WIRELESS IN THE SECOND ANGLO BOER WAR 1899-1902

L.L. Fordred

Curator SACS Museum, South African Corps of Signals, SA Army Signal Formation, Pretoria, South Africa.

Abstract. The Anglo Boer War of 1899-1902, will be remembered as the last of the gentlemen's wars, the war that marked the end of the Victorian era. For military communications however, it commemorates a beginning, for it was during the Boer War that wireless was used for the first time by an army on active service. This paper will discuss the reaction of both Boer and British forces to the invention of wireless telegraphy. The Boers so often described by the British popular press of that time as being solitary, uneducated, solemn; people who were resistant to change, were eager to obtain "wireless" equipment which they saw as the answer to their military communications problems. The appearance of wireless into British military circles was to prove to be a stormy one, with many years passing before wireless was fully accepted by the British, as the military necessity it is today.

1. INTRODUCTION

Military advancements during the Victorian era had been many and varied. Developments made in the manufacture of weapons were to be especially far-reaching. The transition from the old smooth bore "Brown Bess" of the Crimean War, to the high powered rapid smokeless rifles, available by 1890, constituted probably the single greatest advance in fire power since the invention of gun powder.\(^i\) Communication was implemented during the Napoleonic wars and led to the rapid growth of the army in the field. With far greater fire power now available, military leaders could deploy their forces over larger areas, which therefore demanded better communications. Up until this time demands placed on military signalers had been small and uncomplicated. Military leaders relied generally on mounted orderlies or runners, who would carry their written or verbal dispatches or, if circumstances allowed, visual signals such as flags or heliographs would be used.

2. MILITARY ORGANISATIONS PRIOR TO 1899. THE BRITISH ARMY

The senior structure of the British army in the years leading up to the Anglo Boer War consisted of mainly elderly Generals well entrenched in senior key posts, which some had held for many years. Although the purchase of commissions had been abolished in 1871, wealth and influence were still passports to promotion.\(^i\) These generals felt threatened by the advances being made in the scientific and mechanical fields and tried to discourage change of any kind.

The Crimean War of 1854-56, is a typical example of their views. Telegraphic undersea communications had been provided, but were considered a hindrance rather than a help. To quote General Simpson, Commander in Chief of the British forces, "the confined telegraph has upset everything"\(^i\), he was heard to complain, after being continually bothered with minor queries from the Government in England on the situation at the front. The hierarchy of the British Army were loath to adopt new weapons or military techniques, which were conspicuously absent right up to the outbreak of the Boer War in 1899. Their training manoeuvres were characterised by the disregard of new weapons. The emphasis was on solid line formations, mechanical precision and rigid dependence on order.\(^i\)

The electric telegraph is the one exception to this attitude, and was adopted by the military relatively soon after its invention in 1835. By 1870 the first regular telegraph unit had been established to provide telegraph communications for the army in the field. From this date, members of this unit were to accompany the British Army on all its operations. The unit took part in many small wars and skirmishes, including the Zulu War (1879) and the first Anglo Boer War (1880-1). Therefore, by 1899, this unit had evolved into a body of very experienced men. The Telegraph Battalion on arrival for service in South Africa had few problems in establishing telegraphic communications for their advancing forces, as South Africa had both well established land line and undersea telegraph links, thus enabling the Battalion to provide a fast reliable service.

Copyright. This article is reprinted with the kind permission of the IEEE, from Proceedings of AFRICON '96, Stellenbosch, South Africa, 24-27 September 1996, pp. 1133-1137.
However, communications between the Headquarters and front line, still relied heavily on visual signallers and despatch riders. It was during the Boer War that the heliograph sections [Figure 1] were to receive their highest accolades. Helped by the excellent climatic and geographic conditions, these men became so adept in the use of the heliograph that by the end of the war they were achieving rates of over 16 words per minute - a record which has never been surpassed. As these forms of communications were perceived to be adequate, the arrival of wireless telegraphy was seen by many as superfluous.

3. THE BOER REPUBLICS

After regaining their independence from the British in 1881, the two South African Republics, the ZAR (Transvaal) and Orange Free State, lost no time in appealing to the Governments of Europe to assist with the training of their small fledgling armies. Both Republics were to receive well-trained European officers who were fully aware of the latest military developments and were encouraged by the respective Governments to implement these developments into their training curricula wherever possible.

