Veit Didczuneit

Flashes of Sunlight in the Desert. Light Signalling Systems in German South West Africa 1899 – 1915.

Communication was possible at the speed of light – yet the heliograph light signalling system only played a crucial role in the history of communication for just fifty years, from 1870 to 1920. For Germany, this communication technology was important for an even shorter time – just 20 years from 1900 to 1920. As radio technologies became increasingly efficient, the wireless and eminently affordable light signalling systems were edged into a niche or just kept in reserve.

In November 1903, German engineer Georg Lang was in German South West Africa (today's Namibia) to join the 'Fish River Expedition'. Headed by Alexander Kuhn and commissioned by the German Colonial Society, the expedition was entrusted with the task of exploring options for irrigating the colony. On 4 November in Windhoek, Georg Lang spent the grand sum of 127 marks, plus 11 marks and 20 pfennigs for luggage, on a ticket for the mail wagon to the south of the German colony. "At the same time, I had Herr Kuhn heliograph to Gibeon," Lang noted in his travel diary, "to say that I would be arriving with the mail wagon."[1] The heliograph connection from the capital Windhoek to Keetmanshoop, the key transport hub in the south, stretched over 500 kilometres. The first section to Gibeon was opened on 9 December 1901, and the full line to Keetmanshoop was operational by mid-1902.[2]
On 5 November 1903, Georg Lang and one other traveller set out on the journey in the mail wagon. "The black postillion and two black ox-drivers arrived with their oxen only shortly before nine, and then the wagon could leave. This is one of the standard two-wheeled bullock carts here pulled by a team of ten oxen. The wagon's only luxury is a tarpaulin, more or less white, stretched up above to cast some shade, and we two travellers and the postillion looked for seats underneath it on the mail bags and luggage. So we bumped off."[3]

After a strenuous journey lasting seven days, they had covered the 300 kilometres to arrive in Gibeon. Georg Lang immediately had a message sent by heliograph to Keetmanshoop, asking where the expedition was at present. "The soldiers in charge assure me that all my telegrams have been properly transmitted, and the line to Keetmanshoop is not interrupted."[4] Lang's concern was not ungrounded, since a bloody colonial war had just broken out. As Lang wrote on 2 November to his family in Germany: "You will have already heard that further to the south an extensive uprising has broken out by the tribes of the Hottentots."[5] Alexander Kuhn did in fact receive Lang's message – though only many days later. He was already at the coast. The heliogram had been taken by runner post from Keetmanshoop to Lüderitzbucht.[6]

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1 Georg Lang, "Ein Reisebericht aus Deutsch-Südwest-Afrika, Auszüge", In: Scientific Society Swakopmund, Reports, Vol. 48, 2016, No. 1, p. 14.
2 See Deutsches Kolonialblatt, XIII. Vol., 1902, pp. 218/219 and 443. Previously, telegrams to the south of German South West Africa were sent via Cape Town to Steinkopf in the north of the Cape Colony. From there, they were taken by special messenger to Keetmanshoop.
3 Georg Lang, "Ein Reisebericht aus Deutsch-Südwest-Afrika. Auszüge", In: Scientific Society Swakopmund, Reports, Vol. 48, 2016, No. 1, p. 14.
4 Ibid, p. 19.
5 Ibid, p. 13.
6 Alexander Kuhn, *Die Fischfluss-Expedition. Reisen und Arbeiten in Deutsch-Südwestafrika im Jahre 1903*, Berlin 1904, p. 90.

The heliograph – A nineteenth-century invention

"O welcome light!" exclaims the guard of Argos in Aeschylus's tragedy of Agamemnon, written in 458 BCE, describing how the news travelled of the Greek victory in Troy. The transmission of news using a beacon fire can be ranked with smoke signals as one of humanity's oldest means of communication.[7] In contrast, despite claims sometimes made, there is no evidence of the Classical World communicating by signalling with sunlight.[8] The heliograph, a device using flashes of sunlight reflected in a mirror to transmit coded news, is a nineteenth-century creation. In 1821, German mathematician Carl Friedrich Gauss invented the heliotrope, an instrument which he employed for land surveying. On this basis, an operational light signalling device using movable mirrors was developed around 1870 by British engineer Henry Christopher Mance while stationed in India.

The term 'heliograph', derived from the Greek for 'sun writer', was invented in 1856 by Monsieur Jules Leseurre, a French inspector of telegraph lines in Algeria, during his attempts to communicate with light signals between distant oases. The British colonial troops in India and Afghanistan then adopted this instrument as a communication aid. A heliograph network covering over 500 miles set up by U.S. forces in Arizona and New Mexico in 1890 also provides an outstanding example of this technology. In 1898, the heliograph was also widely used by both sides in the Spanish-American War. Similarly, in South Africa during the Boer War from 1899 to 1902, both the British and the Boers used heliographs to send messages.[9]

Only adopted late by the German military

Against the background of naval armaments and the new colonial challenges, German military emissaries viewed the heliograph technology used by British signals units as early as 1889, and were even given British heliographs to try out. Nonetheless, Germany only devoted more attention to this means of communication around the turn of the century.[10] The German army command was sceptical about any practical application for a light signalling system in northern central Europe. In their main criticisms, they pointed to the heliograph's dependency on the weather and character of the terrain, the slow speed of transmission, and

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7 Claus Eurich, *Tödliche Signale. Die kriegerische Geschichte der Informationstechnik von der Antike bis zum Jahr 2000*, Frankfurt am Main 1995, pp. 32ff.

8 Volker Aschoff, *Geschichte der Nachrichtentechnik. Beiträge zur Geschichte der Nachrichtentechnik von ihren Anfängen bis zum Ende des 18. Jahrhunderts*, Berlin 1984, p. 18.

9 Richard von Fischer-Treuenfeld, *Kriegstelegraphie. Geschichtliche Entwickelung, Wirkungskreis und Organisation derselben*, Stuttgart 1879, pp. 163ff. and David L. Woods, "Heliograph and Mirrors", In: Christopher H. Sterling, Military Communications: *From Ancient Times to the 21st Century*, Santa Barbara 2008, pp. 208ff.

