

Airy and the survey of the Maine–New Brunswick boundary (1843-1845)

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Abstract

Sir G B Airy, the astute Astronomer Royal of the mid-nineteenth century, left an extensive accumulation of archival documents, now housed at Cambridge University in the UK. A small collection of Airy papers, dealing specifically with the Maine–New Brunswick boundary survey of the 1840s, is held by the National Archives of Canada at Ottawa, Canada. An outline of Airy's involvement in this combined astronomy-surveying project is presented in this paper.

Key Words: *Airy, surveying, instructions*

At the time of the closing of Herstmonceux about 1990, the Airy Papers held in the Archives of the Royal Greenwich Observatory (RGO) were transferred to the Archives at Cambridge University, Cambridge, UK. As Airy is reported to have saved every scrap of paper he generated during his lengthy term as Astronomer Royal from 1835 to 1881, this is a very extensive collection. Another small, unique, and important holding of Airy papers is housed in the National Archives of Canada (NAC), Ottawa, Canada. These documents contain the details associated with the Maine–New Brunswick Boundary survey of 1843–1845, an operation in which Airy became the dominant scientist in planning and conducting this major undertaking.

How did the Astronomer Royal, Sir George Biddell Airy, become so involved in a boundary survey? Early in January 1843, the Foreign Office wrote to Airy to see whether he might recommend one or two practical astronomers qualified to undertake the astronomical work connected with running and tracing certain parts of the boundary between the British Dominions in North America and the United States. Following the Revolutionary War, the 1783 treaty delineated the north-east boundary between the two countries as the middle of the St. Croix River to its source, then due north to certain highlands and along them "... to the north-westernmost head of the Connecticut river", Figure 1. Although the southern portion of this boundary was settled, it was not until 1831 that an arbitrator, William I, King of the Netherlands, gave a decision which did not please Maine. The Aroostook War of 1838–1839 was over the boundary; however, General Winfield Scott negotiated a truce and three years later this specific project arose from the terms laid down in the Webster–Ashburton Treaty, signed by the two countries in 1842. In his reply Airy suggested that Officers of the Royal Engineers might be employed for this work, an arrangement which eventually materialized. He also asked the Foreign Office for clarification of certain parts of the Treaty. Within a month, Airy had projected himself into the very heart of the project.

There are seventy-five hand-written pages of "Instructions to Officers Acting as Principal Astronomers for Defining the Boundary Line in North America" in the Airy collection at NAC. These instructions are divided into twelve sections, each dealing with a specific method to be followed in field observations. Was Airy well acquainted with the principles of nineteenth century surveying and capable of drafting such guidelines? When this question was raised with Dr Allan Chapman at Oxford University as to whether Airy "... had more than a casual acquaintance with practical Surveying?" his reply was stated clearly:

At no stage in his life did Airy do any sustained astronomical observation, let alone surveying. Where he gained his intimate familiarity with practical surveying and geodesy, is something of a mystery about which none of his surviving papers speak. I strongly suspect, however, that Airy may never have had such experience or training ... (Chapman 1989).

And so this mystery of Airy's expertise in field surveying remains with us. How well did his "Instructions" permit the field parties to carry out their assignments? He writes:

You remember that I instructed Capt. Robinson & M^r Pison to get the absolute Latitudes and the difference of Longitude of the two ends of the long line (70 miles), then to compute the azimuths, and, laying down marks for these completed azimuths, to cut roadways in straight lines.

This they did, and began simultaneously at both ends to cut through the woods. (Airy 1844).

