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THE **ONYX** ENVIRONMENTAL TRUST



AMBER VALLEY
BOROUGH COUNCIL

The Life of John Flamsteed



*Britain's First
Royal Astronomer*

FLAMSTEED'S DENBY

TRADE AND INDUSTRY

By this time, Denby coal had a considerable reputation. Coal and iron had been mined in shallow pits from medieval times. By an agreement of the Lowe family, dated 9 January 1685, Robert Fletcher of Kilburn was given permission to "sink pits to get coal" in their land, and "to fetch coal with carts, horses and wains" and "to set up engines to de-water the mines". These engines would have been powered by water wheels.

THE VESTRY

All parish and civil affairs were conducted by the vestry. It appointed overseers of the poor, who would levy a rate out of which poor people with a legal right of settlement in the village were given help in cash or kind (known as "poor relief"). The vestry also appointed surveyors of the highway to manage road repairs.

THE HEARTH TAX

The hearth tax was a 17th century tax on hearths or fireplaces. It helps us identify that The Robey family's Denby Old Hall with 13 hearths was the largest property in the village at that time.

FLAMSTEED'S DENBY

Records show that about 250-300 people lived in Denby village in the 1670s. People of today would have recognised the village with its long, twisting main street following ancient field boundaries.

LAND AND FARMING

The main landowners were the Lowes and the Robeys. Maps show that, apart from the common pastures of Denby Common, the village was farmed in enclosed fields as now. A deed of 1658 shows a farmhouse with fields called the Flate, Nine Acres, Six Close, Lady Crosse Meadow, the Broade Close and Smithy Close. Farming would be mixed with an emphasis on raising livestock. Arable farming would be traditional with wheat and corn the main crops and beans the fodder crop.

THE MANOR

The powerful Lowe family ran a manor court at Denby at this time. Those living within its jurisdiction were obliged to attend the lord of the manor's court and could be fined for failing to attend. Through its "view of Frankpledge" the court was responsible for minor misdemeanours such as failing to keep ditches or hedges and fences in repair.

INTRODUCTION

by Sir Martin Rees, Astronomer Royal

John Flamsteed was one of the great pioneers of astronomy, but he received inadequate acclaim during his lifetime. He was unfairly disparaged by Isaac Newton, Edmond Halley and others; many historians failed to do him justice because they concentrated too much on the acrimonious aspects of his career. But he was an immensely energetic innovator, who worked with great persistence against the odds, accumulating a large body of observations that formed the basis for much later work.

His main legacy is the Royal Observatory at Greenwich. Flamsteed became the first holder of the title "Astronomer Royal" and remained at Greenwich for more than 40 years, diligently pursuing his observations, and improving the instruments.

Two centuries later, the Royal Observatory was designated, at an international convention, as defining the prime meridian of longitude. Flamsteed could never have envisaged, when he chose the location for his observatory, that his choice would thereby be imprinted, in perpetuity, on maps drawn in every country of the world. But it is fitting that he is commemorated in this way. It is specially welcome that his career, from his early life in Denby to his lengthy and strenuous Greenwich years, has been succinctly chronicled in this pamphlet, which I hope will help to give his achievements the prominence and admiration they deserve.

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Denby Parish Council wishes to express its gratitude to the help given by Mary Owen who sadly passed away before completion of the project.

FOUNDING OF THE ROYAL OBSERVATORY, GREENWICH

With increasing world trade and more overseas settlements, it became crucial to Britain to determine the longitude (the east-west position) of a ship at sea. Although north-south latitude was fairly easily calculated, it was possible to make position errors of 200 miles or more on longitude.

Dismayed that such basic information was not available, Charles II looked across the channel for inspiration. In 1671, Louis XIV had appointed the celebrated Italian astronomer G-D Cassini as Director of the Paris Observatory. An English observatory, however,