10 "Die Anwendung des Heliographen für die Nachrichtenübermittlung bei der deutschen Schutztruppe", In: Die Welt der Technik. Eine technische Rundschau für die Gebildeten aller Stände, No. 24, 15.12.1904, p. 427.

the possibility of messages being read by enemy forces.[11] However, the records show that the heliograph was used in military exercises by the colonial troops (*Schutztruppe*) in German South West Africa from early 1899.[12] From January to March in 1900, the German Field Telegraph Corps conducted experiments in Berlin communicating with mirrors and signal lamps between the National Monument on Kreuzberg hill and the then Tempelhofer Feld military training area just outside the city. These trials were the result of intensive discussions over the lessons to be drawn from the military campaigns conducted by British, American, French, Spanish and Greek forces in the late 1800s.[13] In these campaigns, the successful use of the heliograph had always played a significant role.[14]

The German East Asian Expeditionary Corps reported positively on using the heliograph during the military intervention to crush the Boxer Uprising in China in 1900 and 1901. Until a field telegraph cable was laid in October 1900, the German forces maintained a heliograph network between Tientsin and Tung-tschau, the harbour town serving Beijing on the Pei Ho River.[15] In February 1901, Major General Lothar von Trotha's unit also communicated by heliograph with Beijing during its punitive expedition.[16] In January 1901, when Lieutenant-General Emil von Lessel, commandant of German troops in China, sent suggestions to the War Ministry for improving the uniforms, equipment and transport of German soldiers, he also proposed copying the excellent British means of signalling.[17] In his war report from China, Baron Binder-Krieglstein even rated the British heliograph technology as "unrivalled and worthy of being copied"[18] and highlighted its considerable value in colonial conflicts and campaigns in mountainous terrain.

The heliograph also became a permanent fixture with the colonial troops in German East Africa and South West Africa from 1901.[19] Introducing light signalling systems so late in German South West Africa shows yet again how little support the colony and its colonial troops received from the imperial German government and the German military

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11 Stefan Kaufmann, *Kommunikationstechnik und Kriegführung 1815-1945*. *Stufen telemedialer Rüstung*, Munich 1996, p. 215.

12 "Heliographische Telegraphie bei der deutschen Schutztruppe in Deutsch-Südwest-Afrika", In: Deutscher Soldatenhort. Illustrirte Zeitschrift für das deutsche Volk und Heer, Vol. X, No. 20 (April 1899), pp. 315/316.

13 "Uebungen mit Leuchtspiegeln", In: *Internationale Revue über die gesamten Armeen und Flotten*, 1900, p. 263-4.

14 For example, "Kriegstechnische Lehren aus dem spanisch-amerikanischen Kriege", In: Kriegstechnische Zeitschrift, 1899, pp. 19ff., "Ueber Signalisiren", In: ibid., p. 210ff. and "Etwas über den Signaldienst, besonders den der Englischen Armee", In: Militär-Wochenblatt, 1900, No 60, pp. 1462ff.

15 Eugen Binder-Krieglstein, *Die Kämpfe des Deutschen Expeditionskorps in China und ihre militärischen Lehren*, Berlin 1902, p. 259.

16 "Der Heliograph im militärischen Nachrichtendienst", In: Kriegstechnische Zeitschrift, 1901, p. 206.

17 Emil von Lessel, *Böhmen, Frankreich, China 1866-1901*. *Erinnerungen eines preußischen Offiziers*, Cologne, 1981, p. 244

18 Eugen Binder-Krieglstein, *Die Kämpfe des Deutschen Expeditionskorps in China und ihre militärischen Lehren*, Berlin 1902, p. 264.

19 Heliographs were first used by colonial troops in German East Africa in 1894 in the campaign against uprisings by the indigenous peoples. See "Ueber Signalisiren", In: Kriegstechnische Zeitschrift, 1899, p. 212. Even during the military campaign in East Africa in 1905–1907, the heliograph's importance and the extent of its use was far less than in German South West Africa. See von Berger, "Optische Telegraphie bei der Ostafrikanischen Schutztruppe", In: Militär-Wochenblatt, 1908, No. 133, p. 3098. I know of no information on the use of the heliograph in Cameroon. On the colonial troops in general, see Jürgen Kraus, Thomas Müller, *Die deutschen Kolonial- und Schutztruppen von 1889 bis 1918*. *Geschichte, Uniformierung und Ausrüstung*, Vienna 2009.

in the 1890s, and is indicative of the chronic underfunding.[20] In his account of military campaigns in the 1890s, Theodor Leutwein, governor of the colony from 1894 to 1905, complained of a lack of effective and modern communication technologies capable of bridging the long distances between the marching and fighting troops, and facilitating communication between command posts and a joint operational command.[21] In the first years, the troops, primarily mounted infantry, only communicated through dispatch runners, riders and patrols who brought news, reconnaissance reports, appraisals of the situation, orders and letters.

Mirrors, keys, etcetera

There were several manufacturers of heliographs, both in Germany and internationally, and many types of models with mirrors of different shapes and sizes.[22] On high-quality devices, the heliograph mirror was set on a wooden tripod with a screw adjustment to properly align the mirror vertically and horizontally and ensure that even as the sun moved, its light was optimally directed to the receiver. If the sun was behind the operator, an additional mirror could project the sun's rays onto the main mirror. German heliographs are known to have used mirrors from 8cm diameter to 12.5cm, 15.5cm, 20cm, and 25cm.[23]

After setting up the heliograph towards the estimated direction of the receiving station, the device was first adjusted to reflect a steady beam of light. The main mirror was in position when a small hole in the centre cast a concentric circular image on the sighting vane. With the mirror now reflecting a steady beam of light, it could be swivelled to start searching for the receiving station. A heliograph's 'effective area' – the range in which the reflected light can be seen – is approximately 50 metres at a distance of 5 kilometres, and around 500 metres at 50 kilometres.[24] When the receiving station saw the signal, it also answered with a steady beam of light. Afterwards, the sending mirror was tipped into the resting position so it did not reflect any light.