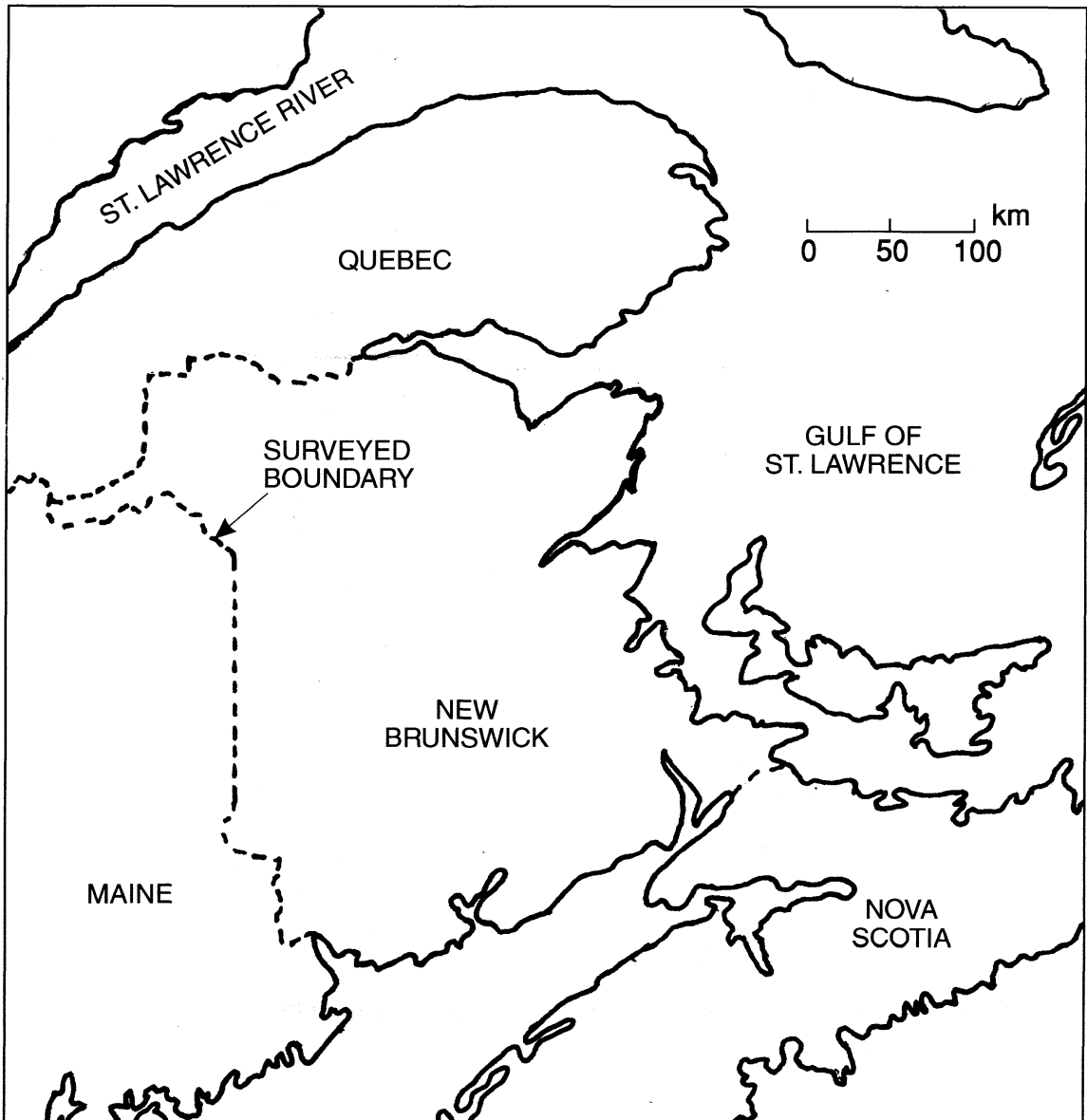


Figure 1. The dashed-line shows the boundaries of New Brunswick with Maine and Quebec. The disputed portion surveyed by the Officers of the Royal Engineers is indicated.

Colonel Estcourt's account is as follows:

On the 17th of April, about 4 PM, M^r Scott (who conducted the stronger party and had cut 42½ miles) from the top of a tree saw an opening begin to appear in the ridge just before him. It increased, and was soon made out to be the head of M^r Pipon's line : it was his cutting party, and apparently directly in line. Upon prolonging the lines until they were abreast of each other, the whole distance between them proved to be 341 feet. (ibid.)

To this success Airy remarked: "This is one of the best operations of its kind that I ever knew." (ibid.) It may well have been the only such operation known to the Astronomer Royal!

