NATHANIEL BOWDITCH, EARLY AMERICAN AMATEUR ASTRONOMER

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Abstract

Nathaniel Bowditch had very successful careers as a seaman/ship's master and as an actuary/insurance executive. In addition he managed to make very substantial contributions to mathematics and astronomy. Bowditch is therefore important as one of the earliest significant amateur astronomers in the United States.

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The family background of Nathaniel Bowditch provides few clues to his future potential. He was born in Salem, Massachusetts, in 1773, to parents who had little formal education or drive for self-improvement. His mother, Mary Ingersoll Bowditch, died when Nathaniel was only ten years old, but had already recognized that Nathaniel was a talented child. She remarked before dying that she was sure Nathaniel would grow up to be "something definite." His father, Habakkuk Bowditch, was a former sea captain who had lost a ship, and found himself land-locked for life. His frustrations led to chronic alcoholism. Nathaniel had been the most promising student in school, but shortly after his mother died his father removed him from school to help with the family cooperage business. Two years later, an opening developed in the shops of Salem's most successful ship's chandler. Habukkuk reluctantly indentured Nathaniel to an apprentice position. The nine following years were crucial to Bowditch's development. Now a resident in the home of his employer, Nathaniel had access to a modest library, and he exploited the opportunity for self-development. He enjoyed mathematics, and so worked extra hard in that area.

The processes by which Bowditch educated himself were unusual. In the earliest stages, he meticulously copied everything he wanted to remember into large notebooks. He called these books his "commonplace" books, and those that are preserved show the dedication of great effort to this process. He reasoned that he might never have access to any particular book again, and therefore made his own library. (At one point this included copying out the complete logarithmic tables!) As his self-education progressed, he came to the notice of the intellectual leaders of Salem who were sympathetic to his plight. They allowed Bowditch to use the more extensive resources of their private libraries. In one of these, Bowditch found a copy of Newton's *Principia Mathematica* in its Latin text. Bowditch accepted this challenge, and learned Latin by translating the text using only a Latin-to-English dictionary. In the process he discovered at least one error in Newton's work. This method of learning languages was later extended. Bowditch translated the New Testament of the Bible into English from the five other languages that he needed for access to the works of the greatest mathematicians in their original texts.

At age 21, with his period of indenture completed, Bowditch took a temporary position as a member of a three-person survey party which mapped Salem for the first time. His contributions to the survey so impressed a ship captain who was also involved that he was offered a berth on the sailing ship *Henry*, as supercargo, or clerk. Thus, when Bowditch first went to sea, he went as a ship's officer and never "sailed before the mast." During this first voyage, and on each of the four voyages that followed, Bowditch made the most of the idle hours at sea. On the first voyage, he invented a method of determining

longitude by lunar sightings, and began to experiment with simple ways of teaching navigation to ordinary seamen. While perfecting his "lunars" technique during his second voyage, he discovered numerous errors in the then-standard text and tables for navigation, Moore's Practical Navigator. His extensive re-examination of these tables revealed over eight thousand errors, of which he attributed six thousand to Moore, and over two thousand to the basic astronomical data provided to Moore by Nevile Maskelyne, the Astronomer Royal. At the end of the second voyage, his review formed the basis for publication of an extensive revision of the Moore tables. But during a third voyage, Bowditch recalculated the entire set of tables, and then completely rewrote the text using his experience from teaching navigation. This completely revised and rewritten text was then published as the New American Practical Navigator, with Nathaniel Bowditch now listed as its author. The New American Practical Navigator eventually went through more than sixty editions, and the successor volume is still in use by mariners around the world. There is no doubt that the NAPN saved many mariners' lives because of its vastly improved accuracy.

After Bowditch's fifth and last voyage, on which he sailed as the ship's Master, he retired from the sea a wealthy man. His skill as a mathematician was recognized, and he was invited to accept a position as president of a marine insurance firm. He was very successful in this role, and later headed a second, larger firm in Boston. He was active in politics, was a member and president of the East Indian Marine Society in Salem, and also raised a large family. By any measure, even without consideration of his involvement in astronomy, Bowditch led an active, full, and successful life.

Bowditch never faltered in his love of mathematics. He published numerous papers on his mathematical studies - many on applications to astronomy - and he is considered the leading mathematician in the United States of the early 19th century. He was invited to accept a position as professor of mathematics at least three times, at three different institutions - Harvard in 1806, the University of Virginia in 1818, and West Point in 1820. He refused each of these offers, perhaps because his insurance business was significantly more remunerative. He did become involved with Harvard University as a member of their Board of Overseers. He was involved in, and probably responsible for, the successful efforts to save Harvard from financial failure during this period. He recognized the superior talent of Benjamin Peirce as a student of mathematics, and interceded to keep him in school at Harvard. Peirce went on to chair the Mathematics Department at Harvard, and was the leading mathematician in the United States after Bowditch's death.

Bowditch was not very active as an observer, although he observed comets extensively in 1807, 1811, and 1819. His interest lay primarily in calculating the orbits of comets, and so his observations focused on determinations of exact positions more than on the appearance, brightness, and other characteristics of comets.

When a great meteor passed over New England in 1807 and was observed from Vermont to Weston, Connecticut, Bowditch toured much of the area in a buggy, interviewing individuals who had observed the meteor. He later published his analysis of the event. His calculations indicated that the height of the meteor was eight miles, its speed 3.5 miles per second, and its mass six million tons. In a paper published by the American Academy of Arts and Sciences in 1809, Bowditch concluded from these and other considerations that the meteor was of cosmic origin. This theory had been advanced in 1794 by Ernst Chaldini in Czechoslovakia, but the Bowditch paper is thought to have been persuasive in the final acceptance of this theory. One interesting aspect of the Weston meteor investigation is that while

Bowditch did this extensive travelling in a buggy he was recuperating from a bout of consumption!

Bowditch made a major contribution to astronomy when he translated P. S. LaPlace's Mechanique Celeste into English. This monumental four-volume work was published in France over a period of several years. Bowditch annotated the text with explanations as he translated, working examples and generally making the work more readable and understandable. In addition, he corrected a number of textual errors, and added credits for contributions from others whom LaPlace had neglected to mention. The errors and omissions were carefully pointed out to LaPlace in letters which were never answered. Bowditch published the four-volume English translation at his own expense, an enormous burden even for a man of his comparatively wealthy status at that time. There can be no doubt that the availability of this English translation greatly accelerated progress in theoretical astronomy in this country.

Many honors were bestowed on Bowditch for his work in mathematics and astronomy before he died in Boston in March, 1838. These included honorary degrees from Harvard and other universities, membership in the Royal Astronomical Society and The Royal Society in London, and the National Academy of Arts and Sciences. His achievements have earned him a lasting place among amateurs in the history of astronomy.