To send a Morse code message with a heliograph, a key controls the mirror's movement to create either a short flash of light (one second for a dot) or a long flash (three to four seconds for a dash). The letter breaks are the length of five dots. The heliograph needed a team of two or three to use it effectively (signaller, reader, note taker). The signaller sent 'calling' (.. - . -) to the receiving station which answered with 'receiving' (- . -). At the sending station, one of the signallers clearly read aloud each word of the message to be transmitted. At the same time, by listening to the sound of the sending key, he monitored

20 Eckard Michels, "Eine deutsche Kolonialarmee? Reformansätze zur Stärkung der militärischen Schlagkraft in Übersee 1900 bis 1914", In: *Reform – Reorganisation – Transformation. Zum Wandel in den deutschen Streitkräften von den preußischen Heeresreformen bis zur Transformation der Bundeswehr*, Munich 2010, p. 201.

21 Theodor Leutwein, *Elf Jahre Gouverneur in Deutsch-Südwestafrika*, Berlin 1907, pp. 4ff., 69, 97, 110ff.

22 On the English manufacturers, see Alan Harfield, *The Heliograph. A Short History*, Blandford Camp 1986, p. 40.

23 Company archive Carl Zeiss Jena GmbH, Archive group: BACZ, No. 039: Heliographen von 80 mm, 125 mm, 155 mm Hauptspiegeldurchmesser, Carl Zeiss Jena T 105, Jena c. 1910 and No. 030: Der 250 mm- Heliograph, Carl Zeiss Jena T 98, Jena c. 1910.

24 "Heliograph für militärisches Signalwesen. Mitteilung aus den R. Fuess´schen Werkstätten in Steglitz bei Berlin", In: Der Mechaniker, Vol. IX, 20. January 1901, No. 2, p. 16.

whether the letters of the message were rendered correctly in Morse code. The signaller at the receiving station observed the transmission of each letter, either with a telescope or with the naked eye, and dictated the letters to a second signaller who noted them down. After each word was finished, the receiving station sent a longer flash of light to confirm that the word had been properly understood. If this was not the case, the receiving station transmitted a particular combination of long flashes. After successfully transmitting the entire message, the sending station signed off with the 'closing sign' (. - . - .), and the receiving station answered 'understood'. There were also set codes to encrypt messages, as well as abbreviations to accelerate communication. The best known of these abbreviations was the heliographer's greeting 'L.G.' standing for 'Licht gut' (Light good) and not, as some jokingly suggested, 'Liebe Grüße' (best wishes).

As yet, there is no known record to show whether the first heliographs used by the colonial troops in German South West Africa were of English or German manufacture.[25] From 1899 – 1900, the optical workshop of Rudolf Fuess in Berlin-Steglitz, which made range-finders and gunsights for the German military, also produced the 'German Army Heliograph'.[26] The Fuess heliograph was based on the tried and tested construction used for the models produced in England, but saved significantly on weight by manufacturing most metal parts from magnalium, an aluminium magnesium alloy that was both light and resistant to corrosion.[27] Together with its stand, the Fuess heliograph only weighed 4.5 kilos, half the weight of heliographs from other producers. It was produced in two models with one mirror or a double mirror and a choice of a mirror with either the small 15cm diameter or the standard 20cm.[28] In 1904, the Imperial Postal Museum acquired one of these heliographs for its collection for the sum of 407 Marks.

A stopgap for the telegraph

From 1897 to summer 1902, as approved by the Reichstag parliament, the German transport corps constructed a railway line of 381 kilometres from Swakopmund to Windhoek. This light narrow-gauge line, the first major German colonial railway, was also authorised in response to the recurring danger of rinderpest bringing the entire freight traffic on the colony's main transport route to a standstill. A railway telegraph line ran alongside the track as well as, from 1901 – 1902, a Reichspost telegraph line. In 1899, Swakopmund was linked to the sea cable from Mossamedes (in Angola) to Cape Town, and so was connected to the global telegraph network. Since it was faster to construct the overland telegraph line than to lay the rail track, the telegraph from Okahandja to Swakopmund was already operational in mid-June 1901. Using heliographs, the gap of slightly over 70 kilometres could now be quickly closed to the capital of Windhoek, home to both the Governor's residence and the colonial force's headquarters. This was the first heliograph line in German South West Africa, but was no longer needed when the railway telegraph

25 Grunow describes heliographs manufactured in England without naming any sources. Walter Grunow, "Der Heliograph und sein Gebrauch in Deutsch-Südwestafrika", In: Scientific Society Swakopmund, Nachrichten, 2009, No. 1, p. 23.

26 Hanns Günther, "Heliographie", In: Technische Monatshefte, Stuttgart 1911, No. 5, p. 145.

27 See "Heliograph für militärisches Signalwesen. Mitteilung aus den R. Fuess´schen Werkstätten in Steglitz bei Berlin", In: Der Mechaniker, Vol IX, 20 January 1901, No. 2, p. 15ff.

28 See "Der Heliograph im militärischen Nachrichtendienst", In: Kriegstechnische Zeitschrift, 1901, p. 209–10.

line reached Windhoek just a few weeks later in late July 1901.[29]

Expanding the electric telegraphy network in the colony required more funding from Germany. Without those funds granted, other ways had to be found to connect the seat of the government in Windhoek with the north and south of the colony. With a total of twenty heliographs, the colonial troops set up two fixed heliograph lines "as a stopgap for the telegraph"[30] to provide communication for the military and administration. Although the heliograph mirrors could only transmit messages during the day, these lines provided a comparatively cheap alternative which was fast to implement. There were thirteen stations on the stretch from Windhoek via Rehoboth to Gibeon and Keetmanshoop. In addition, in 1902 five fixed stations on hills or mountains were set up on the 200km link from Karibib, which was on the Swakopmund–Windhoek railway and telegraphy line, via Omaruru in the north to Outjo. The distances from station to station varied between 20 and 70 kilometres.[31]

Each station was manned by two to three soldiers, initially untrained in heliography and generally learning how to use the devices and the Morse code in the colony. The heliographers usually worked between 6am and 10am. The fastest transmission time from Windhoek to Gibeon for 21 words together with the station identification was two hours and fifty minutes. In clear weather, it took an average of five to six hours to send a message to Keetmanshoop. At the end of 1902 and in early 1903, the number of private heliograms transmitted by the stations totalled approximately 200 a month. The cost for sending a private message by heliograph was calculated by distance, with the minimum rate of 2 Marks offset against the rate charged per word. When Georg Lang sent his heliogram, he was charged 20 pfennigs per word, around twice the fee for a telegram. The text was noted down in pencil or indelible pencil on forms printed in Berlin and headed *Deutsch-Südwest-Afrika. Heliografie d. Schutztruppe* (German South West Africa. Heliograph of the Protection Force). The transmission hierarchy ranked military messages in wartime as the top priority, followed by administrative and then, last of all, private messages.[32]

In 1903, the two heliograph lines connected all company and battery quarters in the north and south of the colony with the field troops staff headquarters in Windhoek, facilitating command of the units and improving security for the soldiers.[33] Members of the colonial troops securing German influence in the far north of the region were also equipped with heliographs. In its name, the Helio water hole, now much visited by tourists staying overnight at the Halali Camp in the Etosha Pan, recalls the heliographs operated by the colonial troops on the nearby Helio Hills. From their two stations on the hills, the heliographs could communicate quickly with the units to the east in Fort Namutoni and to the west in Fort Okaukuejo.

