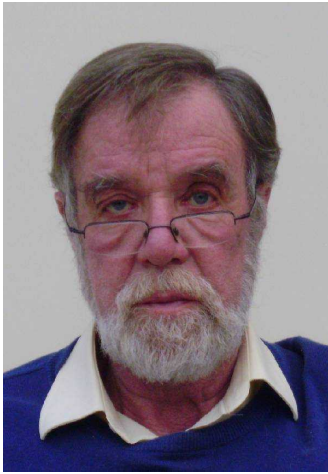


Stanley Cursiter and his contribution to mapping

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Stanley Cursiter (1887-1976) is best known as a towering figure in the artistic sphere of mid-twentieth century Scotland. He was an artist of exceptional ability, but his talents did not stop there. He was director of the National Galleries of Scotland from 1925 to 1948, HM Painter and Limner for Scotland until his death and excelled as an administrator, designer, architect, broadcaster, and writer.² Possibly the least well known of his accomplishments lies in his association with mapping, but his list of honours³ includes a military OBE for services in this field.

Cursiter was born in Kirkwall, Orkney in 1887. The family was comfortably off, and though his father died when he was nine, he seems to have had a happy childhood. From his father he inherited photographic equipment, including a 'magic lantern' (which was to play a major part in his later wartime experience). He early developed a talent for drawing and design.

His first interests in mapping and surveying can be seen at the age of thirteen, while still at school. He attended an evening class in mechanical drawing, gaining a certificate in Advanced Building Construction after two years of study. This stimulated an interest in surveying and he determined to map the area in the vicinity of the family house in the outskirts of Kirkwall. After measuring a base line between two clothes poles he worked out for himself a system of plane table survey, constructing his own 'instrumentation', including a large brass protractor and an alidade. This early aptitude for problem solving and improvisation would remain with him. His main ambition at this time lay in the field of architecture.

In 1904 he left Orkney for Edinburgh. While he still held ambitions to become an architect the necessary funds were not available; instead he embarked on an apprenticeship with a firm of lithographers and printers, giving him skills which again were to be exploited in later mapping applications. He also attended part time courses at Edinburgh College of Art. By 1909 he was earning a living through his painting and a variety of design projects.

On the outbreak of war in 1914 he volunteered for military service as a private in the 7th Battalion, Scottish Rifles but was rejected on the grounds of his health – he was prone to bronchitis but it also seems he was suffering from lead poisoning, attributed to the use of lead based paint. He was eventually accepted into the Officer Training Corps and was sent on training courses in London.

These courses included mapping, which revived his interest in surveying. Such was his ready understanding of the principles of plane tabling (due no

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² Pamela Beasant *Stanley Cursiter, a life of the artist*, Orkney Museums and Heritage (Orkney Islands Council), 2007.

³ HM Painter and Limner of Scotland, OBE, CBE, RSA, FRSE, FRIAS, FEIS, LLD.

doubt to his childhood investigations) that he quickly became an assistant instructor. In time he was posted to the 1st Battalion, Scottish Rifles and in October 1916 he found himself in the trenches at the Somme. Though the battalion was fairly soon withdrawn from the front to recuperate, the dreadful conditions brought on bronchitis and asthma and he was invalided out to convalesce in the South of France. He spent his time there sketching and painting and befriended an RE Colonel who shared an interest in water colour. This officer recovered before Cursiter and on returning to his unit showed some paintings by Cursiter to a colleague, Colonel Jack, who was head of the Map Section at GHQ (subsequently becoming Director General of the Ordnance Survey, 1922-30).

