

Wireless goes to War:

The use of wireless communications in the Anglo-Boer War 1899-1902

By Dr. Brian Austin

THE FIRST TRANSMISSION OF A MESSAGE BY WIRELESS TOOK PLACE ON 14 AUGUST 1894, IN OXFORD, AT A MEETING OF THE BRITISH ASSOCIATION. IT WAS CARRIED out by Oliver Lodge FRS, professor of physics and mathematics at University College, Liverpool. The apparatus he used came directly from his laboratory in Liverpool.¹ The transmitter was operated by a Morse key which caused a powerful spark to jump between two brass spheres connected across the high-voltage winding of a Ruhmkorff induction coil and a battery. One of the spheres was connected to a vertical length of wire which served as the aerial while the other was connected to earth. The receiver contained the most important component, called a coherer by Lodge – a glass tube into which various metallic filings were loosely packed between two conducting plugs at each end. Though discovered by the French physicist Edouard Branly in 1890 as a detector of what would soon be known as wireless waves, this simple device underwent many modifications by various experimenters, most notably Marconi. It was the crucial element of the receiver and, again, had one end connected to its aerial and the other to the earth. Under excitation by a passing electromagnetic wave the coherer changed its state from being an insulator to become a conductor of electricity and the current that then flowed through it from a battery caused a device such as an inkler as used in the telegraph stations of the day to record the Morse code dots and dashes from the transmitter on a moving paper tape. A mere five years after Lodge's famous demonstration wireless went to war when the elementary apparatus produced by Guglielmo Marconi's Wireless Telegraph and Signal Company Ltd., in England, accompanied the British army as it sailed for South Africa.²

Marconi was an entrepreneur who saw applications for scientific endeavour; Lodge, by contrast, was a scientist who, at first, sought none and then, when they became readily apparent, was always following in the wake of his rival. There is little doubt that the first successful commercial exploitation of Lodge's remarkable feat in Oxford was the result of the work of the young Italian whose own wireless experiments began in the splendid surroundings of the family home, the Villa Grifone, at Pontecchio not too far from Bologna in 1895.³ A year later, when he was just 22, Marconi arrived in England, accompanied by his mother. She, born Annie Jameson of Scots-Irish stock, was a member of the Jameson whisky family and she lost no time in using the family's considerable influence and connections to bring her son, and his 'invention', to the attention of Sir William Preece, Engineer-in-Chief of the British Post Office.⁴

Preece and Lodge were well-acquainted as a result of their many technical disputes about what, today, would be considered fundamental aspects of the theory of electricity. Preece was a practical man – in his eyes a superior being to the theoreticians who dabbled in formulas whereas he built the telegraph network that spanned the length and breadth of Britain. One of those 'theorists' was Lodge; another was the genius Oliver Heaviside, unschooled at any university but a man whose theoretical



Guglielmo Marconi c.1896

insight and prodigious mathematical ability had made him one of the giants on 19th century electrical science. In Heaviside's eyes Preece, though the senior engineer in the Post Office, was nothing more than an 'eminent scientificist'. Between them Heaviside and Lodge, with each in turn – depending on the specific encounter – being referred to by Preece as 'the other Oliver', were significant thorns in his hidebound side.⁵

Given this animosity between the most influential man in the world of telephones and telegraphs in Britain and his fellow countrymen who dared to challenge his fitness for the position, it is hardly surprising that Marconi's arrival in England provided Preece with a golden opportunity to ignore the work of Lodge and to make all the facilities of the Post Office available to Marconi to further develop, and demonstrate, his wireless equipment. In June 1896, Preece arranged such a demonstration of Marconi's apparatus when it signalled across the rooftops of London from the General Post Office building in St Martin Le Grand to another Post Office building in Queen Victoria Street.⁶ Over three days in early September, Marconi was on Salisbury Plain along with representatives from both the War Office and the Royal Navy. Among the latter was Captain Henry Jackson RN, himself a serious experimenter in the use of these Hertzian waves – so-called because of the remarkable experiments carried out by Heinrich Hertz in Karlsruhe in 1887 in which he proved the existence of the electromagnetic waves predicted mathematically by the Scottish physicist James Clerk-Maxwell in 1865. Also present as an interested observer on the Plain that day was Captain J.N.C. Kennedy of the Corps of Royal Engineers.⁷ As Marconi himself stated in 1899, when he published a very substantial account of his experimental work, Kennedy was to become one of his most enthusiastic assistants. Together they carried out a number of experiments on Salisbury Plain over the course of the next year during which Kennedy 'tried several experiments with kites and balloons'.⁸ Consequently, the Army became aware of the possibilities of this



Captain J.N.C. Kennedy R.E.

means of communicating without wires now rapidly taking shape in Marconi's Wireless Telegraph Company formed in 1897.⁹

Subsequent to this, Marconi began to focus his attention on the sea. He had the foresight to realise that maritime applications would be very fruitful areas for his wireless signalling system. Until then a ship, once beyond the horizon, was out of contact with anyone on land – but that was soon to change. The initial application he exploited was between lighthouses and lightships with Trinity House, the controlling authority for all such navigational aids around the coast of Britain, being a very interested observer. In 1898 he installed his transmitting and receiving equipment in the South Foreland Lighthouse near Dover with another on the East Goodwin Lightship some six miles off the Kent coast. Results were entirely satisfactory with assistance being called for, by wireless, on no fewer than five occasions within the first few months of operation. In March the following year Marconi achieved the first contact by means of wireless between Britain and France when communication was established between the South Foreland Lighthouse and Wimereux, near Boulogne over a distance of thirty miles.¹⁰

But it was Marconi's involvement with the Royal Navy that really caught the eye of the Lords of the Admiralty when, in the summer of 1899, the annual naval manoeuvres took place. At the instigation of the well-informed Captain Jackson RN, Marconi installed wireless equipment in three ships of the 'B fleet' under the command of Admiral Sir Compton Domville. They were H.M.S. *Alexandra*, *Juno* and *Europa*. Marconi himself was invited aboard *Juno* which was commanded by Jackson himself.¹¹ The other fleet, playing the part of the enemy, had no such wireless facilities but relied on the tried-and-tested methods of signalling at sea: flags and lamps. The exercise was a complicated affair covering a considerable distance south of Ireland and up the west coast of England. The 'B fleet', with its Marconi system functioning well, first established contact at a distance of about 85 miles, and reported excellent communications with complete reliability up to around 60 miles; its 'enemy', by contrast, was both blind and deaf once its vessels had disappeared beyond the

horizon. The outcome, as reported in the naval journals as well as in the columns of *The Times*, was victory for Admiral Domville's fleet and almost complete vindication for Marconi's wireless system temporarily accommodated in three of its fighting ships. The one note of caution concerned the inability of more than one ship to transmit at a time for fear of causing interference, chaos and confusion. Marconi had not yet implemented a means of tuning his transmitters and receivers such that they could operate on different frequencies thereby eliminating interference of one with another.¹²

