164
Burnham	R.F.C Early Warning?	R.F.C 37 Squadron - Woodham Mortimer		A1/305/15/226/164
Canterbury	R.F.C Early Warning?	R.F.C 50 Squadron - Harrietsham		A1/305/15/226/164
Chatham	R.F.C Early Warning?	R.F.C 141 Squadron - Biggin Hill		A1/305/15/226/164
Cliffsend	R.F.C Early Warning?	R.F.C 50 Squadron - Harrietsham		A1/305/15/226/164
Epping	R.F.C Early Warning?	R.F.C 39 Squadron - North Weald		A1/305/15/226/164
Farnborough (South)	Wireless School	No.1 Wireless School	South Farnborough	A1/305/15/226/164
Farnbrough (South)	Wireless School	No.1 Wireless School		A1/305/15/226/164
Harwich	R.F.C Early Warning?	R.F.C 75 Squadron - Elmsett		A1/305/15/226/164
London - Parliament Hill	R.F.C Early Warning?	R.F.C 39 Squadron - North Weald	London - Hampstead	A1/305/15/226/164

Table 2 (continued)

Station name	Type	Unit/Squadron	Location (where identified in archives)	National Archives Ref
London - Staines	R.F.C Early Warning?	R.F.C 39 Squadron - North Weald		A1/305/15/226/164
Netheravon (School)	Artillery and Infantry Co-operation School	Artillery and Infantry Co-operation School	Sailsbury	A1/305/15/226/164
Penshurst Aerodrome	R.F.C Early Warning?	No.2 Wireless School		A1/305/15/226/164
Plumstead Common	R.F.C Early Warning?	R.F.C 39 Squadron - North Weald		A1/305/15/226/164
Putney	R.F.C Early Warning?	R.F.C 39 Squadron - North Weald		A1/305/15/226/164
Redhill	R.F.C Early Warning?	R.F.C 141 Squadron - Biggin Hill		A1/305/15/226/164
Sevenoaks	R.F.C Early Warning?	R.F.C 141 Squadron - Biggin Hill		A1/305/15/226/164
Shoeburyness	R.F.C Early Warning?	R.F.C 37 Squadron - Woodham Mortimer		A1/305/15/226/164
St Albans	R.F.C Early Warning?	R.F.C 39 Squadron - North Weald		A1/305/15/226/164

Table 3: RNAS Aerodromes Sites

Station name	Location (where identified in archives)	National Archives Ref
Anglesey	Gosport	ADM137/4680
Barrow	Isle of Wight	ADM137/4680
Bembridge		ADM137/4680
Caldale	Unknown location	ADM137/4680
Calshot	Nr Southamton	ADM137/4681
Capel	Surrey?	ADM137/4680
Cattlewater	Unknown location	ADM137/4680
Chingford	London	ADM137/4680
Cranwell		ADM137/4680
Dover		ADM137/4680
East Church	Isle of Sheppey	ADM137/4680
Eastbourne		ADM137/4680
Felixstowe		ADM137/4680
Folkestone		ADM137/4680
Grain	Isle of Grain?	ADM137/4680
Gosport Aerodrome		A1/305/15/226/164
Hendon		ADM137/4680
Honton	Unknown location	ADM137/4680
Howden	Yorkshire	ADM137/4680
Killingholme	Lincolnshire (dis airfield nearby)	ADM137/4680
Kingsnorth	Ashford, Kent	ADM137/4680
Lee on Solent		ADM137/4680
Leysdown	Isle of Sheppey	ADM137/4680
London - Wormwood Scrubs	London	ADM137/4680
Manston	Kent	ADM137/4680
Mullion	Cornwall	ADM137/4680
Newhaven		ADM137/4680
Newlyn	Cornwall	ADM137/4680
Plymouth		ADM137/4680
Polegate	Sussex	ADM137/4680
Portland		ADM137/4680
Pulham	Dorset	ADM137/4680
Redcar	Middlesborough	ADM137/4680
Scarborough		ADM137/4680
Scilly Isles		ADM137/4680
South Shields		ADM137/4680
Walmer	Kent (near an airfield)	ADM137/4680
Westgate	Kent	ADM137/4680
Whitley Bay		ADM137/4680
Yarmouth	Norfolk	ADM137/4680