Cursiter was duly returned to his Battalion's base but within a week succumbed to his illness and was once again hospitalised, coming close to being repatriated as 'unfit for service'. He pleaded to be allowed to continue service in France and his letter listing his experience and skills (including, almost as an afterthought, lithographic printing) eventually found its way to Colonel Jack. Recalling the artist with the curious name Cursiter, on the basis of the lithographic experience Jack found a place for him with the 4th Field Survey Company at 4th Army Headquarters. There he quickly formed a lasting friendship with his commanding officer, Major (soon to be Lieut-Colonel) M N MacLeod 'with whom I immediately established the happiest relationship as we had many interests and tastes in common'.⁴ MacLeod would eventually become the Director General of the Ordnance Survey (1935-43). Cursiter's task was to oversee the printing of maps, and as he fully understood the process of lithographic printing he quickly earned the respect of the men under his command and was said to be an officer popular with all ranks.⁵ He had other duties in managing the supply of stores and equipment and he also later set up an experimental radio station to try and improve communications with observation points along the front, further demonstrating his wide range of interests.⁶

In the often chaotic situations of the front up to date maps were essential. The chief compilation source for information on the ever changing trench lines, gun emplacements and other installations was aerial photography. Air reconnaissance in warfare was in its infancy in the 1914-18 war, indeed the first powered flight by the Wright brothers had only taken place some eleven years previously. Cameras were fairly crude, hand held or mounted on the aircraft fuselage. The terrain was fairly level so relief displacement was scarcely a problem, but the combination of light aircraft, enemy action and unsophisticated camera mounting led to considerable problems of tilt displacement in the images. Mapping from these images was a slow and complex process involving estimation of the displacement and using proportional dividers to transfer detail point by point from photograph

⁴ Stanley Cursiter, *Looking back – a book of reminiscences*, (published privately), 1974, p.13.

⁵ An anonymous note in *Pro Patria – The British Legion Scotland Journal*, VI (1930), p.9, reporting briefly on his military service and celebrating his appointment as Director of the National Gallery of Scotland testifies to his popularity.

⁶ Stanley Cursiter, *Looking back – a book of reminiscences*, (published privately), 1974, p.14.

to existing map. Cursiter recognised this as a problem of perspective, a subject he had been particularly interested in when attending courses at Edinburgh School of Art. He immediately saw it as a reversal of his previous experience, where he had been taught to construct perspective views e.g. of building elevations from a chosen viewpoint. Here, in the aerial photograph he had the perspective view generated through the camera lens – the problem thus was how to get back to the correct plan view of the terrain.

He hit on the ingenious solution of re-projecting the photographic negative onto a plane which replicated the tilt present when the photograph was taken. In other words he independently devised a simple method of single photo optical rectification. The ‘magic lantern’ which he had inherited from his father was used to project the aerial photograph onto a ‘map mounted on a board, which could be twisted into any position by means of a ball and socket joint’.⁷ Three or four common points were identified on map and photograph and the distance of the projector to the board and the board’s rotation and angle of tilt were adjusted visually to achieve correspondence of the points. The photographic image was thus close to correct plan and detail could be directly traced off.

After experimentation, a system was developed as follows. Once images had been obtained from the Flying Corps, the draftsman identified control points on map and photographic negative. These points were traced onto a sheet fixed to the board and the adjustments were made to achieve a fit. Cursiter’s account of this goes on to say that they then ‘made a print’ to which the ‘wanted detail could be inked in’.⁸ That is, photographic paper was fixed to the board and an exposure was made. Significant detail then could be drawn on this print and the draftsman then traced this to the map image to update the current situation. A major saving in compilation time was the chief benefit of the process together with improved accuracy (in spite of the fairly crude equipment). There was a dramatic reduction in the compilation time from days to a few hours.

The speed of the process came into its own in the rapid fixing of enemy gun emplacements. ‘Flash spotters’ and ‘sound rangers’ were employed to measure the bearings to gun batteries. Visual observations of gun flashes together with sound estimation of distance were employed. This data was used to direct the Flying Corps to areas for photography. The maps made from Cursiter’s photo rectification system were then employed to provide bearing and distance to direct counter-battery fire. One of the later discoveries made in the course of this mapping work was the identification and subsequent mapping of the ‘Hindenburg Line’. Originally thought to be training areas some distance back from the front, the linking of these areas along a single contour line was revealed when accurately transferred from photograph to map and the massive defensive line being constructed by the Germans in the winter of 1916-17 was verified.

