

How telescopes came to New England, 1620-1740

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The invention of the telescope in Holland in 1608 and the rapid diffusion of low-power examples throughout Europe were contemporaneous with the first successful permanent settlements by the Dutch and English in North America. This might lead us to conclude that the telescope made an early appearance on American shores as ships carried colonists and supplies across the Atlantic, but we would be mistaken. Although there is evidence of the military use of a spyglass on a Portuguese ship off Brazil in 1614, a Dutch ship off Peru in 1615, and by the English governor of Bermuda in 1620, it was rare for there to be a telescope on a ship or across the Atlantic before the mid-seventeenth century.¹ Not until 1655 did the Dutch East India Company (VOC) require the Dutch invention to be a standard piece of equipment on its ships. And even then, the rule may have been little enforced, since the VOC's accountants did not record large-scale purchases of telescopes for its navigators until 1721.² We also find that seaman's manuals did not routinely mention telescopes until many years after that. As for telescopes of greater power and designed for astronomical use, these long tubes were even rarer in the colonies than little spyglasses.

So when did telescopes arrive in North America? What types were they? Who owned them? How were they used? Were there local artisans who could make and repair them? This brief chapter, which is part of a longer study, will focus on a hundred-and-twenty-year period in New England beginning with the plantation established at Plymouth in 1620 and covering the first hundred years of Harvard College, the oldest institution of higher learning in North America. It

will also refer to the instruments in the way that astronomers of that period did – i.e., in terms of tube length rather than aperture.

Telescopes “in a remote Wilderness”

The first known telescope in America for astronomical use belonged to John Winthrop, Jr. (1606-1676), the eldest son of the governor of the Massachusetts Bay Colony, and himself the governor of the adjacent colony of Connecticut in 1657 and from 1659 until his death in 1676. Winthrop's serious pursuits in chemistry, botany, experimental philosophy, and astronomy led to his being the first North American Fellow of the Royal Society.³ Writing from Hartford, Connecticut, to the English educational reformer, Samuel Hartlib (ca. 1600-1662) in London, in the years 1659 to 1661, Winthrop remarked that he owned a ten-foot telescope – a serious optical instrument in his day.⁴ The occasion was a renewal of friendship with Hartlib, whom he had met in London some 20 years earlier. While most of Winthrop's questions concerned alchemy and medicine, he closed his first letter with queries on astronomy:

What more perfection [has been] added to the Telescopium since Drebles [Cornelius Drebbel] and Galileus and what new discoveries in the celestiall bodies; whether any new about the motum perpetuum. I am full of more quæries but I pray excuse me thus farr, for we are here as men dead to the world in this wilderness.⁵

Hartlib generously sent Winthrop a large box of books and papers, including some extracts on telescopes. “Concerning advancement of optically learning,” he told Winthrop to take special notice of Johannes Hevelius's *Selenographia* (a “heavenly work [...] the like hath never been extant being a thick book in folio”) and Christiaan Huygens's *Systema Saturnium*.⁶ Winthrop thanked Hartlib by sending barrels of cranberries and Indian corn, and hoped to learn more of the “fabrique of that new Telescopium in holland” used by Huygens to see Saturn's ring. “My Telescop: of about 10 foot doth shew little of Saturne.” Would Hartlib send him copies of the astronomical texts mentioned?⁷ Hartlib was at his service, sending the Huygens in late summer 1661 as a gift from Lord Brereton. The Hevelius was no longer to be had, but Hartlib offered to write the author in Danzig to see if he might have a spare.⁸

How Winthrop acquired his ten-foot refractor, we do not know. He may have purchased it in 1641-1643 on his last trip to London, or may have ordered it later from America and had it shipped.

In 1661, Winthrop sailed to London a second time. His goal was to obtain a royal charter for Connecticut. He returned in 1663 not only with this prize but

also a new telescope – a “3 foote & halfe wth a concave ey-glasse.”⁹ Winthrop lost little time after his return in making use of the instrument. In January 1665 he sent a letter from Hartford via Barbados to London to Sir Robert Moray, President of the Royal Society, cautiously informing him that he may have discovered a fifth satellite of Jupiter.¹⁰ We now know that Winthrop had mistaken a fixed star for this moon (which would not be discovered until 1892 when E. E. Barnard observed it with the Lick telescope).¹¹ More to the point than his error, this episode demonstrates his enthusiasm for astronomical research and serious scientific goals. Winthrop was not just some gentleman stargazer. He tried to stay current and do his part, even in the development of instruments.

