OBSERVATION BALLOON used during the Antarctic expedition of 1950–52 (detail).

Kites and balloons

Nina Wormbs

One can almost see him dancing, taking one step forwards and a few steps backwards, as one does when flying a kite. Knees slightly bent, leaning back with his coat tight across his shoulders and his behatted head pointing up to the kite in the sky. There is a pole behind Nils Gyldenstolpe. It is not possible to see whether there are wires on it but, in principle, it could be a telegraph pole. If so, this picture would really unite central elements of the then-blossoming meteorological science: the instrument for data collection, the operator and the communications network. But perhaps it is just a pole.

Anyway, it is clear that there is a kite. The picture was probably taken during the kite flight mentioned in the centenary paper of the Swedish Meteorological and Hydrological Institute (SMHI), which dealt with early meteorological collections. The Institute reckons its history back to the establishment of Sweden's Central Meteorological Office in 1873, but one could equally say that its founding year should be 1919; this was when the Swedish Riksdag decided that the Central Meteorological Office was to merge with the Hydrographic Bureau to form the Meteorological and Hydrographic Office. At the same time, its activities were separated from those of the Academy of Sciences. Until this point, the Academy had been the governing authority for important areas of Swedish meteorology, even if this had not always been a given.

Kites were cheaper than balloons. And, from 1906, Vassijaure's scientific research station owned the "necessary equipment for kite flights". But they had limitations. For example, kites were difficult if there was no wind, when

NILS GYLDENSTOLPE launches a kite with meteorological instruments from Vassijaure's scientific research station in 1906.

BALLOON LAUNCH FROM ANTARCTICA during the Norwegian-British-Swedish Antarctic expedition of 1950–52.


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balloons were a better choice. On water, one could create a wind by propelling the vessel forwards, thereby reaching higher altitudes than from land. But balloons were still superior; the highest balloon flight recorded in 1905 exceeded 25,000 metres, while just over 6,000 metres was achieved with kites. Both records were set on the continent.

Kites and balloons registered data that was compiled in tables with humidity, pressure and temperature, and air currents. Of course, some fell from the sky, but "these are the soldiers that are sacrificed in the service of science", as meteorologist Martin Jansson expressed it. He was an expert, following his participation in a French-Scandinavian kite expedition to Hald on Jylland in 1902. The tables were published in *Meteorologiska iakttagelser i Sverige* [Meteorological observations in Sweden], published by the Academy in 1860–1921, even if money was scarce by then; it seems to have been used for the experiment instead.

The logbook from Vassijaure shows that trials continued in 1907 and 1908. It was important to coordinate these with international flights. Comparable measurement data made it possible to create the vital synoptic charts – or weather maps in layman's terms – that were based on information from several different measurement points and provided an overview, a consensus. To literally rise above the particular was important in meteorology, and absolutely necessary for seeing patterns and making connections.

The first international balloon day was held in 1893, after which activities gradually expanded. During an international balloon day at the start of the last century, kites and balloons were sent up simultaneously from Berlin, Paris, Strasbourg, Munich, Vienna, Saint Petersburg and Moscow. But contributions were often also made by Britain, Italy, Spain and Sweden.

Of course, balloons have a longer history, with the Montgolfier brothers' flight in 1783 as an initial milestone. Around a hundred years later, when engineer Andrée suggested a balloon flight to the North Pole, they were well-established, although not yet faultless or without problems. During observations with the Svea balloon in 1893–1895, Andrée had worked with Nils Ekholm, then Ph.D. and teaching assistant at the Central Meteorological Office. However, Ekholm did not join Andrée on his second attempt to reach the North Pole; his decision was grounded in a deep technical understanding of the balloon's functionality. In 1895, he had objected to the balloon being purchased from the Lachambre balloon-makers instead of from aeronaut Mallet, as Ekholm did not feel that the sections of fabric were reliably joined together. Avoiding leaks was, naturally, vital, and during checks on Spitsbergen, Ekholm believed that too much hydrogen was being lost. He demanded that these problems were solved or he would not accompany them next year. But Andrée said no, despite both Nobel and Dickson being willing to invest more money. And so Ekholm stayed at home.

In Sweden, Ekholm continued to develop meteorology and its instruments. He had studied under cloud researcher, and the first professor of meteorology, Hugo Hildebrandsson in Uppsala, but, as has been said, he found employment at the Central Meteorological Office in 1890. There, he was also involved in activities in Vassijaure, which moved to Abisko after a fire in 1910. Abisko Scientific Research Station was established and, since then, it has been an important Nordic hub for various types of field research. Until 1923, its activities were run by the committee for Vassijaure's scientific research station and then, until 1934, by the association for Vassijaure's scientific research station. Between 1934 and 2010 it was organised under the Academy of Sciences, then taken over by the Swedish Polar Research Secretariat.

