Origins of the Halifax Dockyard Observatory

Randall C. Brooks and Joel H. Zemel

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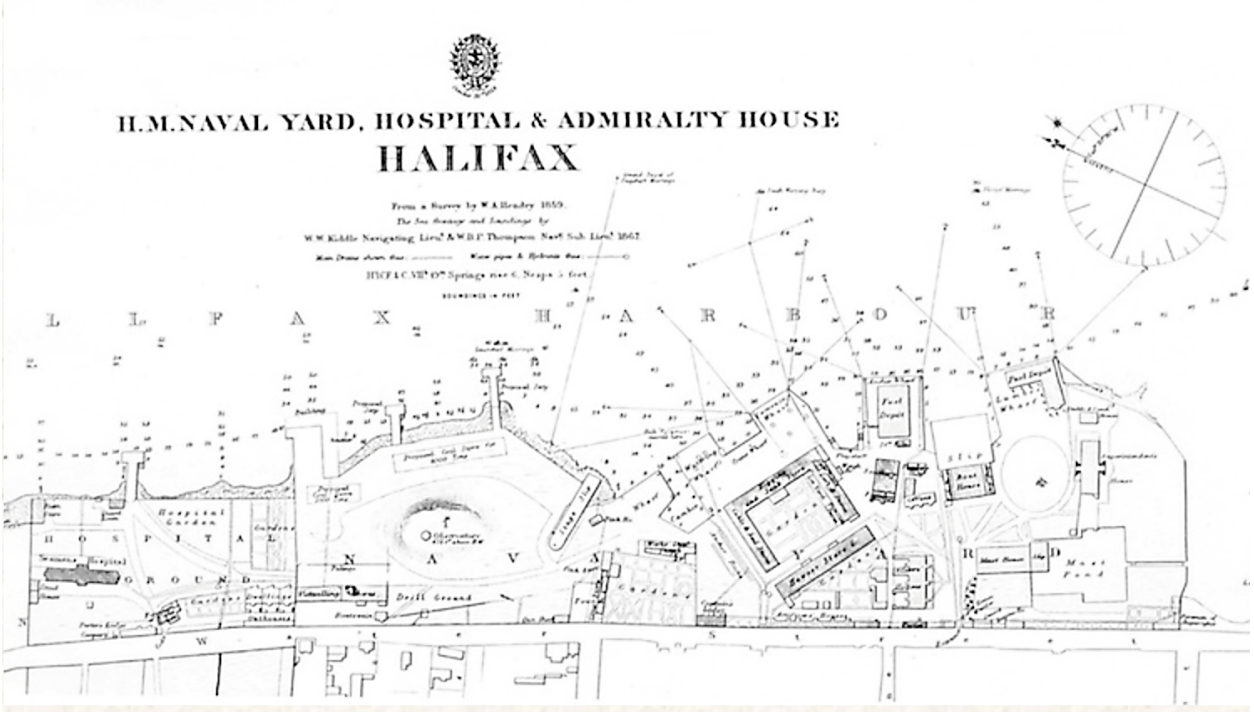

Hendry , 1859

About the authors:

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Abstract

In a previous paper (Brooks, 1992), the origins of a small observatory built to aid in the measurement of the precise location of the Halifax, Nova Scotia, Royal Navy Dockyard was documented to have dated to 1828 or 1829. Subsequent research by others was completed to support the construction of a detailed scale model of the Dockyard to reflect its facilities at the end of the War of 1812-1814. That work suggested this time period or even earlier as its date of origin of the observatory and the built model included a representation of the structure. This paper details efforts to confirm the date for the observatory's construction and during our research for this paper, additional information on the instruments, observers, and subsequent surveys, as well as graphic evidence for the observatory and its later history has been gathered and is presented.

Keywords

Nova Scotia
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Naval
Dockyard
Observatory
longitude
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measurement
instruments
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sextants
telegraph

Publication Data

This Report was prepared to answer a question on whether a structure for an observatory should appear in a model made by the Maritime Museum of the Atlantic (MMA) model builders for the structures in the Dockyard in 1815. Some evidence suggested a date prior to the previously determined date (1828/1829) for the construction of an observatory in the Dockyard. Using the vast resources now available online, the evidence, both archival and graphic, was reviewed and relevant information appears in this report.

Note for Readers:

This document contains links to web sites activated and live as of 2016/12/16 with a minor revision (Fig. 13 added and ref. 70) in 2019.

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Cover Illustration

Captain Michael Seymour's sketch drawn while on HMS Vindictive at anchor in Halifax Harbour 19 June 1845. The transit observatory in HM Dockyard is the small structure with pointed roof right of centre with Admiralty House in the background.
(Art Gallery of Nova Scotia)

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Introduction

The location of Halifax was of importance to both trade and military interests from its founding in 1749. During the Seven Years War, surveyors Joseph Frederick Wallet DesBarres and Samuel Johannes Holland spent time in Halifax after the fall of Louisbourg (1758). Some claim DesBarres provided training in, math, astronomy and surveying to James Cook while on ships wintering over in Halifax. Following that war, DesBarres was assigned by the British Admiralty to survey the coasts of Nova Scotia, while Holland, as Surveyor-General of all British lands in North America, was assigned to survey all other lands from the Potomac River to the Gulf of St.Lawrence and up to Montreal. Cook was assigned to survey the coasts of Newfoundland.[1] Halifax's geographic location, though not the centre of DesBarres' observing efforts, was a key point to be determined. His values of latitude and longitude were used for half a century until, with the use of machine divided sextants and marine chronometers, it became obvious that a more precise determination was required. Indeed, a key flaw of DesBarres' work was the lack of places along the coasts with well determined longitudes so that he could apply a grid to correct the positions. This was especially true with regard to the many headlands.

These new technologies (chronometers and machine divided sextants) were developed in the third quarter of the 18th century mainly by British makers John Harrison and Jesse Ramsden, respectively. The sextant allowed latitude and longitude to be measured using celestial objects — Sun, Moon and stars. However, to determine the longitude, navigators also needed the time at a reference point on Earth. For British sailors, that specific point was Greenwich. Once Ramsden's revolutionary marine chronometer, H4, was proven accurate in 1764, these instruments became the tool used to maintain Greenwich time on board ships. Initially, the British Admiralty was too penurious to purchase the exceedingly expensive chronometers for their entire fleet but, by the early 19th century, the Royal Navy required their captains to have one on board their larger ships and gradually on smaller vessels. In 1825, the Admiralty finally decided to equip all of their ships with chronometers.[2]

Several events and activities leading up to that decision served to make the chronometer a successful deployment. One was the establishment of the "Greenwich Trials".[3] Instrument makers were invited to submit examples of their chronometers to the Board of Longitude[4] for tests as a means of identifying the

best ones which the Navy would then purchase. Success in the Trials was like winning a car race today — it meant sales of other instruments to captains that cost the equivalent of their annual salary.[5] The necessity of having accurate positions for key geographical positions demanded new surveys as well as observatories in key locations where the chronometers could be rated using transit telescopes if required. One such transit observatory was that of R.U. Marsters established in Halifax with provincial government support in 1826.

Evidence for an earlier observatory

The Halifax Dockyard was home to the British North American fleet during and following the American Revolution until the Admiralty decided the title should be shifted to Bermuda during the winter months beginning in 1818. DesBarres' *Atlantic Neptune* charts of Nova Scotia, generally considered good, were those circulated to the RN's captains and navigators. But with the growing number of chronometers and their improving precision, the longitude of Halifax was increasingly being questioned. Thus, new surveys and charts were continually instigated.

We know from an 1808 map made by John George Toler, a "Draftsman, Roy' Engineer Department" that Fort Coote, a blockhouse built on a knoll in the Halifax Dockyard, had been abandoned and demolished by then.[6] The primary graphic evidence of an early date for the presence of an observatory at the Dockyard was an extant map that piqued our interest. The draftsman signed it "Plan of Her Majesty's Careening Yard at Halifax, N. Scotia, Established in 1759. Surveyed & Planned by John G. Toler in May 1815, copied by James McKenzie, 1839."[7] The plan clearly displayed a small octagonal structure in the location of the old fort, around which was printed "Observatory" but the structure was not included in the Reference Tables. We had no idea for whom McKenzie worked. Subsequent searches of the staff of the Royal Engineers (Toler's employer) did not indicate anyone named McKenzie nor could we locate him in available Admiralty records or census records for Halifax.

On the surface, given the wording of the plan's description, one might assume that this was an exact copy of Toler's survey plan and that the observatory illustrated on the map was there in 1815 but, despite a wide and lengthy search, we were unable to locate an original dockyard plan by Toler from this year.[8] To determine its exact nature and purpose, we first had to consider what "copied" meant for McKenzie's 1839 plan — was it a "true copy," a "record copy" or an updated version based on a missing original? In British military documents, faithful copies were generally marked as a "true copy" or "record copy" to indicate the level of accuracy for official purposes. This certified status was missing on the McKenzie's chart but more to the point, the description began: "Plan of **Her** Majesty's Careening Yard... .." Victoria had assumed the throne in 1837. If this were indeed a copy of an 1815 plan, "**His** Majesty" would have been written in reference to George III. As well, certain buildings in the plan were not present in the Halifax dockyard until after 1819. A perusal of the Reference Tables confirmed we were dealing with a copy of an original plan likely drawn up by a contemporary of McKenzie.

At our request, Richard Sanderson, Curator of the Maritime Command Museum at Admiralty House, assisted and subsequently unearthed a copy of an 1831 "Plan of His Majesty's Dock Yard Halifax." The dockyard image and text were clear as was the plan's provenance.[9] The draughtsman's signature read "Geo. L. Taylor." Almost certainly, this plan's creator was George Ledwell Taylor, a renowned civil architect to the Royal Navy.[10] As well, this document was not marked "copied by," "true copy" or "record copy" and had the appearance of an original Admiralty plan. Upon close comparative examination, we found that McKenzie's plan was quite similar to Taylor's and a comparison of the respective Reference Tables showed that, building for building, both included almost identical content with one notable difference: Taylor's plan did not depict an observatory where Fort Coote once stood. Rather, it showed an empty spot surrounded by what appeared to be an earthen berm (Fig. 1). It follows that the draughtsman of a later plan would have updated this feature simply as a matter of course.

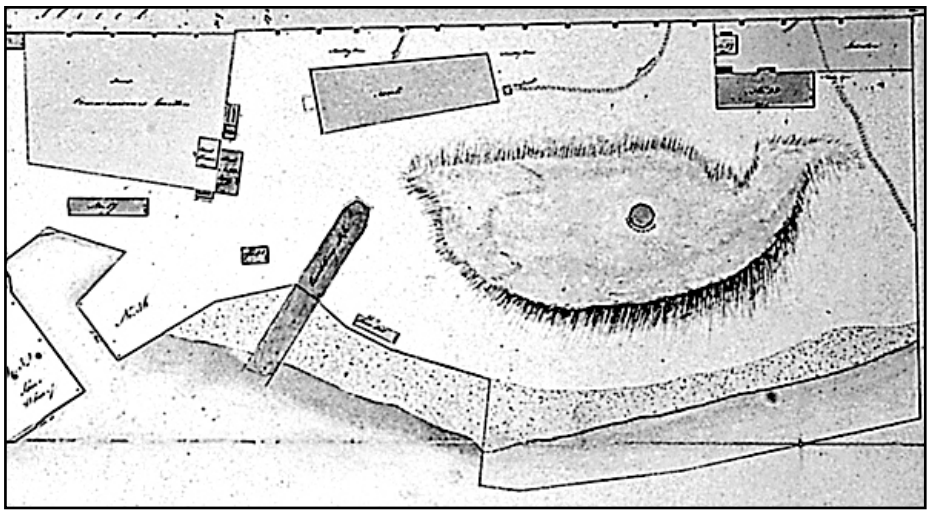

Fig. 1 A small portion of HM Dockyard Plan, 1831 by Geo. L. Taylor.

As stated, earlier published evidence indicated the Dockyard Observatory had been built in 1828 or 1829. So, at this juncture, we decided to look for other documentation of an early observatory by way of general maps and surveys of the Halifax region. Although we had ascertained the McKenzie plan did not represent HM Dockyard as it looked in 1815, we nevertheless made our search as thorough as possible by going back to mid-eighteenth century documents and moving forward from there. Adrian Webb, Archive Services Manager at United Kingdom Hydrographic Office, checked for Toler (& Joler, a sometimes found variation) and other detailed maps at Taunton.

We sought out and examined archival material from the 1750s to 1831 in Library and Archives Canada collections, at Nova Scotia Archives, MARCOM and online. These items included:

1752	C. Morris	"A Draught of part of the Sea Coast of Nova Scotia from Port Senior to Shillingcook"
1759	C. Morris	"A. Chart of the Harbour of Halifax in Nova Scotia"[11]
1798	S. Holland	"A Chart of the Harbour of Halifax in Nova Scotia"
12 July 1798	T. Backhouse	"The Harbour of Halifax in Nova Scotia (HMS *Thisbe*)
1808 & 1809	J. G. Toler	"Plan of the Peninsula and Harbour of Halifax[12]
1 May 1818	A. Lockwood	"A chart of the coast showing Halifax Harbour and Bedford Basin"
1822	E. Sabben (Master)	Quoted references in nautical publications to a survey of Halifax Harbour conducted by HMS *Niemen*
1824	W. Smyth	"The Harbor of Halifax in Nova Scotia"
1828	E. Blunt	"The north eastern coast, North America, New York to Cape Canso" (with insert of Halifax Harbour)[13]

Yet we could find no indication of an observatory. We also tracked many more maps and city plans which dated from ca. 1815 to 1840 but none were sufficiently accurate to show any structure on the knoll. An extract from a very detailed 1827 map of Halifax and approaches by Lieutenant William Scarth Moorsom of the 52nd Light Infantry, obtained from the National Archives at Kew, also showed no signs of anything occupying the space on the hill as in the 1808 and 1809 Toler maps. Nevertheless, this excellent map gave us license to narrow down the timeline of the observatory's construction.