Again, it was Oliver Lodge who led the way. As early as 1888, when he was working on the somewhat arcane subject of lightning conductors, Lodge discovered, by way of a series of brilliant experiments, that the condition of resonance, so well-understood in the world of sound and particularly musical instruments, applied equally well to electrical circuits. He coined the expressive and evocative term 'syntony' to describe the phenomenon and defined it as 'the synchronising of the vibration period of two things'.¹³ In essence he had shown that it was possible to make electrical systems, such as a transmitter and its companion receiver, frequency selective by the process of 'tuning' them, in precisely the same way that a piano tuner plies his trade. Lodge patented his method under the title 'Improvements in syntonised telegraphy without line wires'. The patent was filed in England on 10th May 1897 and it emphasised selective tuning developed in conjunction with his collaborating colleague Alexander Muirhead. In essence the patent showed how the transmitter would radiate its power on a defined frequency to be intercepted at a distant point by a receiver, specially tuned to that same frequency.¹⁴ Three years later Marconi obtained a patent – number 7777, the famous 'four sevens' patent – on 'Improvements in Apparatus for Wireless Telegraphy'. Among these improvements, many of which were undoubtedly true, was Marconi's claim to have invented tuning clearly ignoring Lodge's substantiated case.

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It is of interest to follow this story a bit further even though it had no impact on the use of wireless in the Boer War to come. Marconi had long harboured a concern that the burgeoning wireless industry would challenge him and so, in October 1911, after the drawn-out process of negotiation with the Lodge-Muirhead Syndicate, he purchased the Lodge patent for an undisclosed sum. This patent was subsequently the subject of close scrutiny by the United States Supreme Court when it considered Marconi's claims and, in a judgement, reached in June 1943, it declared the Marconi 7777 patent to be invalid; Lodge's patent of the syntonic circuit of 1897 was deemed to have priority.¹⁵

The first sale of equipment by Marconi's company took place in 1899 and the first customer was the War Office. It had taken the looming war in South Africa to sow the seed that wireless may have some role to play on the battlefield. To the ever-impatient but perspicacious Marconi they were simply tardy.¹⁶

War actually broke out between Britain and the Boers on 11 October 1899. Its causes lie deep in the history of colonial southern Africa but, essentially, the discovery of gold and

were challenging to say the least. It was, Kennedy reported, 'either dead calm with revolving dust storms, or blowing half a gale and raining hard'. Violent thunder storms, plus the attendant lightning, are a feature of that part of Africa and Marconi's men experienced it all. Kennedy's hopes that, in addition to his poles for supporting the aerials, he might be able to use kites and balloons looked like being dashed by the variability of the conditions but he had his men practice erecting poles while also learning the art of flying balloons and kites, with the assistance of Major R.F.S. Baden-Powell, a military aviation pioneer and the younger brother of the gallant defender of Mafeking.²⁶ And there was yet more to come.

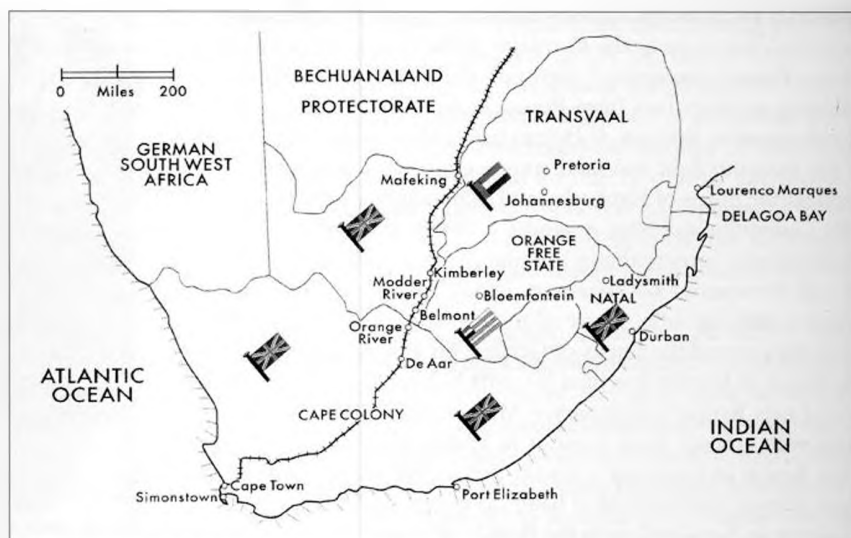
Aerials, as well as requiring tall masts to support them, also require good connections to the earth beneath, as was made clear in the description of the wireless apparatus of Lodge and Marconi above. However, the ground around De Aar and its surrounding countryside was dry and very hard with rocks not far below the surface. It was certainly not Salisbury Plain! Driving metal stakes into the ground to which they could connect the 'earths' proved very difficult and the electrical continuity was poor. They even tried burying large sheets of tin procured from the packing cases and though more effective, it was hardly a practicable solution for the moving installations in the field.

Mr Bullocke, as the senior Marconi engineer in the party, wrote a number of letters to the Company back in England in which he reported on progress or, as was often the case, the problems that confronted them almost at every turn.²⁷ On 11 December 1899 he mentioned that he and his party were now under canvas. 'Last night', he wrote, '... we passed thro a very heavy thunderstorm. The lightning was, I think, the most vivid any of us had ever seen. This, they tell us, is a daily occurrence here - a very delightful time for the X's.' These cryptically-described events were the so-called static crashes which all listeners to the medium wave radios of-old became so accustomed when lightning was about. He went on 'I understand we shall stop here [De Aar] for two or three weeks but for what reason I fail to see'. In the meantime, one of the wireless sets, plus its attending engineer (Elliott), had been sent on to a place called Orange River, some 70 miles north of De Aar. Bullocke wrote again a month later.