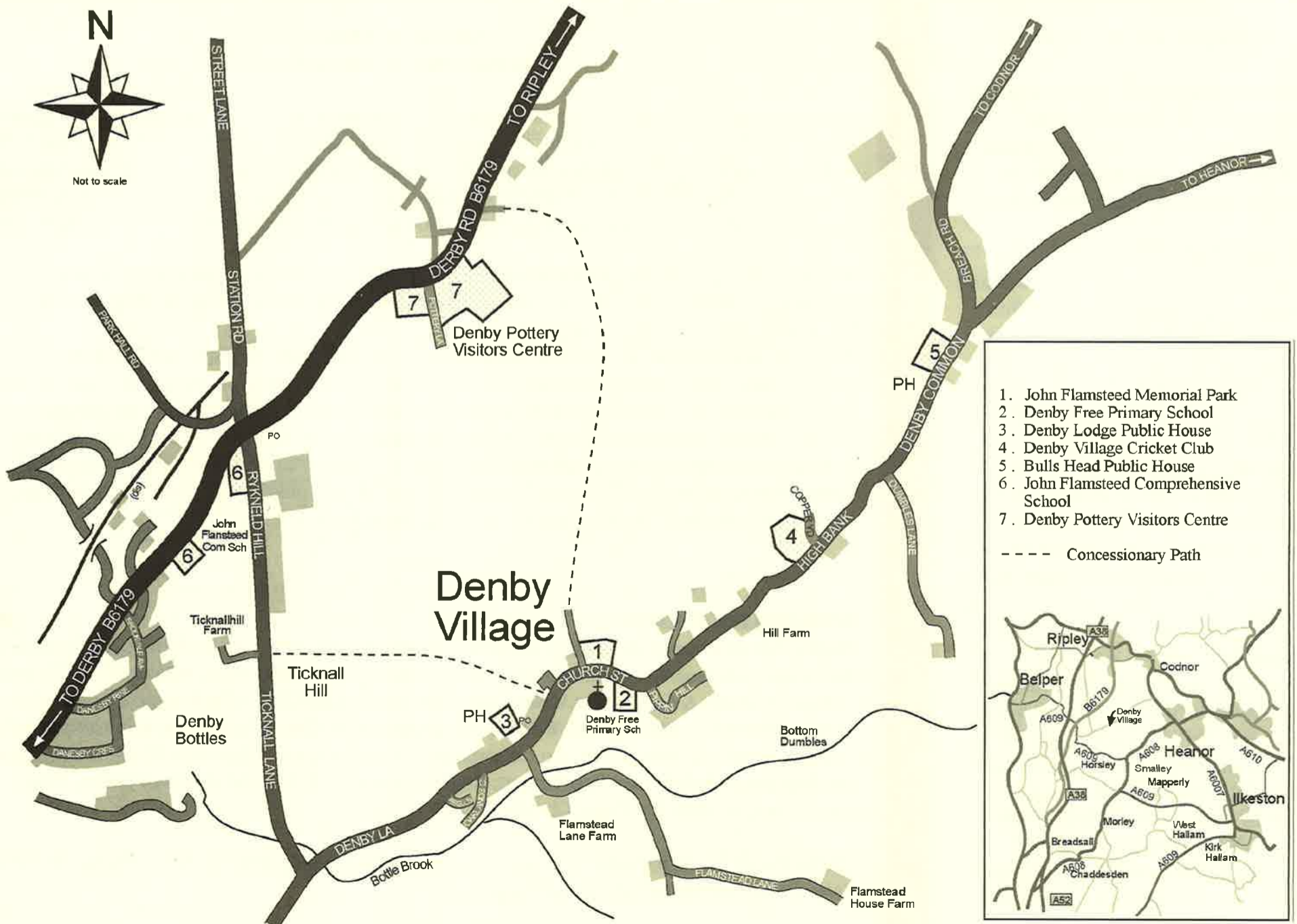
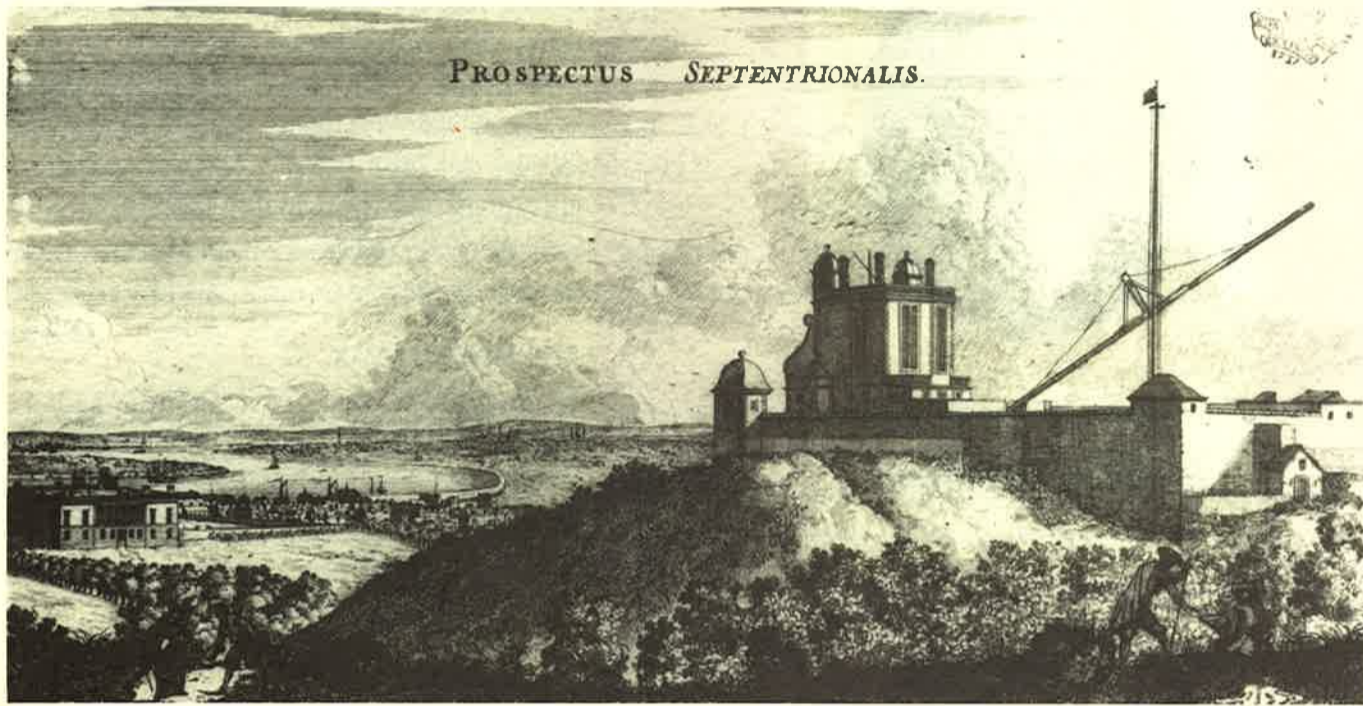
needed to be built on royal land as the cash-strapped king could not afford anything new. Greenwich with its hill and clean air was chosen over Hyde Park or Chelsea College.