New Surveys: early discussions and key staff

In 1822, the Officers and men of HMS *Neimen* under Captain Edward Reynolds Sibly (see the quote below) and Master Edward Sabben were tasked with measuring the latitude and longitude of the Halifax Dockyard. There is not much available information regarding this venture but we know from John Purdy that:

> 3. Halifax.—The latitude of the naval yard of Halifax, from observations very carefully made by the officers of H.M.S. *Neimen* in 1822, was 44° 39' 37". This was gained by eleven *meridian* altitudes with the artificial horizon, and several observations made on each side of noon at small intervals; the mean true altitudes being computed from the hour angles. The longitude, 63° 33' 43', was obtained as the mean result of more than thirty sets of lunar distances. These observations were made at considerable varieties of temperature, for which corrections were applied, and the index errors of the sextants were carefully ascertained at each observation. We formerly gave the longitude from M. des Barres, &c. as 63° 32' 40"; and therefore presume that a statement of 63° 37' 48", which has lately appeared, is four minutes too far West."[14]

The third mentioned longitude measurement for the Halifax Dockyard resulted from a series of surveys conducted between 1828 and 1830. As better chronometers were assigned to ships going to Halifax, it appeared the longitude determined in 1822 had come under scrutiny by the Admiralty. In 1828, Rear Admiral Sir Charles Ogle, Bart. (Fig. 2a), Commander in Chief of the North America and West Indies Station based in Halifax, under the directions of the Lord High Admiral, readied to conduct an extensive three-year survey of areas in and around the eastern seaboard; including Nova Scotia, parts of Newfoundland, the Bay of St. Lawrence, the Bay of Fundy and Bermuda. The initial phase of the new project had been formalized on 1 March 1828 when William Edward Parry (Fig. 2b), Secretary to the Admiralty, wrote to Ogle stating:

> "It will be observed that, in the charts composing the atlas of Nova Scotia etc "compiled from documents in the Hydrographical Office" we have not been able to apply the usual scales of latitudes and longitude, in consequence of having no materials of this kind in which a proper degree of confidence can be placed. It would therefore be conferring an essential benefit upon the navigation of these coasts, if the officers of HM ships should have an opportunity of making accurate observations for the latitude and longitude of any of the principal points; it being understood that the above-mentioned charts may be depended upon as good local

charts, though the absolute geographical position of the points is uncertain."[15]

Fig. 2a (L) *Admiral Sir Charles Ogle, Bart., Commander in Chief in Halifax* by Cornelius Durham, 1850 (Library and Archives Canada, C-103575)

Fig. 2b *Captain William Edward Parry Secretary to the Admiralty* by Charles Skottowe, 1830 (Royal Museums Greenwich)

Rear Admiral Ogle was to comply "with the suggestions of the Hydrographer, which accompanied their Lordships letter No. 13 of 3rd March 1828, for improving the Charts of Nova Scotia etc."[16] Soon after, the lengthy process began with acquisition of supplies and equipment as well as the selection of officers and men who were to undertake the arduous work. Ogle tasked the survey to Master John W. Jones of his flagship, HMS *Hussar,* to be assisted by Admiralty Mate Horatio Jauncey. On 15 May, the commander in chief reported to Captain Parry that a meridian had been fixed in the Dockyard.[17] During the five months of extensive preparations for this "Action of His Majesty's Ships," Ogle carried out frequent efficiency inspections and delivered a detailed report to the Admiralty just two days before before the survey was to commence.[18]

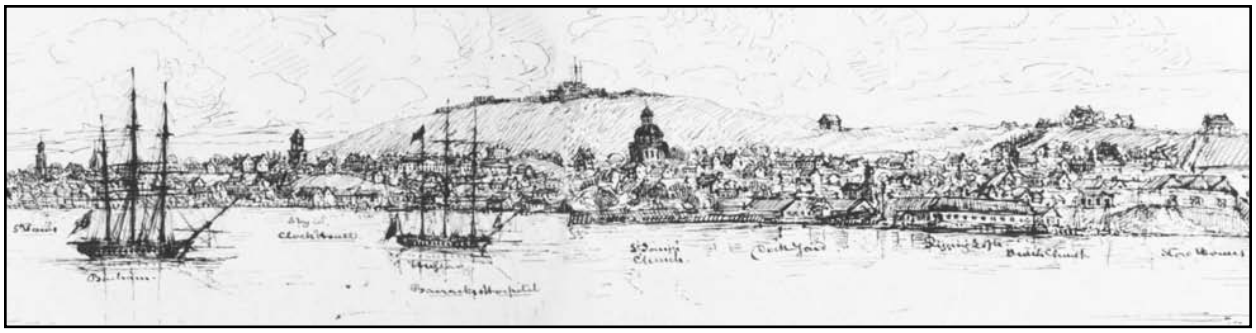

Fig. 3 *Portion of a print showing HMS Barham and HMS Hussar in Halifax Harbour, 1826*. (NSARM Photo Collection)

According to *Belcher's Almanack*, 1824 to 1830, John Jones was present at the Halifax Dockyard from 1824 to 1826 and served on at least two ships before HMS *Hussar*. He was master of HMS *Dotterel* in 1824 under Rear Admiral W.C. Fahie and in 1825 under Rear Admiral Willoughby T. Lake. However, in 1826-27, Jones is not listed as serving aboard any of the ships stationed in Halifax (he was mistakenly recorded in *Belcher's Almanack* as having been the captain of HMS *Orestes* instead of Commander William Jones). Whether he was even in Halifax is unknown, but Jones reappears in 1828. From then until 1830, he is listed as Master of HMS *Hussar*, a 46 gun fifth-rate frigate under Ogle. It was while in this position that he was charged with carrying out the astronomical observations to determine longitude and latitude.

John W. Jones was born in 1787 in Llanfwrog, Anglesea, Wales. It appears he may have been self-taught — a man who, with great aptitude, acquired his navigational experience at sea — though he would have been required to pass an examination by Trinity House in London before receiving his Master's papers. The Navy List of 1812 (and subsequent volumes) show that he gained his seniority on 12 June of that year.[19] Although Jones was a non-commissioned senior warrant officer (similar in rank to a lieutenant), Rear Admiral Ogle and later, Captain Henry Wolsey Bayfield, were duly impressed with his abilities as a navigator and surveyor.

The goal of the initial phase of the survey was to improve the marine charts of Nova Scotia for navigators. To this end, the latitude and longitude of a "primary meridian" had to first be determined and in this case, the Halifax Dockyard was chosen. With the meridian established, one could then use a set of chronometers to determine the difference in longitude between Halifax and another location. This could be accomplished by sailing to the location and recording the difference in longitude as indicated by the chronometers and a set of standard astronomical

observations — usually the passage of the Sun or Moon through the meridian (north-south line on the sky). This "running of chronometers" between key places was also used in the 1820s to determine the longitude of Boston west of Greenwich and then from Boston to Halifax.

Instruments and methods employed

According to the log books of HMS *Hussar*, kept by Midshipman Francis H. Stanfell, the survey began on 10 August 1828.[20] Until its conclusion on 20 July 1830, Master Jones and Mate Jauncey, as well as the navigators on the other survey ships, had access to a number of chronometers. At the time, a minimum of three chronometers was necessary because, if the rate of one began to change, i.e. to slow or speed up, the rates of the other two would indicate the problem. With available online records, we are able to track those instruments which we now know were used at some point to determine the Dockyard position as well as positions of ninety other locations along the Nova Scotia coastline.[21] The following table lists all the known chronometers employed in Halifax and/or on the associated surveys:[22]

Table 1: List of Chronometers used between 1828 and 1830

Maker	***Serial #***	***notes recored concerning their origins***
Arnold	No. 257	Received from HMS *Champion* in lieu.
Arnold	No. 465[23]	Received from HMS *Champion* in lieu.
Arnold	No. 494	Received from HMS *Columbine*
Barraud	No. 502 (or 102)[24]	Source of instrument unknown
French	No. 3302	Owned by Lieutenant George Brown of HMS *Hussar*[25]
French	No. 1895 (*see* [25])	Received from HMS *Champion*
French	No. 4300[26]	Received from HMS *Champion*
Grayhurst & Harvey	No. 89[27]	Received from HM Store Ship, *Weymouth* supplied to HMS *Tyne*
Parkinson & Frodsham	No. 253[28]	Brought from England on HMS *Hussar* received from the Royal Observatory at Greenwich
Parkinson & Frodsham	No. 287[29]	Brought from England on HMS *Hussar* – supplied to HMS *Columbine* in lieu

The specific instruments assigned to Jones and Jauncey for use in Halifax were as follows:

> "Among the equipment used by John Jones was a 9 inch reflecting circle by Thomas Jones and a sextant by Macneil used by Horatio Jauncey (both with mercury artificial horizons) and chronometers Parkinson & Frodsham nos. 253 and 287 and French no. 3302. Assistance was also provided by the Schoolmaster of HMS Hussar, Mr. Kerr."[30]

In a letter to John W. Croker, dated 17 November 1828, Ogle confirmed:

> "Having obtained the loan of the Transit and Telescope from the King's College at Windsor, in this Province, I am taking great pains, with the assistance of the Professor of Astronomy in accordance with the wish of the Hydrographer, to ascertain correctly the Longitude of this place by means of occultations of the Stars etc. and the Moon's transit over the Meridian."[31]

The reflecting circle on stand and sextant did not require an observatory; though a protected site, especially with the fixed mount on the reflecting circle[32] would have added repeatability to the observations. In a letter dated 25 November 1828 to Captain Parry, Ogle stated:

> "The chronometers on board the *Hussar* are excellent, but some of the chronometers in the other ships cannot be depended on, I have therefore requested the Admiralty to send me out three more good ones, which I think will enable me to complete the business entirely to your satisfaction _ The chronometers on the Tyne are not so good as I could wish, and those in the Columbine, Ringdove and Manly not to be relied on for the important object we have in view _ While in Harbour the chronometers have been constantly compared with one another, and an account kept of their Rate by the Master of the Hussar _
>
> The little observatory on the Hill in the Dock Yard is completed, and I think will answer very well: We shall begin our observations immediately, for the purpose of ascertaining the longitude of the Dock Yard correctly, which has been considered the Meridian _ the professor of Astronomy at Windsor (who I shall invite into my house for six weeks); Mr. Jones, Master of the Hussar, Mr. Rose, Master of the Tyne and Mr. Jauncey, Mate of the Hussar will be the persons employed on this service, and I hope when these observations are compared with those taken at the Observatory at Boston you will be able to depend on the Results _ Mr. Jones has already tried the time between Halifax and the observatory at

> Boston, with the *Hussar's* beautiful Chronometers, and finds by the longitude of Boston, they say, assisted from numerous Occultations of stars, that the longitude of Halifax differs at least five or six Miles."[33]

The Professor of Astronomy at King's College at that time was an alumnus, John Stevenson. He had been appointed Professor of Mathematics and Natural Philosophy in 1826 and remained at at the college until 1855. Stevenson had replaced Pierce (Perez) Morton who withdrew unexpectedly from King's in April 1826. Morton was a student of Sir George Airy, who later became Astronomer Royal. On 24 January 1827, Morton made a donation to the college of the books and astronomical and mathematical instruments which he brought with him to Windsor but had left behind. These instruments included:

> 1 transit telescope of 1 1/2 inch aperture, 2 eyepieces and detached spirit-level
> 1 sextant with artificial horizon
> 1 portable planetarium by Wm. Jones, London.[34]

From the President of King's report (George McCawley) and Professor Sumichrast's report on the state of the King's scientific apparatus (both from 1872), we learn Jesse Ramsden in London had made the 1 1⁄2" transit telescope, circa 1795 to 1800 (the year Ramsden died), and that it was still in good condition. The transit, apparently still in use, is displayed with a group of King's engineering students in a surviving photo (Fig. 4).[35] That Ogle was aware of the Ramsden transit at King's is not surprising since many of the Halifax gentry had close connections and summer homes in the town of Windsor, Nova Scotia. The judge of the Court of Vice Admiralty, Hon. Sampson Salter Blowers, was a member of the King's Board of Governors and thus, the Commander in Chief in Halifax, Admiral Ogle, would most likely have been aware of the donation of the instrument the year before he called for assistance from Stevenson. Despite its age, the theodolite was large enough and of a type to make it well suited to the observations required to determine the latitude and longitude of the Dockyard. The instrument was one of Ramsden's smaller survey theodolites with the divided scale appearing being about 16" in diameter. Access to this instrument may very well have been the impetus to construct an observatory in the dockyard — i.e. to have a solid base on which the instrument could be mounted and left unmoved for the period of the observations. Repeatability was essential for accurate measurements.

We also know that Jones was using a 9" reflecting circle by Nathaniel Worthington and James Allan when surveying in Newfoundland in Bonnycastle[36] and

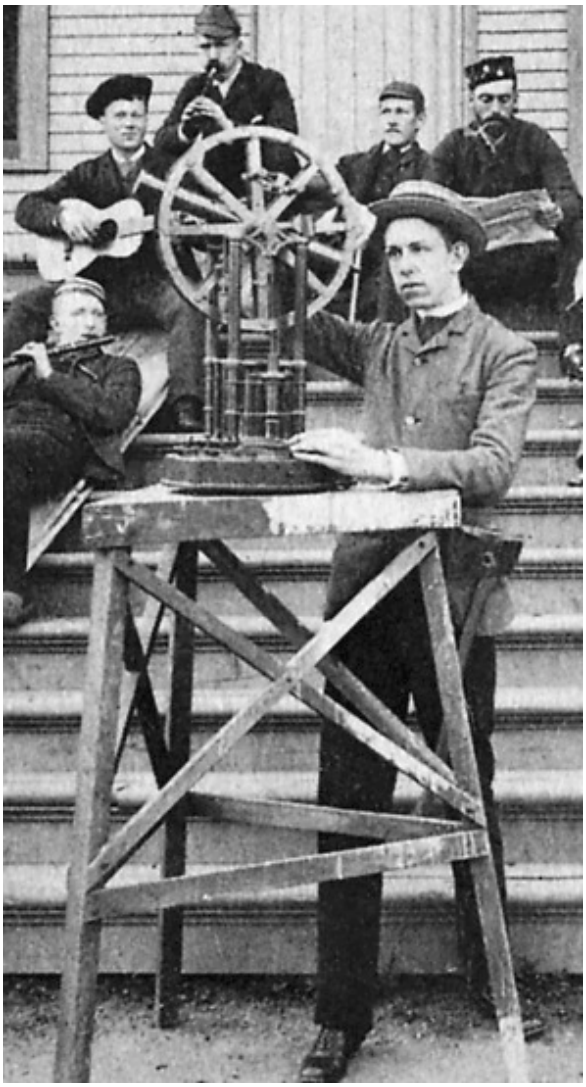

Fig. 4 *The Ramsden theodolite (ca. 1795-1800) in 1889. Ramsden was the premier astronomical and surveying instrument maker of his time.*

Bouchette.[37] Its use during The Virgin Rocks survey of 1829 by Master Edward Rose of HMS *Tyne* and Lieutenant Henry W. Bishop, HMS *Manly* was also mentioned in *The Nautical Magazine* (1832).[38] Otherwise, no additional information concerning its use or whether it survives has been found. It is interesting to note that the British Board of Longitude had approved the loan of Ramsden's famous circular scale dividing engine to Worthington in 1821.[39] Therefore, it is possible that it was used to divide the scale of this instrument and certainly would have been used to divide the King's College's Ramsden survey theodolite.

Observational and Computational Methods:

Determining the latitude was a relatively straightforward process beginning in August 1828 and continuing through the fall. It could have been measured most directly with the Ramsden theodolite but was probably also accomplished as a check using the two sextants with artificial horizons. Artificial horizons were devices which held a pool of mercury under a glass cover. With the sextants, instead of using the distant horizon as the reference point (from the Halifax Dockyard, a sea horizon was not visible due to land blocking the view of the harbour mouth. *See* Fig. 6 below), the observer placed the artificial horizon a short distance in front of him. Next, he lined up the Sun in order to see both the direct image and the reflected image in the sextant's telescope. He then read off the angle from the arc of the sextant and divided this by half to get the altitude of the object.[40] By observing and recording the altitude of the Sun and the time on the chronometer before and after noon, the observer could subsequently plot the altitude of the Sun with time and find the exact moment of noon. The angle at that time subtracted from 90˚ plus the Sun's declination for the date gives the latitude. Of course, this could also be measured and verified with the Moon or bright stars at night. Observations carried out on land made this a relatively easy and accurate process.