Table 4: RFC Aerodromes Sites

Station name	Unit/Squadron	National Archives Ref.
Andover	R.F.C Southern Training Brigade, 36th Wing, 105 / 106 Squadron	A1/305/15/226/164
Anesbury	R.F.C Southern Training Brigade, 36th Wing, 104 Squadron	A1/305/15/226/164
Ashford	R.F.C Wye (Home Defence and Training Airfield)	ADM 137/4699
Beaulieu	R.F.C station (East Boldre)	ADM137/4680 (book S.561)
Beakesborne (Corr. Bekesbourne) Aerodrome	R.F.C 50 Squadron - Harrietsham	A1/305/15/226/164
Beverley	R.F.C station	ADM137/4680 (book S.561)
Biggin Hill Aerodrome	R.F.C 141 Squadron - Biggin Hill (LONDON AIR DEFENCE AREA)	A1/305/15/226/164 & ADM 137/4680
Boscombe Down	R.F.C Southern Training Brigade, 36th Wing, 6? Training ? Station	A1/305/15/226/164
Bramham Moor	R.F.C station	ADM137/4680
Brooklands	R.F.C Station	ADM137/4680
Bury	R.F.C 190/191 Training Squadron	A1/305/15/226/164
Catterick	R.F.C Northern Training Brigade, 19th Wing, 115 Squadron/ 46/53?/76 Training Squadron	A1/305/15/226/164
Cramlington	R.F.C station	ADM137/4680
East Retford	R.F.C 199 Training Squadron	A1/305/15/226/164
East Retford	R.F.C 200 Training Squadron	A1/305/15/226/164
Filton		ADM137/4680
Gainsbrough (Kleh?)	R.F.C 33 Squadron - Gainsborough	A1/305/15/226/164
Hadleigh	R.F.C 75 Squadron - Elmsett	A1/305/15/226/164
Hainault Farm	R.F.C 44 Squadron	A1/305/15/226/164
Harlaxton	R.F.C Northern Training Brigade, 24th Wing, 20/53/64 Training Squadron	A1/305/15/226/164
Hylton	R.F.C 36 Squadron - Newcastle	A1/305/15/226/164
Kilnsea, Humber	R.F.C 33 Squadron - Gainsborough	A1/305/15/226/164
Lake Down	R.F.C Southern Training Brigade, 33rd Wing, 107/108/109 Squadron	A1/305/15/226/164
Marham	R.F.C 51 Squadron	A1/305/15/226/164
Milton Mobray	R.F.C 38 Squadron	A1/305/15/226/164
Narborough	R.F.C Eastern Training Brigade, 7th Wing, 83? Squadron /25/69 Training Squadron	A1/305/15/226/164
Newmarket	R.F.C 192 Training Squadron	A1/305/15/226/164
Northolt	R.F.C station	ADM137/4680
North Weald	R.F.C 39 Squadron - North Weald	A1/305/15/226/164

Table 4 (continued)

Station name	Unit/Squadron	National Archives Ref.
Norwich	R.F.C Eastern Training Brigade, 7th Wing, 9 Training Squadron	A1/305/15/226/164
Old Sarum	R.F.C Southern Training Brigade, 33rd Wing, 58/99/103 Squadron	A1/305/15/226/164
Port Meadow, Oxford	R.F.C station	ADM137/4680
Rendcombe	R.F.C station	ADM137/4680
Ripon	R.F.C 76 Squadron	A1/305/15/226/164
Rochford	R.F.C 61 Squadron	A1/305/15/226/164
Rochford	R.F.C 198 Training Squadron	A1/305/15/226/164
Scampton	R.F.C station	ADM137/4680
Seaton Carow	R.F.C 36 Squadron - Newcastle	A1/305/15/226/164
Sedgeford	R.F.C Eastern Training Brigade, 7th Wing, 110 Squadron	A1/305/15/226/164
Shawbury	R.F.C station	ADM137/4680
Spittlegate	R.F.C Northern Training Brigade, 24th Wing, 15/37/50 Training Squadron	A1/305/15/226/164
Stonehenge	R.F.C Southern Training Brigade, 33rd Wing, 3? Training Station	A1/305/15/226/164
Sutton Farm	R.F.C 78 Squadron	A1/305/15/226/164
Ternhill	R.F.C station	ADM137/4680
Thetford	R.F.C Eastern Training Brigade, 25th? Wing, 12/25? Training Squadron	A1/305/15/226/164
Throwley	R.F.C 112? Squadron	A1/305/15/226/164
Throwley	R.F.C 143 Squadron	A1/305/15/226/164
Upavon	R.F.C station	ADM137/4680
Waddington	R.F.C Northern Training Brigade, 27th Wing, 4? / 44/48/51 Training Squadron	
Wyton	R.F.C Eastern Training Brigade, 25th? Wing, 31/55 Training Squadron	
Yatesbury	R.F.C Southern Training Brigade, 28th Wing, 13/16/17/66 Training Squadron	