In 1912, the same year as the first building in Abisko was completed, Ekholm proposed experimenting with pilot-balloons. It is possible that he was inspired by an international commission for scientific aeronautics, which that year had proposed the creation of a European network of pilot-balloons that could be sent up at lunchtime every day. Thirty balloons were purchased from the Russian-American India-Rubber & Co. in Saint Petersburg, while a theodolite – a graded telescope – was bought from I. & A. Bosch in Strasbourg, and Nordiska Syrgasverken in Stockholm received an order for hydrogen. There could be almost no doubt that the technical design of the vessel was vital to how well the scientific investigations could be performed. Contractors and subcontractors for materials and constructions were chosen with great care, and expertise was something that could develop over time.

In 1914 and 1915, a large number of balloons were launched by newly employed staff. But these activities also suffered problems. When balloon assistant Carlstedt, B.Sc., requested his pay, he had to settle for half until he had submitted the "proper reports". The committee referred to the "thus far grievous experiences", probably meaning an incident a few years previously, when an employee had not submitted reports and they had finally turned to a public notary for help. However, Carlstedt, who, it turned out, had been partly conscripted during the war, produced his report in due course. This was published as an appendix to *Meteorologiska iakttagelser i Sverige*, but there were simply not enough functional balloons and observations to be able to make scientific advances. The circulation of knowledge demands, de facto, that material is compiled and published in order to progress.

Balloons continued to have a central place in meteorological research and activities in the 20th century. They were also relatively easy to use, particularly compared to rockets, aeroplanes and other more complicated carriers. For example, on the Norwegian-British-Swedish expedition to Antarctica in 1950–1952, a "radiosonde launch" was performed every day. The hydrogen for the balloon was produced locally on the Maudheim base, and one of the

aims was to measure wind direction and temperature. Data was sent to South Africa and, by using simultaneous measurements there, on boats in the Southern Ocean and on the Falkland Islands, synoptic charts could also be created. In parallel, measurements were actually also made from a pole, or rather a mast, that meteorologist Gösta Liljequist had to climb regularly.

Kites are not often found in scientific writing any more, but balloons kept their place as instrument carriers throughout the 20th century and into the 21st century. For example, the Esrange rocket base outside Kiruna launches around fifteen high altitude balloons annually; they make meteorological measurements, but also supply data for research in atmospheric physics and astronomy. With volumes exceeding a modern sports arena, they settle at altitudes of 15 to 45 kilometres and can then sail around the North Pole before being retrieved.

They do sometimes fall out of the sky, just like they used to. Perhaps one could say the air went out of them, even if they are normally filled with hydrogen or helium. However, it often does not matter if a balloon turns into a rag, because it continually transmits data via radio. As if through an invisible wire (or without a wire, wirelessly) it remains in radio contact with the operator on the ground, a contemporary Gyldenstolpe.

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The logbooks for Vassijaure are part of the archive of the Committee and Association for Vassijaure's scientific research station, at the Center for History of Science, the Royal Swedish Academy of Sciences. It is very probable that the person by the pole in the picture is Nils Gyldenstolpe, who was there at that time. An overview of the research station's history is provided by Carl Gustaf Bernhard in *Abisko naturvetenskapliga station* (Stockholm, 1985). There is no general book on Swedish meteorology. Instead, I have primarily relied on the Swedish Meteorological and Hydrological Institute's centenary text by Jan Moen (ed.), *Vädret, vattnet och vi: SMHI fyller 100 år* (Stockholm, 1973), Gustav Holmberg's article on Ekholm in Gunnar Broberg, Bengt Forkman & Carl Magnus Pålsson (eds.), *Vem styr forskningen?* (Lund, 2003), and Peter Hansson's bachelor dissertation in the history of ideas, "… och nu vädret: Meteorologin i Sverige 1859–1872", from Uppsala University, 2003, on early meteorological organisations. A great deal has been published about the Andrée expedition, much of which is easily accessible. The Norwegian-British-Swedish expedition to Antarctica, 1949–1952, has been described by the participants themselves, first in John Giæver & Valter Schytt, *Antarktisboken* (Stockholm, 1952) and later in Gösta Liljequist, *High Latitudes: A History of Swedish Polar Travels and Research* (Stockholm, 1993). Research in the history of science is extensive, with the most recent substantial contribution coming from Peder Roberts, *The European Antarctic: Science and Strategy in Scandinavia and the British Empire* (New York, 2011).