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29 *Jahresbericht über die Entwicklung der deutschen Schutzgebiete in Afrika und der Südsee im Jahre 1900/1901*, Berlin 1902, p. 64.

30 "Heliographendienst in Deutsch-Südwestafrika", In: Deutsches Kolonialblatt, Vol XIV, 1903, p. 682.

31 See the maps "Karte des Geländes zwischen Rehoboth und Gibeon sowie der Heliographenlinie Windhuk-Gibeon", Scale 1:200.000, Berlin 1902 and "Karte der Heliographenlinie Karibib-Outjo sowie der Wege zwischen Etiro und Outjo", Scale 1:200.000, Berlin 1903, as well as "Kriegskarte von Deutsch-Südwestafrika", Scale 1:800.000, Berlin 1904.

32 See "Heliographendienst in Deutsch-Südwestafrika", In: Deutsches Kolonialblatt, Vol XIV, 1903, p. 682.

33 Theodor Leutwein, *Elf Jahre Gouverneur in Deutsch-Südwestafrika*, Berlin 1907, p. 435.

A communications weapon in the colonial war

The German-Herero conflict from 1903 to 1908 saw the armed uprising of the Herero and Nama peoples against colonial rule. In response, the colonial troops were quickly reinforced and the communication network steadily developed.[34] Expanding a communication system with a wide reach that operated reliably was essential for fighting a colonial conflict with relatively few soldiers in an inadequately mapped country that was one-and-half times the size of Germany and without any properly developed road network.[35] Within the tactical unit command, heliographs, field signal devices and, from late May 1904, the stations for wireless telegraphy in the colony, connected support points for the colonial troops and halting places on their marches so that reconnaissance findings, situation assessments, orders and calls for assistance could be quickly transmitted. With machine guns and artillery, as well as their modern technical means of communication, the colonial troops had a strong strategic advantage over the Herero and Nama which, ultimately, left them in a vastly superior position.[36]

If the opportunity presented itself, the Herero also attacked military stations as well as lines of communication and transport, However, since such actions were not systematic, they remained only isolated incidents.[37] In their desire for revenge and rectifying the injustice and suffering they had experienced, the Herero primarily focused on raiding the hated settler farmers and merchants.[38] In early 1904, when raids left a gap in the telegraph line between Swakopmund and Windhoek, it was possible to re-establish communications with the heliographs already in the country until the line was repaired. On 15 January 1904 in Gibeon, the Second Field Company under Captain Victor Franke received a heliograph message from Windhoek informing them of the Herero uprising in the north. In a forced ride lasting just four days, the unit returned to Windhoek. By early February, the surrounded towns of Okahandja and Omaruru were liberated – and from the German perspective, the conflict had its first heroes. On 11 February 1904, Franke sent a heliogram from Omaruru to Major von Glasenapp in Karibib: “Enemy gathering. Moving north east. … If enemy to be apprehended need at least 250 men and 4 field guns. … No emergency here.”[39]

Aside from flare pistols and signal flags, the Marine Expeditionary Corps dispatched to German South West Africa in early 1904 also brought ten samples of an entirely new device – the combined mirror and lamp signal device Model C/1902 designed for bad weather and night-time communication and developed in cooperation with Telegraph Corps

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34 On the course of the conflict, see Walter Nuhn, *Sturm über Südwest. Der Hereroaufstand von 1904 – Ein düsteres Kapitel der deutschen kolonialen Vergangenheit Namibias*, Bonn 1997 and Walter Nuhn, *Feind überall. Der Große Nama-Aufstand (Hottentottenaufstand) 1904-1908 in Deutsch-Südwestafrika (Namibia)*, Bonn 2000.

35 Susanne Kuß, *Deutsches Militär auf kolonialen Kriegsschauplätzen. Eskalation von Gewalt zu Beginn des 20. Jahrhunderts,* Berlin 2010, pp. 232ff.

36 Hans-Georg Kampe, *Nachrichtentruppe des Heeres und Deutsche Reichspost. Militärisches und staatliches Nachrichtenwesen in Deutschland 1830 bis 1945*, Waldesruh bei Berlin 1999, pp. 153ff.

37 Boethke, “Die Verkehrstruppen in Südwestafrika”, In: Supplement to the Militär-Wochenblatt, 1906, No. 2, p.45.

38 On the Herero idea of armed conflict, see Susanne Kuß, “Der Herero-Deutsche Krieg und das deutsche Militär: Kriegsursachen und Kriegsverlauf”, In: *Namibia-Deutschland. Eine geteilte Geschichte. Widerstand. Gewalt. Erinnerung*, Larissa Förster, Dag Henrichsen and Michael Bollig (eds.), Cologne 2004, pp. 67-8. and Werner A. Wienecke, “Das Geschichtsverständnis der Herero”, In: Scientific Society Swakopmund, Reports, Vol. 48, 2016, No. 2 , p. 34.