Table 5: Lightships

Station name (county)	Type	National Archives Ref.
Cross Sands Lightship	Trinity House	ADM137/4680
East Goodwin Lightship	Trinity House	ADM137/4680
Gull lightship	Trinity House	ADM137/4680
South Godwin lightship	Trinity House	ADM137/4680
Sunk lightship	Trinity House	ADM137/4680
Tongue lightship	Trinity House	ADM137/4680

Table 6: Experimental Portable

Station name	Unit/Squadron	National Archives Ref.
Aldershot (Portable)	Experimental Signals Establishment - Woolwich Common	A1/305/15/226/164
Portable near Woolwich		ADM137/4680
Test Park, Biggin Hill	Experimental Signals Establishment - Woolwich Common	A1/305/15/226/164
Woolwich Common (Portable)	Experimental Signals Establishment - Woolwich Common	A1/305/15/226/164
Woolwich Common	Experimental Signals Establishment - Woolwich Common	A1/305/15/226/164

16 Appendix 3: Contemporary List of Wireless Equipment

Research at the Bodleian library identified inventories of the wireless stations, that detailed the equipment in use for the stations at York, St Nicholas on Wade and Lowetoft. The following list of equipment is identified as being in use at the Flamborough Head station in 1918 (MS Marconi 338).

- Small masts, insulators, aerials, insulators, stays and fittings
- Leading in insulators
- Buzzer board and condenser No. 115887 (buzzer, switch and two cells)
- 10 teak wall blocks (for wiring)
- air condensers Nos. 120882, 122174 & 119220
- 2 aerial cut-out switches Nos. 122484, 122486
- 1 earth arrester
- 1 direction finder No. 99919
- 1 coupling coil No. 1161158
- 1 ultra magnifier (in box) No. 110552
- 1 rectifier no118997 (transformer No. 106849) including 1 Weston voltmeter
- 1 magnifier panel (2nd & 3rd magnifications) No. 117629 (transformer Nos. 114121, 110563) including 1 Weston voltmeter
- 18 EPS 6 volt accumulators
- W? boxes (200 volts) Nos. 118475, 118478, 118474, 118482 & 118476
- Pair of telephones & leads Nos. 47755, 49988, 47380 & 5?0217
- S? type valve
- 1 50 volt W?T testing lamp
- 1 Weston voltmeter or testing
- 1 complete set of wiring including 'phone lead connection
- 1 Hicks Hydrometer

This list of equipment is described as 'Wireless gear in use at various stations' (MS Marconi 338).

AD/B? Station

- 1 Old two point earth arrester?
- 4 Partition insulators
- 1 Buzzer box No. 49430?
- Disc Condenser No. 43841? with calibration card, used in conjunction with buzzer box
- D.P.D.T switches on ebonite base
- Aerial tuning condensers, Air 003 W.F capacity, See 80413 and 80415
- 1 Billi Condenser No. 140483
- 1 Direction finder No. 43909
- 1 Disc condenser No. 84019
- old jigger
- Air tuning condenser ? W.F capacity No. 103686
- ? A receiver No. 135921
- 200 volt W.T battery box No. 75587
- Universal transformer No. 159159
- 1 400 ohm potentiometer on an ebonite base

- 1 ? valve holder with adjustable resistance No. 100776
- 1 Ditto No. 95880
- 1 Universal transformer No. 98237
- Telephone transformer No. 74423
- Pair Browns double head phones
- various cleats and wire

F1/? Station

- Partition insulators
- Old two point earth arrester?
- A ? Two pair switch No. 153923
- Aerial tuning condenser air, 0008, Kel 15500T
- ? Jigger on ebonite former
- Old ? Receiver fitted with iron
- 1 Universal transformer No. 136229
- 400 ohm potentiometer
- Double note magnification Board complete No.1 00204
- 1 240 volt W.T battery box No. 84120
- Pair Browns double head phones

F3? Station

- 1 Partition insulators
- 1 Aerial ? ? Insulator on ebonite former
- 1 Aerial tuning condenser air, 0008 W.T capacity No. 143972
- 1 Intermediate tuning condesnor ?? To A.T.G Con W.W 183974
- 1 ? Jigger on ebonite former
- 1 ? ? ? 7.M.F valves and 1 ? for valves
- 1 10 ohm series resistors, adjustable
- 1 400 ohm potentiometer
- ??
- 1 100 ohm potentiometer
- 1 Universal transformer No. 95619
- 1 ? Valve holder with adjustable series resistance No. 95073
- 200 ohm potentiometer
- Telephone tranformer No .84499
- 1 200 volt W.T battery box No. 84921
- 1 Pair Browns double headphones
- various cleats and wires

C1 Station

- Partition insulators
- Tight coupled Direction Finder No. 92287
- Porcelain D.P.D.T switches
- Weston Calvo No. 962
- Double tube bill condenser
- Jigger with recation cell