When did this small collection of Airy papers reach Canada? In 1898, Otto J Klotz visited Greenwich in search of documents relevant to the settlement of the Alaskan Boundary dispute (Order-in-Council, 1898).¹ While it must be admitted that the Maine-New Brunswick boundary was far removed from Alaska, Klotz somehow persuaded the Astronomer Royal to have these Airy papers transferred to Ottawa, which in turn involved approval by the Admiralty, the Colonial Office, and the Office of the High Commissioner for Canada. These papers did not reach the Public Archives of Canada, now NAC, until 1934. With so much time spent in an environment without controlled temperature and humidity, the Airy papers suffered serious deterioration, consisting of embrittling of the pages, fading and migration of the ink. When the collection was examined at Ottawa in the early 1980s, it was quite apparent that immediate steps should be taken to preserve the essential parts, namely Airy's "Instructions to Officers", the "Correspondence", and "Supplementary Correspondence" connected with the 1843-1845 boundary survey.

In 1984, mainly owing to financial considerations, the only process readily available for the preservation of these documents was the preparation of typescript copies. NAC provided the University of Saskatchewan with photocopies of the Airy papers cited above and agreed to copy the typescripts on acid-free paper for long-term preservation. The deciphering of Airy's handwriting, coupled with the quality of the photocopies, made progress slow and the project time-consuming. With the assistance of the University of Saskatchewan Archivist, the monthly completion amounted to about twenty pages of satisfactory typescript. Over a period of nearly three years, the seventy-five pages of the "Instructions to Officers", along with nearly six hundred pages of "Correspondence" (Figure 2) and "Supplementary Correspondence", have been preserved using this approach.

Among other items in the Airy collection at NAC are thirty field books, volumes (on which the Greenwich shelf numbers are still retained) of reductions by Airy of the field observations, star transit observations by the two Royal Engineers – Robinson and Pipon – checking of chronometer rates and transport of these for the determination of longitude differences and observations with Altitude-Azimuth instruments for latitude determinations. While these documents, for the benefit of historians of science, might be preserved by microfilming before further deterioration occurs, the demand for and availability of these services at NAC has delayed the implementation of this programme. A substantial portion of this important Airy collection may not be preserved for future study.

In retrospect, Airy's "Instructions to Officers" covered all the basic procedures for the field survey of the boundary in 1843-1845, such as adjusting a Transit instrument, the proper use of an Altitude-Azimuth instrument for determining the latitude, checking the rates, and keeping warm the chronometers which were used in the survey. Few of these procedures would be utilized in carrying out a field survey in the latter part of the twentieth century. In little more than 150 years the advances in technology have been so rapid that the mid-nineteenth century procedures outlined by