39 Quoted from the illustration of the heliogram in Walter Nuhn, *Sturm über Südwest*, Bonn 1997, pp. 373-4.

No. 1, the Cavalry Telegraphy School and the Transport Corps' test department .[40] The Carl Zeiss company in Jena was commissioned to manufacture the device in 1903.[41] The "Supplement to the Budget for the South West African Protectorate in the Financial Year 1904" estimated a sum of 475,000 Marks for procuring and maintaining military light signalling and communication devices, including surveying equipment.[42]In 1904 and 1905, for the conflicts in the colonies, Carl Zeiss delivered 89 of the new signalling devices to the military at an average unit price of 1,200 Marks as well as 98 heliographs at an average unit price of 250 Marks.[43] The new field signal device used a flame from an acetylene gas and oxygen mix to heat a small thorium mantle, producing a bright light then optically intensified in the lamp. The process, developed by German chemist Oskar Knöfler, could generate a light up to approximately 80,000 candlepower. The lamp, heliograph and sighting telescope were set as a fixed unit on a base, which could be freely turned, to ensure the optical axes of the three instruments were always exactly parallel.

Since there were only three trained NCOs who could work the ten signal lamps, the training of other operators already started on the voyage. Departing from Hamburg, Lieutenant-General Lothar von Trotha, who was soon to take over as commander-in-chief of the colonial troops, arrived in Swakopmund on 11 June with his staff and a large entourage including significantly more communication specialists and equipment. Led by Lieutenant Rückforth, the arriving unit comprised five cavalry officers, including Lieutenant Auer von Herrenkirchen, who were all trained in signals, 40 field signallers and 14 Zeiss field signalling devices. In this case too, the voyage was used to train the use of heliographs with these "quite excellently constructed devices".[44] The communication troops and equipment already in the colony were quickly placed under the new field signals unit.

The 'Auer light' at the Waterberg

The Battle of Waterberg in August 1904 clearly illustrates the vital importance of light signalling devices in communication. In this military engagement, the heliograph was the standard means of sending and receiving signals. Even as early as 7 August, the troop divisions, then at a considerable distance from each other, received their marching and attack orders by heliograph: "All divisions to advance to the enemy position by the afternoon of 10 August, general attack in the morning of 11 August at 6am. Signed v. Trotha."[45] On 10 August, five signal stations were operational on the Waterberg. Lieutenant Auer von Herrenkirchen, then 28 years old, was ordered to set up his signal unit directly on the Waterberg table mountain. This vantage point, which was not occupied by the Herero, offered the best view of the battlefield, and excellent

40 Rückforth, "Die Anwendung von optischer Nachrichtenübermittlung im Herero- und Hottentotten- Aufstand", In: Militär-Wochenblatt, 1906, No. 4, p. 61 and Groß, "Die modernen technischen Mittel des militärischen Nachrichtenwesens insbesondere für die Befehlsübermittlung", In: Supplement to the Militär-Wochenblatt 1904, p. 223.

41 Edith Hellmuth, Wolfgang Mühlfriedel, *Carl Zeiss. Die Geschichte des Unternehmens 1846 – 1905*, Weimar 1996, p. 219.

42 See Document No. 509. In: Stenographische Berichte über die Verhandlungen des Reichstages (Stenographic Reports of the Reichstag Proceedings). 11th Legislative Period. First Session 1903/1905. Volume 5, Berlin 1905, p. 2673.

43 See Carl Zeiss Jena GmbH Company Archive, Archival Holding: BACZ, No. 11376.

44 Helmuth Auer von Herrenkirchen, *Meine Erlebnisse während des Feldzuges gegen die Hereros und Witbois*, Berlin 1907, p. 5.

45 Ibid, p. 38.

conditions for heliograph communication. “Suddenly, on the horizon, we saw a flash of dazzling light, which disappeared and reappeared,” General Staff Officer Bayer noted in 1909 in his account of the campaign. “With long and short flashes in Morse Code, the ‘Auer light’ told us what had happened the day before.”[46] The news was transmitted unencrypted. In this critical situation, though, due to lack of equipment and general wear and tear to the devices, Lieutenant Auer only had one heliograph at his disposal and a field signal device, usually referred to as a mirror or lamp by the communication corps. Nonetheless, Auer constantly sent reports back to headquarters on the movements of the Herero fighters and the locations of the German troops. “But the skirmishes in the battle changed so quickly from one moment to the next and there were too many units for us to have time in the first stages of the battle to send detailed telegrams with just the one heliograph, so it was far more an exchange of questions and answers with headquarters.”[47]

For a time, Auer’s signalling station was also unable to operate, since it came under heavy fire.[48] Similarly, in the heat of battle, not all the reports on the troop positions were accurate. In his account of the campaign, Auer believed his easily visible signalling station could have been of far more use if, during their advance, the division under Colonel Deimling and Major von der Heyde’s unit had not failed to bring the signalling devices with them or, where they had them, failed to set them up for operation.[49] As a result, they were unable to communicate with the other troops. It was indeed in the Waterberg section under Major von der Heyde where the Herero managed to break through their encirclement, and fled with such fateful consequences into the desert.

Acting on the instructions of the German Emperor and the imperial staff, Lieutenant-General von Trotha[50] and his troops violently crushed the Herero armed uprising. After the battle, as commander-in-chief in German South West Africa, von Trotha was responsible for the death of thousands of Herero men, women and children who had escaped to the near-totally arid Omaheke desert. In his report to Berlin after the failed encirclement, he also mentioned the efficiency of the communications equipment: “Without the field signals unit, I would have not been able to conduct the operation at all, and without the telegraphy unit it would have been very difficult indeed.”[51] The later military accounts of the Battle of Waterberg also underlined the heliograph’s “absolutely crucial role”.[52] The communication systems also played their part in pursuing the defeated Herero and

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46 Maximilian Bayer, *Mit dem Hauptquartier in Südwest-Afrika*, Berlin 1909, pp. 144-5.

47 Helmuth Auer von Herrenkirchen, *Meine Erlebnisse während des Feldzuges gegen die Hereros und Witbois*, Berlin 1907, p. 42.

48 *Deutsche Reiter in Südwest. Nach persönlichen Berichten bearbeitet von Friedrich Freiherr von Dincklage-Campe*, Berlin c. 1909, pp. 442-3.

49 Ibid, p. 43. Renowned as a dashing and daredevil figure in the colonial troops, the heliograph lieutenant had to return to Germany in 1905 for health reasons. He died in the First World War in 1915. See the diary entries by Georg Hillebrecht, In: Andreas E. Eckl, *“S´ist ein übles Land hier”. Zur Historiographie eines umstrittenen Kolonialkrieges*, Cologne 2005, p. 142.