In 1668, Winthrop informed Henry Oldenburg, Secretary of the Royal Society, that the *Philosophical Transactions* had inspired him to make a new and improved telescope of eight to ten feet:

In them I find yt many great, & ingenious persons, in divers parts of Europe are Indeavouring to bring their Telescopes to greater perfection, and have made some in London of extraordinary extent, and one in Poland expected to be made of double that length: that favour of this intelligence, doth now occasion me to lett you know, that I have beene and am studiously endeavouring to add something towards the further improvement of such instruments for more perspicuous discerning of remote objects.¹²

The problem for Winthrop, “an exile in a remote Wilderness,” was the want of good materials and skilled labor, particularly in securing good, figured optics to try the experiment:

[I am] much discouraged in respect of fitting both the obiect & eye glasses to be such as wilbe necessary, there being much difficulty to have them made to that perfection, wch is requisite in that way intended, especially here: though for that experiment a tube of 8 or 10 foote may I suppose be long ynough in wch if any thing be attained there shalbe a further account of it.¹³

“I must crave excuse,” Winthrop begged, “if I am too suddaine to expresse my endeavours, and studies, before the effects of them can be demonstrated: we have not every weeke a post hence for correspondence.”¹⁴ Nothing further is known about the project, but it probably did not succeed. Basic materials were scarce in the colonies; there were no lens grinders, no glass houses, no instrument makers; and the governor was also becoming elderly.

Telescopes at Harvard College

In early 1672, Winthrop gave his three-and-a-half-foot telescope to Harvard College for use by its younger observers, encouraging them to look at “those satellites about Jupiter at any tyme by the telescope... and the moone or any of those things to their satisfaction.”¹⁵ Three of the college tutors acknowledged the gift:

Cambridge, Febr: 2, 1671 [old style]

Right Worshipfull,

Wee cannot but thankfully acknowledge, that great and undeserved Love and Respect, manifested towards us; in that Large and Learned letter sent unto us, by Mr. Martin; (wherein your worship has been pleased to prescribe many usefull Directions, to instruct us in our fitting the Telescope for use, according to the Rules of Art.) As alsoe, in sending therewith severall Instrumentes, whereby wee might be enabled to reduce the former precepts into practice. The eye-glasse sent by Mr. Greene wee have received in safety: wee have not as yet had an opportunity of doeing any thing considerable with it (the two Last nights being Cloudy;) but wee hope (God willing) to employ it shortly in the service of Urania.

Wee have likewise (Honoured Sir) Received the two Drawers, enclosed in a round case of wood for their safer carriage: wee find upon Tryall, that the outwardmost Drawer is fitted exactly for the Tube, soe that both will be of use unto us. Wee readily graunt that our Addition to the Tube wherewith it was lengthened, may (and shall) be taken away as uselesse; seing that the Drawers will (if need be) adde greater length thereunto. The box committed to the trust of Mr. Martin, was carefully delivered unto us: Inclosed wherein, wee Received not only a paire of cutting Compasses; but alsoe the modell of a supporter, which your worship was pleased (proprîâ manu) to frame for our Instruction.

Honoured Sir, wee have received all the forenamed particulars, as a sure witnessse of your unfeigned Love to Learning; and a clear Demonstration of your hearty desire, eminently to promote the same in this schoole of the prophetes. Our Reverend president (who has been sickly of late) [Charles Chauncy] does presente his service to your worship; and Renders you many thanks, for that extraordinary care and Respect, manifested in this case.

Were wee capable of performing any considerable service for your worship, and thereby of manifesting our sincere Gratitude (Gratias agendo; as the Latines phrase it:) wee should acknowledge it as a greate Kindnesse, if you would be pleased to employ us therein.

Honoured Sir, Craving your pardon for our present boldnesse, and for our giving your worship the former Trouble: wee take leave humbly to present our service, and unfeigned Respects; and are, Right Worshipfull,

Your much obliged servantes,

Alex: Nowell.
Joseph Browne.
John Richardson.¹⁶

The thank-you letter is instructive in showing the extent of the gift and how information and apparatus were exchanged. The gift included the telescope, eyepiece, two additional draw tubes, and directions and tools for mounting the instrument. The shipping from Hartford to Cambridge – a hundred miles – was not trivial in 1672. Parts arrived at different times and by different agents. The eyepiece came separate from the tube assembly, which itself came in two shipments. It appears that the Harvard tutors had extended the main tube to match the focal length of the objective, but realized this was unnecessary once the draw tubes arrived in a protective, wood barrel. The overall impression we get of the provincial letter writers is that they had never used a telescope before and were so grateful for the opportunity that they thanked their benefactor every other sentence.