On Friday we made an excursion about two miles outside of camp and endeavoured to get through to Orange River but it did not succeed. The cause of failure is unknown. We had a curly aerial about 60 ft in height and good earth. There was not sufficient wind for kites. Yesterday we tried again but Elliott had the Misfortune [sic] to break his pole so that we again failed to get signals through.

He continued:

We had arranged a very nice programme last week but up to the present the authorities at Modder River will not have a detachment sent there. The plan was to have a station at Modder River, Belmont and Orange River [...] This we could have done with the poles at our command, and it would have been a start to better things. However as the Commandant at Modder River will have nothing to do with us we can only sit down and wait. Should we get through from Orange River to De Aar it may wake them up somewhat and an opportunity may be given us. Captain Kennedy is however confident that opportunities will not be wanting in a little time.



South Africa showing the British territory and the two Boer republics

It is clear that the problems they encountered were not all of a technical or practical kind: the military mindset was not about to have its operations and procedures determined for them by a bunch of civilians and their complicated technical contraptions. But Kennedy's enthusiasm was clearly undimmed because all his shared triumphs when using Marconi's apparatus in England continued to spur him on. News had just reached them of another triumph: the first transmission by wireless of the latest events of the day from shore to ship. It had occurred when Marconi was a passenger aboard the steamship *St Paul* returning with his equipment to England from America where he had been to see it being used to report on the annual yacht races off the east coast. Evidently the results exceeded all expectations with 'over four thousand words being transmitted in the space of less than five hours on several days.' Then, just a few days after his departure for home, the war in South Africa broke out and there was intense interest on the *St Paul* for the latest news. Marconi knew that one of his stations was operating from The Needles on the Isle of Wight, so he set up his wireless apparatus in the ship and called The Needles at a distance of some 66 nautical miles out at sea. Communications were established and the latest war news was sent to them and immediately printed in a newsheet which they called the 'Transatlantic Times' and distributed among the passengers.²⁸

In the meantime, Kennedy had been kept busy preparing the equipment in the expectation of orders to move out. He had become particularly concerned by the state of the bamboo poles. Being untreated (unseasoned was his word) they soon developed large cracks which traversed them from end to end. Despite binding the poles with stout wire at intervals of 18 inches they were too fragile for anything but light work. He immediately sent a telegram to Cape Town requesting that the original Marconi poles be sent to him as soon as possible. In the midst of all this he was visited by Colonel Hippius, the Director of Telegraphs, and then Lord Methuen, who was commanding the 1st Infantry Division on the western borders of the Cape Colony, 'interviewed' him twice on the subject of wireless.²⁹

A decision was clearly in the offing and it came on 31st December when Kennedy was ordered to send two wireless installations to Natal to assist General Buller who was leading the tortuous attempt to relieve the besieged town of Ladysmith. Kennedy decided to go himself along with the two wireless-equipped wagons under the control of Marconi's men Bullocke and Taylor.³⁰ However, intelligence reports indicated a pressing

diamonds far from the British-controlled colonies of the Cape and Natal, but close to the heartland of the Boers, was a major factor. Britain precipitated the war; the Boers declared war following an ultimatum from President Kruger delivered to the British Agent in Pretoria.¹⁷ Britain had underestimated the will of the Boers to fight and their resourcefulness to do so. By 14 October the towns of Kimberley and Mafeking were under siege with Ladysmith suffering a similar fate two weeks later. The 18,000 Boers, farmers almost to a man, were unmilitary in make-up and demeanour but they were expert horsemen and highly effective with the rifle. Many of them had proved their worth when they routed the forces of General Sir Pomeroy Colley on the slopes of Majuba less than 20 years before. They were well-armed too: Kruger's weaponry – Mauser rifles from Germany along with artillery from Creusot in France and further pieces from Krupp in Germany – meant they could put a significant force of men onto the field of battle, as long as they could spring a surprise in Natal and catch the British off-guard.

Back home, in Pretoria, Kruger had commissioned the building of four forts to protect his capital, plus another in Johannesburg on the road of advance of invading forces from the south. To be effective they needed to be able to communicate, one with another, but the weak links in any communications chain were the telegraph lines tying those forts together and Kruger's General Manager of Telegraphs, one C.K. van Trosenburg, believed he had found a solution. He could do it without wires if he could obtain the apparatus which his reading of the technical papers had revealed was being developed in Europe.¹⁸ No one, and least of all the British, could have imagined the Boers being so technically competent, and so familiar with the latest scientific developments in Europe, that they were about to embark on installing a wireless communication system for their use during the war now about to erupt. This fascinating saga will be touched on below.

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Britain despatched a force of almost 47,000 men (to increase ten-fold by the war's end) within a month of the Boer's attacks in Natal. Among them were six engineers from the Marconi Company (Messrs Bullocke, Dowsett, Elliott, Franklin, Lockyer and Taylor) and five so-called portable wireless stations. With them was Captain Kennedy, though they sailed separately with Kennedy leaving Southampton on 21 October 1899 on the troopship the *S.S. Gascon* in the company of the Coldstream Guards. His Marconi colleagues left some two weeks later along with all their equipment.¹⁹ It had been the intention that the wireless equipment would be used for ship-to-shore communications in Durban to assist in the process of transferring men, materials and the impedimenta of war to dry land. When writing his report some while later, Kennedy added rather poignantly 'In the light of later experiences it is to be regretted that the original idea was not adhered to'.²⁰ As it happened, after disembarking in Cape Town and then making contact with the military authorities at the Castle, he was informed that the equipment was to be used 'up country' and so he approached the recently-arrived Marconi engineers and asked them whether



Marconi's engineers and R.E. sappers

they would be prepared 'to sign a certificate that they were willing to go under fire'.²¹ They were, and they were then joined by fifteen R.E. sappers and their NCO who immediately set about preparing the wireless equipment for its journey to the front. Improvisation was very much the order of the day.

The five wireless sets and their batteries were installed in standard General Service (G.S. Mk VIII) horse-drawn wagons. The batteries were placed in straw, covered with cocoanut matting and boarded over. On top, and firmly fastened to the wooden floor, was the transmitter. To use the Morse key the operator would stand on the ground at the back of the wagon. The receiver with its coherer, being a more delicate instrument, was suspended in a tray from two of the bale hoops in the centre of the wagon. Each wagon carried six 28-foot bamboo poles, fastened to the sides by straps. Their purpose was to support the aerial wires. Once assembled a 'show' was put on at the Cape Town Castle for the General, his Staff officers and foreign military attaches by sending signals a few hundred yards between two of these wireless-equipped wagons. It was, according to Kennedy, a 'great success'.²² The next day Kennedy, the Marconi engineers, their sapper assistants, plus their wireless-equipped wagons entrained for the railway junction of De Aar on the route to the besieged town of Kimberley. They were part of General Lord Methuen's relief column.