- 1 Clockwork driven condesnor – 003 M.F capacity
- Short wave jigger on ebonite format with reaction coil
- 55 Receiever No. 155349
- 1 Telephopne transformer No. 63614
- Q valve holder with adjustable series resistance No. 95678
- Universal transformer No. 97503
- Q valve hilder (typo) with adjustable series resistance No. 95677
- Telephone transformer No. 877005
- 200 volt W.T battery Box No. 87242
- 1 Pair Browns double headphones
- various cleats and wires

J1 Station

- Partition insulators
- 1 Clockwork driven condensor.003 M.F capcity No.
- Clockwork in a H.T battery box No.
- D.P.D.T switches on a porcelain base
- S.P two way switch on wooden base
- 1 Jigger with reaction coil
- 1 Weston Calvo No. 559
- 1 55 Receievr No. 152673
- 1 Telephone transformer No. 87004
- 1 Q valve holder with adjustable series resistance No. 95679
- 1 400 ohm potentiometer
- Universal Type tranformer No. 147680
- 1 200 volt H.T battery box No. 83632
- Single note magification board complete No.107192
- 1 Pair Browns double headphones
- various cleats and wires

BD Station

- Partition insulators
- 1 Buzzer box No. 105854
- 1 High note shunted buzzer No. 142933
- 1 Disc condensor No. 65290
- 2 D.P.D.T switches on ebonite base
- 1 Aerial tuning condenser air, 0008 M.F capacity No. 155008
- 1 Ditto No. 154756
- 1 Billi Condenser No. 140455
- Loose coupled Direction Finder No. 146656
- 1 Jigger on ebonite former
- 1 Disc condensor No. 105260
- 1 55 Reciever No. 163382
- 1 Universal transformer No.147679
- Q valva holder with fixed resistance No. 145007
- 400 ohm potentiometer

- 1 Universal transformer No. 149383
- Double note magnification Board complete No. 107069
- 1 200 vol H.T battery box No. 83637
- Pair Browns double headphones

17 APPENDIX 4: WIRELESS EQUIPMENT HELD WITHIN ENGLISH MUSEUMS

Table 7: The Museum of the History of Science, Oxford

Inven-tory No.	Summary
35386	Silver Table Lighter With Case, by Alfred Foster, London, 1912
22136	Forward 'B' Spark Wavemeter No. 1339, by War Department, Britain, c. 1918
78507	Townsend Wavemeter, by Marconi Company, London, c. 1918
92109	Townsend Wavemeter, by Marconi Company, London, 1918
12772	Forward Spark 'B' Wavemeter No. 1511, by War Department, Britain, c. 1918
71985	Empty Case Of Forward Spark 'B' Wavemeter No. 2001, by War Department, Britain, c. 1918
88505	Empty Case Of Forward Spark 'B' Wavemeter No. 1360, by War Department, Britain, c. 1918
37889	Empty Case Of Forward Spark 'B' Wavemeter, by War Department, Britain, c. 1918
46600	Short Wave Receiver Type CM294C, by Marconi Company, USA, 1917
39440	Amplifier Type 91, by Marconi Company, London, c. 1918
37413	Ladies' Silver Pocket Scent Bottle, by Charles Perry & Company, Birmingham, 1911
86740	Silvertown Condensor, by GEC?, London, 1918
94035	Experimental Two-Valve Set, c. 1916
89862	Telephone Jigger Box, by Marconi Company, London, c. 1916
76048	Experimental Two-Valve Set, c. 1916
56341	Forward Spark 'B' Wavemeter No. 2006, by War Department, Britain, c. 1918
44893	Short Wave Tuner & Amplifier No. 17, by Robert W. Paul, London, c. 1915
61008	Portable Valve Transmitter, by Marconi Company, London, 1919
99012	Marconi Crystal Receiver With Valve, by Marconi Company, London, c. 1916
20815	Marconi Bellini-Tosi Direction Finder, by Marconi Company, London, c. 1916
56721	Marconi Commemorative Plaque, by D. Sodini, Florence, 1911
23050	Marconi Commemorative Plaque, Rome, 1912
33191	Marconi Radio Valve Type Q, by Ediswan, London, c. 1916
32845	Round Radio Valve Type CA, by Ediswan, London, c. 1915
59017	Osram-GEC Radio Valve Type R4, by Osram-GEC, English, c. 1916
35122	Round Radio Valve Type CA, by Ediswan, London, c. 1915
94475	Marconi Radio Valve Type R, by Marconi Company, English, c. 1916
80773	Osram Radio Valve Type R, by Osram, English, c. 1918
96640	Osram-GEC Radio Valve Type R4, by Osram-GEC, English, 1917
27357	Marconi Radio Valve Type Q, by Ediswan, London, c. 1918
45902	Marconi Radio Valve Type Q, by Ediswan, London, c. 1918
73073	Fama Radio Valve Type R, by Fama, Holland, c. 1916
13117	Round Radio Valve Type CA, by Ediswan, London, c. 1915
39244	Round Radio Valve Type N, by Ediswan, London, c. 1915
24865	Experimental Round Radio Valve Type CA, by Ediswan, London, c. 1915
22293	Round Radio Valve Type N, by Ediswan, London, c. 1915
50748	Siemens & Halske Experimental Radio Valve, by Siemens & Halske, German, c. 1917
63794	Marconi Crystal Receiver Type 16, by Marconi Company, London, 1916
66117	Tuning Condenser, by Marconi Company, English, c. 1916
98095	Tuning Condenser, by Marconi Company, English, c. 1915
18093	Tuning Condenser, by Marconi Company, English, c. 1915
75237	Tuning Condenser, by Marconi Company, English, c. 1916
34701	Tuning Condenser, by Marconi Company, English, c. 1916
48535	Tuning Condenser With Capacitor Box, by Marconi Company, English, c. 1916
96057	Tuning Condenser, by Marconi Company, English, c. 1916
69944	Small Tuning Condenser, by Marconi Company, English, c. 1916
78859	Marconi Bellini-Tosi Direction Finder, by Marconi Company, London, c. 1916
96891	Facsimile of Daily Sketch of April 16, 1912, Reporting the Titanic Disaster
65827	Painting (Oil on Canvas, Framed) of Guglielmo Marconi, by Gustave Muranyi, 1914
23434	Instruction Manual For The Marconi Direction Finder Type No. 6, by Sanders Phillips & Company, London, c. 1916