50 Christoph Kamissek, “‘Ich kenne genug Stämme in Afrika’. Lothar von Trotha – eine imperiale Biographie im Offizierskorps des deutschen Kaiserreiches” In: Geschichte und Gesellschaft, Vol 40 2014, No. 1, pp. 67ff

51 Quoted after Paul Flaskamp, *Tätigkeit der beiden Funkentelegraphen-Abteilungen in Südwestafrika 1904-1907*, Berlin 1910, p. 9.

52 Hesse, “Der Einfluß der heutigen Verkehrs- und Nachrichtenmittel auf die Kriegführung”, In: Supplement to Militärwochenblatt 1910, No. 1, p. 18.

implementing the infamous 'extermination order' (*Vernichtungsbefehl*) issued by von Trotha on 2 October 1904.[53] In the course of the conflict, together with field telegraphy, the light signalling systems were the means of communication most frequently used. In this context, they can also be considered as a 'weapon of destruction' since, thanks to the improved communications, the troops could act more effectively, resulting in larger numbers killed.

From a heliograph line to a communication network

In autumn 1904, with the uprising by the Nama people, the main focus of the military action shifted to the south of the colony. However, in contrast to the Herero, the Nama followed a policy of guerrilla warfare, and avoided any possibility of a pitched battle as at Waterberg. This mobile warfare required a secure line of communication from Windhoek to the south and, in addition, mobile lines capable of moving quickly in the individual areas of conflict. The signal units with their heliographs and field signal lamps gradually increased their area of communications. In his account of the campaign, Captain Bayer, stationed in Windhoek, noted, "Day and night, a constant stream of telegrams arrived at headquarters. The number of replies necessary numbered up to 100 in 24 hours."[54]

In July 1905, aside from its commander Lieutenant Rückforth, the field signals unit for the colonial troops already comprised nine signals officers and over 200 signallers. They had 71 field signal devices and around 36 individual heliographs as well as an extensive supply of spare parts and reserve materials. Above all, the reserve depots at support points scattered across the entire colony contained the acetenyl and oxygen, as well as thorium mantles, needed to work the signal lamps. In addition, repair workshops for the signals equipment had been set up in Windhoek and Keetmanshoop. According to Rückforth's progress report in 1906, the military network of fixed signal lines now extended 2,560 kilometres. The heliograph stations in Windhoek and Ramansdrift in the far south of the colony were 800 kilometres apart, and each of the over 70 signal stations serving the line were manned by two to three signallers with three to six riflemen to protect the station, and up to nine riflemen if serious danger threatened. However, it proved impossible to realise the aim of equipping each of the signal stations with two devices to accelerate the flow of messages. Rückforth also mentions numerous mobile stations travelling with combat and reconnaissance units to maintain communication with the fixed signals network and other troop divisions. However, he notes, not every company has two signal devices.[55]

Similarly, it was not possible to meet the considerable demand for qualified signallers. To ensure the numbers of the communication corps remained stable, soldiers were trained in the colony to compensate, at least in part, for signallers who were sick or wounded, or had been killed. The memorial tablet unveiled in 1923 in the Christ Church in Windhoek lists 16 members of the field signal corps killed in action, including Lieutenant Fürbringer's signal unit which was wiped out entirely in May 1906 during a skirmish in the south of the colony. Since new signallers had to learn Morse code, it usually took several weeks of training before they could join their units. In contrast, learning to operate the signalling devices themselves only took a few days. Although in some cases African soldiers in the troops were trained to use

53 Helmuth Auer von Herrenkirchen, *Meine Erlebnisse während des Feldzuges gegen die Hereros und Witbois*, Berlin 1907, pp. 60ff.

54 Maximilian Bayer, *Mit dem Hauptquartier in Südwest-Afrika, Berlin 1909,* p. 209.

55 Rückforth, "Die Anwendung von optischer Nachrichtenübermittlung im Herero- und Hottentotten- Aufstand", In: Militär-Wochenblatt, 1906, No. 4, pp. 61ff.

signalling devices or the heliograph – for example, in German East Africa where child soldiers were also trained as signallers[56] – this did not happen in German South West Africa, both due to security concerns and a colonial mindset resolutely rejecting the possibility that the indigenous people could learn signalling.

The nature of the terrain was a prime factor in establishing the signalling stations, and demanded considerable supply efforts when they were set up away from the main transport routes and with no water supply nearby.[57] Where the ground was level, for instance, over a stretch of 200 kilometres south of the Waterberg to Okahandja, towers up to thirty metres high were constructed for the stations using stones found in the area and sandbags, as well as other natural desert materials. “Using a leather rope ladder we made ourselves from ox skins, we climbed any number of trees,” wrote Auer von Herrenkirchen on 13 July 1904 in his field diary, “but it was a waste of time and effort, as none of the trees were high enough.”[58] Heliography was demanding precision work. Well-trained signallers could transmit 200 cycles a minute, approximately three to four words, and around 200 words an hour. “This required pushing the devices and the signallers to their extremes. Anyone familiar with the effort needed to read optical signals from a great distance can appreciate just what these signallers achieved. For months at a time, they were on barren, lonely heights, exposed equally to the weather and enemy attacks; constantly on duty day and night, without a break or anyone to relieve them. When they lay down to sleep, the sentry would wake them as soon as the light of a sending station was visible announcing a new message. It was not unusual to have 30 heliograms transmitted down the line in the space of 24 hours.”[59] In accounts by the colonial troops, the heliographs and field signal devices were praised for their excellent work. The devices were relatively easy to transport on horses or pack animals, and they could be operational in just a few minutes. In the case of the field signal lamps, the oxygen storage bottles were rather cumbersome and could weigh up to one hundredweight and if the lamps were to be in constant use, enough replacement fuel had to be carried. However, the lamps also had the advantage of working without a cable. So even if ‘light telegraphy’, as it was known, was slower than wire telegraphy, it was more reliable and allowed messages to be transmitted over the heads of the enemy. In contrast, field cables for telegraphy not only had the disadvantage that they could often be cut by the enemy, but might also be damaged by grazing or wild animals, or even by the weather. In areas where the field cable was not sufficiently protected, electric telegraphy was often supplemented by wireless signals. At that time, one of the more insensitive comparisons common among the colonial troops claimed that it was more difficult to defend a telegraph line against a troop of Witbooi warriors of the Nama tribes that to defeat the Herero in a skirmish.[60]

The potential distance for communicating between two heliograph stations on raised ground depends on the strength of the sun’s rays, the angle at which those rays hit the mirror, and

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56 von Berger, “Optische Telegraphie bei der Ostafrikanischen Schutztruppe”, In: Militär-Wochenblatt, 1908, No. 133, pp. 3098-9.