In order to determine longitude, the process was much more demanding as a small error in time on the chronometers could result in errors of several miles when at sea. Briefly, longitude is the difference in time (or degrees) east or west of the Royal Observatory in Greenwich, England. Chronometers maintained Greenwich time, but one also needed to determine local time. There were a number of techniques and, for critical locations, more than one method or series of observations of astronomical objects was employed as a check. For the period we are discussing, the *Astronomical Ephemerides* were calculated at Greenwich thereby providing the positions of the Sun, Moon, bright planets and even the times of events related to the moons of Jupiter. Having two people conduct the observations was, for some techniques desirable as it shortened the calculations and also diminished the uncertainties. Having a third person to signal or record the time was also an advantage and improved the precision of the observations. It is possible that William Kerr, the schoolmaster aboard HMS *Hussar,* was employed as a third observer.

The calculations to use observations, tables and to make the necessary corrections were very involved and the observer had to be knowledgeable of and experienced in the calculations and possible sources of error. Without calculating machines, these computations were done in long hand or by use of log tables including those

for trigonometric functions. It was not uncommon to take an hour or more to compute a single value of longitude from a set of observations. To get the required precision, the more sextant observations one had and the more chronometers to which one had access, the better the final readings by averaging the results. Uncontrollable factors were the weather and steadiness of the atmosphere. Access to an astronomical transit and an astronomical clock would have been ideal and, in fact, an astronomical transit was owned by Richard Upham Marsters in Halifax.[41] Why Marsters was not consulted for this project is not known; though it may reflect the Navy's preference (perhaps prejudice) to use their own personnel.

Correspondence relative to the Longitude and Latitude observations

There were a number of pieces of correspondence circulated which commented on the abilities of those involved in the observations as well as the accuracy of the instruments. Soon after the commencement of observations, Captain Boxer wrote to Rear Admiral Ogle stating:

HMS Hussar
Halifax Harbour
11 Septr 1828

Sir

In forwarding this report of a series of observation made by officers of His Majesty's ship Hussar under my command, I have the honour to inform you as to the degree of confidence that can be placed in them, I beg leave to observe that during the whole time employ'd on that service, our chronometers were going remarkably steady, that the observers were quite equal to that duty, & whose attention to the same was unremitting. I am therefore confident that the Geographical positions stated in this report are determined with great accuracy.

[to] I have the honour to be Sir
Sir Charles Ogle Bart Your most obedient Humble
Rear Admiral etc Servant
Commander in Chief &&40 Edward Boxer Captain.

As previously mentioned, Rear Admiral Ogle had sent a communication to Captain Parry (q.v. **ref. 31**) expressing his dissatisfaction with the performance of most of the chronometers at his disposal save for the "excellent" chronometers on board HMS *Hussar*. In a letter and report directed to John W. Croker several days earlier (q.v. **ref. 29**), he wrote:

> "I cannot depend of some of the chronometers on the Ships, and therefore with observations to be taken again next year, on several points, before the latitudes and longitudes are fix'd, I request their Lordships will be pleased to allow send three more Chronometers, that can be depended upon, to be sent to me."[42]

Margin notes by Croker on the folder containing this letter and dated 23 December show that he suggested Captain Parry examine Ogle's revisions and make the decision whether to send the requested chronometers. Margin notes written by Parry on the same folder and dated 26 December state:

> "the reports accompanying this letter are by far the most valuable and important ever transmitted to this office by ships not specifically employed by the Surveying Service. I think the Chronometers should be furnished as the Admiral requests, and I beg to suggest whether as an encouragement to such exertions, their Lordships would not be pleased to express by their approbation to Sir Chas. Ogle and the Officers who have obtained the observations."

Yet another small note along the edge of Ogle's 17 November letter confirmed that three chronometers were ordered to be sent to Admiral Ogle on HMS *Champion* on 11 March 1829.[43]

From comments in reports to the Admiralty and other documents, we get the sense that Jones and Jauncey were quite competent and doing good work. Notwithstanding, in an 1829 letter to Captain Francis Beaufort, Parry's successor as Hydrographer to the Navy, Captain Bayfield expressed his concern that the Admiralty Board had prematurely published some of the positions that had been sent to them by Ogle.[44] Bayfield's name is well recognized in Canadian marine surveying. Beginning in 1817, he surveyed the Gulf of St. Lawrence to the Great Lakes for many years. While Jones and Jauncey were conducting their observations at the Dockyard, Bayfield was based in Quebec City where his work involved linking the surveys between the two cities. Thus, he was intimately familiar with the work being carried out in Halifax. It is worth noting that Jones and Jauncey were working under Ogle's command and not the Hydrographer to the Navy (Beaufort). This was unusual for such work. The nature of the arrangement reflects the urgency that was placed on the effort; right up to His Royal Highness, the Lord High Admiral.

Despite some early concerns, the preliminary results of the surveys by Jones and Jauncey gained high praise. From Bayfield's letter of 28th Jan. 1830 to Beaufort we learn:

"As Mr. Jones has been stationed at Halifax during two winters for the express purpose of ascertaining the Longitude, and has an Observatory furnished with the Requisite instalments. He has much superior means than I have at Quebec. He also devotes his whole time to one object, whilst mine is fully occupied in laying down our work, and the other duties of this service.

Mr. Jones' observations consist of occultations of the fixed stars, Eclipses of Jupiter's Satellites, Transits of the Moons, and Lunars. Of those, the two first are for Jupiter and I think he has the Longitude already to less than a minute of a degree, — I cannot omit here to bear testimony to the highly trustworthy Zeal, care and ability which Mr. Jones has displayed."[45]

Not long after, Ogle also commended the work of Jones and Jauncey to Croker stating:

"In the performance of this important service, [i.e. measuring the positions of all the important points and headlands in the area of Ogle's command in Nova Scotia] Mr. Jones, the Master, and Mr. Jauncey, Admty Mate, of His Majesty's Ship *Hussar*, have been most indefatigable; and shown such ability that I feel it my duty to recommend them to the notice of their Lordships.

Mr. Horatio Jauncey, Admty Mate, who I understand is the son of an Old Officer in the Navy, has passed his examination nearly 8 years: he bears as very high character, and when their Lordships see the work, I flatter myself they will think him deserving of promotion."[46]

Sir Charles Ogle was certainly satisfied with the results of the surveying project and ordered that a tablet (Fig. 5), be erected in the dockyard to record the location of the Dockyard Observatory for posterity. Thus, this relatively obscure structure had become a recognized "secondary meridian". The plaque states:

"The Latitude and Longitude of this
spot, determined in 1828 and 1829 by Mr. Jones, Master of His Majesty's Ship Hussar, assisted by
Mr. Jauncey, Admiralty Mate, from Lunar Occultations of Stars and numerous other Observations according to the order of
HIS ROYAL HIGHNESS, THE LORD HIGH ADMIRAL REAR ADMIRAL SIR CHARLES OGLE BT Commander-in-Chief.
Latitude, 44° 39' 26' N.
Longitude, 63° 37' 48" W.
Variation, 21° 18' 68" W."

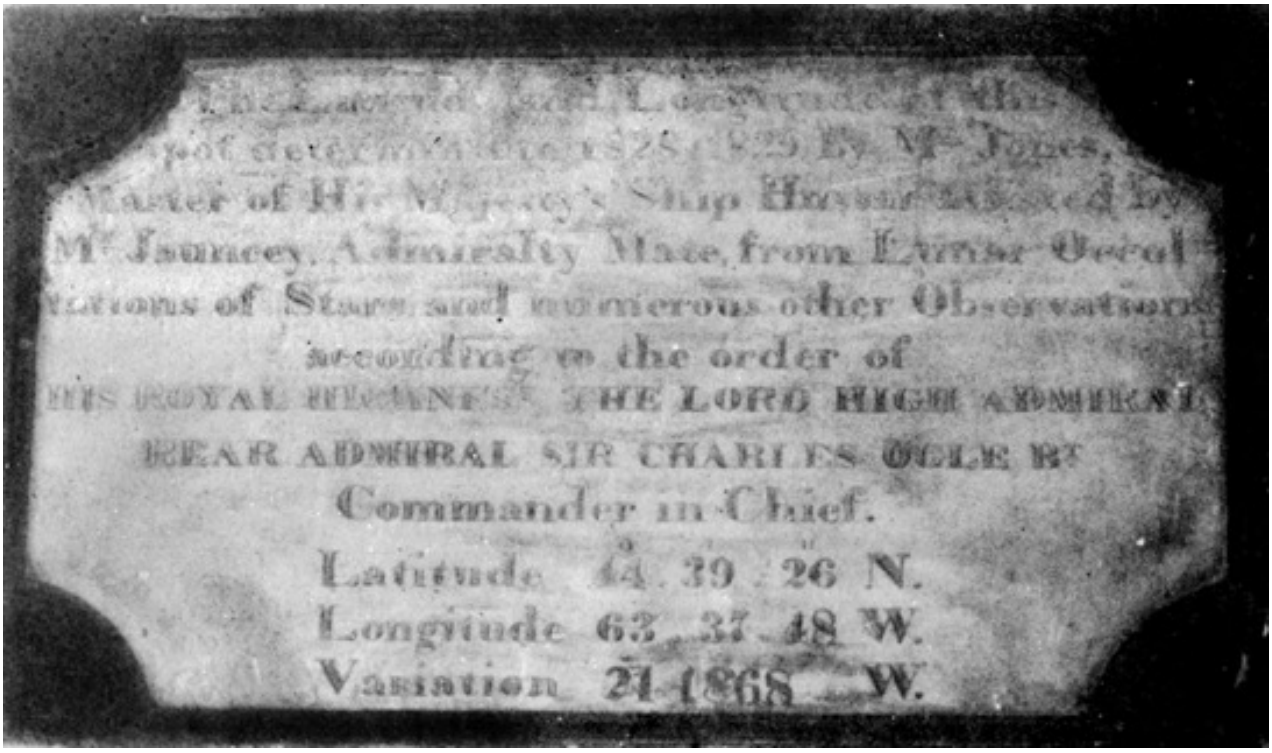

Fig. 5 The Dockyard tablet erected in 1830 noted the location of the secondary meridian.

[NB: the original magnetic variation of 17° 10’ 36” W was changed on the plaque to 21° 18’ 68” W”, using the then annual rate of change of magnetic north in the mid-19th century, probably after ca 1852.]

Assessments of Jones' and Jauncey's work

Given the unusual nature and high profile of the survey project, Ogle had been eager from the beginning to select key personnel with the requisite skills whom he could trust to do the work with care. Even a few months into the endeavour, Ogle was expressing his satisfaction with their progress and those sentiments continued throughout. Others also officially commented on the quality of the results. A sense of the impact of Jones' and Jauncey's work is provided in the following excerpts. From Henry Bayfield's letter to Francis Beaufort we learn:

> "It is but justice to Mr. Jones to remark that wherever I have followed him, as at Gaspé, Mingan, Anticosti, & Pt. des Monts, I have always found him extremely accurate. I make this remark in order that the results of his numerous observations may have their just value."[47]

Perhaps with even greater weight, Bayfield, again in a report to Beaufort dated Quebec, 31st December, 1836, discussed the precision of longitudes in the areas for which he was responsible, and the link to Halifax and Boston. His observations compared to those made in the 18th century by Lieutenant Bullock (working with James Cook) disagreed by seven miles in longitude. He went on to state:

> "I have considered it my duty to point this out to you as soon as possible — I feel certain that my difference in Longitude from Quebec is very nearly on and I think I have the absolute Longitude of Que. within half mile — I may also add that I have found Mr. Jones's observations correct to within a mile in almost every instance where I have followed him and the difference between us very seldom exceeds that amount, whilst in the great majority of instances we agreed within a few seconds …"[48]

Though, in a report to Francis Beaufort in 1843, Captain Bayfield indicated a correction for the location of the tablet noting "Mr. Jones' Stone Tablet East of old observatory stone tablet .... 10"."[49] Indeed, within a few years of the completion of the survey by Jones and Jauncey, a belief had begun to circulate in the nautical world that their longitude measurement of 63° 37' 48" might not be precise. However, this presumption of inaccuracy, repeated annually in various marine publications by John Purdy and Alexander L. Findlay, was not aimed solely at the 1828/1829 measurement. The following item appeared in the 1843 edition of *The British American Navigator*:

> 19. HALIFAX.—In Mr. Raper's valuable work, the longitude of Halifax is assumed as a secondary meridian, in 63° 37' 26"; but, as this position cannot be considered as finally determined, we have repeated the longitude as given in the *Atlantic Memoir*, p. 55, and the *Colombian*

> *Navigator*, vol i. p. 9; and, judging from the coherency of former results, the longitude above is probably nearly 4 minutes too far west___ See the note on p. 171 hereafter.[50]

The text on page 171 clarified that the "former results" were those of Mr. E. Sabben, Master of HMS *Niemen* (63° 33' 43") made in 1822. Essentially, this note was a reprint of "3. Halifax" found in our earlier reference [i.e. ref. 14] to the 1839 edition of *The Colombian Navigator a*nd also presumed "that a statement of 63° 37' 48" [i.e. Jones and Jauncey], which has lately appeared, is four minutes too far west." The "valuable work" referred to was *Practice of Navigation and Nautical Astronomy,* written by Royal Navy Lieutenant Henry Raper (1840). Even forty-five years later, the work was described as "a book of sterling merit."[51] In the supplement to his volume, Raper listed eighteen *Secondary Meridians* from around the world along with their measurements, including "18. Halifax, pillar in the Dockyard (E. coast of N. America) 63 37 26 W" [This measurement was very close to the one made by Jones and Jauncey], and added: "These positions will not be altered without much deliberation."[52] His note on the possibility of the Dockyard reading being changed even slightly was: "Halifax, probably, not much." That Purdy and Findlay favoured the 1822 measurement by Sabben or even the very early one by DesBarres was curious and unexplained. The 1847 edition of *The British American Navigator* contained the following addition to "19. Halifax" noted above. Captain Owen's reading placed the longitude of the second meridian a bit further east:

> "This is in some measure confirmed by the observations of Capt. W.F.W. Owen, in H.M.S. *Columbia*, in 1844, while on the Survey of the Bay of Fundy, &c. He gives the position of the tablet in the Dockyard, in longitude 63° 35' 28* W. Variation, 16° 46' W."[53]

After surveying with Henry Bayfield and leading other surveys along the coasts of Africa, Captain William FitzWilliam Owen had returned to live in New Brunswick and was recalled from retirement to undertake the new measurements. Surveys were carried out by both Bayfield and Owen throughout the 1840s. This has been dealt with in Brooks.[54] Doubts of accuracy expressed by Purdy and Findlay even extended to Captain Bayfield himself who had named Halifax as "the most important Secondary Meridian in British North America."[55] The 1861 edition of the *Atlantic Memoir* stated that Bayfield assumed 63° 37' 48" [i.e. Jones and Jauncey] as the longitude of the Dockyard for his 1853 survey of Halifax Harbour [in retrospect, the closest to the actual value] and added:

> "Recent observations show that M. Des Barres' longitude is as near the truth, accidentally perhaps, as that resulting from the refined operations of Admiral Bayfield, [a] mean between two positions being that which must now be adopted. In the determination of this and other longitudes, the Electric Telegraph has decided the question beyond controversy.[56]

The text went on to state that the 1851 determination by Professor Bond and Captain Shortland, R.N., "makes the Halifax Dockyard Observatory to be in 63° 35' 35" W. of Greenwich."