It was in De Aar that they encountered the first of their many problems: the un-sprung G.S. wagons were found to be utterly unsuitable for the task in hand. After some delay they obtained lightly-sprung Australian wagons and the process of transferring all the equipment started all over again. Fortunately, or so it seemed, just before leaving Cape Town, Kennedy had been summoned by the Customs authorities to a warehouse at the dockside.²³ There he was shown some suspicious-looking objects in polished wooden cases with brass fittings. With his experienced eye he recognised them as the elements of a wireless telegraphy system remarkably similar to his own but bearing the name of the German company Siemens and Halske. What Customs had impounded had been delivered to Cape Town on-board five ships all having left from ports in Germany. This was the wireless equipment intended for the Boers.²⁴ Kennedy immediately 'cannibalised' some of its superior components but he rejected the German-made composite poles, complete with fittings, and capable of being erected to heights of 50 to 100 feet because of their complexity. Instead he decided to rely on those locally-sourced bamboo poles which, he hoped, could be lashed together to provide the suitably tall masts required. Initial trials had looked promising with mast heights of 80 feet being achieved. He reported that 'Mr Bullocke was of the opinion that with this height it would be possible to communicate 30 miles with certainty'.²⁵

Meanwhile reports received from the front indicated that weather conditions in the height of a South African summer

local need as well. Methuen feared a 'surprise' in the vicinity of Enslin, a little place some 17 miles from Modder River, and he wanted Marconi's wireless communications close at hand. As a result, Bullocke planned to set off the next day as soon as the poles had arrived from Cape Town in order to establish the stations at Modder River and Enslin so that the two places could be in permanent communication. His latest missive to the Marconi Company went off that same day. In it he reported that stations had been set up and were 'in working order' between Orange River and Modder River and, on a most optimistic note, he informed London that: 'The distribution of staff is such that should our services be required at any time, I have the greatest confidence in showing our system to advantage.'³¹

Bullocke's records inform us on that 'distribution of staff'. It involved a fair amount of musical chairs – for whatever reason is not disclosed. In early December, Mr Elliott was in charge of set No.1 at Orange River. Three weeks later it was transferred to Modder River where Mr Lockyer took over, having himself originally been responsible for set No.2 at Belmont. Lockyer had bravely volunteered to make his way through enemy lines, along with his wireless equipment, to assist those besieged in Kimberley but Lord Methuen refused permission.³² Then, near the end of January that set became the responsibility of Mr Franklin. The third set was under the control of Mr Dowsett and remained in his charge, after being moved to Enslin on 2 January. Finally, sets 4 and 5 were those now intended for service in Natal.³³

This was the equipment that was to assist General Sir Redvers Buller, recently superseded as the General Officer Commanding in South Africa by Field-Marshal Lord Roberts and effectively demoted to command the Army in Natal.³⁴ Captain Kennedy, along with Messrs Bullocke and Taylor, would thereby, it was hoped, add wireless communications to Buller's armoury as he advanced on Ladysmith. In every instance, Marconi's engineers had a contingent of R.E. sappers with them whose function was not only to provide the necessary manpower for the erection of the poles, or to tussle with kites and balloons when these could be flown, but also to provide the necessary armed protection should the enemy encroach on their places of deployment. On 8 January, Kennedy, Bullocke and Taylor, and their two wireless wagons, left De Aar by train. With them were seven of those sappers as well as three drivers, two horses and twelve mules.³⁵ They boarded the Dunnottar Castle in Port Elizabeth a week later and reached Durban after two days at sea. One of their wagons had been damaged when being hoisted onboard before their departure, and so, after disembarking, they were delayed for a few days while repairs were carried out. Eventually, on the 24th, they reached their destination at Spearman's camp overlooking the Tugela River. A fierce battle was raging in the distance on a prominent hill known as Spion Kop. Kennedy observed the fighting at a distance and recorded laconically in his diary 'Could not understand it at first. [The soldiers] returned at night unable to hold hill'.³⁶ It was, in fact, a major setback for the British Army.

The diary unravels somewhat at this point, at least as far as wireless is concerned for Kennedy never mentioned it again!

On 4 February he was instructed by the Chief of Staff to join the Headquarters Company. Henceforth his function changed; instead of erecting and testing Marconi's elementary wireless equipment in the midst of what was, at times, an erratic process of military manoeuvring on the battlefield, he resumed the job for which he had been trained originally: erecting telegraph and telephone lines between the widely-scattered elements of an army in the field. On 12 February he saw the Chief of Staff who 'gave me full authority to act in complete charge of telegraphs.'³⁷ On the



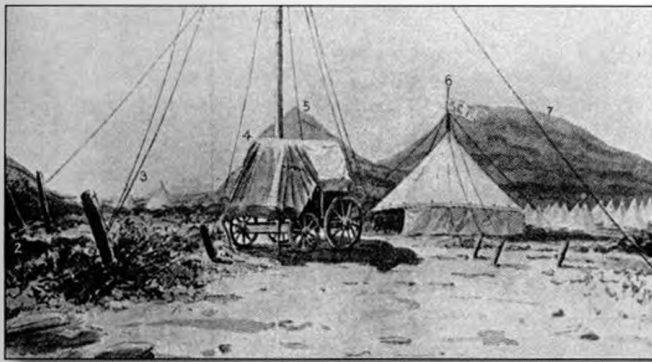
Three generations of fighting Boers

same day, the Director of Army Telegraphs (Col. R.L. Hippisley) 'gave orders for the Kimberley Line stations to be dismantled'.³⁸ Bullocke and Taylor's two sets in Natal had, apparently, done little more than cover large tracts of land in their wagons without ever being tested, let alone being called upon to render useful service. Between 15 and 21 February all the equipment, on both the Kimberley line and in Natal, was put into packing cases which made their way, eventually, to Cape Town.³⁹

We could at this point continue with the somewhat fractured chronological sequence in the life of Marconi's wireless equipment in South Africa and pick it up again once in its new *modus operandi* aboard Her Majesty's ships carrying out blockade duties in Delagoa Bay. However, I'll now detour to look at the remarkable story of the Boers who so nearly acquired wireless apparatus themselves.