57 *Deutsche Reiter in Südwest. Nach persönlichen Berichten bearbeitet von Friedrich Freiherrr von Dincklage-Campe*, Berlin c. 1909, pp. 143ff. and 382-3.

58 Helmuth Auer von Herrenkirchen, *Meine Erlebnisse während des Feldzuges gegen die Hereros und Witbois*, Berlin 1907, p. 23.

59 Rückforth, “Die Anwendung von optischer Nachrichtenübermittlung im Herero- und Hottentotten-Aufstand”, In: Militär-Wochenblatt, 1906, No. 4, p. 65.

60 “Heliographische Telegraphie bei der deutschen Schutztruppe in Deutsch-Südwest-Afrika”, In: Deutscher Soldatenhort. Illustrirte Zeitschrift für das deutsche Volk und Heer, Vol X, No. 20 (April 1899), p. 315.

the size of the mirror. While the mirrors in use in German East Africa, especially the 15cm-diameter mirror, allowed the transmission of signals up to 70 kilometres, even longer distances were possible at times in German South West Africa. There is, though, no evidence known as yet to show the use of 25cm mirrors or even 75cm mirrors with a range of 150 and 300 kilometres respectively. The field signal lamps could be read at night at an average distance of 80 to 100 kilometres, and under certain conditions were still clearly visible at 160 kilometres. The field telegraphy devices, in contrast, had a range of around 150 kilometres. With clear, dry air and mostly bright sunny days, German South West Africa offered excellent conditions for heliography. Interruptions to the light signal lines due to poor weather were an exception, and primarily limited to the rainy season.

Expanding the Reichspost network

From 1904, German South West Africa saw a rapid expansion of the electric telegraph lines under the Reichspost, an infrastructural improvement helping to support the control and monitoring of the colony, implement colonial rule, and develop the country to the benefit of the colonial power. As yet, no study has been conducted into the Reichspost's use of forced labour in the colonies, and the major part played by African prisoners of war as forced labour in constructing this infrastructure.[61] German South West Africa developed into a colony with a well-established postal infrastructure and the latest technical means of communication with telegraph centres, telephone networks and wireless stations.[62] By 1907, 3,616 kilometres of overland cables had been laid providing the colony with an extensive telegraphy network. With a reach of 2,636 kilometres, the network connected all the larger German settlements across an area of 835,000 square kilometres with the colonial centre of Windhoek and the key coastal towns of Swakopmund and Lüderitzbucht. In addition, there were also 4,000 kilometres of temporary field telegraph connections along lines provisionally laid on the ground. In the wake of the dramatic reduction of the colonial troops from 14,500 in May 1906 to fewer than 4,000 after the official declaration of the end of the state of war on 31 March 1907, these lines were either abandoned or, by 1909, taken over by the Reichspost.[63]

The major post-war investment by the German imperial government in German South West Africa's infrastructure increasingly served the goal of establishing the planned settler colony. With the successful connection to the South African telegraph network from Warmbad, German South West Africa had a second link to the worldwide telegraph network. By 1914, telegraph lines had also been established along the 2,100 kilometres of railway track constructed in the colony. At the end of 1908, there were only a few active heliograph lines in the south of the colony, which was still experiencing guerrilla attacks. These lines comprised a total of 14 stations and 35 additional signalling devices on stand-by, 21 in Keetmanshoop and six in Warmbad. The Signals Corps was reduced to 144 officers and

61 For an example of forced labour in the Reichspost, see Wilhelm R. Schmidt, Otto Schiffbauer. *Als Telegrafenbauer in Deutsch-Südwest*, Erfurt 2006, p. 99.

62 Sebastian Mantei, *Von der "Sandbüchse" zum Kommunikationsnetzwerk. Die Entwicklungsgeschichte^des Post- und Telegraphenwesens in der Kolonie Deutsch-Südwestafrika (1884-1915)*, Martin-Luther- Universität Halle-Wittenberg 2004.

63 Ernst Thomas, "Deutsch-Südwestafrika", In: *Geschichte der Deutschen Post in den Kolonien*, Leipzig 1939, pp. 36-7 and the overview of postal and communications services in Udo Kaulich, *Die Geschichte der ehemaligen Kolonie Deutsch-Südwestafrika* (1884-1914), Frankfurt am Main 2001, pp. 474ff.

men in total.[64] Over the years, some lines were officially permitted to transmit messages from the German civilian population.[65] During the state of war, the military signal lines had also sent private telegrams where possible free of charge.[66] In principle, this communication system was not open to the African population. This was not only due, as a rule, to a lack of knowledge of German for sending messages, but also because the indigenous peoples would not have been able to pay the expensive fees charged in peacetime. Moreover, they did not necessarily need to use such a communication channel as they already had established, traditional means of communication. Nonetheless, there is a record of a heliogram sent by Nama leader Hendrik Witbooi from Gibeon to General von Trotha in Windhoek during the time before the Nama uprising. Some of the around one hundred Nama soldiers fighting with the German forces against the Herero were absent without leave. Witbooi assured Trotha on 21 August 1904 of his regret at this situation and reassured him that all those Nama in the field would "faithfully do their duty".[67] In December 1904, Captain Goliath, himself a member of the Nama but not involved in the uprising against the colonial rulers, also sent a heliograph message from Berseba about the Witbooi fighters.[68]

Communications in retreat during the First World War

Just a few weeks after the war broke out in August 1914, mobilisation in the colony again increased the colonial troops to 6,000 troops. These forces were quite large enough to protect a white population of 9,000 in total and maintain colonial rule over an African population of approximately 100,000. However, there was little they could do when the South African army advanced with over 35,000 soldiers into the territory, especially since they received no further support from Germany or the East Asian Fleet.[69] To begin with, the field, occupying and support troops relied on the Reichspost network as well as the military communication channels to exchange information. After all, in comparative terms, they had a wealth of signalling, telegraph, telephone and radio devices available. However, in the face of advancing South African forces, a mobile warfare of steady retreat required constantly recalibrating communication channels.