The British Government underestimated both how much the Boers were prepared to sacrifice for their independence and the strength of their armies. Admittedly the Boers regular forces were tiny, the ZAR State Artillery having only 473 serving officers and men in 1898. However, added to this, was the estimated 35,000 male citizens between the ages of 16 and 60, who were also called to arms by their Governments. This citizen force was considered of no account by the British, as these men had no formal training and were expected to fight without pay, uniform or provisions. The fact that most of these men were experienced horsemen and excellent shots who would form a formidable guerilla force, was not fully realised, with dire consequences for the British.

The Republic of the Orange Free State, State Artillery were also in possession of an established field telegraph department, which was to give good service during the early stages of the Boer War, but as they only possessed visual signalling equipment, they will not be discussed further in this paper.
4. THE Z.A.R. PREPARES FOR WAR

On 23rd November 1888 Paul Constant Paaff [Figure 2], an employee of the Amsterdam telegraph department, arrived in the ZAR in answer to a request made by President Paul Kruger for the services of an experienced telegraphist on a two year contract.

In May 1890 the Volksraad (National Council) voted for the establishment of a Field Telegraph Department to form part of the ZAR State Artillery. This decision coincidentally coincided with the completion of Paaff’s contract. He was offered, and accepted, a commission in the State Artillery, as the head of the field telegraph department. Paaff’s first official duty was to train 15 telegraphists to man the Department. These telegraphists could on the completion of their training receive and send messages in Morse, by means of telegraph, heliograph, flag and lamp – the recognised tools of a military signallers trade 10. [Figure 3].

Gold was discovered in the Transvaal during 1886, followed by the discovery of diamonds in Kimberley in 1870. The “gold rush” to the Transvaal led to a massive influx of foreigners or “Uitlanders” into the Boer Republic. The Uitlanders’ discontent grew as President Kruger continued to refuse them any form of representation in the Volksraad, and made matters worse by introducing a new and very restrictive franchise law. As tension on the Rand increased, two British multi-millionaires who had made their fortunes in South Africa, Cecil John Rhodes and Alfred Beit, conspired with the Reform Committee of Johannesburg to overthrow the Transvaal Government. An armed force of 480 men entered the Transvaal from Rhodesia* on 29th December 1895, under the command of Doctor Leander Star Jameson. The invasion was a disaster from the outset, ending with Jameson’s surrender outside Johannesburg on 2nd January 1896**.

---

* Now Zimbabwe.
** Jameson and his accomplices stood trial in London, both Lt Paaff and Mr Van Trosenburg were summoned as witnesses.
Jameson’s unsuccessful raid, brought the possibility of war with Britain much closer. The Volksraad realised that immediate steps would have to be taken to enlarge its army. As part of this expansion programme, five forts Klapperkop, Wonderboom, Schanskop, Daspooortrand and later Johannesburg, were built at enormous expense to protect the Republic’s capital, Pretoria. Although these forts were to fall to the British without a shot being fired, they were at the time of their construction considered impregnable. The government imported only the best Europe could offer to equip them.

Not only were these forts armed with the new 16 inch (40cm) Creusot guns and Maxims, they also possessed their own electricity dynamos to provide lightning and to power searchlights, steam powered pump stations, and lightning conductors, to prevent the accidental detonation of ordnance. Fort Wonderboom was linked directly by means of telephone to the Artillery camp and the Commandant Generals office 13. Originally it had been planned to link all the forts to the Artillery Camp in Potgieter Street in this way by using underground cable, but the cost of laying such a cable was very high. The 4½ miles of cable already laid had cost the government over £9,000. The process of laying such cables was very labour intensive, which made it impossible to keep the location of such cables a secret. This would make them vulnerable to enemy action and “tapping” during war.

The Government therefore acted on the recommendations of Mr C.K. Van Trosenberg [Figure 4], General Manager of Telegraphs in the ZAR, and cancelled plans to lay cable links to the other forts. Working heliograph links had been established by the men of Paaff’s field telegraph department. These links connected all the forts to each other and to the Artillery Camp, but this type of communication had serious drawbacks. Firstly security was impossible, as all the messages could be clearly seen from the city and were often read by the general public. There was also no site of suitable elevation within the Artillery Camp which would allow heliographic messages to be sent out to the forts.