Early in 1896, Dr. Leander Starr Jameson, a close confidante of Cecil Rhodes, Prime Minister of the Cape Colony, led his 600 men from Pitsani on the Bechuanaland border into South Africa in an attempt to unseat President Paul Kruger of the South African Republic (ZAR), better-known as the Transvaal. To succeed would have required an uprising by the *Uitlanders*, the foreigners – mainly British and American – in Johannesburg, who had been attracted there in their thousands by the discovery of gold in 1886 but who had been refused the franchise by the fearful Boers. The fear of being 'swamped', by somebody, was ever-present. However, divisions among the *Uitlanders* saw no concerted effort to march on Pretoria, the capital of the ZAR some 30 miles to the north. The Boers got wind of Jameson's plans and easily overwhelmed his invading force, causing a significant number of deaths in the process. To Kruger this pointed to only one thing: it was inevitable that Britain would declare war on the ZAR in the near future so he immediately set in train the process of arming his nation of recalcitrant Boers.

Sympathy for the Boer cause had long been apparent in both Germany and France so Kruger soon found willing suppliers of weaponry. In addition, the construction soon commenced of the five forts to protect his capital, with the additional need for good communications between them. The ZAR already had a sophisticated telegraph and heliograph network between Pretoria and various places in northern Natal. Once hostilities commenced it was rapidly extended to all the Boer *laagers* close



Enslin Camp 1899 from a sketch by H.M.Dowsett

to the front. As we have seen, Kruger's adviser on these matters (van Trotsenburg) had suggested it could be done by means of the new wireless apparatus now becoming available in Europe.

Van Trotsenburg lost no time in writing to the suppliers of this new technology in England, France and Germany. Given the sensitivity of the political situation in the ZAR, he was circumspect in his choice of words; no details of the application were disclosed other than the bald facts that defined his needs. He thus wrote, to Siemens Brothers in London, on 28 February 1898.¹⁰

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 1,2,3,4. Are there any difficulties, if so which?, if not can you supply us with the necessary instruments complete, ; (*sic*)

If you can supply them, please send one set (two instruments) for taking a trial, for use either between 'A' and 1, or 1 & 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 of post 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 cablewords in order to place us in a position to give you an order by cable.

I have the honour to be, your obedient servant,

C.K. van Trotsenburg.

General Manager of Telegraphs.

This is a quite remarkable letter in the history of wireless communications. It was written a mere three years after Marconi's first successful wireless transmissions. And it came from the heartland of the most conservative of the peoples that made up the population of this part-colonial, part-republican, southern tip of Africa. The god-fearing Boers were not known for their depth of reading beyond the Bible – their President was no more than semi-literate – but he was astute and he surrounded himself by some able people, like-minded in their stolid support for the republican cause of the Boer nation. Van Trotsenburg, a Dutch immigrant, being one of those.

The reply received from Siemens Brothers in London a month later is interesting. It indicated that, 'The exploitation of the Marconi system of Wireless Telegraphy in this country is in the hands of a Company which owns the Marconi patents. We have interviewed the Managing Director of this Company on the subject of your letter and so far as we can understand there should be no very great difficulty in carrying out the installation you desire ...' It continued after some technical considerations,

'The Company were anxious to know for whom the apparatus was required but as you had marked your letter "confidential" we did feel at liberty to satisfy them on this point.'

Van Trotsenburg's carefully-chosen phraseology had achieved what it set out to do.

The 'Company' referred to is clearly The Wireless Telegraph and Signal Company which would soon rename itself Marconi Wireless Telegraph Limited with its headquarters in Finch Lane off Threadneedle Street, London. In their next letter Siemens Brothers were more forthcoming. 'We have again seen the Managing Director of the Marconi Company but regret to say we can make no progress with them'. The stumbling block was neither technical nor, evidently in any way connected with van Trotsenburg's reluctance to divulge more than he had done. It all revolved around the Marconi Company's unwillingness to sell the apparatus but rather to lease it on a long-term basis in order 'to obtain their return from a tax on its employment.' Siemens Brothers then began to explore other avenues even to the extent of suggesting the equipment made by Oliver Lodge though it was hardly more than laboratory apparatus at that time; the Lodge-Muirhead Syndicate, which did eventually venture into the commercial market, only came into existence in 1901 by which time Marconi's much more enterprising approach had secured for him an almost complete stranglehold on the world of wireless communications.⁴¹

Meanwhile van Trotsenburg had, similarly, explored further afield. He wrote to the Johannesburg agents of the German firm Siemens and Halske in April 1898. The commonality of the Siemens name between Germany and England stemmed from the fact that the Siemens family, who were renowned as electrical engineers, had established industrial enterprises to exploit their numerous technical developments in both Germany and England. One of these, which was much influenced by Marconi's early success, was wireless telegraphy. On 21 June, the parent company in Germany communicated with van Trotsenburg and offered to supply him with '[...] five stations at a total price of four hundred and eighty seven Pounds Sterling, delivered at Pretoria'. In addition, the letter went into considerable technical detail about the equipment and its installation. One needs to compare the cost of £487 quoted by Siemens and Halske with the figure of £9,000 which van Trotsenburg had estimated to be the cost of the buried telegraph cables required to link those five forts to appreciate the considerable advantage conferred by wireless telegraphy in both commercial and technical terms.⁴²

No order was placed, however. Boer procrastination and the fluidity of the political situation no doubt played their parts. But, by the next year, the situation was becoming rather dire and war with England looked increasingly likely as neither side was prepared to concede. Deadlock between Kruger and Joseph Chamberlain, Secretary of State for the Colonies, had intensified.⁴³ In June 1899 van Trotsenburg travelled to Europe. He had appointments in London, Berlin and in Paris with the *Société Industrielle des Téléphones* who had also ventured into the field of wireless communications.⁴⁴ A letter he received, dated 1 July 1899, from Marconi's Company in London is both fascinating and very revealing, particularly in the light of events still to unfold. There was no pretence or obfuscation now on the part of either party: this was business. Addressed to C.K. van Trotsenburg, Esq., General Manager of Telegraph (*sic*), Pretoria, South African Republic it said:

Dear Sir,

In connection with your visit to this office yesterday and the matter then discussed, I have pleasure in confirming what I

then stated, viz:- that we would be willing to supply instruments for one or more installations of wireless telegraphy to your Government. The cost of instruments complete would be as enclosed sheet, amounting in all to £95.10.0. Royalty for the use of the instruments would be as might be arranged, this depending on the distances dividing the stations for the installations. As I understood from you yesterday that five stations (which you mentioned as being the probable number you would require at once) would all be included within a radius of five miles, and that you would wish all these stations to intercommunicate if possible. The royalty for this number would be £500 a year, or £100 for each set of instruments.