Table 7 (continued)

Inven-tory No.	Summary
39535	Instruction Manuals For Marconi Crystal Receiver Type 16, by Marconi Company, London, c. 1916
94575	Painting (Oil on Canvas, Framed) of Guglielmo Marconi, by Albert Chevallier Tayler, London, 1912
56351	Proof Print (?Lithograph) of a Portrait of Guglielmo Marconi, by G. B. Black, London, c. 1914
29140	Large Rotary Converter, by Electric Construction Company, English, 1915

Table 8: The Science Museum, London

Objects in grey rows may have been disposed or are in the process of being disposed.

Object Number	Collection	Date Made	Description
1921-112	SCM - Radio Communication		Long wave tuner Mk IV No. 10 (2500 - 10500 metres)
1921-113	SCM - Radio Communication		Short wave tuner Mk III No. 98 with 4 inert cells
1921-116	SCM - Radio Communication		H.T. W.T. unit, 100 watt, No. 416
1921-118	SCM - Radio Communication		W.T. station tester, Mk II, No. 1097
1921-120	SCM - Radio Communication		Amplifier, valve, C Mk IV, No. 2378
1921-372	SCM - Telecommunications		German field telephone, World War I, No. 6991
1921-373	SCM - Telecommunications		Office Fullerphone, Mk I, ebonite base of relay broken
1921-627	SCM - Radio Communication		Wavemeter, wireless telegraphy, German No. 469
1921-629	SCM - Telecommunications		Thirty-line telephone switchboard (together with Ericsson table telephone)
1921-629 Pt1	SCM - Telecommunications		Thirty-line Telephone Switchboard
1921-629 Pt2	SCM - Telecommunications		Ericsson Telephone Handset
1922-458	SCM - Telecommunications	before 1922	Pair telephone head receivers, No. 4000 Sullivan's Patent
1922-463	SCM - Telecommunications		Repeating coil, marked 7188
1924-11	SCM - Telecommunications		Telephone magneto field, box type
1924-12	SCM - Telecommunications		Lamp and buzzer set combination, in case, by Siebt
1924-13	SCM - Telecommunications		Telephone buzzer and magneto, field pattern, German
1924-16	SCM - Telecommunications		Five-line portable exchange (test panel)
1924-18	SCM - Telecommunications		Twenty-line switchboard, magneto cord
1924-19	SCM - Telecommunications	1917	Field induction telegraph set, 1917 model
1924-20	SCM - Telecommunications		Power buzzer, experimental type No. 211
1924-23	SCM - Telecommunications		Power buzzer, German
1924-24	SCM - Radio Communication		2-valve amplifier, type EV 89, No. 10,073
1924-162	SCM - Radio Communication		Lefroy tuner
1924-163	SCM - Radio Communication		Wired wireless sets, B. C. and D.
1924-165	SCM - Radio Communication		Amplifier, valve Mk 1 No. 40
1924-167	SCM - Radio Communication		Type W. aircraft transmitter
1924-168	SCM - Radio Communication		Two valve amplifier, Mk. III, complete with one white valve and audion valve