In early 1898, the Transvaal government again asked Van Trosenberg for advice, concerning alternatives to solve its military communications problems. The ZAR was very fortunate to have men such as Van Trosenberg and Paaff available to them. Both men were dedicated to their work, and followed all the new developments taking place in Europe with close interest. When told of the problem, Van Trosenberg immediately suggested the possible use of “wireless” telegraphy which had been patented in Britain by Marconi in 1896.
Van Trosenberg offered to write to various companies in Europe who were producing "wireless" equipment, to see if it would be suitable for use in the ZAR. In February 1898 he contacted Siemens Brothers of London (a subsidiary of the Company Siemens and Halske of Berlin) describing the problem as follows [See Figure 5]:

"Gentlemen,

A certain place "A" in a valley is surrounded by hills. I wish to correspond telegraphically without wires between this place "A" and those hills as marked in margin 1, 2 and 3. Are there any difficulties, if so which? If not can you supply us with the necessary instruments complete. If you can supply them, please send one set [two instruments] for taking a trial, for use between A and 1, or 1 and 2, etc; the most exhaustive directions for use should accompany the instruments. Of course we require the best known instruments of this class with all the improvements which have since been introduced in the instruments of Marconi. We will be pleased to learn by return post of what you can do for us. In case you send the instruments, please send them via Durban. If the trial is in any way successful, we will give you a further order. Please indicate certain code words in order to place us in a position to give you an order by cable."
Siemens replied that they could foresee no problems, as recent British experiments had proved that a distance of 13 miles could be achieved as long as the word speed (Morse not speech) did not exceed 20 words per minute. A problem however, lay in the fact that Marconi held all the rights to his equipment, which he would only allow to be hired, not purchased outright. Marconi's Company, being British, realised that war against the Republics was looming and wanted to know who the prospective clients were to be. This Siemens naturally had refused to divulge [3].

Van Trotsenburg was sent to Europe in June 1899, to view the various types of equipment at first hand. He visited companies in London, Paris and Siemens and Halske of Berlin, where he was very impressed with what he saw. Siemens and Halske guaranteed that their equipment could cover a range of 9½ miles (15 km) providing the sets were operated by experts and that atmospheric conditions did not prove too hard to overcome. The price of the equipment was £110 per set which included a 120 ft mast [9]. Siemens & Halske had an established agency in Johannesburg through which both Republics had ordered large amounts of visual signalling equipment in the past. It was suggested that, should they receive the order, all further negotiations be entered into through this agency.

On 24th August 1899, Van Trotsenburg, with the approval of his Government, placed an order for six "vonkentelegraafinstrumenien" (spark telegraph instruments) and accessories with the Johannesburg agency of Siemens and Halske [9]. For security reasons it was agreed that Siemens & Halske - Berlin, would decide on the safest route for the shipment, either via Cape Town, Durban or Delagoa Bay, and that the equipment would only be transported in a German ship and addressed to the Siemens and Halske Agency in Johannesburg. Despite all these precautions, what the Government had feared most took place. The shipment of equipment, only arrived in Cape Town, after the declaration of war, and was confiscated by the British customs authorities. Had the war broken out a few months later, allowing for the system to be delivered and installed, the ZAR would have been the first country in the world to have had a network of wireless telegraphy posts available for military purposes.

5. MARCONI MEETS THE MILITARY

The first British patent ever issued for wireless telegraphy was granted to Guglielmo Marconi in 1896. Marconi is remembered by many as the father of wireless, but why is this so when many other scientists were working on similar ideas at the same time. Marconi’s apparatus itself was created by incorporating the work of Maxwell, Hertz, Lodge and others. The answer lies in the fact that not only did Marconi possess a brilliant mind, he was also a great "marketeer". He not only created a workable system, but could see a practical use for it. While other scientists discussed their findings with colleagues as interesting phenomena, Marconi envisioned a worldwide marketplace for his equipment and went to great lengths to promote his invention. He was also one of the first to realise the power of publicity, and made his systems available to people who he thought could promote it and from whom he would then receive favourable publicity in the world's press. A good example of this marketing strategy occurred in 1898 when Marconi offered to install his equipment into the Royal Yacht for the duration of the Cowes regatta. In this way he received enormous publicity by enabling the Prince of Wales who was aboard, to send by means of wireless telegraphy, daily messages to his mother Queen Victoria, who was staying at Osborne House on the Isle of Wight [10].