Table 2: Dockyard Longitudes, Latitudes and Magnetic Variations (where provided)

Dockyard Tablet Actual (Google Maps): (Uncertainty: ± 10 m)	63° 35" 15'	44° 39' 39"	
DesBarres, J.F.W. (op. cit., ref. 1, 1767)	63° 32' 40"		13° 35' W
Toler, J.G. (op. cit., **r**ef. 12, 1809)	63° 23'	44° 36'	
Royal Engineers map (an error of 20 km) Assumed by Napier, J., Master, HMS *Newcastle* under Captain Fanshawe, A. (1819)[57]	63° 33' 40"		
Sabben, E., Master, HMS *Niemen* under Captain Sibley, E.R., (1822)[58]	63° 33' 43"	44° 39' 37"	
Nautical and Astronomical Tables (1825)[59]	63° 36' 0"	44° 44' 0"	13° 36' W
Assumed by Rose, E., Master, HMS *Tyne* & Lieut. Bishop, H.W., HMS *Manly* (1829)[60]	63° 38' 41"		
Jones, J.W. & Jauncey, H. (1828/29)	**63° 37' 48"W**	**44° 39' 26" N**	**17° 10' 36" W**
magnetic variation changed ca. 1860			21° 18' 68" W
Raper, H. (1840)	63° 37' 26"		
Owen, W.F.W., HMS *Columbia* (1844)[61]	63° 35' 28"		16° 46 W
Bond, R.F. & Cdr. Shortland, P. (1851)[62]	63° 35' 35"		
Bayfield, H.W., *Gulnare* [3] (1853)[63]	63° 35' 21"	44° 39' 38"	
Inman, J., *Nautical Tables,* p. xvii (1872)	63° 35' 30"	44° 39' 7"	

Pictorial evidence for and subsequent history of the Observatory

For what was a modest structure, there is ample documented visual evidence for the Dockyard Observatory. This reflects the importance of astronomy to navigational interests of the late 18th and 19th centuries. The Earth's daily rotation and the motion of the major objects in the solar system, e.g. Sun, Moon, Jupiter (and its moons), Saturn etc., was nature's clock that provided the tools to determine longitude at any point on Earth. Sophisticated instruments and ephemera were required in order to correlate the motions of the solar system objects and a matrix of places with well determined locations. Halifax was the North American base for the Royal Navy and thus, one of those locations.

Fig. 6 A portion of an engraving by Edward Hicks ca.1780, "View from Needham Hill" shows Fort Coote on the left (NSARM accession no. 1979-147 no. 614).

The observatory was located atop a small knoll close to the harbour side in the Dockyard. Prior this, a six-sided blockhouse named Fort Coote was situated in the same position. Edward Hicks' image (Fig. 6) of ca.1780 shows the fort (on the extreme left) as part of a young but expanding town focussed around its military fortifications at the Dockyard and the Citadel. However, in an 1801 engraving by George I. Parkyns, *View from Fort Needham*, it is evident that the fort had been

torn down and removed.[64] This is confirmed by John G. Toler's 1808 and 1809 maps wherein the location on the knoll is described as "Formerly Fort Coote." As we have shown from Rear Admiral Ogle's letter of 25 November 1828, the Observatory was built in the late fall or winter of 1828 but even the 1831 Dockyard plan did not show its existence on the knoll (*see* Fig. A3 in Appendix 1). This was possibly due to the plan having been updated from existing ones in the UK and not by an onsite survey — a factor also relevant in some of our samples of plans and drawings. Another reason may have been that the updated information regarding the structure was simply not available before the plan's date of publication. We cannot say for certain. A print entitled *Halifax, View from the Red Mill, Dartmouth* (published 1839, Fig. 7) by William Eagar, shows a small structure resembling the

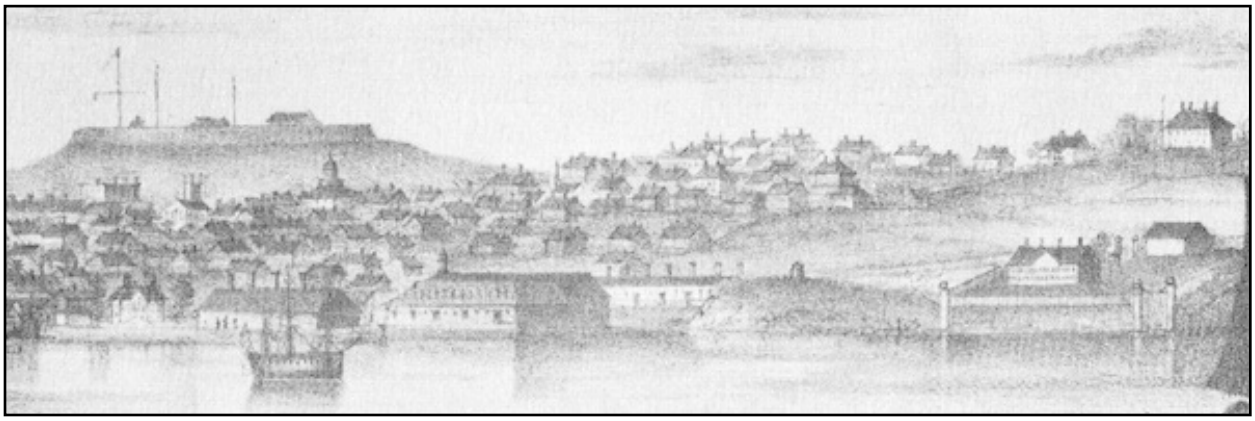

Fig. 7 A close-up of William Eagar's print "Halifax, From The Red Mill, Dartmouth," 1839, illustrates the observatory as a small structure on the knoll just right of centre.

observatory on the knoll south of a building known as the Official Residence. The general perspective regarding the relative sizes of dockyard structures within this print is not presented in any accurate way and was obviously not a concern for the artist. However, it is worth noting that Eagar lived and worked in Halifax and only had to traverse the harbour to create his image onsite (*"*...views taken on the spot and on stone*"* - July, 1839).[65]

As stated earlier, James McKenzie's 1839 plan (Fig. 8) of the Dockyard was the impetus for searching for a pre-1828 origin of the observatory. The title/ description of the plan suggested it was an exact copy of an 1815 plan and that the observatory had existed earlier. As we have shown, this was not the case. The available evidence also indicates McKenzie did not make an onsite survey and was likely in the UK when he drew up his plan. Based on a detailed first hand 1845 drawing by Michael Seymour (Fig. 9), the observatory was still extant. Thus in

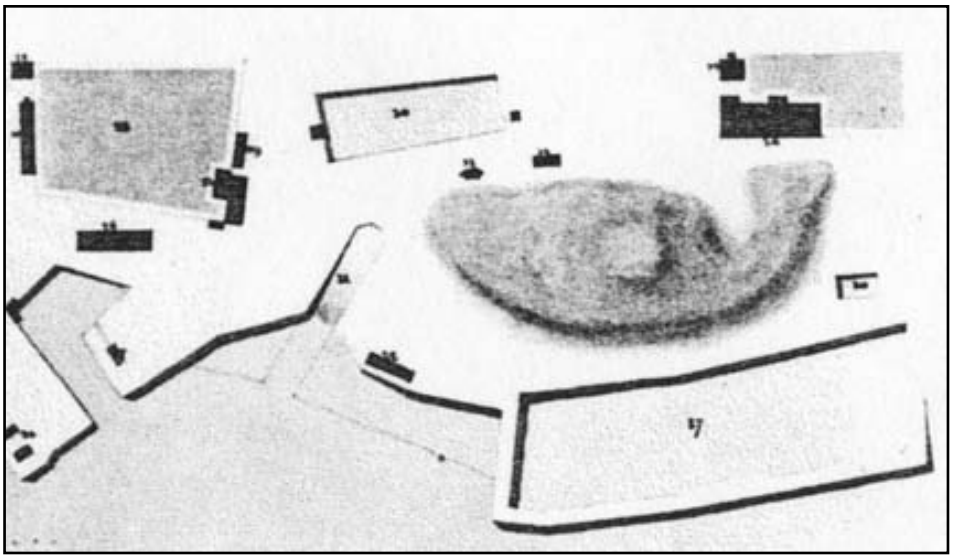

Fig. 8 A small portion of "Plan of Her Majesty's Careening Yard at Halifax, N. Scotia, Established in 1759. Surveyed & Planned by John G. Toler in May 1815, copied by James McKenzie, ***1839****" (Both copies obtained from Maritime Command Museum, at Admiralty House, Halifax, NS)*

1839 we have a viable explanation for its depiction by McKenzie in his plan. Although the structure's size and location appear to be fairly precise in the plan, the drawing shows its shape to be inaccurate. The reason McKenzie drew it with eight sides and not four was likely a mistaken notion based on common British construction practices of the time. Otherwise, his 1839 plan appears to be an authentic representation of HM Dockyard in 1839 (see Appendix 1 Fig. A4).

The excellent view of Observatory Hill from HMS *Vindictive* (Fig. 9) was created by Captain Michael Seymour, RN, upon his ship's arrival in the port. In his carefully executed pencil drawing, dated 19 June 1845, Seymour utilized perspective points from his ship moored in the harbour. We were unaware of his work because our search had not initially covered this late a date. Luckily, Zemel happened upon a previously published image of the sketch and immediately noticed that the observatory exhibited a surprising feature — windows.

It also first appeared as if the building may have had more than four sides. However, after close examination of the original drawing in the vault of the Art Gallery of Nova Scotia and a very high resolution scan, we discovered that the strong outline of the structure indicated only four sides. These delineating lines appeared much more defined than those of the building immediately behind and the roof below and to the right, thus indicating that the observatory was indeed a stand-alone structure perched atop the knoll. We believe Seymour's drawing is a

Fig. 9 Michael Seymour's elegant sketch of Admiralty House from a vantage point in Halifax Harbour just off HM Dockyard dated 19 June 1845 (Art Gallery of Nova Scotia)

very accurate representation. This conclusion is based upon his faithful depiction of Admiralty House at the top centre. Onsite examination of the extant building at Maritime Command (MARCOM) revealed that all of its main features as well as many intricate details presented in the sketch were indeed factual and precise.

The observatory shows windows looking south (left side), what appears to be a door is facing east (right side) with very possibly shutters for observing the sky

(two lines) on the roof facing south. All of these details strongly suggest the observatory was not built to the usual British specifications of the period — a rotating octagonal structure e.g. contemporary examples built in Australia and South Africa. Given the instruments to which Jones and Jauncey had access and/or those Ogle provided, it follows that a non-rotating, rectangular structure would have been adequate for observational purposes. The small black spot at the peak, may have been a ball to top off the structure (as on the earlier Prince's Lodge on the shore of Bedford Basin) or a chimney. Normally though, a source of heat would not have been included in an observatory because the effects of rising air would have caused degradation to the steadiness of the air through which the astronomers were observing with telescopes — what astronomers now refer to as "seeing". However, like Samuel Holland in the 1760s, who kept his astronomical clock going in the chill of a Charlottetown, P.E.I. winter, Jones and Jauncey may also have decided it was desirable to keep their chronometers at a more constant temperature during the winter months. Although temperature compensation was the major advancement found in chronometers, it had still not been fully perfected by the late 1820s.

Later Evidence for the Observatory and Conclusions

In 1851, William Cranch Bond, the first director of the Harvard College Observatory, proposed determining the difference in longitude between Boston and Halifax with the assistance of Henry Bayfield and using a new method Bond had developed. Because Bayfield was too busy with his survey work elsewhere, he assigned Commander Peter Shortland to take his place. The proposal was to incorporate Bond's new technique using telegraphic signals to compare the times of stars passing across the meridian of each place. To this end, a telegraph repeater station was established in Bangor, ME and a telegraph cable was run to the Halifax Dockyard.[66] However, William's reference to a transit telescope "being established at a small temporary Observatory erected in the dock-yard" was ambiguous although, his son, Richard F. Bond, did express his intentions to use the structure in a letter to A.D. Bache, Superintendent of the United States Coast Survey. This is dealt with in Brooks.[67]

The transit instrument would have required a roof opening aligned North — South and opening right through the zenith to allow observations of stellar passages though the meridian. In Captain Seymour's drawing, there is an indication of an opening in the observatory roof with shutters — a common practice going back to the origins of the Royal Observatory at Greenwich in 1675.

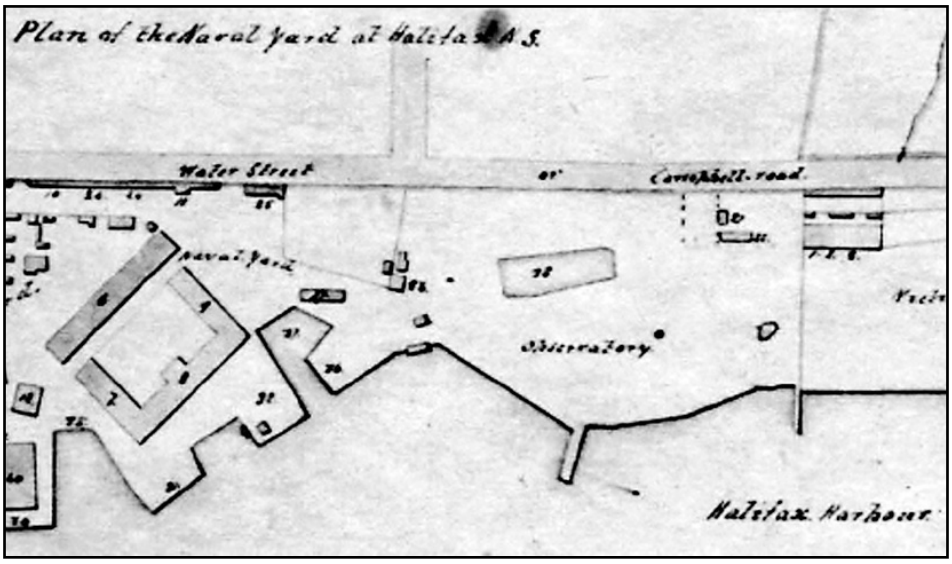

Fig. 10 A portion of a Dockyard plan dated 13 November 1851, signed by Royal Engineers, Lt. Col. H.J. Savage and Lieut. Arthur P. Smith. Plan of Military Property in and around Halifax. (1/6/250-1831, Nova Scotia Archives. The original is a "blueprint" negative.)