Table 8 (continued)

Object Number	Collection	Date Made	Description
1924-169	SCM - Radio Communication	1917	C.W. transmitter/receiver, Mk.1, also known as Trench set C.W.Mk.1, possibly made by H W Sullivan, England, 1917
1924-176	SCM - Telecommunications		D.MK 111 telephone set
1924-177	SCM - Radio Communication		120-watt set, Mk.1.
1924-180	SCM - Radio Communication		Rotary spark gap for lorry set
1924-189	SCM - Radio Communication		French 8-valve amplifier
1924-190	SCM - Radio Communication		French Amplifier with 4 horn type valves (one broken) (Two valves reported as deficient and written off by Treasury authority). 19.1.1938.
1924-194	SCM - Telecommunications		Western electric screening set
1924-195	SCM - Telecommunications		Fullerphone, P.O. pattern 237A
1924-361	Disposal - ScM		Fragments of damaged insulator from Leafield wireless station.
1924-496	Disposal - ScM		Tune A receiving jigger No.18
1924-597	Disposal - ScM		Model of 820ft wireless mast at Empire Wireless Station, Rugby.
1924-598	Disposal - ScM		Relief model of Empire Wireless Station, Rugby.
1926-585	SCM - Radio Communication		Specimen of high frequency cable 6561 wire, as supplied to Rugby wireless station
1948-282	SCM - Radio Communication		Scale model of W S 10 trailer van
1959-192	Disposal - ScM		Transmitting jigger in wooden box
1959-224	SCM - Radio Communication	1900-1950	Large main jigger (oscillation transformer) in wood case (No. 72260), made by Marconi's Wireless Telegraph Company Limited, Chelmsford, 1900-1950
1975-532	SCM - Radio Communication	1922	Card of authority to use portable receiver, issued by GPO in 1922. Issued on April 13 1922 to the Hon. E H Cozens-Hardy, of Letheringsett Hall, Holt, Norfolk. The card reads 'The bearer, the Hon E H Cozens-Hardy of Letheringsett Hall, Holt, Norfolk, has been authorised by the Postmaster General to conduct experiments with portable wireless receiving apparturs within a radius of ten miles of (1) Messrs Pilkington Bros Works, St Helens, (2) Letheringsett Hall, Holt, Norfolk (but not withing one mile of any Government wireless station)
1998-867	SCM - Telecommunications	1880-1920	General Post Office Type B landline telegraph relay capable of regeneration, 1880-1920

Table 9: Imperial War Museum

Draft Log by R J Howes, A W Fisher, D C Willis
First brief listing of Sub-collection of World War 1 Equipment in Duxford B285 Room1 – made 9 March 2011 updated 22 July 2011
Note: at this stage the application term 'Line' includes both speech telephony and Morse code telegraphy equipment
Note: the condition of some pieces are poor or incomplete (details to be logged later).

