Making Telecommunications in the First World War

Friday 24 January 9.15am – 5.30pm

University Club, 11 Mansfield Road, Oxford

Supported by the AHRC-funded project:
Innovating in Combat: telecommunications and intellectual property in the First World War

Centre for History & Philosophy of Science, University of Leeds
in partnership with the Museum of History of Science, University of Oxford

Online Registration (closes Monday 20 January):
http://tinyurl.com/makingtelecommunicationsinWW1

Map & Directions: http://www.club.ox.ac.uk/contact-a-information/61-how-to-find-us

Programme – last updated on 16/01/14.

Unless otherwise noted, each talk will last 20 minutes with a 10 minute discussion at the end of each paper.

9.15-9.45: Welcome and tea and coffee

9.45-10.00: Elizabeth Bruton and Graeme Gooday, About "Innovating in Combat"

10.00-10.30: Dr Phil Judkins, University of Buckingham Centre for Security and Intelligence Studies,
Trawling the Waves: Warfighting and Wireless in World War 1

Abstract: This first global electronic war began at sea. Before war was even declared, Britain's cableship *Alert* sailed to sever Germany's international telegraph links to Southern Europe, Africa and the Americas. With the rapid expansion of wireless use, the military of all the nations at war competed in the dark arts of SIGINT, ELINT and cryptanalysis, and in the effective application of the resulting electronic intelligence to successful warfighting.

On the eve of the Armistice which ended the conflict, nations' instructions to their negotiators were intercepted and the information used against them; and the German High Seas fleet sailed to internment, scuttling, and scrapping, on wireless instructions.

The paper compares and contrasts land and sea operations in their use of wireless, direction finding, intercept and decryption, ranging from Coronel and the Falklands to the Dogger Bank and Jutland, and

across Europe from Tannenburg and Galicia to the Western Front, to extract universal - and sometimes remarkably contemporary! - lessons of command, control, information management, cryptanalysis, doctrine and training.

Also explored are the questions whether either side could have employed primitive marine radar, a device already patented but not used for fear of IPR litigation; and of the shadow which electronic technologies, emergent in 1918, would cast towards the Second World War some twenty years later.

10.30-11.00: David Barlow, Radio Officers Association and Lizard Wireless Museum, *Wireless and direction finding at sea and in the air in World War I. - with emphasis on the role of Captain Henry Joseph Round*

Abstract: Wireless, both telegraphy and telephony, and direction finding equipment were in the words of the first Lord of the Admiralty. Admiral Sir Henry Jackson "a major strategical which brought about the meeting of the British and German fleets at the battle of Jutland on 31st May 1916". He placed the credit as the responsibility of Captain Henry Joseph Round.

The development of the thermionic valve led to the British having superior receiving capabilities used in both wireless receivers and direction finding equipment. Much of the research work was done by Henry Round who also helped develop wireless on board aircraft.

My paper will trace Round's technological advances from his joining the Marconi Company in 1902 for the 12 years before the start of the war, his discovery and development of the directional properties of the radiation from aerials (direction finding), his role in enhancing the work of Ambrose Fleming in the development of the thermionic valve.

Round also played a significant role in the development of wireless on board aircraft which was used to relay the positions of enemy gun emplacements, in addition air ships were used to locate enemy submarines and send their location back to shore stations by wireless.
Note: David will be presenting his paper via Skype.

11.00-11.30: Tea and coffee

11.30-12.00: Keith Thrower, *Army radio communication during the Great War*

Abstract: At the start of the war army communication was principally by field telephone. Valve technology was still at a primitive stage of development so radio communication was by spark transmitters and crystal receivers. These transmitters continued in use during the whole of the war, particularly where long ranges were necessary and was also used in aircraft for communication back to the ground to direct artillery.

Radio communication was to undergo a major step forward when a new type of amplifying valve was produced in France by engineers working at the French Military Telegraphic Service in 1915. This valve was known as the TM and variants of this could also be used in low-power transmitters.

Within a year, the valve was being manufactured in the UK and it was very quickly designed into radio receivers and transmitters. One of the great benefits was that the valve could produce continuous oscillation making it possible to communicate by speech, whereas the spark transmitters could only be used for the transmission of Morse signals.