Ultimately, whether R.F. Bond used the actual structure for his experiments is debatable. This 1851 plan of the Dockyard (Fig. 10) signed by Lieutenant Colonel H.J. Savage and Lieutenant Arthur P. Smith of the Royal Engineers shows a small structure marked "observatory." We don't know the circumstances of the creation of this plan but it does provide evidence that the original structure was still present on Observatory Hill prior to the commencement of the Bond / Shortland project late in the year.

The evolution of Dockyard structures was continually documented with plans, drawings and eventually, photos. Two hydrographic charts show the observatory. One is an 1853 map by Captain Bayfield[68] and the other was originally drawn up in 1859 by W.A. Hendry and corrected to 1868-1869 by Richard J. Powell (Fig. 11). However, the Hendry map shows the observatory as a hexagonal building which is unlikely for practical reasons. The structure had to have been either four-sided as illustrated by Seymour or octagonal, as was common for observatories with a rotating dome.[69] Hendry's map shows the depth in fathoms along the shore and docks and also indicates the height of Observatory Hill as 47 1⁄2 feet above high water (HW). To determine the position of the Dockyard Observatory, we used an overlay of this plan with a current map of Halifax (Google Maps). We estimated

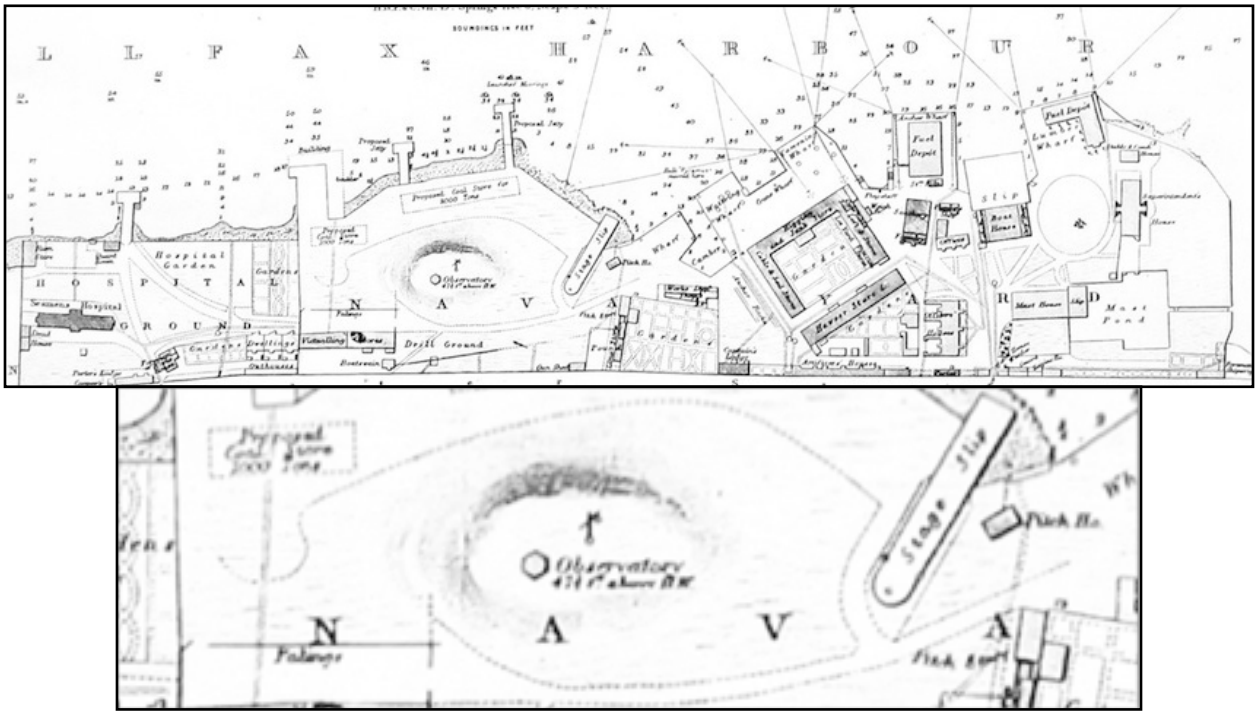

Fig. 11 View and magnification of HM Naval Yard, Hospital & Admiralty House, Halifax from a survey by W.A. Hendry, 1859. Corrected to 1868-69 by Richard J. Powell (Library and Archives Canada, Cartographic material, Microfiche NMC458).

the precision to be approximately ± 10 m. The primary position and orientation for registering the overlay were North and Gottingen Streets. Google Maps provided the latitude and longitude to approximately 0.1", well within the uncertainty of the structure's location on the Hendry plan; it's location was slightly north of the approach to the Angus L. MacDonald Bridge at Geo URI Measurement Latitude: 44.660952 Longitude: -63.587714. In the more common WGS84 format, the reading is **Latitude**: **63° 35" 15.8'** and **N Longitude**: **44° 39' 39.4" W**.

Powell's correction of the date on Hendry's hydrographic map suggests the observatory was extant as late as 1869. Due to a lack of corroborative documents or images, our suspicion is that the Dockyard Observatory was removed not very long after this date.

The original focus of the image in Fig. 12 was the careening yard and the receiving / hospital ship, HMS *Pyramus*, seen moored on the far left. However, our interest is on the hill itself. Taken in 1869 by Notman Studios, this is the only known

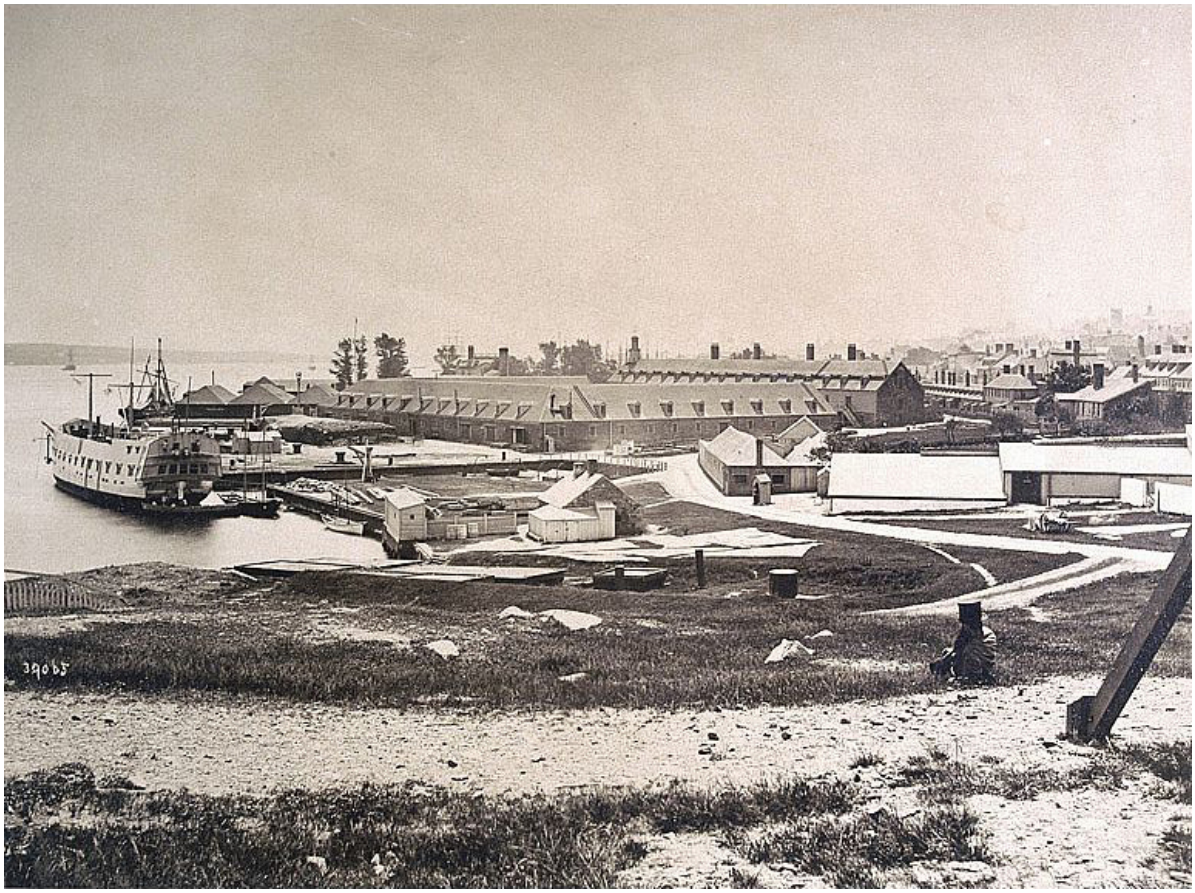

Fig. 12 H.M. Naval Yard Halifax, NS, HMS Pyramus, 1869.
(Notman Studio NSARM accession no. 1983-310 O/S no. 39065, Nova Scotia Archives)

photograph of Observatory Hill before it was levelled by the Royal Engineers. It is important to note that this view looking to the southeast towards the mouth of Halifax Harbour is the same wide vista including McNab's Island (above *Pyramus)* that would have been seen by Master Jones and Mate Horatio Jauncey between 1828 and 1830 while conducting their measurements at the Halifax Dockyard Observatory. At present, there is no way to discern whether the structure was extant when this image was taken. If this were so, it would have been situated only a few yards behind the camera's lens.

It was certainly gone by 1879, for *Ruger's Birdseye Map of Halifax, Nova Scotia* (1879)[70] and the hill on which Fort Coote and the Observatory were located was levelled by the Royal Engineers (1881-82)[71] and then removed (1884-85) by Thomas Giles under a contract dated July 28, 1884 between the Federal Government and the Intercolonial Railway. The job was described as "Removal of observatory hill in Her Majesty's dockyard, Halifax, and depositing material on Intercolonial Railway lands."[72,73]

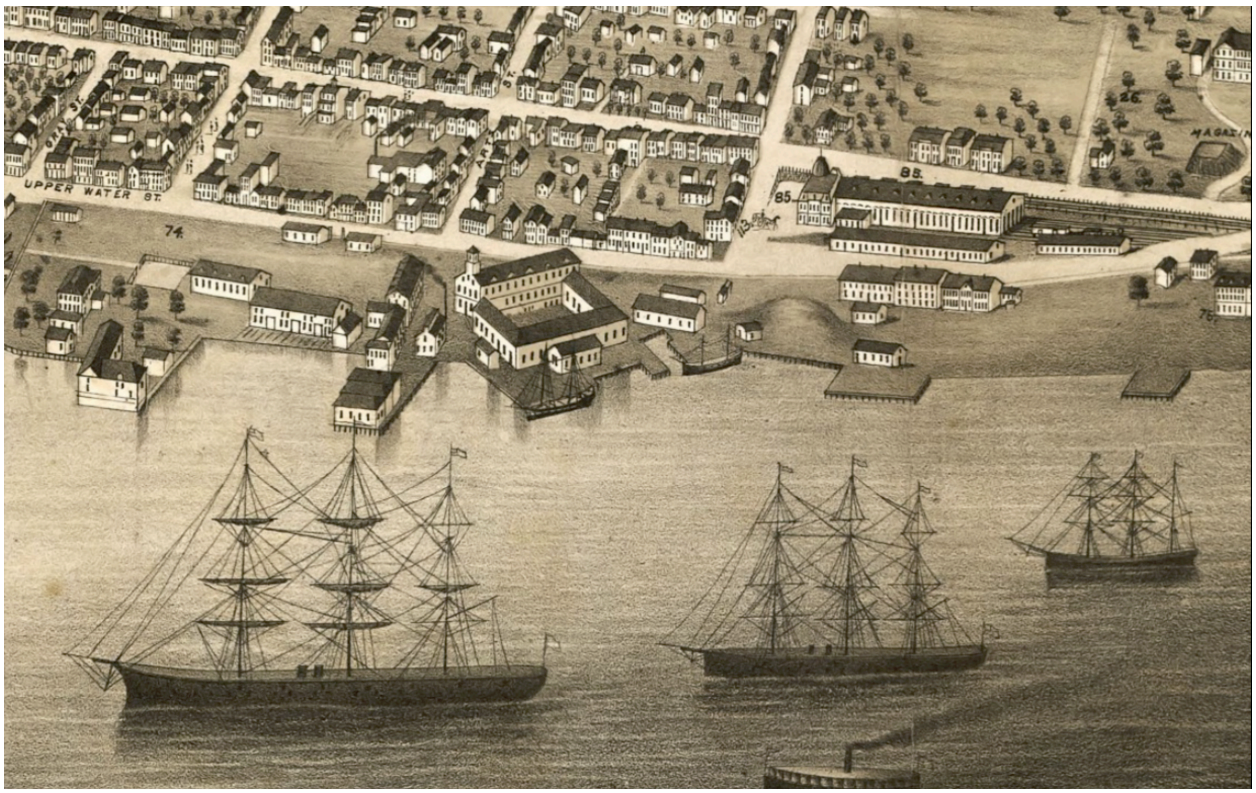

Fig. 13 Segment of the 1879 *Ruger's Birdseye Map of Halifax* showing the Dockyard and the hill on which the Observatory had been located (immediately below the building identified as # 85, the Intercolonial Railway Station).

In conclusion, we have offered considerable and substantive evidence to show that the Halifax Dockyard Observatory was a small four-sided structure with a solid base and non-rotating roof built atop a knoll northwest of the Careening Yard.; that it was constructed by order of Rear Admiral Sir Charles Ogle, Bart. in the fall of 1828 and served as a transit observatory and site of a fixed meridian. We have shown that the longitude of the Halifax Dockyard was first assumed to be 63° 37' 41'' then fixed at 63° 37' 48'' and that this secondary meridian ran through the structure or a wall nearby bearing a stone tablet stating the geographical position of the Halifax Dockyard Observatory. We have established that these measurements, taken by Master John W. Jones and Admiralty Mate Horatio Jauncey of HMS *Hussar,* were the benchmarks for an extensive and important series of Admiralty ordered surveys conducted from 10 August 1828 to 20 July 1830, the goal of which was to determine the "Latitudes and Longitudes of Headlands" (See Appendix 5).

After the survey's completion, the Halifax Dockyard Observatory served no apparent purpose until its possible utilization for W.F. Owen's 1844 determination and Richard F. Bond's 1851 telegraphic experiments to redetermine the location of the tablet by his father's new and more direct method.

Although depicted in an 1859 hydrographic map by W.A. Hendry, corrected to 1868-1869 (Fig. 10), we believe the observatory was dismantled and removed about 1869. There is no available evidence to suggest the structure existed beyond this time.