Comments	Description	Country	Application	Date or era
	Handlamp	British	Lighting	1918
like com 507	WT sets forward spark 20W TX 'B' MKII Front	British	Wireless TX	1917
	Power buzzer amplifier	British	Line	1918
	Shortwave sets No. 230	British	Wireless RX	1915
goes with com3	WT sets forward spark 20W RX MKII Rear (2 valves)	British	Wireless RX	WW1
used with WT stations	Wireless equip sets trench CW selector	British	Wireless	WW1
goes with com74 or 27	Wilson 130 Watt TX (with motor fitted)	British	Wireless TX	1914
goes with com15	WT sets forward spark 20W TX 'B' Part A MKII ant base	British	Wireless TX	WW1
	Micro-ammeter 0-40uA	British	Instrument	WW1
	Wireless tuner 300-1500 metres	British	Wireless RX	WW1
used with WT stations	Station tester MKII	British	Wireless	1915
used with WT stations	Station tester MKII	British	Wireless	1915
	Wavemeters No.3 RAF 300-4000 metres	British	Wireless	post 1918
	Switchboard unit buzzer visual 5+3 lines	British	Line	1917
	Accumulator box 10 Volt 9 Ampere hours	British	Wireless	1918
spark gap tester	Forward sets B spark tester 80 metres front (quantity 4)	British	Wireless	WW1
used with WT stations	Forward spark B wavemeter (crystal detector)	British	Wireless	1917
goes with com14	WT sets forward spark 20W TX 'B' MKII TX Rear	British	Wireless TX	1917
	Lamp signalling B	British	Signalling	1911
	Lamps electric signalling daylight	British	Signalling	1917
goes with com74 or 27	Wilson 130 Watt Transmitter longwave (no motor)	British	Wireless TX	1914
	Portable telephone switchboard cordless 10 line MK235	British	Line	1916
used with WT stations	Heterodyne wavemeter MKI	British	Wireless	1917
	Message capsule - pidgeon red small	British	Messaging	WW1
	Message capsule - pidgeon aluminium	British	Messaging	WW1
	Message capsule - pidgeon double clip	British	Messaging	WW1
	Message capsule - pidgeon various	British	Messaging	WW1
	Message capsule - animal dog medium	British	Messaging	WW1
	Message capsule - animal dog medium	British	Messaging	WW1
	Message capsule - animal dog large	German	Messaging	WW1
	Message capsule - animal dog large	German	Messaging	WW1
	Animal dog collar for message capsule with pouch	German	Messaging	WW1
	Animal dog collar for message capsule with pouch	German	Messaging	WW1
	Message capsule - animal dog large	German	Messaging	WW1
	Dienst hund - Service dog - label disks	German	Messaging	WW1
	Pidgeon service message kit - complete in tin box	British	Messaging	WW1
	Pidgeon service message capsule with message	British	Messaging	1918
	Pidgeon service message book Army Book 418	British	Messaging	1919
	Pidgeon service message book Army Book 418	British	Messaging	1918
goes with com40	Unit HT WT 30 Watt MarkI	British	Wireless	1917
goes with 322 or 25 or 28	Shortwave tuner MKIII*	British	Wireless RX	1918

Table 10: Royal Engineers Museum

Object No.	Title	Description	Period
7701.1.3		AWWII radio transmitter consisting of wireless headset; hand microphone no.7 in bakelite and rubber, earphones. Also funnel-shaped rubber plug, parked 'Plug 5 Point No.5.ZA 1853'	
8012.4.4		A wireless set no.38 Mk2, ZA13280, serial no.93348, consisting of green painted metal container; black aerial socket set at angle on top; black plastic graduated tuning dial,black switch with 'send/receive/off' positions; black lead to plug connected to junction box itself having a short black lead to three-pin plug.	
8012.4.5	Wireless Set	A wireless set no.38 Mk2, ZA26348 serial no.5489, consisting of metal container, with black plastic graduated tuning dial on top, mic and phone sockets and 'send/receive/off' switch; AE socket with lead to metal container screwed to side of set. This is marked 'Calibrator's Crystal no.9' having black lead from bottom. Top of set also has black flexible cable terminating in hand switch marked ZA27832	
8208.21.9		British Wireless Press, published at Constantinople for July 8th, 9th and 10th 1923	
8404.4.3		A wireless set no. 19 Mk III. Green and blue painted rectangular container, top painted grey with assembly of switches, dials, sockets etc. It is mostly in black.	
8606.18		A wireless set, consisting of six dark green rectangular boxes, earphones, wires and plugs.	
8909.6.1	Wireless Set	A wireless set no.17 Mk.II, in dark brown painted wooden case, 1938-47 (c.) Both the front and back of the case are held in place by two catches at either side and can be opened up.	
2001.283	Telephone loudspeaker units	Two field telephone loudspeaker units, about 7.5" diameter and marked 'TRVVOX'. Painted grey. In green wooden overcases with open sides. Top of each has painted instruction 'press to signal' and stamped '943'.	
8111.4.7		Signal arm, bracket, lamp and relay; standard pattern LNER signal arm on wooden post with fittings. Could include the glass-less black painted lamp and 4'-long iron bracket with damaged foot	
8304.7.7		Part of Larkspur radio equipment: signal satchel in khaki green.	Windsor, 1910-
8611.24.1	The signal service in the european war of 1914 to 1918	Book outlining work of the signal service in WWI	
9111.11.1	Small signalling tools	Black case with metal instruments. Eight small signalling tools for use with sounder, morse key and relay adjustment, held in small leather case. Metal apart from spatula-like item with a wooden handle. Case stamped with broad arrow.	
2001.283.1		A small box containing signalling instruments, fixed into box.	Late Victorian, 1876-1901
201406.25.3	Circular Signalling Mirror	A circular signalling mirror with a dot in the centre. The mirror is contained in brown leather with a brown leather reverse. On the front the leather surrounds the mirror and has two circular rows of stitching to hold the mirror in place.	

