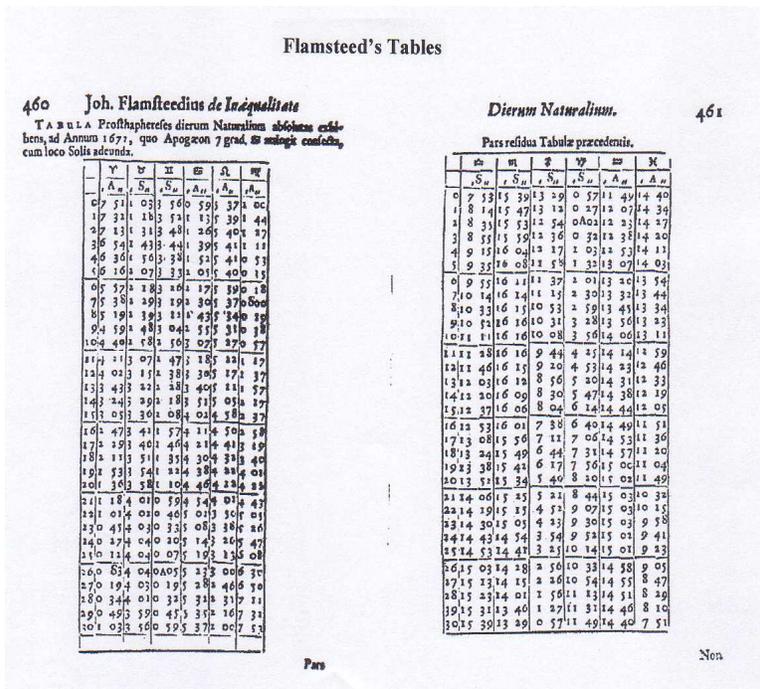
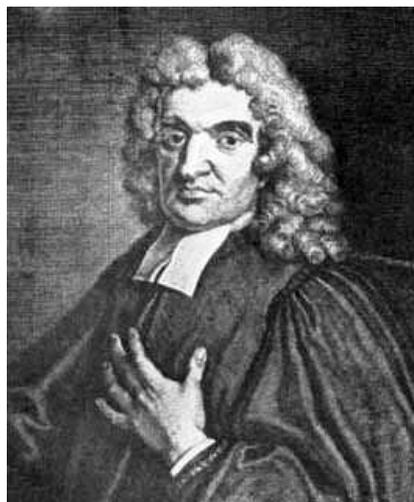


John Flamsteed

The Reverend **John Flamsteed** (August 19, 1646 – December 31, 1719), the first Astronomer Royal of England, is remembered for accurately mapping the skies, rather than for proposing radical new theories. He determined the latitude of Greenwich, the slant of the ecliptic, and the position of the equinox. Flamsteed produced a table (Figure 8.10), which begins with the position of the sun at the spring equinox. The angular distance of the sun from this point is called its *longitude*. If one has the Sun's longitude when measuring *apparent time*, the table gives the equation of time to be added (*A*) or subtracted (*S*) from the apparent time in order to give the *mean solar time*. The latter is time measured by a hypothetical sun thought of as moving along the equator at a uniform rate because the Sun itself is not a suitable point of reference for solar time.



Some 300 years later, it was Flamsteed's work that was at the heart of computer programs NASA scientists used to guide the first spaceships to the moon. Most of the 6000 stars visible to the naked eye are not given names, but rather are identified by a Greek letter or a number. In 1603 astronomer Johann Bayer used Greek letters to code the stars; generally with *Alpha* designating the brightest star in the constellation, the second brightest star of the constellation was named *Beta* and so on through the Greek alphabet. Edmond Halley established the practice assigning numbers to the stars, now called Flamsteed numbers. The stars are numbered from west to east in the constellation.

Flamsteed was born at Crowtrees in Derby, Derbyshire the son of a prosperous businessman. He was educated at the Free School in St. Peter's Churchyard, an institution that prepared children for a university education, but he suffered from a chronic rheumatic condition, which led to frequent absences. At age fourteen, his affliction caused so much pain in his knees and joints and shortness of breath that he was scarcely able to crawl to school. His father decided that his son was too sickly to go to a university and forced him to leave school. Between 1662 and 1669 Flamsteed studied astronomy on his own. He was sent to various doctors and healers, which sometimes improved things at least for a short period, but did not free him of his feelings of weakness. Learning of the cures done in Ireland by Mr. Valentine Greatrakes, by the "stroke of his hands, John's father sent his 19 year old son on an arduous journey to Ireland, where Mr. Greatrakes "touched" him. On his return home, Flamsteed's health seemed to improve a bit, though whether this was due to Greatstakes' "touch" or the journey and vomiting at sea, Flamsteed was uncertain. At the beginning of 1665, he wrote his "Mathematical Essay," in which he detailed the construction and uses of a quadrant, to which he added an appendix "The Projection of the Universal Dial" and a catalogue of seventy of the fixed stars.

Flamsteed went to London in 1670, where he became acquainted with Sir Jonas Moore, Master of the

Royal Ordnance, who presented the young man with a micrometer and furnished him with telescopes at moderate prices. Moore convinced King Charles II to grant a warrant so that his young friend might attend Jesus College, Cambridge. Flamsteed was awarded an M.A. in 1674 and was ordained in 1675 the same year that the Government offered a reward for “determining a ship’s latitude at sea.” The King appointed a commission to examine the various means proposed. Flamsteed read the proposals and maintained that “they were insufficient, as neither the position of the stars nor the moon’s path was known with sufficient accuracy.” His assertion that the locations of the fixed stars in the Catalogue of Stars were incorrect startled the King. The monarch said he must have them “anew observed, examined and corrected for the use of his seamen,” and when asked who could provide this service, Flamsteed replied, “the person who informs you of them.” The king founded the Royal Greenwich Observatory and appointed Flamsteed its director. Charles II’s charge to Flamsteed read: “[You are to apply] the most exact Care and Diligence to rectifying the Tables of the Motions of the Heavens, and the Places of the fixed Stars, so as to find out the so-much desired Longitude at Sea, for perfecting the Art of Navigation.” Flamsteed was given an allowance of 100 pounds a year and the assistance of a laborer to move his instruments.