Spark transmitters were not economical of radio spectrum whereas valve transmitters could be made very selective, enabling many radios to be used in close proximity.

The talk will describe several of the radios in use during the War and indicate how the improved communication made possible as the war progressed was a key feature in the ultimate allied victory.

12.00-12.30: Professor Anthony Davies, Emeritus Professor, King's College London and Visiting Professor, Kingston University, Surrey, *The right tunes? Wavemeters for British army and air force uses in World War I time*

Abstract: Until well after WWI, military radio relied primarily on spark transmitters, and in the British Army static telephones still predominated (supplemented by motor cycles and pigeons). The Royal Flying Corps came under Army Control, while the Royal Naval Air Squadron was under the Navy, until in 1918, the RAF became an independent force in 1918. Although radio was essential to support flight operations, this was also predominately with spark transmitters and Morse Code.

Spark transmissions occupy a wide bandwidth, and severely limit the available 'channels': to control transmissions, the use of wavemeters was widespread.

Much earlier the Admiralty had been persuaded of the benefits of radio communication for Naval use, but believed that only one powerful spark transmitter could operate at a time in each area, until Marconi demonstrated that by 'tuning' more than one could operate. The Admiralty commenced with 'A tune' at 400 feet (e.g. 2.5MHz) and 'B tune' at 1025 feet (950kHz), which were separated sufficiently for simultaneous operation, and later added further 'tunes'. Describing transmissions by wavelength, and later, by frequency, arose subsequently. Naval transmitters used substantial voltages and currents at the spark: for example 16kV and 17A for 18 words per minute Morse.

Against this background supporting instruments were essential for 'tuning' – wavemeters for maintaining the correct 'tunes' and decrementers to control the spectrum-spread of the spark transmissions.

In ~1904, J.A. Fleming invented what he claimed was the first wavemeter (which he called a Cymometer, sometimes incorrectly called a Cynometer), although prior to this it seems that some wavemeters had been developed and even marketed commercially in Germany.

By WWI, the Army therefore needed wavemeters to support their spark transmitter sets, and at first similar instruments (for example J.S. Townsend absorption wavemeters) were adopted for aircraft applications. The RAF continued with what they called Syntonisers, which were heterodyne based instruments using a single thermionic valve, which they distinguished from Wavemeters, although the requirement was essentially the same.

The paper will incorporate photographs, circuit diagrams and explanations of a number of these early wavemeters, which laid a foundation for rapid development of many innovative RAF wavemeters during the rapid technology progress of the interwar years, and then many further wavemeters to support the radar developments of World War II.

12.30-1.00: Stephen Erskine, Green Howards Museum, *'Victory calling'-evolution of operational communications: an infantry Battalion experience*

Abstract: How did British operational experience influence the development and use of communications technology?

Using the experience of the 7th battalion of the Yorkshire Regiment (The Green Howards) at Fricourt on the Somme in 1916 and at Sailley-Salisell in 1917 this paper will examine how costly communication failures on the Somme were learnt, disseminated and applied leading to success in 1917 and beyond. Based on battalion records, diaries we will look at how 'top-down' theories were honed and improved thus foreshadowing the all-arms strategy (the co-ordination of infantry, artillery and air-power) on which success in the 100 days from August to November 1918 was based.

In 1916 the Battalion commander, Ronald d'Arcy Fife could only command and control the part of the battlefield over which his voice could be heard or over which runners could carry and return messages.

Visible communications whilst having the virtue of being seen over greater distances and improving the speed of communications had the draw-back of being seen to foe as well as friend and targeted for destruction. Such rudimentary communications led to tragic mistakes and lost the allies tactical and strategic opportunities.

By 1917 men like Fife had fed their experience into the system and, despite an enduring image, British strategic command were receptive to new ideas, embraced technology and established the administrative and logistical means of sharing experience-based best practice.

1.00-2.00: Lunch

2.00-2.30: Paul Coleman, University of Leeds, *Wireless defence: the use of wireless telegraphy against U-boats in the First World War.*

Abstract: When combined with aircraft, wireless was one of the most powerful weapons for the Royal Navy particularly against the menace of German U-boats. Early wireless sets were too heavy to be carried by seaplanes, the set installed on HMA.1 "Mayfly" in 1911 weighed 500 pounds. However, by 1915 the coastal class airships carried a type 53 spark gap transmitters, which weighed 100 pounds and had an effective range of 100 to 120 miles. Continued improvements in design further reduced the weight in addition to increasing range.