And this letter came from the Managing Director himself. Thus, Marconi's Company in England was committing itself to a business deal with the Boers on the eve of a war which was looking more and more likely.

As events transpired, van Trosenburg, on his return to Pretoria weighed up the various options on both technical and financial grounds. He came to the conclusion that the equipment which would best serve his needs was that manufactured in Germany by Siemens and Halske. Of Marconi's 'instruments' he concluded that 'It is still a novelty... Sometimes it works well, sometimes not when a strong wind prevails, there is considerable difference of which no satisfactory explanation can be given'.

On 24 August 1899, van Trosenburg placed an order with Siemens and Halske in Berlin, via their agent in Johannesburg, for six sets of 'spark wireless telegraphy instruments' (*wonkeltelegraafinstrumenten*).⁴⁵

In light of events still to come in connection with Marconi's apparatus when used by the British army for which there were indeed no satisfactory explanations (see ref.38), those remarks of Kruger's technical adviser might seem very prescient. As will be discussed later, the meteorological conditions responsible for disrupting wireless communications in and around Lord Methuen's column south of Kimberley involved a variety of what we might describe these days as geophysical phenomena.

In the event, the Boers were never to see their wireless equipment as it had fallen into British hands in Cape Town where it had been unloaded after hostilities had already commenced. Meanwhile, Marconi's apparatus, a 'novelty' in van Trosenburg's eyes, was now on its way to the Royal Navy in Cape Town after its less-than-glorious performance with the Army.

The Navy had a ready application for wireless communications between its ships in Delagoa Bay off Portuguese East Africa. It was there that the RN was running a blockade operation to prevent the supply of weapons and other contraband to the Boers through the port of Lourenco Marques (now Maputo). Four navy cruisers were intercepting, boarding and searching all foreign vessels entering the bay. The experience with wireless during the summer manoeuvres of 1899 had convinced Their Lordships that this mode of communications had a vital role to play in any future naval actions and so, on 14 February 1900, they readily took over Marconi's apparatus from the Army including Marconi's operators.⁴⁶ Only four of the sets were in a usable condition. Set No. 5, in the list prepared by Marconi's engineers, had been dismembered in order to replace parts of the other sets that

had deteriorated following their use by the Army. H.M.S. *Forte*, *Magicienne*, *Racoon* and *Thetis* received the equipment between 6 and 10 March 1900 and its installation then commenced. The first ship of the Royal Navy to be equipped with wireless communications in an active theatre of war was H.M.S. *Thetis*.⁴⁷ In his subsequent report to the Admiralty, her commander, Captain F. Stokes-Rees R.N., stated, *inter alia*, that the Marconi apparatus became operational on 17 March. The ship's main mast was extended to a height of 141 feet – a requirement spelt out by Marconi's engineers and clearly intended to overcome the serious problems experienced when using the equipment with inadequate masts and poles in the previous months when with the Army.

Stokes-Rees provided results from numerous tests and during actual operations. 'The maximum distance signalled over by wireless from this ship is 53 miles [nautical miles]', he wrote. 'The first record was obtained on 19th March, [when] the *Thetis* was then on No.1 Beat and the *Forte* on No.2 ...[.] The position of each ship was taken ... and the maximum distance signalled over was found to be 49 miles. He continued with, amongst other things, the following:

On 4th April the *Thetis* was in touch with the *Magicienne*, *Forte* and *Racoon* simultaneously, and exchanged signals by wireless without the least difficulty, each ship answered the signal sent to her and there was no confusion.

At Durban on 30th April the maximum number of messages (30) were passed by wireless between H.M. Ships *Magicienne*, *Thetis* and *Forte*.

During this period Marconi's man aboard H.M.S. *Thetis* was H. Melville Dowsett, who carried the rank of Honorary Lieutenant R.E. He was both the operator of the wireless equipment as well as being the instructor in its use charged with training the naval signals personnel in the intricacies of this strange new method of conveying messages over considerably greater distances than was hitherto possible. According to Captain Stokes-Rees, Dowsett 'has introduced several improvements in the fittings since the instruments were first installed, these having greatly simplified the method of working, and by introducing suitable switches he has rendered it easier to test the instruments when necessary'. As a result, he reported, 'The signal and torpedo staffs of this ship are now fully qualified to work the instruments without the constant supervision of a representative of Marconi's Wireless Telegraph Company, Limited'.

Two further most pertinent points were made by Stokes-Rees in his next report when he stated that communications 'had been constant and certain, either by night or day, whenever the ships have been in range'. In addition, he noted, that maximum results (i.e. range) had been obtained between the *Forte* and *Thetis* on account of 'the superior heights of masts [which] are not in any way excessive'.⁴⁸

The versatility and usefulness of this revolutionary new method of communicating was taken to another level entirely when it was reported that H.M.S. *Magicienne*, while lying at anchor in port at Lourenco Marques, maintained regular communication with the other ships on patrol outside of Portuguese territorial waters. And, for the first time ever,



C.K. van Trosenburg



A modern reconstruction of the wireless receiver supplied to the Boers

it allowed the Commander-in-Chief, some 1200 miles distant in Simon's Town, to communicate directly, by telegraph, with those wireless-equipped ships of his fleet operating in Delagoa Bay. This was made possible by linking the *Magicienne* to the extensive landline telegraph network that existed between Lourenco Marques and the Cape Colony via those republics deep in the South African interior.⁴⁹

In his covering remarks to these reports, Captain H.W. Fisher R.N., the Senior Naval Officer Delagoa Bay and Natal Division announced, with an eye not just on the wireless apparatus, and the competence in its use by those under his command, but also on the proliferation of extraneous personnel aboard his ships.