Harvard College had been founded in 1636, and astronomy had been part of the curriculum from its inception. Nevertheless, Governor Winthrop's gift was Harvard's first telescope (in fact, its first recorded piece of any scientific apparatus), and it was the college's pride and delight. The little telescope received a lot of use by the college president, tutors, and students.¹⁷ Within a few years, the almanacs that issued from the college's printing press included observations made with the refractor and essays on the history of telescopes.¹⁸ Increase Mather (A.B. 1656, fellow from 1674 and future Harvard President, 1685-1701) was among the residents of Boston who rode into Cambridge especially to observe with the refractor. His observations of the comet of 1682 with the telescope were noted in his *Kometographia* (1683).¹⁹ The college instrument was used not just for enrichment, but also for research. Observations of the comet of 1680 by Thomas Brattle (1658-1713, A.B. 1676) – likely made with the telescope – earned a spot in Newton's *Principia*.²⁰

By the end of the seventeenth century, Harvard had another telescope—a “4 ½ foot Telescope, with all four Glasses in it” used by Brattle to observe a lunar eclipse in 1700.²¹ In contrast to Winthrop's telescope, which was Galilean in design, this was a terrestrial telescope of the form devised by Anton Maria Schyrle de Rheita and Johann Wiesel around 1645. It had four convex lenses – the objective lens, the ocular lens, a field lens, and an erector lens. It may have been the case that the field lens and erector lens were in a

'converter tube' that could be removed at will to make an astronomical telescope of Keplerian configuration, because Brattle also reported using a four-and-a-half-foot, two-lens telescope to observe a solar eclipse in 1703.

I observ'd...with a Telescope of one joynt, 4 foot and a half in length, and [it] had only 2 Glasses, so that it inverted the object; and I had a red Glass which suited it, so that I could screw it in just before the Eye-Glass, and was not fain to hold it in my hand, [...] which was a great convenience.²²

Other telescopes followed: an eight-foot refractor in 1712, and a twenty-four-foot in 1722.²³ The latter was a gift of Thomas Hollis, a wealthy London merchant, who in 1727 endowed a professorship at Harvard of mathematics and natural philosophy, which was accompanied by a magnificent apparatus. From surviving inventories of the Hollis apparatus made in 1730 and 1738, we learn of an additional "small Telescope or rather perspective with a Concave Eye glass," whose ocular lens was loose by 1738.²⁴ This spyglass was Galilean in optical design and would have produced an upright image. In all likelihood, it was a teaching tool for optics as much as astronomy. For astronomical research and more in-depth training, the chamber windows and roofs of Harvard buildings served as observatories, and the go-to instruments were the longer, refracting telescopes and an astronomical quadrant of two-foot radius with telescopic sights (formerly used by Dr. Halley at St. Helena and acquired by Harvard College in 1689).²⁵

In the eighteenth century, telescopes were also in the hands of private individuals associated with Harvard College. Edward Holyoke (1689-1769), a Harvard graduate and tutor, devoted compiler of ephemerides, and later the ninth college president, owned a tiny Gregorian telescope made in England about 1720 (Fig. 1).²⁶ John Winthrop (1714-1779), the Hollis Professor of Mathematics and Natural Philosophy at Harvard College (and the great great nephew of the aforementioned Governor John Winthrop, Jr.) also owned a small, personal, reflecting telescope.²⁷ It too was English made (Fig. 2). These telescopes were distinguished from the college's own instruments in three significant ways. They had short brass tubes rather than long pasteboard drawtubes covered in vellum or leather. They were more portable, being able to sit on a table or be screwed to a post or tree trunk rather than hung by ropes from a mast or mounted to a large stand. They were also of the new reflecting design, which used metal mirrors rather than glass lenses to magnify images without the nuisance of chromatic aberration. The college did not acquire any reflecting telescopes of its own until John Vassall and Admiral Sir Peter Warren donated fine and handsome reflectors in 1747 and 1749 or 1750. Until then, the college

made do with the older refractors, “fixing Cross hairs in a Sell [cell] in the 8 foot-Telescope” and getting “A New hook for the Pully of the Telescope, A New Tube for the long Telescope” in 1740-1741.²⁸



Fig. 1 - Gregorian reflecting telescope, English, circa 1720, owned by Edward Holyoke, author of eight almanacs between 1708 and 1716, and President of Harvard College, 1737-1769. Collection of Historical Scientific Instruments, Harvard University, 5002.