Wireless enabled swift and easy communications between aircraft and the convoys under their protection, while not all merchant vessels carried a wireless set, the vessel carrying the convoy's Commodore always did. The aircraft could use wireless report the position of enemy I-boats, call for reinforcements in the shape of surface vessels to attack a target, as well as call for assistance in case of emergency.

Wireless direction finding also played a key role in anti submarine warfare. While the use of direction finding in regards to tracking Zeppelins and U-boat positions is relatively well known, British aircraft could also use the same tracking stations to provide navigational assistance.

John J. Abbatiello, states that. "Wireless communications systems were force multipliers for maritime air units ... the communication capabilities of 1918 – taken for granted today – represented a technological leap of immense proportions and greatly enhanced the effectiveness of aircraft in the anti-submarine campaign." (Abbatiello, 2006)

Wireless telegraphy was considered of such importance that airship crews were instructed "not to fly if their wireless equipment was inoperable and to return to base if it failed in flight [...]" (Abbatiello, 2006)

The war against the U-Boat in the First World War is often looked at simply as a precursor to the U-Boat offensives of World War Two, yet it had the potential to force Britain out of the War. Wireless Telegraphy combined with aircraft was only one weapon in this fight, yet without Britain may well have been forced to surrender.

2.30-3.00: Dr. Andreas Marklund, Post & Tele Museum, Denmark, *Watching for the State: Cable Censorship and Practices of Surveillance at the Danish State Telegraph during World War I*

Abstract: During the years of the Great War, Denmark was a hub of telegraph communications in the northern areas of Europe. Vast amounts of information were carried through the cables of the neutral and strategically well-located country, stemming from Russia, Britain, northern Scandinavia, the European continent – and the motley crew of "embassy envoys and military orderlies, hordes of journalists and messengers from businesspeople and ship-owners", who, in the words of a contemporary observer, crowded the main telegraph station in Copenhagen. Yet the telegrams transmitted by the Danish State Telegraph were subjected to censorship and secret monitoring by Danish state authorities. Starting in early August 1914, the Telegraph Authority issued a steady stream of censorship instructions, for instance against

coded telegrams, “forbidden languages” and content that compromised Danish neutrality. Censorship was initially loosely organized, expected to be carried out by the senior telegrapher on duty. But it was formalized and extended as the war dragged on. By 1916, censorship at the Copenhagen station was executed by four specially appointed censors who received daily instructions from the Foreign Ministry. In my paper, I will look at the practical dimensions of telegraph surveillance: how it was organized, staffed, recorded and legitimated. Through a close-reading of censorship instructions, censor logs and intercepted telegrams, I will scrutinize the daily routines of surveillance within its administrative, legal and technological context.

3.00-3.30: Axel Volmar, University of Siegen, Germany, *Where Only the Explosives Prevail: German Innovations in Sound Ranging and Telecommunications in World War I.*

Abstract: This paper draws the attention to the battlefields of WWI as a sound environment which greatly shaped the auditory media culture of the first half of the 20th century. Bound to the trenches of positional warfare, a whole generation of soldiers developed numerous listening skills that allowed for an interpretation of their life-threatening surroundings. At the same time, scientists and electrical engineers introduced new technological means to enhance the detection and ranging of sound sources on the ground, in the air, and under water, and to facilitate the interception of messages in telecommunications systems.

By focusing primarily on the German context, I will highlight the interplay between scientific experimentation, technological innovation and combat tactics regarding auditory forms of military reconnaissance during the war. I will also trace how these new practices of listening, eavesdropping, and sound ranging diffused into the cultural practices and memories of the subsequent Weimar period – developments which resulted in practices of ham-radio or narratives which staged the war in novels, radio drama, movies, and music. In doing so, the paper aims to show how the sense of hearing was mobilized to serve as an *epistemic means* for various tasks of auditory observation and how this led to a general revaluation of listening in the interwar period.

3.30-4.00: Tea and coffee

4.00-5.00: Roundtable discussion, chaired by Stephen Johnston

5.00-5.30: Closing remarks and thanks