Table 11: Royal Signals Museum, Blandford Camp

YEAR OF INTRO-DUCTION	DESCRIPTION	IMAGE
1914	**Marconi WT Wireless Set No 1 - The Sterling Spark Set Transmitter** Used by aircraft to guide the Artillery.	
1914	**Marconi WT Wireless Set No 4 - The Sterling Spark Set Transmitter** Used by aircraft to guide the Artillery.	
1914	**Marconi WT Wireless Set No 1 - The Sterling Spark Set - Station Tester Mk II** Used to test the "Sterling Spark" sets. One tester was issued for every four wireless sets.	
1915	**W/T Set Trench 130 Watt Wilson** Used for Division to Corps communications. Range of up to 9000yds.	
1916	**Power Buzzer Amplifier C Mk III**. The power buzzer transmitted signals through the earth. Range 2–5,000yds depending on ground conditions.	

Table 11: (continued)

1917	**WT Set Trench C.W. Mk III* Receiver and Transmitter** First all valve station of 1914–18 war Used for forward area communications Range 4000yds to 50 miles.	
1917	**High Tension 30 Watt Power Supply** Designed as a power source for the Trench Set CW Mk IIIs.	
	Prismatic Compass. Used with the C.W. Trench Set at the Headquarters of the 12th Division on the Somme. The set was destroyed by the operator when Germans counterattacked. He then used the compass to make his way back to Corps Headquarters. The compass was normally used to orientate the aerials of the wireless set.	
1917	**W/T Receiver Short Wave Mk. III**** General purpose receiver.	
1917	**Telephone Wireless Aircraft Mk. II Transmitter** Used with a receiver in an aircraft, for two-way communication between the aircraft and the ground. Complete with a remote control box to extend the microphone and earphones (telephone). Range 2 miles to other aircraft and 15 miles to ground stations.	

Table 11 (continued)

1917	**Tuner Short Wave MK III*** General purpose receiver. Used by Artillery to receive observations from aircraft.	
1917	**W/T Set Forward Spark 20 Watt "B" - The Loop Set -Transmitter and Receiver (Rear Station)** Used for forward communications. Range 2000yds Comprised a Front and a Rear Station with non interchangeable equipment.	 
1917	**W/T Set Forward Spark 20 Watt "B" - The Loop Set - Wavemeter** The wavemeter was used to tune accurately to the desired frequency (65 or 80 metres).	
1918	**Battery Box - 6 VOLT** Dated 1918. It was used in the trenches, for example with the loop set wireless.	
1918	**Short Wave Tuner Mk III*** Receiver, or tuner to receive Morse code from transmitters installed in aircraft flying over the trenches. “ Receives wavelengths between 100 and 700 metres	

Table 11 (continued)

1918	**Amplifier Valve C. Mk. IV** General purpose audio amplifier developed to boost the output from early wireless transmitters and power buzzers.	
1919	**Wireless Field Telephone Set** Comprises an upper (placed close to the aerial) and a lower part (in dugout). Used for forward area R/T and general purpose communications. Range 2–3 miles.	
1910	**Telephone "No 44".** Designed for civilian use by the General Post Office repair teams. It was lightweight, robust and portable. It was issued to the Royal Engineer Signal Service Units and used until 1915.	
1914	**Telephone "C" Mk II** This telephone was an improvement of the 1910 "C" Mk I telephone and was used in the trenches, although not really suitable for wet and muddy conditions. It was used until about 1915.	
1915	**Portable Telephone "D" Mk III.** The standard army field telephone from 1915 until 1940. It had a buzzer unit and earphone so that it could be used as a Morse transmitter and receiver.	

Table 11 (continued)

1915	**Listerphone** Field telephone designed by the Royal Canadian Signal Corps.	
1918	**Telephone 110 B Mk 234.** Made by British Post Office Telephones. This telephone type was used interwar and up until WWII	
1916	**Early Fullerphone** Designed by Major Fuller, Royal Engineer Signal Service. By using a weak electric current the telephone was more secure and it also provided a separate undetectable telegraph circuit.	
1917	**Fullerphone Mk III.** These were manufactured from 1917 and used until the early 1950s. It has a hinged lid and front, giving access to the hand set, generator handle and line terminals. The painted canvas cover made it more waterproof than earlier models.	
1917	**Switchboard Magneto 10 Line Mk 236** The MARK 236 was self contained with its own instrument, calling generator, night bell and speaking set. Two or more could be set up in tandem to increase the number of subscribers. Having given excellent service until 1918 it went on to serve during the Second World War. The UC was a portable field switchboard which had 10 discreet units. This allowed for repair of one unit without disturbing the remaining subscribers.	

Table 11 (continued)

1919	**Switchboard Magneto 10 Line Mk 234** Portable switchboard for use in field telephone systems. It could be used in any climate. It was designed for magneto calling only and Telephone set "T" (or the equivalent) would be used by the operator. Alarm facilities are provided.	

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