Flamsteed wrote that "The King allowed £500 in money with bricks from Tilbury Fort where there was a spare stock; and some wood, iron and lead from a gatehouse demolished in the Tower; and encouraged us further with a promise of affording what more should be requisite." And encouragement was all Flamsteed received as the king didn't pay for anything else. The observatory came in just £20 9s 1d over budget.



The main part of the observatory was designed by Sir Christopher Wren, the architect of St Paul's Cathedral. Building, including his ground floor apartment, was designed, as he conceded, for his "habitation and a little for pompe". The "pompe" is apparent from the Great Star Room (now called the Octagon Room) but most of his observations were done from a small sextant house in the garden.

Flamsteed signed the Royal Warrant to become the king's first "Astronomical Observer" - with its annual salary of £100 - on 4 March 1675. His job description required him to "forthwith apply himself with the most exact care and diligence to the rectifying of the tables of motion of the heavens, and the places of the fixed stars, so as to find the so-much-desired longitude of places for the perfecting of the art of navigation". He was 28 years old - and remained royal astronomer until his death 44



FLAMSTEED'S QUARREL WITH NEWTON AND HALLEY

Such is the renown of scientist and mathematician, Sir Isaac Newton (1642-1727), that he is generally recognised as the "greatest English scientist" and his times as "the age of Newton". In 1665 or 1666 the fall of an apple in his garden inspired the train of thought that led to the law of gravitation. Knighted in 1705, he embodied outward success, but he was also a lonely, withdrawn and unkempt man who commanded respect rather than affection. He was often irritable, spiteful and even paranoid. And he could pick a fight.



Isaac Newton

His relationship with Flamsteed was friendly at first but broke down over his refusal to publish his observations, which Newton

required for the working out of his lunar theory. Flamsteed was fierce in his desire only to publish when his work was, for him, satisfactorily accurate and complete.

The more overbearing Newton became, the more stubborn became Flamsteed's refusal. This antagonism became a great scandal. Recruiting the idle, stupid and heavy-drinking Prince George (Queen Anne's consort) to his cause, Newton forced a reluctant Flamsteed - upon condition that they be not published - to hand over 97 pages of approved data and later another 175 pages of uncorrected proofs.

Looking to further force Flamsteed's hand, Newton persuaded the queen to appoint him as inspector in charge of the Observatory - thus becoming Flamsteed's boss. Newton took Flamsteed to court for refusing to follow an instruction. Flamsteed, in turn, took Newton to court for the return of his books. Newton then vetoed Flamsteed membership of the Royal Society. Flamsteed wrote that "all Newton's words were in a rage and he called me many hard names; 'puppy' was the most innocent name of them."

An exasperated Newton gave Flamsteed's papers to Edmond Halley (1656-1742) who pirated them. He published 400 copies of his *Historia Coelestis* ("The Story of the Heavens") in 1712. Halley, who correctly predicted the return (in 1758, 1835 and 1910) of the comet that now bears his name, succeeded Flamsteed as Astronomer Royal in 1720.