Marconi’s wireless telegraph system first came to the notice of the British War Office late in 1896, when military representatives were invited by Sir William Preece Chief Engineer of the Post Office, to witness a demonstration of "communication without wires" on Salisbury Plain. The Royal Engineers, who were responsible for all military signalling at that time, were instructed to monitor the progress of the system, but no orders or further interest were forthcoming. Marconi had to wait a further three years before he was given the chance to prove the worth of his system in the military context. This was when he was invited to install his apparatus into three Royal Navy ships HMS Juno, Alexandra, and Europa, for the duration of the annual summer manoeuvres. The exercise consisted of two fleets, of which only one was to be equipped with wireless. Marconi himself was on board HMS Juno to oversee the operation of the equipment. The antenna, the only frequency determining element on Marconi's equipment, was attached to the topmasts of the three ships, from where 52 m (170 ft) of wire was lowered down to the after bridge where the sets had been installed. Signals were exchanged both by day and night, with the maximum range 85 of miles (136 km) being achieved [11]. The trials were a great success. The advantages of being able to communicate with other ships or land well beyond visual range, was obvious to all those present.

6. WAR

On 9th October 1899, President Paul Kruger of the ZAR having been informed that the spring grass needed to feed the horses of his mounted army was sprouting, issued his final ultimatum to the British Government. He demanded the withdrawal of all British forces from both Republics' frontiers and that all the reinforcements that had recently been sent to
South Africa must leave. The ultimatum was ignored by the British, and on 11th October 1899, the Republics of the Transvaal and Orange Free State declared war on Britain, immediately dispatching commandos to invade Natal. Even though reinforcements were already arriving in the British Colonies of the Cape and Natal, in the early days of the war the Boer forces outnumbered the British 3 to 1, thus forcing the War Office to send massive reinforcements from every corner of the Empire to protect British citizens and property.

Marconi lost no time in suggesting to the War Office that wireless telegraphy would be of great use to its forces, now heading for South Africa. This would be especially true for ship to shore communications in Durban and Cape Town where troopships were arriving daily, causing massive congestion and delay in the harbours. [13] This suggestion added to the glowing reports on the success of the Marconi equipment used during the Naval manoeuvres earlier in the year, convinced the War Office to hire 5 wireless sets and operators on a six-month contract which commenced on 1st November 1899. The agreement was that the equipment would be used to control shipping in the ports.

However, on their arrival in Cape Town on 24th November 1899, the Marconi engineers Messrs Bullocke, Dowsett, Elliot, Franklin, Lockyer and Taylor, discovered that the original agreement had been changed, when local military authorities invited the Marconi engineers to volunteer for active service in the field. This the men were prepared to do, but stressed that modifications would have to be made to their equipment, which had been designed for permanent installation, not for accompanying an army into the field. Captain J.N.C. Kennedy, Telegraphic Section, Royal Engineers, who had been present at Marconi's early demonstrations and who knew him personally, was serving in South Africa at the time and was appointed to assist the Marconi engineers with the modifications.

The major problem to be overcome was how to transport the large battery power supplies for the equipment into the field. It was decided to install the equipment into wagons. The power supplies which comprised large capacity dry cells and jelly accumulators were secured to the bottom of the wagon, with the transmitting apparatus. The key was arranged as to enable the operator to stand on the ground at the back of the wagon while sending messages, well away from the dangerous arc of the spark coil. The coherer and receiving instrument were suspended in a tray from two bale hoops in the centre of the wagon. Trials were then undertaken to test the sensitivity of the equipment. A demonstration of the equipment was also arranged for the military staff and foreign attaches, and took place on 4 December at the Castle in Cape Town. Captain Kennedy describes this "as proceeding with entire success." [13] While these tests and installations were being completed Captain Kennedy went to examine the "Boer sets" which were being stored in the customs sheds [Figure 6]. He noted that there was "little difference in appearance, but as the sets were not encased in metal would not be suitable for use in the field." He did, however, take the oscillators and mast head keys which he considered were of "more substantial design." As Marconi's engineers had presumed that their equipment would be installed onto ships, no suitable antennas had been brought out from England. Captain Kennedy had examined the steel masts which had accompanied the Siemens & Halske sets, but as there were no accompanying instructions and little time available, it was decided that bamboo poles of 30 ft in length would be adequate. [14]