Acknowledgments

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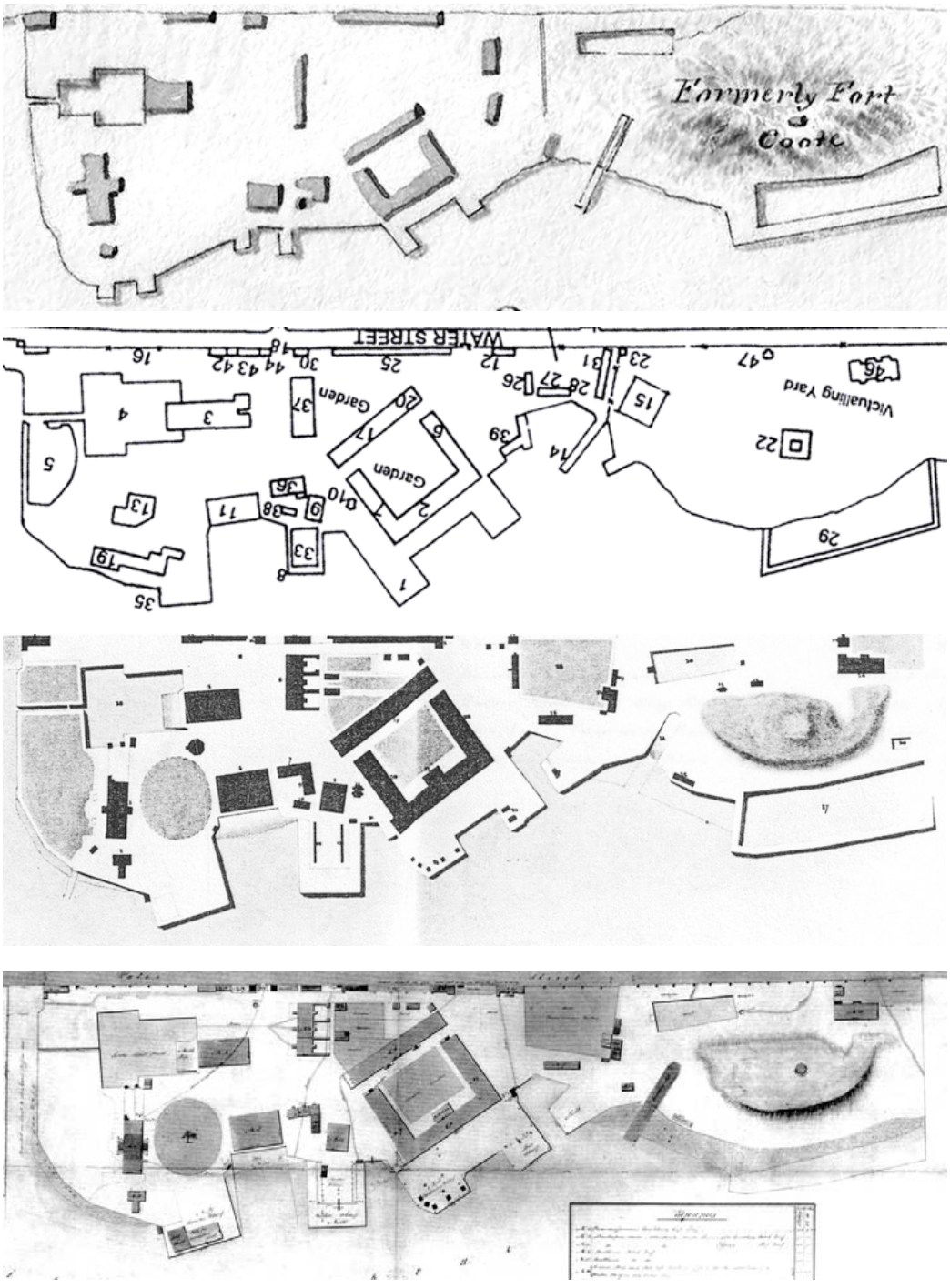
Appendix 1: HM Dockyard - Built Forms (1809, 1818, 1831, 1839)



From top: Fig. A1 ***1809****, J.G. Toler (LAC); Fig. A2 (****1818****), B. Raymond (N.S. Museum); Fig. A3* ***1831****, Plan of His Majesty's Dockyard* ***1831****, Geo. L. Taylor (MARCOM / RMG); Fig. A4* ***1839****, J. McKenzie, (MARCOM / RMG).*

Fig. A1 (1809) unambiguously labels the knoll as “Formerly Fort Coote”.

Fig. A2 The following text and 1818 diagram (Fig. A2) are from ***Tracing the Built Form of HMC Dockyard*** by Brent Raymond, Nova Scotia Museum Curatorial Report No. 88, 1999. In Raymond’s 2006 paper, “King George III’s Naval Yard at Halifax (*Nautical Research Journal*, (2006), **51**, #2, pp. 84-91) John Green identifies #22 on Raymond’s diagram as Fort Coote but we have shown it had been demolished by 1808 and probably several years previous. Note that the Observatory itself is not mentioned in either report. Further,

> “When the period of intense development ended in 1815, the Dockyard assumed a peacetime position. In 1819, the Commissioner officially moved the North American Station to Bermuda during the summers. The role of the Dockyard had thus been diminished. Consequently, little growth occurred during the following 22 years. Only six new site features were introduced: Storehouse No. 12, Storehouse No.5, the Cooperage, the new Pitch House, Storehouse No. 4, and the Victualling Stores.* Nonetheless, the Navy continued to use the Dockyard as a training and supply base throughout this period of relative inactivity.”

Fig. A3 Although the 1809 John G. Toler excerpt is from a broad-range map, it shows the main buildings that were present in HM Dockyard at the time.

Fig. A4 Note that Fort Coote was drawn in but was not extant in 1815, the date on the original map McKenzie had copied.

Appendix 2: Letter from Secretary Parry to Sir Charles Ogle

[Transcription by Adrian Webb, UKHO]

Hydrographical Office Admiralty
March 1st 1828

Memorandum respecting the improvement of the charts of Nova Scotia etc etc.

It will be observed that, in the charts composing the atlas of Nova Scotia etc "compiled from documents in the Hydrographical Office" we have not been able to apply the usual scales of latitudes and longitude, in consequence of having no materials of this kind in which a proper degree of confidence can be placed. It would therefore be conferring an essential benefit upon the navigation of these coasts, if the officers of HM ships should have an opportunity of making accurate observations for the latitude and longitude of any of the principal points; it being understood that the above-mentioned charts may be depended upon as good local charts, though the absolute geographical position of the points is uncertain.

With respect to the observations, both for latitude and longitude all altitudes should if possible be taken on shore with an artificial horizon, that of the sea being subject to a considerable apparent elevation and depression dependant principally on the relative and varying temperatures of the air and water.

The principal methods to be recommended for the determining the absolute longitudes of places, are: occultations of fixed stars by the moon; solar eclipses; eclipses of Jupiter's satellites; and lunar distances; and these may be considered as capable of accuracy in the order in which they are here stated. Any observations of this nature, carefully conducted, will possess great value, especially if made at places frequently visited by ships, such for instance as Halifax, Quebec, and Bermudas. The whole of the data of such observations should be carefully preserved and transmitted to the Admiralty.

As however few individuals may have leisure or means for making such observations, I beg to remark that a more easy and scarcely less desirable mode of proceeding is that of simply measuring the relative longitudes, or meridian distances between places, by means of well rated chronometers, and in intervals of time as short as possible.

For the North American Station, Halifax should be considered as a first meridian; some decided and well known spot being there fixed upon, where observations may be made without interruption, and to which all future observers may refer without the possibility of mistake or confusion. Whatever spot is thus decided upon it would be useful to perpetuate it by a large flat stone, and having cut upon it the word "Observation".

The annexed list contains some of the prominent points selected from the charts; on each of these it would be particularly desirable to obtain some good observations for the latitude, and between any two of them to determine chronometrically, by short runs. The actual meridian distance, it being always kept in mind that it is of great importance thus to connect them with the place of observation at Halifax.

I may also remark that it would be a matter of great interest and utility to determine by chronometers, the meridian distance between Halifax and Quebec, and also between Halifax and Bermudas; and it would be desirable, both at Quebec, and Bermudas to fix and mark a stone, in the same manner as above recommended for Halifax.

It need scarcely be remarked that all local surveys of harbours or other detached portions of the coast will be very acceptable. In such surveys the latitude of one well defined spot should be carefully ascertained, and its meridian distance from Halifax, if possible.

Good observations for the variation of the magnetic needle made on shore and at a distance from any known local attraction, for the time of high water at full and change; the direction and strength of the stream of tide; and the rise of spring and neap-tides; will form a valuable addition to our hydrographical information.

In all observations transmitted to the Admiralty, the circumstances under which they may have been made should be distinctly stated – for instance, with what instruments – the names of the observers – the number of observations – the numbers and makers of chronometers – whether the observations were made upon the actual spot – if not, how the bearings and distance were obtained – together with any other circumstance which may effect the accuracy of the result.

Signed W.E. Parry

(NB: An extensive "List of points on which the geographical position is required" was included in the letter but has not been included here.)

Appendix 3: Letter from Sir Charles Ogle to Secretary Perry

Page 1.

Admiralty House, Halifax, Nov. 25, 1828

Dear Capt. Parry

By this packet I have transmitted to the Admiralty the reports made to me from the ships on the different stations under my orders, which will of course be laid before you, and I can assure the officers have taken these observations with the greatest care, being strongly impressed with the importance of the service they have been employed on, and strictly attending to your directions. You will remark that I have written in red ink the degree of confidence I exercise, may be placed in the various reports, as I intend to direct that fresh observations be taken on several of

Page 2.

NB "Anno Jany. 1st" appeared on the left margin of this page.

the same points next year, when it will be practicable to do so with my limited means, for you cannot imagine the trouble, and indeed danger the officers have experienced in getting to some of the Headlands: I could not have accomplished so much had I not availed myself of the buoy boat, on the schooner (hired for the purpose of carrying the mails) to send along the Coast of Nova Scotia - The chronometers on board the *Hussar* are excellent, but some of the chronometers in the other ships cannot be depended on, I have therefore requested the Admiralty to send me out three more good ones, which I think will enable me to complete the business entirely to your satisfaction - The chronometers on the *Tyne* are not so good as I could

Page 3.

wish, and those in the *Columbine*, *Ringdove* and *Manly* not to be relied on for the important object we have in view _ While in Harbour the chronometers have been constantly compared with one another, and an account kept of their Rate by the Master of the *Hussar* _ The little observatory on the Hill in the Dock Yard is

completed, and I think will answer very well: We shall begin our observations immediately, for the purpose of ascertaining the longitude of the Dock Yard correctly, which has been considered the Meridian _ the professor of Astronomy at Windsor (who I shall invite into my house for six weeks); Mr. Jones, Master of the *Hussar*, Mr. Rose, Master of the *Tyne* and Mr. Jauncey, Mate of the *Hussar* will be the persons employed on this service, and I hope when these observations are compared with those

Page 4.

taken at the Observatory at Boston you will be able to depend on the Results _ Mr. Jones has already tried the Time between Halifax and the observatory at Boston, with the *Hussar's* beautiful Chronometers, and finds by the longitude of Boston, they say, ascertained from numerous Occultations of stars, that the longitude of Halifax differs at least five or six Miles _

As soon as the next packet arrives I shall sail for Bermuda, but shall leave Mr. Jones, Master of the *Hussar*, to conduct the observations, in which I feel so much interested _

Believe me
Dear Capt. Parry
Yours very truly
Chas. Ogle
To Capt. Parry etc.

l - l - l.

Source: UKHO, LP1857 O144 Ogle to Parry, 25 November 1828

Kindly provided by Adrian Webb.

Letter transcribed by Joel H. Zemel (2014) with certain amendments kindly suggested by Adrian Webb based on his earlier transcription.

Appendix 4: Biographies of Jones and Jauncey

Master John W. Jones RN (1787-1857)

John Jones was born in 1787 in the town of Llanfwrog, Anglesea, Wales. He began his sea career around age 13 and received seniority as Master in the Royal Navy in 1812 and was assigned to HMS *Phipps* in the same year.* From 1824 to 1830, Jones was stationed in Halifax, N. S.. as the master of *Dotterel* (1824-1825). From 1828 to 1830, he was master of HMS *Hussar* and headed an extensive hydrographical survey commissioned by Rear Admiral Charles Ogle and Captain William Parry, Royal Hydrographer. The survey stretched from the St. Lawrence to Bermuda with Halifax considered the Meridian. The complete original log books of these voyages, kept by Midshipman Frederick Henry Stanfell, are housed at the Nova Scotia Archives.

Jones had a wife, Elizabeth and two daughters, Matilda Elizabeth, and Mary Ann (2 years apart). In 1830 after completing his work on the survey, he briefly returned to England and subsequently travelled with one of his daughters from Liverpool to Quebec where he assumed the duties of captain of S S *Royal William*** in 1831. This ship was constructed for the Quebec Halifax Steam Navigation Company which included Samuel Cunard as one of the major shareholders. Mr. Jones is shown as Master in *The Navy List* from 1835 into the 1840s. In *The New Navy List* books by Joseph Allen, which present more information regarding service, he appears as Assistant-Surveyor of Docks in Liverpool as early as November, 1840. This entry was also present in available Joseph Allen books between 1842 and 1855.

The 1851 UK Census lists Jones as "Master Royal Navy half-pay." The family resided in Liverpool at 121 Stanhope Terrace and had a live-in servant named Jane Hoff.

[added: in the 1855 Joseph Allen book, Jones is listed in the "Masters On Reserved Half-Pay" section.]

John Jones, Master with the Royal Navy, died some time after 20 March 1857 (probably in April) at 70 years of age. He left his worldly possessions to his wife and provided trusts for both of his daughters. ***

Sources: Ancestry.com, *The Navy List*, *The New Navy List* (Joseph Allen), *The Pictou Observer* (1831), 1851 UK Census, The Ship's List, archival letters.

* The Naval Chronicle: Volume 28, July-December 1812, Volume 28, edited by James Stanier Clarke, John McArthur, p. 83.

** Under the command of John MacDougall, S S *Royal William* crossed the Atlantic Ocean in 1833 using mostly steam power for the voyage. Sails were used during periods of maintenance.
*** John Jones' Last Will and Testament.

Note on term "**MASTER":** This was the senior warrant rank and can be equated to a "professional" seaman and specialist in navigation, rather than as a military commander. Their rank approximated to that of Lieutenant and were well educated. They were professionally examined by Trinity House and re- qualified if appointed to a larger rated ship. Masters were able to stand watches and command ships in non-combatant duties. In the mid-nineteenth century Masters attained full commissioned rank and titles were changed to assimilate them into the main commissioned structure.

The specialized Navigating branch was no longer required and phased out. As part of his duties on board ship, the Master's primary duty was navigation, taking ship's position daily and setting the sails as appropriate for the required course. He supervised Midshipmen and Mates in taking observations of the Sun and maintained the ship's compass. He was also responsible for ensuring the maintenance of the rope rigging and sails. Other duties included the stowing of the hold, inspecting provisions, taking stores so that the ship was not too weighted down to sail effectively and reporting defects to the Captain, security and the issue of drink on board and supervised entry of parts of the official log such as weather, position and expenditure.