Fig. 2 - Gregorian reflecting telescope, English, circa 1735, owned by astronomer, John Winthrop, Hollis Professor of Mathematics and Natural Philosophy, Harvard College. Collection of Historical Scientific Instruments, Harvard University, 0054.

As the eighteenth century wore on, public enthusiasm for astronomy can be gauged by short notices placed in the Boston newspapers, the sale of almanacs, and public lectures given by Professor John Winthrop.²⁹ Nonetheless, there were no shops selling locally-made telescopes or any other optical instruments. One had to place a special order in London and have the telescope shipped or buy it off someone else who had imported it previously. Likewise, if any lens or mirror needed repair or replacement, one had to have the instrument serviced by workmen in London. The same was true for brass fittings, except for the brief period when John Dabney, who had trained in London with Jonathan Sisson, set up a shop in Boston (1739-1743).³⁰ The apparatus at Harvard and the associated archival records – bills of sale and lading, correspondence with instrument makers and benefactors, college records, and lecture notes – confirm this dependence on London and the provincial nature of Boston.³¹ It was not until the second quarter of the nineteenth century that locally made telescopes started to be available in New England.

Notes

¹ E. Sluiter, 'The First Known Telescopes Carried to America, Asia and the Arctic, 1614-39,' *Journal for the History of Astronomy* (1997), 28, 141-145.

² H. J. Zuidervaat, 'The "Invisible Technician" Made Visible: Telescope Making in the Seventeenth and Early Eighteenth-Century Dutch Republic,' in *From Earth-Bound to Satellite: Telescopes, Skills and Networks* (ed. A. D. Morrison-Low, S. Dupré, S. Johnston and G. Strano), *Scientific Instruments and Collections*, 2, Brill, Leiden, 2012, 41-102, see 98-101.

³ R. P. Stearns, *Science in the British Colonies of America*, University of Illinois Press, Urbana, 1970, 117-139.

⁴ John Winthrop, Jr., Hartford to Samuel Hartlib, 25 October 1660, in George H. Turnbull, ed., 'Some Correspondence of John Winthrop, Jr., and Samuel Hartlib,' *Proceedings of the Massachusetts Historical Society*, Third Series (Oct., 1957 - Dec., 1960), 72, 58-62. The correspondence is discussed in R. S. Wilkinson, 'John Winthrop, Jr., and America's First Telescopes,' *The New England Quarterly* (Dec. 1962) 35 (4), 520-523.

⁵ John Winthrop, Jr. to Samuel Hartlib, 16 December 1659, in Turnbull, 'Some Correspondence,' 36-40, quotation, 40.

⁶ Samuel Hartlib to John Winthrop, Jr., 16 March 1660 N.S., in Turnbull, 'Some Correspondence,' 40-49, see 47. The receipt of the items and a list is given in Winthrop's reply to Hartlib, 25 August 1660, in Turnbull, 49-58.

⁷ John Winthrop, Jr. to Samuel Hartlib, 25 October 1660 and 7 January 1660/61, in Turnbull, 'Some Correspondence,' 58-67.

⁸ Samuel Hartlib to John Winthrop, Jr., 3 September 1661 and William Brereton to John Winthrop, Jr., 2 October 1661, *Proceedings of the Massachusetts Historical Society* (1878), 16, 212-215.

⁹ John Winthrop, Jr. to Sir Robert Moray, President of the Royal Society, 27 January 1664/5, *Proceedings of the Massachusetts Historical Society* (1878), 16, 220-222,

see 221.

¹⁰ *Ibid.*.

¹¹ John W. Streeter, 'John Winthrop, Junior, and the Fifth Satellite of Jupiter,' *Isis* (1948), 39, 159-163.

¹² John Winthrop, Jr. to Henry Oldenburg, Secretary of the Royal Society, 12 November 1668, *Correspondence of Henry Oldenburg* (ed. and trans. by A. Rupert Hall & M. B. Hall), 13 vols, University of Wisconsin Press, Madison, 1965-1986, 5, 150-157, see 156. Note the transcription of this letter is incomplete and missing this section in the *Proceedings of the Massachusetts Historical Society* (1878) 16, 234-239.

¹³ *Ibid.*

¹⁴ *Ibid.*

¹⁵ John Winthrop, Jr., Hartford. Letter, presumably to Wait Winthrop, 29 April 1672, Winthrop MSS, 5:70, Massachusetts Historical Society; S. E. Morison, 'The Harvard School of Astronomy in the Seventeenth Century,' *The New England Quarterly* (1934) 7, 3-24.