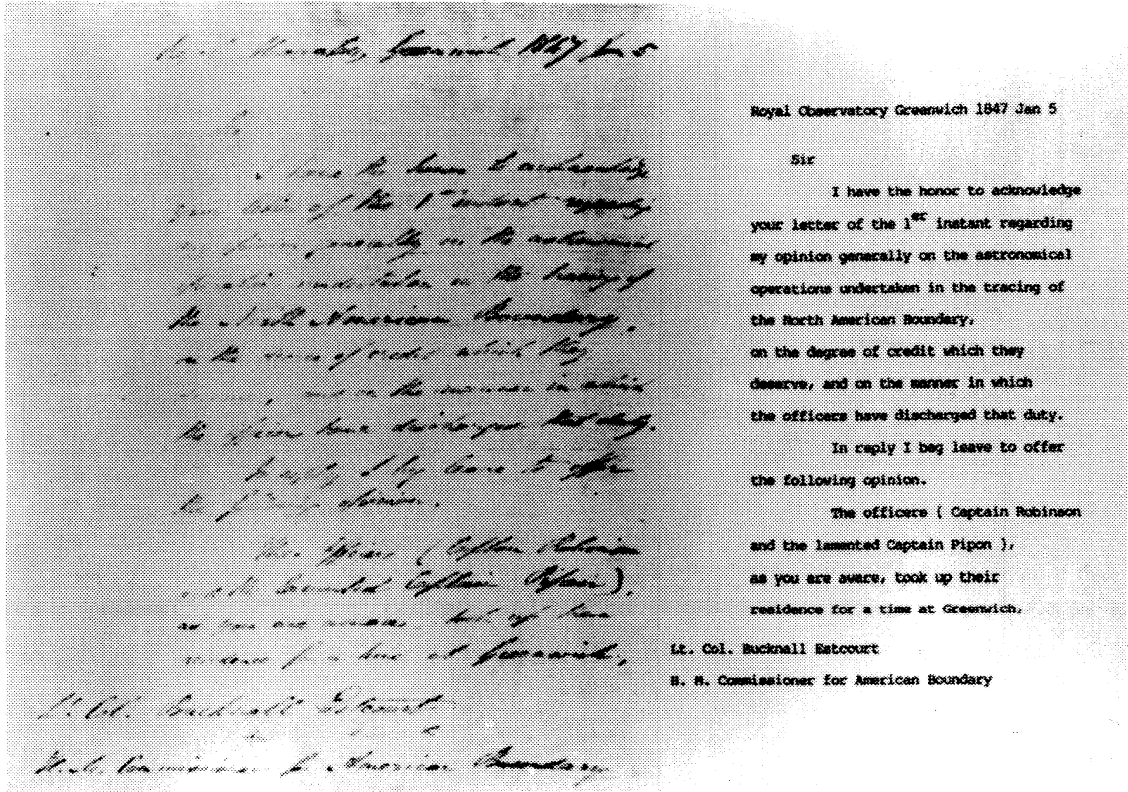


Figure 2. A composite of a page of the photocopies supplied by NAC of a letter from Airy to Lt.-Col. Bucknall Estcourt and the typescript prepared from this letter. The quality of the photocopy, coupled with Airy's handwriting, made the preparation of typescript a lengthy and painstaking process.

Airy may soon be forgotten. When our attention is turned to the Global Positioning System (GPS), along with permission to use the most precise code available from the related satellites circling above Earth, the field surveyors now have at their disposal the ability to fix locations on Earth's surface with an accuracy far superior to the best work which could have possibly been obtained by the Royal Engineers in 1843-1845.

Airy's contributions to the Maine-New Brunswick Boundary survey remain as one of his many important achievements as Astronomer Royal. He was among the top-ranking British scientists of the middle and later part of the nineteenth century. Not only did he dominate development in all phases of astronomy in Britain, he also played a major part in the progress of science in closely related fields (see Airy 1896). At the same time he sensed the need to communicate information on astronomy to people in all walks of life; his Ipswich Lectures (Airy 1849) remain a clear testimony to his ability to carry this venture through successfully, as well as to implore other scientists to do likewise.

Reporting to the Board of Visitors of the Greenwich Observatory in 1844, Airy stated that the survey work on the Maine-New Brunswick Boundary had been achieved by a party of British Officers working in accordance with a plan devised by the Astronomer Royal. Never an individual to fail to remind the politicians of the day about the Royal Observatory, Airy remarked: "I think that I may here assume that the aid of this institution has been beneficial to another department of state." (Chapman 1989). Unquestionably a very astute Astronomer Royal, time and again during his long and illustrious career at Greenwich, Airy took full advantage of this golden opportunity to influence the Foreign Office in carrying out the Maine-New Brunswick Boundary survey of 1843-1845.

While the Archives of the RGO were still at Herstmonceux, a gift was made to them of the typescript of the Airy "Instructions to Officers". After the Archives were moved to Cambridge, the Archivist purchased from the University of Saskatchewan Archives, typescript copies of Airy's "Correspondence" and "Supplementary Correspondence" associated with this Boundary survey. While this portion of the NAC collection has been preserved adequately for historians of science in both Canada and the United Kingdom, concern remains over the potential loss of some important sections of Airy's contributions to field surveying in the mid-nineteenth century.

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NOTES

1. This Order-in-Council, quoted in part below, stated that W.F. King (Note 8), Commissioner under the International Commission of 1892, was to be sent to Europe "... to search for maps and documents relating to the boundary between Canada and the United States ..." With a meeting of the International Commission scheduled to be held in Quebec in August of that year to consider the Alaskan boundary question, the Minister of the Interior was of the opinion that it conversant with the main points of the Canadian contention ... be sent to Europe in place of Mr. King." Klotz was a member of a group of scientists responsible for planning the Dominion Observatory at Ottawa and became its second director in 1917. As a surveyor, Klotz was involved in establishing positions for the Canadian Pacific Railway right-of-way through British Columbia in 1885, and in the determination of the longitude of Montreal with respect to Greenwich. W.F. King, referred to above, was responsible for the formation of the astronomical branch of the Department of the Interior, and later became the first director of the Dominion Observatory in Ottawa.

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