From "Officer Ranks in the Royal Navy, the Naval Hierarchy Explained," Royal Naval Museum.

Horatio Jauncey

Horatio Jauncey [b 17 Jan. 1803] is eldest surviving son of Capt. Henry Fyge Jauncey, R.N.* (1821), who died in July, 1834.

This officer entered the Navy, 1 Aug. 1816, as Fst.-cl. Vol. on board the Hope 10, commanded by his father in the Channel; and, from Oct. 1818 until July, 1822, served on the Irish and West India stations in the *Tribune* 42, Capt. Nesbit Josiah Willoughby. He then joined the *Gloucester* 74, flag-ship at Chatham of Sir Benj. Hallowell; and in the following Dec, after having passed his examination, he sailed for South America in the *Bkiton* 46, Capt. Sir Murray Maxwell.

Returning to England in Sept. 1826, Mr. Jauncey was next, in March, 1827, nominated to a Mateship in the *Hussar* 46, bearing the flag of Sir Chas. Ogle at Halifax, where he continued until promoted to the rank of Lieutenant 26 Feb. 1830. His appointments in the latter capacity were- 10 Dec. 1833, to the *Endymion* 50, Capt. Sir Sam. Roberts, on the Lisbon and Mediterranean stations — and, 28 Dec. 1836, 3 Nov. 1840, and 17 Jan. 1843, as Senior, to the *Snake* 16, Capts. Alex. Milne and John Baker Porter Hay, *Vernon* 50, Capt. Wm. Walpole, and *Caledonia* 120, flag-ship of Sir David Milne, on the West India, Mediterranean, and Plymouth stations.

He was advanced to his present rank in honour of a visit paid by Her Majesty to the *Caledonia* 25 Sept. 1843; and has been employed, since 16 Nov. 1846, as Second-Captain of the *ALBION* 90, part of the Channel squadron. Agents- Messrs. Halford and Co.

Source: A *Naval Biographical Dictionary*.djvu/592, p. 578 JAUNCEY. (Commander, 1843. F-P., 23; H-p., 8.)

Obituary:

"At Stoke, Davenport, aged 62, Horatio Jauncey, Retired Capt. R.N., eldest surviving son of the late Henry Frye Jauncey, Capt. R.N. He entered the navy Aug. 1, 1816, as first-class volunteer, on board the "*Hope*," 10, commanded by his father in the Channel; and from Oct. 1818 until July 1822, served on the Irish and West India Stations. He obtained his lieutenancy in 1830 and was advanced to commander in honour of a visit paid by Her Majesty to the "*Caledonia*," Sept. 25,

1843. He was subsequently employed as second captain of the "*Albion*," 93, part of the Channel squadron, and obtained the rank of captain on the retired list Aug. 31, 1860."

The Gentleman's Magazine, and Historical Chronicle, for the Year 1865, Volume 218, p. 529.

Appendix 5: Table of Latitudes and Longitudes of Headlands

No. 3.

A Table showing the Latitudes and Longitudes of Headlands, &c. on the Coasts of North America, Newfoundland, and Bermuda, from a series of Observations made on the spot, in the years 1828, 1829 and 1830, by Mr. John Jones, Master, and Mr. Horatio Jauncey, Mate, of H. M. Ship Hussar, and other Officers of the Squadron;—Halifax being considered as the Meridian.

Place of Observation.	Latitude north.	Longitude west of Greenwich.	Variation westerly.
NOVA-SCOTIA AND GULF OF ST. LAWRENCE.			
Halifax, Naval-Yard, [Meridian]	44 39 26 2	63 37 48	17 10 36
Maugher's Beach [Lighthouse]	44 36 2	- - -	
Sambro Lighthouse	44 26 17	63 35 16 2	16 45
Shut-in-Island, south-west end	44 36 35	63 17 48	
Jedore Head	44 40 5	63 5 10 5	
Tangier Island [off Tangier Harbour]	44 44 28	62 41 7 5	
Outer Beaver Island, [south-east point]	44 48 24	62 21 43	
Green Island, [country harbour, south point]	45 4 55	61 34 49 5	
Berry Head, [near Torbay]	45 10 44 3	61 21 9	
White Head, [off White Haven]	45 10 17	61 9 49 5	
Canso Lighthouse	45 19 33	60 58 30	
Eddy Point, [Gut of Canso]	45 30 25	61 16 54	
Cape St. George, [ditto]	45 51 22	61 55 12	
Pictou Island, [south side]	45 47 52	62 37 33	19 35
Pictou Harbour	45 41 56 7	62 42 0	19 0
Pictou Academy	45 40 20	62 44 28	19 0
Cape Prospect, [extreme point]	44 26 38	63 46 39	16 10
Point Rose, [Malaguash Bay]	44 18 7	64 15 33	16 15W
Cape Lehave, [south point]	44 11 8	64 23 43 8	15 9
Lehave Rock	44 10 50	64 22 24 8	
Indian Island, [south point]	44 0 40	64 26 51	15 15
Metway Head, Metway Harbour	44 6 24	64 35 9	14 59
Liverpool, Lighthouse	44 1 52	64 40 49 8	14 43
Western Head, Liverpool Bay	43 59 13	64 42 34 8	14 43
Little Hope Island	43 48 34	64 49 48	14 1
Easternmost Rugged Island, south-east point	43 41 14	65 3 43 6	
Long projecting point between Rugged Island Harbour and Green Harbour	43 30 40	65 11 28 0	13 41
Shelburne Lighthouse	43 37 31	65 18 40 5	
Sandy Point, Shelburne Harbour	43 41 57	65 22 11	12 58
Cape Sable, south point	43 23 57	65 38 3	12 24
South Sea Island, south point	43 23 51	65 50 42	14 0
Ditto, north point	43 26 22	66 1 38	14 0
Sable Island, east end	43 50 15 7	59 48 17	
Ditto, west end	43 56 30	60 13 34	
Just-aux Corp Island, south point	45 58 19	61 37 51	20 40
Port Hood, Cape Linzee	45 56 31	61 36 15	21 14
Ship Harbour, Gut Canso	45 36 25	61 21 43	19 16
Cape Hinchinbroke, a small island off the Cape	45 34 20	60 42 36	20 11
Green Island, off Isle Madame	45 27 47	60 57 48	18 36
Cape Portland	45 47 57	60 7 36	
Louisburg, ruins of the old Lighthouse	45 53 31 5	59 59 48	
Cape Breton, extreme point	45 56 26	59 50 15	
Scattery Island, east point	46 1 19	59 43 29	
Cape Granby, extreme point	46 9 18	56 53 0	22 27
Cape North, north-east point, Breton Island	47 2 13	60 26 53	23 30
Bona Venture Island, north-west point	48 29 30 3	64 13 37 3	
Douglas Town, south end of the beach	48 48 33	64 25 18	20 46
Cape Gaspe, south-east point	48 45 14	64 13 38	21 33
Cape Tormentine, north-east point	46 7 38	63 51 41 7	
Point Escuminac, north-east point	47 5 1 8	64 53 30 3	
Point Miscou, north-east point	48 1 27	64 35 49 5	
NOVA-SCOTIA AND GULF OF ST. LAWRENCE.			
Cape Traverse	46 13 37	63 42 47	
Prince Edward Island, west point	46 37 48	64 24 21 8	
Ditto, east point	46 27 36	62 0 8	21 0
Ditto, Cape North, north-east point	47 4 20	64 4 15 6	
Ditto, Cape Bear	46 0 2	62 29 57	
Paspebiac, south point of the beach	48 0 54 6	65 18 16 7	19 40
Anticosti, west point	49 52 29	64 36 54 0	22 55
Ditto, north point	49 57 38	64 15 1 4	
Ditto, east point	49 8 30	61 44 56 0	24 33
Mingan Harbour	50 17 35 4	64 5 32 7	
Ditto Island, east side	50 13 7 4	64 12 11	
Cape Rosier	48 50 41	64 15 24	
Point Des Monts, Lighthouse	49 19 32	67 24 49 5	
Ditto, extreme point	49 18 38	67 26 19 5	
Magdalen Island, north-east point	47 37 37	61 26 51	
Brion's Island, north-east point	47 48 8	- - -	
Entry Island, west south-west point	47 16 7	61 47 26	22 25
Bird Island, northernmost	47 50 28	61 12 53	
City of Quebec	- - -	71 16 25 5	12 54
St. Paul's Island	47 12 38	60 11 24	23 45
BAY OF FUNDY.			
St. John, N. B.	45 15 0	66 6 19	
Partridge Island, Lighthouse	45 18 36	- - -	
Beaver Harbour, south-west point of the entrance	45 3 12	66 47 28	
Navy Island, south-east point	45 2 24	67 5 47	
Bliss Island, south-west point, Etang Harbour	45 0 15	66 54 27	
Head Harbour Lighthouse, Campo Bello	44 56 50	66 56 58	
Grand Manan, north point	44 46 49	66 49 7	
Ditto, Swallow-tail point	44 44 54	66 47 21	
Ditto, White Head Island	44 36 59	66 45 4	
Brier's Island, Lighthouse	44 13 51	66 26 54	
Digby Lighthouse	44 40 25	65 50 15	
NEWFOUNDLAND.			
St. John's, Fort Townshend	47 33 33 8	52 45 10 7	
Cape Broyle, south point	47 2 10 8	52 55 33	
Cape Race	46 40 27	53 8 6	
Virgin Rocks	46 26 15 3	50 56 35	
Trespassy, Point Powles	46 43 11 8	53 27 0	
Placentia, Point Verde	47 13 51 1	54 6 16 7	
Blue Beach Point, Cape Chapeau Rouge, south 22, east one and a quarter miles	46 54 16	55 28 10 7	
Cape Raye, extreme point	47 36 49	59 21 0	
Port aux Basque, Road Island	47 34 11	59 10 39	24 2
BERMUDA.			
St. Catherine's Point	32 23 43	64 11 25 8	
Dock-Yard	32 19 1	64 51 18	
Wreck Hill	32 16 1	64 57 21	
Gibb's Hill, Flag Staff	32 14 18	64 55 12	
North Rock	32 29 26	64 50 18	

Hussar, at Bermuda, 15th May, 1830.

CHARLES OGLE,
Rear-Admiral and Commander-in-Chief.

Fig. A5 Latitudes and Longitudes of Headlands in Nova Scotia, Gulf of St. Lawrence, Newfoundland, Bermuda. Source: British Dominions in North America, Vol. 1 by Joseph Bouchette Esq., (1831), p. 303.

Appendix 6: Images erroneously identified as the Observatory

The mysteries surrounding the presence of an observatory in the dockyard were compounded by an octagonal structure situated in front of the Naval Hospital. It was actually a smoking house built sometime after 1869 and, according to the first government flyover of Halifax, still present in 1921.

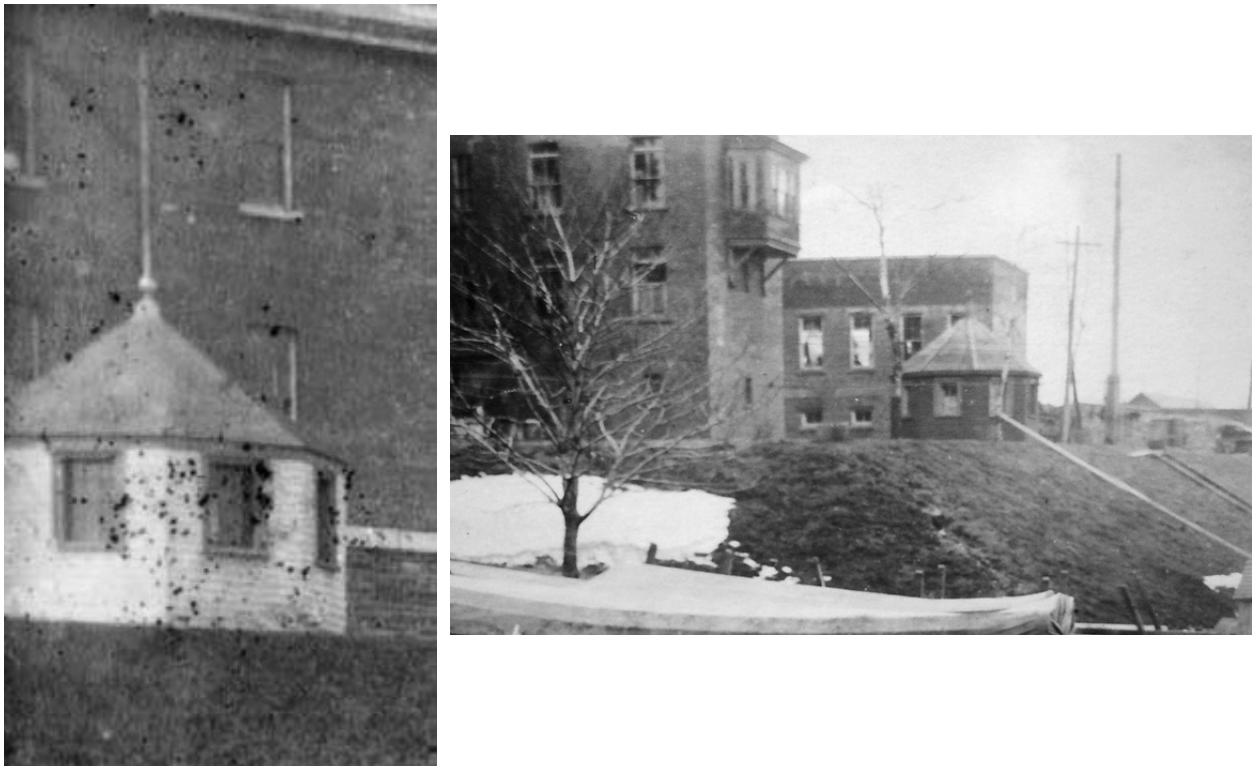


Fig. A6
(l.) - Dockyard, Halifax ca. 1883, a portion of Royal Engineers NS Archives photograph no. 6872 (Piers no. 374) / neg. N-4569, Nova Scotia Archives;
(r.) - a portion of a 1918 panorama Officers and Men of HMCS Niobe, by W.G. MacLaughlin. (Courtesy, Maritime Museum of the Atlantic.)

References & Notes:

[1] Roy L. Bishop, "An Eighteenth-Century Nova Scotia Observatory", JRASC, 71 (1977), pp. 425-442 (see p. 427); and Roy L. Bishop, "Castle Frederick Observatory", *JRASC*, 106 (2012), pp. 142-149.

[2] W.E. May, "How the Chronometer Went to Sea," in *Antiquarian Horology*, **9** (1976), 638-663.

[3] Rupert T. Gould, *The Marine Chronometer.* London: The Holland Press, 1973.

[4] The UK's Board of Longitude and its Prize was formed in 1714 as a result of a very serious naval disaster off the southwest coast of the UK. See Richard Dunn's history at Longitude Prize.