I would submit that the assistants may now be discharged, for, as I telegraphed on 16th ultimo, their services can be dispensed with, and they occupy a good deal of space in the small accommodation of the ward room of *Magicienne* and *Thetis*. It is for consideration whether one for the general supervision of the squadron be retained in *Forte*, where the accommodation is less limited, and I recommend Mr. Dowsett as being the most suitable.⁵⁰

It was left to G.L. Bullocke, the senior Marconi man in South Africa, to elaborate in his letter to Mr H.W. Allen, the Secretary of Marconi's Company in London on those operational aspects for which he, in his modest and understated way, was clearly very much responsible as well as on his colleagues, some of whom had succumbed to illness while others were fully employed aboard H.M. ships.⁵¹

H.M.S. Forte
Lourenco Marques
2nd May 1900

Dear Mr Allen,

Wireless continues to go satisfactorily here. Capt. Fisher has reported favourably to show up its great advantages. He has suggested to the Admiral that one assistant remains to superintend.

Mr Dowsett who has done very good work has often expressed a wish to remain as long as possible so that I do not hesitate in recommending his staying.

Mr Lockyer was very comfortable at Durban and is almost well. He has had enteric fever. The matron has promised to see that he has everything necessary for his speedy and complete recovery.

The men are at present working wireless on all the ships and I am only waiting for the necessary instructions from you

to transfer gear to the Captains and leave for England. The tubes which sent are not yet to hand. I instructed Franklin who left for Durban about a week ago to wire Capetown respecting them. The consul general here is a keen admirer of Wireless.

Yours faithfully,

G.L. Bullocke

By this time the war was changing. It was no longer a conventional conflict - whatever that might mean - between two armies confronting each other head-on. By no stretch of the imagination could one class the forces of the Transvaal (the ZAR) and the Orange Free State as an army. Even though Kruger had a well-trained and disciplined *Staats Artillerie*, his forces were dominated by itinerant farmers who fought in their *Kommandos*, not by military rules underpinned by discipline but out of simple conviction. As Pakenham describes it, they fought with the tactics of the mounted frontiersman.⁵²

By the end of May 1900,
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On 13 March, Bloemfontein, the capital of the Orange Free State fell to Lord Roberts, its defending Boers having disappeared into the huge expanse of surrounding veld, the endless grass and rock-studded plains that are so much part of inland South Africa. Then, first Johannesburg and within days Pretoria both surrendered. By the end of May 1900, it looked to the casual observer not conversant with the bloody-mindedness of the Boers that the war was over. As a conventional encounter it was; but its next phase was about to begin. Lord Roberts, his job done, headed home; his deputy, Lord Kitchener, assumed command. However, the Royal Navy's activities in Delagoa Bay continued for many months as merchantmen from Europe, having been at sea while those climactic events unfolded in the Transvaal, headed for Lourenco Marques with cargoes possibly intended for Queen Victoria's enemies. Writing from H.M.S. *Philomel*, now equipped with the wireless apparatus previously on H.M.S. *Forte*, Dowsett informed his masters in London that 'There appears to be no prospect of the blockade being raised yet as the Boers still appear to be making occasional successful moves. H.M.S. *Thetis* is still in Delagoa Bay, H.M.S. *Magicienne* at Durban, and we are nor (*sic*) proceeding to the latter place'. As well as informing Marconi's managers that the personal expenses incurred by himself and his colleagues were rising, he provided some information about the future of wireless communications in this southernmost part of the African continent.

He continued, 'As regards the instruments which are now being used, as I said before, they are in too bad a state now to be made into new sets but if they are thoroughly overhauled and repaired, many of them may be made serviceable again. This can either be done in England or out here and I think if Wireless is adopted by the Cape Government and the Portuguese Government it will be economical to take the latter course'.⁵³ The war in South Africa still had a long time to run. Peace terms proffered by Britain were rejected and the Boers took to



H.M.S. *Thetis* showing her extended main mast carrying the wire aerial

waging a guerrilla war. But wireless had served its purpose – at least at sea. The British Admiralty, impressed by their captains' reports which confirmed what they had seen during the 1899 manoeuvres, placed orders with Marconi's Company in July for the supply and installation of wireless equipment aboard twenty-six naval vessels and at six Admiralty coast stations. A new era of military communications had now begun.⁵⁴

Marconi himself had not been idle. Addressing members of the Royal Institution in London, in February 1900, he had pressed his claims that progress in wireless communications, as developed by himself and now advanced by his Company's engineers, 'is many times as great as the predictions of five years ago had led us to expect in so short a time.'⁵⁵ This was certainly true and the fact that his apparatus had been deployed to an active theatre of war had provided, by far, the most realistic and challenging scenario in which to test it. The fact that it had failed to impress the British Army, and yet had performed admirably when used by the Royal Navy, was, according to him, a matter of ill-preparedness on the Army's part and had nothing whatsoever to do with his equipment. Whereas there may have been some culpability on Captain Kennedy's part in abandoning, too readily, the masts and poles provided by Marconi and, perhaps, he should have pilfered those supplied by the Germans to the Boers, the real problem was not, as Marconi asserted, caused by 'the lack of proper preparation on the part the local military authorities.'⁵⁶ With the hindsight of a century of radio communications theory and practice behind us it is now possible to identify the real causes of the problems, only one of which can be blamed on those bamboo poles that accompanied Marconi's men to the 'ironstone, kopje-studded, dry, sandy plains of the Northern Karroo.'

With the hindsight of a century
of radio communications theory
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Lest anyone should suggest that his Company had in any way been complicit in providing the Boers with wireless apparatus, Marconi asserted: 'I hardly need add that ... the Boers cannot have obtained any of our instruments.'⁵⁷ But they may well have done had Marconi's terms, discussed just a while before, been more favourable!

An in-depth analysis of the communications problems that plagued Marconi's equipment when it headed north via the railhead

at De Aar en-route to Kimberley was published by the author in 2001.⁵⁸ I shall therefore limit my remarks here to just a summary. It was shown that a combination of factors played a part in severely degrading the performance of Marconi's very elementary wireless transmitting and receiving apparatus when it was used by the Army. In no particular order of significance these were the time of the year when the hardware was deployed on land and at sea; the particular lengths of wire used as very makeshift aerials on land compared with the much longer and more competently-erected aerials on H.M. ships; the effect of the thunderstorms, particularly lightning, on the receivers and the geological characteristics of the ground in the De Aar to Kimberley vicinity.