The Herculean task facing Flamsteed was twofold: first, construct a more extensive and accurate catalogue of the fixed stars than any then existing; and secondly, systematically observe the sun, moon, and planets in order to revise theories of their apparent movements so that tables could be constructed from which their positions could be accurately computed. Moore gave Flamsteed a micrometer, a telescope with object glass of 16-meter focal length, two great clocks and some books. Despite the king’s promises of help, no further funds were made available and Flamsteed was forced to supply all other needed instruments. He had to take private pupils to augment his meager stipend and the small inheritance from his father to pay for his assistants. Flamsteed reckoned that he spent over £2000 of his own money to equip the observatory.

The observatory, designed by Sir Christopher Wren, was built on the site of Greenwich Castle, overlooking the River Thames. While the Observatory was under construction, Flamsteed took up residency in the Tower of London. The ravens of the Tower often interrupted his work by fouling his telescopes. The King ordered the ravens killed but he was reminded of the legend that if the ravens left the Tower, the monarchy would fall. Charles wisely allowed some ravens to survive. In July 1676 Flamsteed moved into the Observatory where he lived until 1684. The observatory [Figure 8.11] was one of the birthplaces of modern positional astronomy. It eventually had to be moved from Greenwich because London lights disrupted clear views of the sky and the railway system caused magnetic vibrations to show up in equipment used to measure the Earth's magnetic field.

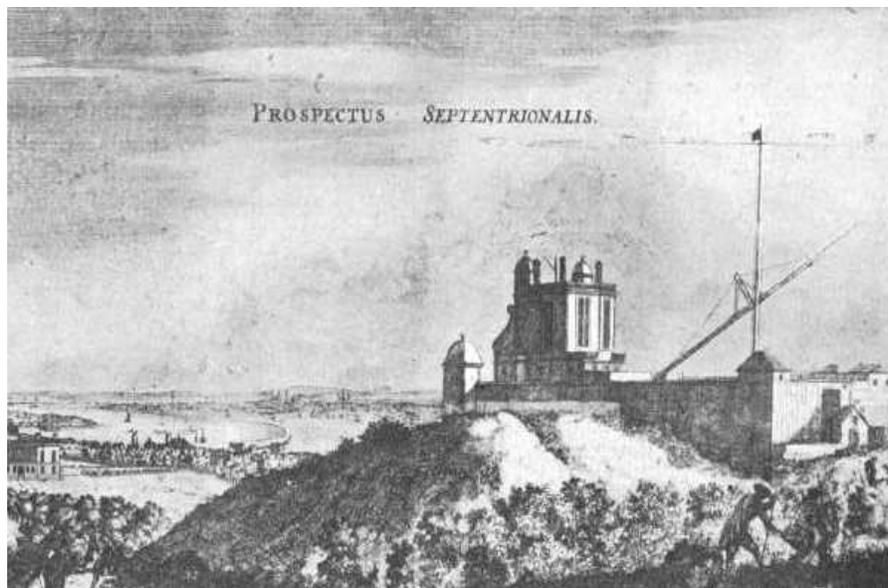


Figure 8.11

The latter part of Flamsteed's life passed in controversy. His intention not to publish his stellar observations until his work was completed led to bitter disputes with Newton who wanted to publish a second edition of the *Principia*. To do so he needed Flamsteed's data to verify his gravitational theory.

Newton used his clout at court to have the Royal Society publish the incomplete results over Flamsteed's strenuous objections. His papers were virtually seized and Halley edited the incomplete observations. Four hundred copies of the unauthorized star catalogue were printed. Flamsteed got his revenge after Newton's court supporters died. He convinced the Lord Chamberlain, to buy 300 copies of the rogue catalogue, which Flamsteed burned in a huge bonfire in front of the observatory.

Flamsteed eventually completed his work, the *Historia Coelestis Britannica*, but it was not published until 1725, six years after his death, finished by his loyal assistants. It contained the positions of nearly 3,000 stars. In all Flamsteed conducted 30,000 individual observations, each dutifully recorded and confirmed with telescopes he built himself or bought at his own expense. His atlas contained twenty-six maps centered on the major constellations visible at Greenwich, and two planispheres, the work of his assistant Abraham Sharp. The completed star catalogue tripled the number of entries in the sky atlas compiled by Tycho Brahe at Uraniborg in Denmark. After his death Flamsteed's widow removed all of his instruments from the observatory, so that his enemy Halley, his successor as Astronomer Royal, couldn't use them.

Quotation of the Day: "Newton's design was to make me come to him, force me to comply with his humors, and flatter him and cry him up as Dr. Halley did. He thought to work me to his ends by putting me to extraordinary charges. Those that have begun to do ill things never blush to do worse to secure themselves. Sly Newton had still more to do and was ready at coining new excuses and pretenses to cover his disingenuous and malicious practices... I met his cunning forecasts with sincere and honest answers and thereby frustrated not a few of his malicious designs. I would not court him, for, honest Sir Isaac Newton (to use his own words) would have all things in his own power, to spoil or sink them; that he might force me to second his designs and applaud him, which no honest man would do nor could do; and, God be thanked, I lay under no necessity of doing." – John Flamsteed