[5] As an example, Francis Beaufort, Hydrographer to the Navy, directed the Astronomer Royal, John Pond, to pay the following amounts for the best chronometers tested in 1830: Thomas Hayes, 75 Guineas; James Murray, 70 Guineas; Gardner & Co., 70 Guineas; Appleton, 70 Guineas; Robert Molyneaux & Son, 67 Guineas and John Eiffe, 65 and 60 Guineas for two instruments.

[6] Possibly as early as 1800. Toler's 1808 plan (LAC item MIKAN no. 4514437).

[7] MARCOM / Admiralty Library Pfo B 23.

[8] To complicate matters, in some of the archival records, Toler's name is misspelled Joler.

[9] National Maritime Museum, Greenwich, England, Negative Number A-5921.

[10] National Maritime Museum, Greenwich, England, Negative Number A-5921. Taylor, George Ledwell (1788-1873), architect in *Oxford Dictionary of National Biography.*

[11] A 1759 draught of the Harbour of Halifax by Charles Morris. (H2/240/Halifax/1759, microfiche no. 18350, Collections Canada)

[12] A 1759 draught of the Harbour of Halifax by Charles Morris. (H2/240/Halifax/1759, microfiche no. 18350, Collections Canada)

[13] David Rumsey Map Collection. View map.

[14] John Purdy, *Colombian Navigator; or Sailing Directory for the American Coasts and The West Indies,* Vol. 1, 1839, p. xix. Specifically read: 3. Halifax. HMS *Niemen*'s Master, Mr Edward Sabben is credited for his quotes, p. xx. The 1822 survey is not mentioned in the 1823 volume. Other earlier editions which may contain related information are unavailable; Information on Captain E.R. Sibly from *A naval biographical dictionary: comprising the life and services of every living officer in Her Majesty's navy...inclusive* by William R. O'Byrne (1849), p. 115. The artificial horizon mentioned is a device holding a small amount of mercury to act as a reflecting surface when making measurements with a sextant when there is no sea horizon visible as is often the case when taking observations from land.

[15] William Edward Parry's letter to Sir Charles Ogle, dated 1 March 1828 preserved in the Archives of the Hydrographic Office, Taunton, UK.. *See also* Appendix 1.

[16] Rear Admiral Ogle to John Wilson Croker, Secretary to the Admiralty, 25 April 1830. Admiralty, Secretary's Department – In-letters, 1 / 516, Admirals' Dispatches, Halifax, 1828-1829, PANS mfm 127, acc. 1991-133.

[17] Ogle to Parry, 15 May 1828. Ogle states that a meridian had been fixed in Halifax Dockyard. *See* UK Hydrographic Office file MB. Original is in UK Record Office.

[18] Ogle to Croker, 8 August 1828, Admiralty, Secretary's Department – In-letters. op. cit. The list of ships initially included HMS *Acorn* and HMS *Contest*. The former disappeared in a gale and the latter was wrecked off Halifax. Both disasters occurred in April 1828 with the loss of all ship's personnel.

[19] *See* Appendix 4.

[20] HMS *Hussar*'s original log books are housed at the Nova Scotia Archives, MG 7 Vol. 13A (Nos. 1, 2 & 3). Ogle had confirmed to Croker in his 8 August 1828 letter from HMS *Tyne* in Halifax Harbour that preparations were complete. *See also* the article in The Atlas regarding the findings at Sable Island published in the 8 November 1828 issue on p.63. Francis H. Stanfell eventually rose in rank to commander in the Royal Navy, gaining seniority on 24 November 1856 (The Navy List, 1858, p. 325).

[21] Letters from John Barrow, Second Secretary to John Pond, of the Admiralty to the Superintendent of Chronometers, and 6th Astronomer Royal (1811-1835) at Greenwich can be found on the Cambridge Digital Library website at: The Papers of John Pond. *See also* The Fair Minutes of the Board of Longitude.

[22] Ogle to Croker, 4 July 1830, Admiralty, Secretary's Department – In-letters. op. cit. This letter contains a list of chronometers Rear Admiral Ogle was returning to the Admiralty after completion of the survey and before he relinquished his command of the Halifax station.

[23] The Arnold No. 465 was subsequently designated Chronometer S, one of twenty-two instruments used aboard HMS *Beagle*'s second voyage from 1831-36. Source: *Proceedings of the second expedition, 1831-1836, under the command of Captain Robert Fitz-Roy*, Parker King & Charles Darwin (H. Colburn, 1839), Appendix to the Second Volume, p. 325.

[24] The Barraud chronometer does not appear on Ogle's list. Information that the G. & H. Chronometer No. 89 and a Barraud (misspelled "Baraud") No. 502 were used in July of 1829 is mentioned in *Newfoundland in 1842: A Sequel to "The Canadas in 1841"* by C B Sir Richard Henry Bonnycastle, Vol. 2, (footnote), p. 247. *British Dominions in North America*, Vol. II, by Joseph Bouchette, Esq., 1831 and 1832, p. 87, shows a copy of a report to Rear Admiral Ogle dated 20 October 1829 from Master John Jones on St. Paul's Island wherein he mentions using, among other instruments, chronometer No. 102 with the assistance of Admiralty Mate, Mr. Jauncey. We found the letter at the Nova Scotia Archives but the page was completely worn off exactly where the number would have been. Nevertheless, we suspect that this instrument was the Barraud chronometer. With regard to the two cited references, many archival documents have been misinterpreted due to illegible letters and/or numbers. The number "1" as it appeared in the report, could easily have been mistaken for number "5" or vice versa. As it stands, the correct number of the chronometer is unknown.

[25] Communicated by A.C.F. David, Lieut. Commander, for the Hydrographer of the Navy (RN),Taunton, 1980/01/10. Lieut. David's letter also confirmed that the Thomas Jones reflecting circle had a stand.

[26] Letter from James Moore French to Thomas Taylor, Greenwich re; order for nos. 1895 and 4300. View letter.

[27] Barrow to Pond, 15 October 1828. Barrow confirms a chronometer is to be turned over to Rear Admiral Ogle by Captain Miller upon HM Store Ship *Weymouth*'s arrival at Bermuda. Read the letter. This chronometer is the Grayhurst and Harvey No. 89 referred to in Ogle's 4 July 1830 letter to Croker.

[28] P & F No, 253 is also referenced in William Edward Parry *Parry's Journal of a Voyage for the Discovery of a North-West Passage*, Volume 1, p xxxiv (see Parry's Account). In the appendix to his 1821 Journal, Parry noted that P&F 253's "going rate" was "Loosing 0H 0M 19.76S and "Gained 1 s in 31 days — fluctuating 1-10th of a second fast and slow" which was very good. Its performance in the Arctic was one reason it was forwarded to Halifax for this effort.

[29] Barrow to Pond, 6 March 1827, letter 13 / 380, chronometer No. 287 is mentioned as one of two instruments issued to Captain Edward Boxer of HMS Hussar. Read the letter.

[30] Brooks, op. cit., ref. 17, p. 178. The copy of the *MSS* was obtained from Library and Archives Canada Microfilm A-423.

[31] Ogle to Croker, 17 November 1828. Admiralty, Secretary's Department – In-letters. op. cit. p. 8.

[32] A Jones reflecting circle with stand is held in the National Museum of American History collection. An image may be seen here: Jones reflecting circle.

[33] Ogle to Parry, November 25, 1828. Admiralty, Secretary's Department - In-letters. Op. cit. Master Edward Rose of HMS *Tyne,* under Captain Richard Grant, carried out the 1829 survey of The Virgin Rocks and Surrounding Bank. See also Appendix 2.

[34] William J. Calnen, "Astronomy at King's College, Windsor, N.S.," *Roy. Ast. Soc. of Can,* **74** (1980), pp. 57-63.

[35] The engineering programme at King's was established soon after 1872 by Prof. John Oram. Only small fragments of the instrument survive and are in the University of King's College Archives.

[36] Sir Richard H. Bonnycastle, *Newfoundland in 1842*, Vol. 2. London (1842), p. 247.

[37] Joseph Bouchette, *British Dominions in North America*, Vol. 1, London, 4yb (1831) p. 87. Reports usage of the circle but does not name it.

[38] *The Nautical Magazine*, p. 10, 1832. View here.

[39] Papers of the Board of Longitude, RGO 14/7, Minutes of meeting "held at the Admiralty 1 Nov. 1821," pp. 368-69. View here. The Ramsden circular scale dividing engine is preserved in the National Museum of American History in Washington.

[40] One also had to make adjustments for the apparent diameter of the Sun for the specific date and taken from tables in published ephemerides.

[41] See Randall C. Brooks, "Richard Upham Marsters: the first Chronometer Maker in North America", *eRittenhouse*, 25, (2014). Available at R.U. Marsters.

[42] Ogle, op. cit. ref. 31.

[43] This is also confirmed in Barrow to Pond, 11 March 1829. Correspondence to the Admiralty, op. cit., correspondence marked 490 / 144. Read the letter.

[44] Bayfield to Beaufort 2 November 1829, p.8 (Library and Archives Canada, Admiralty Records, Reel A-423).

[45] Bayfield to Beaufort, 27 January, 1830, p. 3 (LAC, Admiralty Records, Reel A-423).

[46] Charles Ogle to J.W. Croker, from the *Hussar* at Bermuda, 25th April 1830. (Library and Archives Canada, Admiralty Records, Reel A-423). *See* **Appendix 5:** *A Table of Latitudes and Longitudes for Headlands* approved by Ogle. Published in Bouchette, op. cit., ref. 37, p. 303.

[47] Bayfield to Beaufort on 1 November 1832, p. 4. (Library and Archives Canada, Admiralty Records, Reel A-423).

[48] Henry Bayfield to F. Beaufort dated Quebec, 31st December, 1836, p.2. (Library and Archives Canada, Admiralty Records, Reel A-424).

[49] Henry Bayfield to F. Beaufort, Hydrographer, 31st October, 1843, p.10 (Library and Archives Canada, Admiralty Records, Reel A-424). This statement is in a table Bayfield compiled while trying to rationalize an apparent error of "a mile or two" for the Jones' 1828/29 observation. Bayfield was connecting Quebec's longitude (which he had been determining for several years) using observations he made between Quebec and then Pictou and Halifax by two runs using eight chronometers. These runs were carried out on a streamer. The wording indicates that the stone tablet erected at Ogle's direction was not right on or at the Observatory but affixed to a stone wall nearby – a difference of 10 arc seconds which Bayfield considered worthy of note. The tablet in the photo (Fig. 5) was the original and shows it with the changes made ca. 1860. NB that published references to measurements taken at the Halifax Dockyard Observatory as well as those to the tablet, the stone tablet and pillar are all synonymous.

[50] John Purdy, Alexander G. Findlay, *The British American Navigator: A Sailing Directory for the Island and Banks ...*, 1843, p. xix. Mr. E. Sabben's name was added to the note on the HMS *Niemen* observations of 1822, p. 171. Read the volume.

[51] *Memoirs of Hydrography, including brief biographies,. ... Between the Years 1750 and 1885*, Part II, complied by Commander L.S. Dawson, RN, (1885), p. 22.

[52] Henry Raper, *Supplement to the First Edition of the Practice of Navigation*, 1840, p. 55-56. View the

[53] John Purdy, Alexander G. Findlay, *The British American Navigator: A Sailing Directory for the Island and Banks ...*, 1847, p. xix. Read the volume. We did not have access to editions from 1844 to 1846 but the Owen addition may be in one or more of these.

[54] Brooks, op. cit., ref. 17.

[55] Bayfield , op. cit., ref. 49.

[56] John Purdy & Alexander L. Findlay, M*emoir, descriptive and explanatory, of that sea* (1861), p. 63.

[57] John Purdy, *Memoir, descriptive and explanatory, to accompany the general chart of the Northern ocean, Davis' strait and Baffin's Bay*, 1845, p. 50-51; Captain Arthur Fanshawe and Master James Napier of HMS *Niemen* (433), *The Navy List*, Corrected to end of December, 1819, p. 81.

[58] Purdy, op. cit., ref. 14, p. xix re Captain E.R. Sibly.

[59] *Nautical and Astronomical Tables: Compiled and Computed for Facilitating Operations in Navigation and Nautical Astronomy,* by Thomas Lynn, (London) 1825, p. 48.

[60] Op. cit., ref. 38, p. 10.

[61] Peter Shortland, Monthly Notices of the Royal Astronomical Society, **13** (1852-3), pp. 226-227. Peter Frederick Shortland entered the Navy 15 Jan. 1827; passed his examination 4 Dec. 1834; was promoted (from the Excellent gunnery-ship at Portsmouth, Capt. Sir Thos. Hastings) to the rank of Lieutenant 1 April, 1842; and, from 11 May following until advanced to the rank of Commander 20 Jan. 1848, was employed on surveying service in North America in the Columbia steamer, commanded during that period by Lieuts. Alfred Kortright and John Harding, by Capt. Wm. Fitzwilliam Owen, and for upwards of two years by himself.

[62] Purdy, op. cit, ref. 56, *Memoir, descriptive and explanatory,* (1861), p. 63.

[63] Op. cit, p. 62. Also Capt.Bayfield, Halifax Harbour, cartographic material 1853, Library and Archives Canada (LAC). View map.

[64] *View from Fort Needham* by George I. Parkyns (NSARM Photo Collection). View image.

[65] Alexandra E. Carter, "EAGAR, WILLIAM," in *Dictionary of Canadian Biography*, vol. 7, University of Toronto / Université Laval, 2003.

[66] The telegraph cable was run from the Dockyard to the offices of the American Telegraph Company located at 174 Hollis Street, approximately two and a quarter miles southeast of the observatory.

[67] Brooks, op. cit., ref. 17, pp. 184-189.

[68] Op. cit., ref. 63, Bayfield map.

[69] Octagonal structures were used in the 19th century when a rotating dome was desired. The angles (45° and 135°) were easier for carpenters to construct and the top of the walls and bottom of the dome were close enough to a circle to make a round track for balls or fixed wheels to rotate upon.

[70] Ruger's map is a panoramic view of the city of Halifax created and published in 1879. There is no structure at the location of the Observatory in what is an amazingly detailed depiction of city structures right down to homes and barns. It may be viewed on line at *View Ruger 1879 Map*

[71] Notes of Harry Piers, "Dockyard: Drill Ground." Reference no.: Royal Engineers, Nova Scotia Archives no. 6857 (Piers no. 359).

[72] *Annual Report of the Minister of Railways and Canals* (July 1884-June 1885) "Statement of Contracts entered into between 1st July, 1884 and 30th June, 1985, pp. 217-218.

[73] From two published papers by Curator of the Provincial Museum, Rev. David Honeyman, D.C.L., we learn that the hill, geologically, was the remnant of a glacial drumlin. Honeyman noted that running through the coarse clay and sand were many different types of large boulders including "enormous" quartzite masses; "the weight of one was estimated by Mr. Nolan [the superintendent] at 13 tons." The task of removal took nearly fifteen months to complete. We also learn from Honeyman that "The hill disappeared finally, on November 4th, 1885, at 3:50 P.M., railway time; I watched its disappearance." Proceedings and Transactions of the Nova Scotian Institute of Natural Science, (1890), 7, pp. 78-85. See p.79.