As noted above, none of Marconi's wireless equipment used in South Africa contained any form of 'tuning' or syntony as Oliver Lodge had called it. The only frequency-sensitive element was the length of wire used for the aerial. Since no two stations would ever likely to have used the same length of wire during the 'army phase' of their deployment, the respective transmitters and receivers would never have been operating on exactly the same frequency. However, in the circumstances, the very broadband nature of the signals emitted by a spark transmitter would have tended not to make that shortcoming too significant.

On the naval vessels all the aerials would not only have been much longer (and hence have been more effective) but doing things in some well-determined standard way is a fact of life in a disciplined service such as the Royal Navy, and so all aerials will almost certainly have been of similar lengths. It was the South African summer when the equipment was used by the Army. During that season, thunderstorms and their attendant flashes of lightning are an almost daily occurrence, particularly the further north one happens to be. A lightning flash, even many miles distant, is a formidable source of electromagnetic energy which could have easily overwhelmed the coherers in Marconi's receivers. Such effects were the 'Xs', so aptly described by Marconi's men at the front. The Navy had use of the equipment in winter when thunderstorms are almost non-existent in South Africa. And finally, the electrical conductivity of the sea water is orders of magnitude higher than that of dry, hard, geological substances just as rock and sand. The so-called 'ground wave', which is almost certainly the mode of radio propagation applicable in this case, is very much affected by the conductivity of the 'ground' over which it travels. The higher that conductivity the greater the distance the signal propagates. Hence the significantly longer range achieved at sea than anything Marconi's men managed on land. We can therefore conclude that the wireless apparatus probably worked as well as it feasibly could have done under the prevailing conditions, most of which were beyond the wit of man to do anything about.

Wireless communications made their debut on the battlefield in what was seen, by some, to be an entirely unequal encounter between the forces of the mightiest military power at the time and the irregulars, just farmers, of the Boer republics. But that's not the way events unfolded in what may also have been the last of the gentlemen's wars. Though unsuccessful when tried by the British Army, Marconi's apparatus performed admirably when used by the Royal Navy.

Acknowledgements

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Notes

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- ⁴ H.G.J. Aitken, *Syntony and Spark: The Origins of Radio* (Princeton, Princeton University Press, 1985), pp. 179-180.
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- ⁶ Jensen, p. 19.
- ⁷ G. Marconi, 'Wireless Telegraphy', *Proceedings at the Meeting of the Members of the Royal Institution of Great Britain*, 16, 1900, pp. 247-256.
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- ⁹ Aitken, p. 229.
- ¹⁰ Marconi, 1899, p. 278; Marconi 1900, p. 250.
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- ¹⁶ Marconi, 1900, p. 254.
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- ²¹ Kennedy, Diary, 26 November 1899.
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- ²³ Austin, 1995, p. 235.
- ²⁴ L.L. Fordred, 'Wireless in the Second Anglo-Boer War 1899-1902', *Transactions of the South African Institute of Electrical Engineers*, 1997, Sept., pp. 61-71; Baker, 2006, pp. 421-454.
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- ²⁶ Marconi, 1900, p. 254.
- ²⁷ G.L. Bullocke, correspondence with the Marconi Company between 11.12.1899 and 2.5.1900. Oxford, Bodleian Libraries, MS Marconi 334.
- ²⁸ Marconi, 1900, p. 254.
- ²⁹ Kennedy, 1901, p. 159 and Diary 14 and 23 December 1899.
- ³⁰ Kennedy, Diary, 31 December 1899.
- ³¹ Bullocke, letter to the Marconi Company of 31 December 1899. In it, when referring to the stations set up at Orange River and Modder River, he used the phrase 'the immediate station being Belmont'

when perhaps he meant intermediate. This has been taken by some authors to imply that communication between Orange River and Modder River required an 'intermediate', or a relay station, at Belmont, but this is open to interpretation.

- ³² Kennedy, Diary, 5 January 1900.
- ³³ Marconi Company archive material. A chronological list of the distribution of the five sets of Marconi wireless equipment giving the dates on which they arrived at their particular destinations, the names of their Marconi operators and their dates of being despatched to Cape Town before being transferred to the Royal Navy. Oxford, Bodleian Libraries, MS Marconi 334.
- ³⁴ Pakenham, p. 244.
- ³⁵ Kennedy, Diary, 8 January 1900.
- ³⁶ Kennedy, Diary, 24 January 1900.
- ³⁷ Kennedy, Diary, 12 February 1900.
- ³⁸ W.J. Baker, *A History of The Marconi Company* (Methuen and Company, Limited, 1970), p. 51. In his autobiography *Life and Adventure in Peace and War* (Arnold, 1924, p. 241), Major General Sir Elliott Wood, the then Engineer-in-Chief in South Africa, claims to have taken that decision himself. He stated that 'all efforts to get good results [with the wireless apparatus] in the country round Orange River failed and the operators could suggest no reason. Eventually I sent them to the Navy at Simons Bay for use between shore and ships.'
- ³⁹ Kennedy, Diary, 12 February 1900 and 33.
- ⁴⁰ D.C. Baker p. 430; source File TLD No.1 The National Archives of South Africa, Pretoria, South Africa.
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- ⁵⁰ H.W. Fisher, *op. cit.*, ref. 48, p. 58.
- ⁵¹ Letter by G.L. Bullocke addressed to H.W. Allen, Secretary of Marconi's Wireless Telegraph Company, dd. 2 May 1900. Oxford, Bodleian Libraries, Marconi 334.
- ⁵² Pakenham, p. 105.
- ⁵³ Letter from Dowsett to the Marconi Company, London, dd. 19th July 1900. Oxford Bodleian Libraries, Marconi 334.
- ⁵⁴ W.J. Baker, p. 51; Aitken p. 232.
- ⁵⁵ Marconi, 1900, p. 248, 255.
- ⁵⁶ Marconi, 1900, p. 248, 255.
- ⁵⁷ Marconi, 1900, p. 256.
- ⁵⁸ Austin, 2001, pp. 123-125.

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Brian Austin is a retired academic from the Department of Electrical Engineering and Electronics at the University of Liverpool. He was born in South Africa and served as an officer in the Reserves of the South African Corps of Signals. One of his research interests has been the use of electronic technology in warfare, with particular emphasis on the evolution of radio communications and radar. He is the author of *Schonland: Scientist and Soldier*, published in 2001, the biography of Sir Basil Schonland, the South African scientist who played a significant part in the earliest use of wireless by the British Army in WW1 and in the development of radar in WW2. By the war's end, Schonland was serving as scientific adviser to Field Marshal Montgomery's 21 Army Group.