The engineers left for De Aar, the main supply and dispersal depot for British troops moving north on 11th December 1899 [Figure 7]. From here the technicians and equipment would be assigned to the various British columns operating in the area, with the intention of creating a wireless network to link them. On their arrival in De Aar it was found that the type of wagon, supplied in Cape Town, was totally unsuitable, and that Australian pattern sprung wagons were needed. Further delays were then experienced while the equipment was installed into the new wagons. The field trials finally commenced on 22nd December 1899. Soon after the start of the tests, the bamboo spars, which were untreated, began to develop large cracks. Every attempt was made to check this, but without effect. This was a serious setback as the antenna formed a vital part of the equipment, the transmitter relying almost entirely on the natural resonance of its antenna for any degree of tuning or selectivity. The decision was then taken to replace the bamboo poles with 6 ft linen kites which had been loaned from the Balloon Section of the Royal Engineers, to be flown with conducting wires to serve as replacement antennas. These were found to be impracticable due to South Africa's unstable weather conditions. Captain Kennedy wrote in his report: "The
weather conditions were so variable that it was either
dead calm with revolving dust storms or blowing a
gale and raining hard. It frequently happened when a
fairly suitable wind was obtained at one station that
quiet weather conditions existed at the other. It
therefore seldom happened that the sending and
receiving kites were flying simultaneously\textsuperscript{[1][2]}[Figure
8]. On the few occasions that the kites were flown
successfully, communications between the Orange
River and De Aar, a distance of about fifty miles were
achieved, but only by using a relay station at Belmont.
This, however, was a rare occurrence. Marconi's
systems were unserviceable for three of the six-week
test period. Adding to the problem, it seems that some
of the equipment had also suffered during
transportation to South Africa. Set No 1, which was
stationed in the Kimberley area, gave constant
problems. In his engineer's report Mr Taylor wrote:

*Set No 1 is not to be relied upon. All instruments
except the coils and accumulators went overboard by
accident. Receivers were not very good before that*\textsuperscript{[3]}.

Marconi was quick to defend his engineers and
equipment. In a discourse which he delivered at the
Royal Institution on 2nd February 1900 he criticised
the military authorities in South Africa, saying that
although the results obtained were at first not altogether
satisfactory, this was due to the fact that the tests were
attempted without the proper antennas. Marconi went
on to state "it is, therefore manifest that their partial
failure was due to the lack of proper preparation on
the part of local military authorities and has no
bearing on the practicability and utility of the system,
when carried out under normal conditions. Had the
light bamboo poles not collapsed from the dryness
there is no doubt that a very practicable arrangement
existed." These statements infuriated the Director of
Army Telegraphs who, on hearing them, personally
gave the order for the three Kimberley line stations to
be dismantled immediately. Two of the five sets of
equipment, had been sent to join General Buller's force
in Natal a month earlier and were to experience the
same fate shortly afterwards.

Marconi had without realising it, already discovered the
reason why his equipment had performed so badly in
South Africa, when he stated in his paper to the Royal
Institute that the trials had "no bearing on the
practicability of the system under normal conditions".
The environmental conditions in the Northern Cape
were far from normal when compared to the weather
conditions in England, where most of Marconi's experi-
mentation had taken place. Firstly the intensity of
lightning storms on the South African veld had a paralysing effect on the coherers within the receivers, these storms were for the duration of the trials, almost a daily event. This caused Mr Bullocke to remark in his report of 11th December 1899 that "it would be a delightful time for X's" (the atmospherics which disrupted wireless communications).

Secondly, the importance of a good earth connection had not yet been fully realised. The quality of the earth connection was seriously impure by the nature of the ground in the Northern Cape, although Marconi had scoffed at the idea that "the iron in the hills" was hindering the equipment's performance. With hindsight we can see that this was true. The poor earth connections would have decreased the amount of power actually being radiated by the antenna and would have affected the ground wave which was almost certainly the mode of propagation used, if the distances and frequencies involved are taken into consideration. As Marconi's receiver was basically a coherer, its performance and therefore its range was entirely dependent on the power radiated by the transmitting antenna, as well as the degree of tuning achieved by the length of its receiving antenna, and the quality of the ground between the stations. Captain Kennedy reported that the engineers tried to rectify the problem of poor ground connection by burying sheets of tin below the antenna masts but apparently without success. Added to this, no two sets were ever likely to be operating on exactly the same frequency because of the variability in the height of the antennas.