On 20 March 1915, for example, the heliograph station on the Langer Heinrich, a mountain massif in the Namib desert around 85 kilometres east of Swakopmund, had to be evacuated under enemy pressure. This station was nearly 1200 metres above sea level,

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64 "Die Deutsche Schutztruppe im Friedensverhältnis", In: Militär-Wochenblatt, 1908, No. 31, pp. 701ff. and the map "Feldtelegraphen- u. Signalverbindungen in S.W.Afrika nach dem Stand vom 20.XI.1908", In: Deutsches Kolonialblatt, 1909, between pp. 168 and 169.

65 Sebastian Mantei, *Von der "Sandbüchse" zum Kommunikationsnetzwerk. Die Entwicklungsgeschichte des Post- und Telegraphenwesens in der Kolonie Deutsch-Südwestafrika (1884-1915)*, Martin-Luther- Universität Halle-Wittenberg 2004, p. 165.

66 National Archives of Namibia. Zentralbureau des Kaiserlichen Generalgouvernements. ZBU (1719) T.V.f.1 Feldtelegraphenlinien Generalia, p. 1 Kommando der Schutztruppe 6.3.07. I would like to thank Werner Hillebrecht, former Director of the National Archives of Namibia in Windhoek, for his support in providing this source material.

67 Quoted from Theodor Leutwein, p. 455. For this reference, I am also very grateful to Werner Hillebrecht, who had prepared a complete edition of the correspondence of Hendrik Witbooi. See also Werner Hillebrecht, "Hendrik Witbooi: Ikone und Inspiration des antikolonialen Widerstands und des unabhängigen Namibia", In: *Namibia-Deutschland. Eine geteilte Geschichte. Widerstand. Gewalt. Erinnerung*, Larissa Förster, Dag Henrichsen and Michael Bollig (eds.), Cologne 2004, pp. 144ff.

68 K. Schwabe, *Der Krieg in Deutsch-Südwestafrika 1904-1906*, Berlin 1907, p. 347.

69 Walter Nuhn, *Auf verlorenem Posten. Deutsch-Südwestafrika im Ersten Weltkrieg*, Windhoek 2014.

and offered a view of shipping on the sea and in Walvis Bay, as well as the British military base set up in the Walvis bay enclave. Seven weeks before, Professor Fritz Jäger, head of the Colonial Department at the University of Berlin's Geographical Institute[70] and conscripted while on a research trip to the colony, had noted in his diary: "Over the course of the day, we saw two heliographs flashing in the west. One of them was Husab, which we had already contacted yesterday, around 30 km away. To begin with, we were not sure about the station further in the distance; it then identified itself as Goanikontes, around 55 km away. We communicated very easily. It really is a fine thing: in the slightly hazy distance, a light on the horizon flashes from a mirror hardly the size of your hand, and with that we can communicate." [71]

During the course of the war, the telegraph and light signalling network, originally so extensive, was significantly reduced. Shortly before the colonial troops surrendered, there were only eight heliograph stations in the region around Otavi in the north to transmit heliograph messages.[72] The last actions were lost due to lack of proper communication between the troop units. The subsequent peace treaty of 9 July 1915 provided for the colonial troops to hand over power honourably. The interned soldiers were returned their weapons without ammunition. All other weapons and equipment as well as property of the German colonial government was handed to troops of the Union of South Africa under General Louis Botha.[73] Before they surrendered, the colonial troops had already sunk weapons and equipment in the nearby Lake Otjikoto.

German South West Africa had over one hundred heliographs and signal devices operational for military and civilian purposes, but very little has survived. A complete heliograph from this time can be seen in Fort Namutoni, while the permanent exhibition in the Swakopmund Museum is showing a glass oxygen bottle. In 1975, 60 years after the colonial troops surrendered, the container was found by a battlefield researcher on the Langer Heinrich and gifted to the museum as a memento of the conflict. The container's markings read: weight when empty 20.1 kilos, max. admissible filling 8.15 kilos, checked 20.7.1904.[74]

In contrast, quite a few topographical names in today's Namibia recall this historical communication system, such as Heliographenberg hill (for example, near Witvlei east of Windhoek) or Signalberg hill (for instance, near Fish River Canyon in the south). The many well-tended military cemeteries also eloquently testify to the country's colonial history. Below the Waterberg, one can still find the memorial stone for the Auer signal station which was unveiled after the war. From 1904 to 1907, German South West Africa had one of the largest light signal communication networks which the world has ever seen. Yet the military command in Germany, with its faith in modern telephony and radio technologies, did not

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70 Jürgen Zimmerer, "Wissenschaft und Kolonialismus – Das Geographische Institut der Friedrich- Wilhelms-Universität zwischen Kaiserreich und Drittem Reich", In: *Kolonialmetropole Berlin. Eine Spurensuche*, Ulrich van der Heyden and Joachim Zeller (eds.), Berlin 2002, p. 129.

71 Fritz Jäger, "Als Funker auf dem Langen Heinrich, Tagebuchauszüge, Meine Soldatenzeit in Deutsch-Südwestafrika 1914/15", In: Scientific Society Swakopmund, News, 2009, No. 1, p. 13.

72 Hans von Oelhafen, *Der Feldzug in Südwest*, Berlin 1923, p. 218.

73 Ibid. p. 231-2.

74 See "Gas für Heliographen?" In: Nachrichten. Gesellschaft für Wissenschaftliche Entwicklung Swakopmund, Vol 8, No. 1, May 1976, p. 4. I would like to especially thank Trudi Stols at the Sam Cohen Library in Swakopmund for her helpful and fruitful advice on sources, and the excellent library services for materials from around the world.

take to heart the lesson of this successful use of heliographs and signal lamps that a military conflict requires the complementary use of all means of communication. It was only the unreliability of the electric telephone and radio communication at the front in the middle of the First World War that prompted a reversion to traditional communication systems. In 1916, after initial failures, light signal troops, dog teams and mobile pigeon cots were systematically set up to fill the gaps in a fault-prone communication network .[75]

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75 Thomas Jander/Veit Didczuneit, *Netze des Krieges. Kommunikation 1914-1918*, Königswinter 2014.