In the early days maps still had to be returned to Southampton to be printed, so a six-week time lag ensued before the finished maps were available to the

⁷ Stanley Cursiter, *Looking back – a book of reminiscences*, (published privately), 1974, p.14.

⁸ Stanley Cursiter, *op cit*.

forces. Cursiter had two hand-operated presses which could be used where there was particular urgency; in his words, they had to resort to 'the unenviable task of mangling out copies'.⁹ However, he made a chance discovery of three lithographic flat bed presses in a local printing shop. An agreement was made with this local firm whereby the army had full time access to one of these presses. It should be remembered that the flat bed presses of the day were crude compared to modern four or six colour rotary or web offset presses of today, capable of printing full colour prints at speeds of several thousand copies per hour. The flat bed press used a lithographic stone or zinc plate bearing the image and this was transferred to the paper via a feed cylinder. Paper sheets were fed manually from the feed board and two hundred copies per hour in a single colour was an excellent rate of production from a skilled operator. Subsequent colours were added in succession, so any additional colours would need separate press runs. In spite of this, production rates were vastly improved, and the six week time lag in supplying map copies for the front eventually was cut to 24 hours.

Cursiter suggested further improvements to production, with requests for a rotary press which could be mounted on a truck to give a mobile printing unit. This idea was rejected by the War Office but he discovered from the press manufacturers that they had actually supplied such a system to the American Army which, by then, had entered the combat. He managed to visit the American Survey Unit to find that they were fully equipped with printing facilities. Indeed, they seem to have been over equipped, as he was able to borrow a mobile printing press from them.

Cursiter's wartime contribution was recognised with a military OBE and he was twice mentioned in dispatches. He was demobbed in 1919 and returned to Edinburgh to resume his work as an artist. In 1925 he was appointed Keeper of the National Galleries of Scotland and in 1930 became Director. The story of his connection with the mapping world might have ended there, but there are two interesting footnotes.

His former CO, Colonel (later Brigadier General) MacLeod, published in 1923 details of an instrument which he called the MacLeod Tilt Finder.^{10,11} While this custom-built instrument was certainly much more sophisticated than Cursiter's improvised assembly, it is possible that this original concept contributed in some small way to MacLeod's design as he would have been intimately aware of the method devised by Cursiter. The instruments were, in fact, quite different; Cursiter's device was intended to eliminate tilt displacement by optical projection while MacLeod's was directed at measuring the angle of tilt. Two examples of the device were built, at the Ordnance Survey and the Royal Aircraft Establishment, but it became largely forgotten. The concept was later 're-invented' at the

⁹ Stanley Cursiter, *Looking back – a book of reminiscences*, (published privately), 1974, p.15.

¹⁰ M N MacLeod, Recent developments of air photography: the adjustment of air photographs to surveyed points, *The Geographical Journal* 61, (1923), p.413-419.

¹¹ G Petrie, A short history of British stereoplotting instrument design, *Photogrammetric Record* 9, (October 1977), p.213-238.

Ordnance Survey. This new instrument was described as the Blogg Tilt Finder in a paper read at the Conference of Commonwealth Surveyors in 1951¹² - a meeting attended by the then retired MacLeod. Petrie notes that this resulted in 'a rather embarrassing situation for both the author and MacLeod'. One may only speculate as to whether MacLeod had any thoughts of Cursiter at the time.

MacLeod was appointed Director General of the Ordnance Survey in 1935, serving in this post until 1943. With the outbreak of war in 1939 he again thought of Cursiter and asked him to come to Southampton to assist with map production. Special leave was obtained from the National Galleries and Cursiter was put in charge of the drawing office, with the task of overseeing a staff of nearly a thousand draftsmen. Many of these were quickly called into military service so it was decided to take the then novel step of recruiting women and Cursiter was charged with the training of the initial intake. His time at Southampton was vital but short lived and he returned to Edinburgh late in 1940 with the sincere gratitude of MacLeod.