7. NAVAL APPLICATION

The appearance of wireless telegraphy on the battlefield did not revolutionise the whole concept of warfare as Marconi had hoped. The spark transmitters of that time worked most effectively on long waves, which made them ideal for Naval application. The Navy had been considering the practical applications of Marconi's wireless telegraphy for its ships at sea since the naval manoeuvres of 1899. The armies' obvious dissatisfaction with the Marconi equipment led the navy to offer to take over the contracts for the five sets. By March 1900 the sets had been installed onto the ships Forte, Thetis, Dwarf, Raccoon and Magicicca of the Delagoa Bay Squadron who were operating between Durban and Delagoa Bay on blockade duties. On board ship, the equipment enjoyed a more permanent installation. The masts of the cruisers had been extended to accommodate the long wire antennas, and aided by the higher conductivity of the sea, the equipment worked well. Later an experimental twin wire horizontal aerial, rigged on the Thetis, proved to be so successful that it eventually became a standard feature on all Marconi shipboard installations.
The equipment remained in Naval service in South Africa until November 1900. By this stage of the war, the Boer forces had implemented their guerilla tactics and the need for ports to be blockaded had diminished. This had been sufficient time, however, to prove beyond all doubt that wireless telegraphy was indispensable for a ship at sea. The Admiralty, realising this, placed an order with the Marconi Company on 4th July 1900 for supply and installation of equipment aboard 26 of its naval vessels and at 6 of its coastal stations.

8. CONCLUSION

The Boer War was to provide a transition period, from the military ways of past centuries, to those of our own. It cannot be denied that Marconi equipment sent to South Africa was not ideal for use in the field. The equipment was large and cumbersome, the receivers insensitive and unselective. The Royal Engineers Corps' history states simply that "the system was not sufficiently developed to be of use on active service", while the Royal Signals' history describes the trials as "a creditable failure". The practical experience gained by both the Marconi Company and the military however, far outweighed the failure of the military trials. Marconi was given a clear indication as to where improvement was needed on his military apparatus. While the British army was forced to concede that wireless had a place in the modern army, and by 1903 portable wireless stations had been attached to both the 1st and 2nd cavalry Brigades of the Army Corps. Tentative experiments and trials were also carried out by the military at regular intervals up until 1913, when wireless telegraphy was finally recognised as an integral part of the British Expeditionary Force heading for France.

In South Africa, both Boer Republics and therefore their regular forces ceased to exist after the signing of the peace treaty, that ended the Boer War, on 31st May 1902. The Marconi Company was able to maintain a good business relationship with the new South African Government. The company agent in South Africa wrote to the then Colonel Sir Duncan McKenzie, Commandant of the Military militia, on 7th September 1909, to inform him of the improvements which had been made to the Marconi military equipment. The sets he wrote, could now "transmit signals in any desired direction" while stressing that "it's importance in military work cannot be overestimated". At the outbreak of World War I, the South African Prime Minister, General Louis Botha, was requested to invade and capture German South West Africa on behalf of the British. Again the Union Defence force was not to be left behind and entered into the First World War with wireless equipment described in the Wireless World as being "quite as up to date as the enemy".

Figure 8. George Kemp, formerly Marconi's Chief Assistant, with a Baden-Powell kite. [Marconi Company Archives.]
ACKNOWLEDGEMENTS

I would like to take this opportunity to thank the following people. Professor Duncan Baker for all his help and encouragement, in the compilation of this paper. Mr Roy Rodwell of GEC Marconi for providing many of the photographs and copies of the original documents. The archival staff of the State Archives, the SANDF Documentation Services and Mr James Rattie of the Royal Engineers Museum, for their suggestions and help in tracing original documents and photographs.

REFERENCES

[14] Extracted from Capt J.N.C. Kennedy's report to the Royal Engineers Committee, 84/M/9586, IOF, Royal Engineers Museum Archives, Gillingham, Kent, 11-2-01.

RECOMMENDED READING