¹⁶ Alexander Nowell, Joseph Browne, and John Richardson, tutors of Harvard College to Governor John Winthrop, Jr., Cambridge, 2 February 1671/2, Massachusetts Historical Society, Winthrop Autographs, a.149; transcribed by S. E. Morison, 'Harvard School of Astronomy,' 17-18; *Proceedings of the Massachusetts Historical Society*, second series (1887-1889), 4, 265-266.

¹⁷ S. Schechner Genuth, 'From Heaven's Alarm to Public Appeal: Comets and the Rise of Astronomy at Harvard,' pp. 28-54, in *Science at Harvard University: Historical Perspectives* (ed. C. A. Elliott and M. W. Rossiter), Lehigh University Press, Bethlehem, 1992; Associated University Presses, London, 1992, esp. 28-31.

¹⁸ Thomas Brattle (A.B. 1676), 'Observations of a Comet seen this last Winter 1680, and how it appeared at Boston in N.E.' in John Foster (A.B. 1667), *An Almanack of Coelestial Motions...for...1681*, Boston, 1681; Cotton Mather (A.B. 1678), 'A Description of Last Year's Comet,' *The Boston Ephemeris...for... MDCLXXXIII*, Boston, 1683; Nathaniel Mather (A.B. 1685), 'Discoveries that have been made in the Heavens with, and since the invention of the Telescope,' *The Boston Ephemeris...for...MDCLXXXV*, Boston, 1685; Henry Newman (A.B. 1687), 'Of Telescopes,' *News from the Stars: An Almanack...for...1691*, Boston, 1691.

¹⁹ Increase Mather, MS diary, 1680-1684, 87, American Antiquarian Society, Worcester, MA; Increase Mather, *Kometographia*, Boston, 1683, 129.

²⁰ Schechner Genuth, 1992, *op. cit.*, 31. Cf. R. Kennedy, 'Thomas Brattle and the Scientific Provincialism of New England, 1680-1713,' *The New England Quarterly* (Dec., 1990), 63 (4), 584-600.

²¹ T. Brattle, 'An Account of some Eclipses of the Sun and Moon, observed by Mr. Tho. Brattle, at Cambridge, about four miles from Boston in New-England,' *Philosophical Transactions*, (1704-1705) 24, 1630-1637, see '[Observations] of a Lunar Eclipse, that happen'd Feb. the 11th, 1700, in the evening,' pp. 1633-1634.

²² Brattle, 1703-1704, *op. cit.*, see 'The Observation of the Eclipse of the Sun...November 1703,' pp. 1634-1635.

²³ *Ibid.*; Thomas Robie (A.B. 1708), 'Part of a Letter from Mr. Thomas Robie, Physician in New-England, to the Reverend Mr. Derham, F. R. S. Concerning the Effects of Inoculation; The Eclipse of the Sun in November 1722; And the Venom of Spiders,' *Philosophical Transactions*, (1724-1725) 33, 67-70; and I. Bernard Cohen,

Some Early Tools of American Science, Harvard University Press, Cambridge, 1950, 28, 30.

²⁴ Cohen, 1950, *op. cit.*, 138.

²⁵ Robie, 1724-1725, *op. cit.*, 69; Brattle, 1703-1704, *op.cit.*, Cohen, 1950, *op. cit.*, 28.

²⁶ Now preserved in the Collection of Historical Scientific Instruments, Harvard University (hereafter CHSI): an English reflecting telescope, circa 1715-1720 (CHSI 5002) owned by Edward Holyoke.

²⁷ Now preserved in CHSI, John Winthrop's personal English reflecting telescope, circa 1735 (CHSI 0054).

²⁸ 'Hollis Book', Records relating to the philosophical apparatus of the Hollis Professorship of Mathematics and Natural Philosophy, 47-48, Harvard University Archives, UAI 15.960; Cohen, 1950, *op. cit.*, 39-40.

²⁹ Schechner Genuth, 1992, *op. cit.*

³⁰ For Dabney's advertisements, see *The Boston Gazette*, 16-23 July 1739, issue 1017, p. [3], and *The Boston Evening-Post*, 13 August 1739, issue 209, p. [2]. Record of Dabney servicing Harvard instruments is found in the Hollis Book, 47-48.

³¹ David. P. Wheatland, *The Apparatus of Science at Harvard*, 1765-1800, Collection of Historical Scientific Instruments, Harvard University, Cambridge, 1968; Cohen, 1950, *op. cit.*