They remained in contact and a letter from MacLeod to Cursiter in June 1941, in addition to the obviously friendly exchange of news of family and mutual acquaintances, reveals some tantalising points regarding MacLeod's appreciation of Cursiter's work and ideas.¹³ The training of drawing office staff started by Cursiter had been successfully continued and, with the last of the original civilian drawing office staff due to leave for military service, some 200 women and 200 boys were now fully trained. Paradoxically MacLeod seems unsure of how he will keep them occupied! The mobile printing units that Cursiter had advocated in World War I were now to become standard with each corps to be allocated two presses and a lorry load of paper. There is reference also to a colour separation process suggested by Cursiter and this had been developed to a stage where MacLeod claims the some of the colour separated map prints look better than the originals! Colour separation of original printed maps was quite commonly carried out where copies or revisions of maps were required and no original separation material was available. Cursiter naturally would have been quite familiar with the colour separation process in connection with the reproduction of fine art.

Thus, while revered primarily as an artist, Cursiter's connections with mapping and the Ordnance Survey seem to have been largely overlooked. He held the post of Director of the National Galleries until 1948 and was appointed to the prestigious office of HM Painter and Limner for Scotland in the same year, a post he held until his death. He returned to his native Orkney and continued an active life, painting and designing an astonishing range of items ranging from architecture and interior design to book covers and knitting patterns. He also participated actively in local Orcadian affairs, was appointed Deputy Lieutenant of

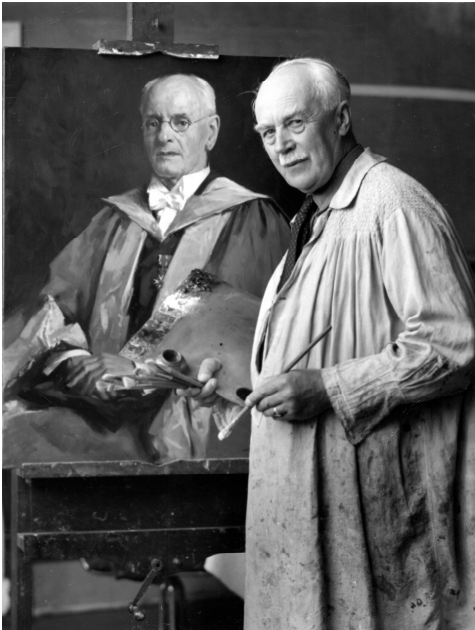
¹² R C N Jenney, 'The use of air photographs for Ordnance Survey large scale mapping', *Proceedings of the Conference of Commonwealth Survey Officers*, London: HMSO, 1951, p.219-233.

¹³ M N MacLeod, Private letter to Stanley Cursiter, 17 June 1941, in the Cursiter Archive, Orkney County Library (ref D26/6/1/M).

the County of Orkney and was granted the Freedom of the City and Royal Burgh of Kirkwall. He died in 1976 at the age of 89.

Acknowledgements

I wish to thank staff of the Orkney Library Archive Section (Kirkwall, Orkney) for assistance in accessing the extensive Cursiter archive material.



Stanley Cursiter *Landscape in the Orkneys by Stanley Cursiter, 1954*
 [left: photo courtesy Orkney Library and Archive, right: fair-use image from Wikipedia]

Other Cursiter paintings are found on National Galleries of Scotland website at www.nationalgalleries.org/collection/artists-a-z/C/3030/artistName/Stanley%20Cursiter.

Peter Chasseaud adds:

The French were using photo-projection rectifying apparatus from 1915 – the Roussilhe apparatus – so there is a strong presumption that Jack, MacLeod, Winterbotham, Cursiter, etc., knew all about this (especially as we know that there was close liaison between Allied survey units and also their respective survey offices at GHQs). So MacLeod's apparatus was not that unique. The Germans, incidentally, developed a similar system.

Fans of railway infrastructure will be fascinated by the plans and drawings which National Rail have now made available on their website at www.networkrail.co.uk/VirtualArchive.