To add salt to Flamsteed wounds, not only did Halley alter the names and numbers of stars, he also wrote a preface suggesting Flamsteed was a lazy and mediocre astronomer while promoting his own standing and ability. Halley - whom the outraged Flamsteed called a "lazy, malicious thief" - became an enemy for life.

Following the death of Queen Anne in 1714, Newton's royal influence waned and Flamsteed successfully sued to have remaining copies of his "corrupted and spoiled" findings returned to him. He burnt 300 copies "as a sacrifice to heavenly truth" on a bonfire in Greenwich Park. He then resumed work on his own "official" star catalogue - *Historia Coelestis Britannica*. Despite his death, the work was finished by two colleagues, Joseph Crosthwait and Abraham Sharp, and published by Flamsteed's wife in 1725.



Edmond Halley

FLAMSTEED THE SCIENTIST

John Flamsteed was a great scientist, not just because of his ideas but by the way he put these into practice. He is classed as the first true analytical scientist and the father of modern scientific methods. His wonderful aptitude for maths influenced his methods. He realised that the more measurements he compiled of an object, and then averaged, the truer the final reading would be. This was not a new idea but he took it further.

Flamsteed also realised the great importance of modern scientific instruments and used them to the full. He was not afraid to try new

ideas, unlike many of his time. Also, his scientific mind and his passion for accuracy meant that he was also quick to dismiss any inferior instruments for better ones.

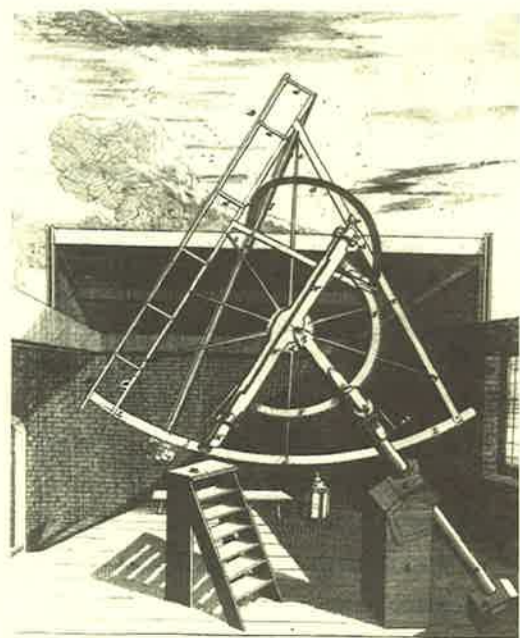
One of his first instruments, put to great use at Greenwich, was the adaptation of a telescope to a sextant - an instrument like a small telescope mounted on a metal arc. Sextant is from the Latin for "sixth" - the arc being one-sixth of a circle. He realised that a telescope at 30 times magnification on the sextant could be 30 times more accurate. Likewise, the telescope and sextant could be 30 times smaller and keep the original accuracy.

He also used what are claimed to be the most accurate pendulum clocks ever made. Designed by Thomas Tompion - "the father of English clock making" - each clock had a 13 foot pendulum. They beat once for every two seconds and could run for a year without winding. The clocks helped Flamsteed establish that the Earth rotated at an even rate. The accuracy of the instrumentation and calculations meant that most of Flamsteed's work was not improved upon until the 1930s.

The memorial to John Flamsteed has been based on his great star map *Historia Coelestis Britannica* and has been manufactured in bronze and brass, the materials of Flamsteed's day. The map rotates daily showing accurately the position of the visible stars in the sky at that precise moment in time.

With the stars giving off a faint red glow at night, each star can be traced from the globe to its relevant position in the sky. All of this is worked by an accurate, computer controlled quartz clock drive, as Flamsteed would have wanted.

Such is his standing, that if John Flamsteed were around today he wouldn't be, as many would perceive him, working with his old brass telescopes, he would be the inventor and director of something as outstanding as the Hubble Space Telescope.



Flam. Sextans Equatorior 7 ped. Rad.

Etching by Francis Place of Flamsteed's 7ft equatorially mounted sextant



A picture of the Hubble Space Telescope

THE EARLY LIFE OF JOHN FLAMSTEED

EARLY YEARS

John Flamsteed was born at 7.16pm on 19 August 1646 in Denby. The two-storey house, the site of which would have been on today's Flamstead Lane, was substantially built with windows, oak beams and in dressed stone. The original house was demolished some time between 1866-80, when it still may have had a family connection.

Flamsteed's father, Stephen, was the third son of William, of Little Hallam Hall, near Ilkeston. He was a malter who also owned a lead mine in the Peak District. Flamsteed's mother, Mary, the daughter of a Derby ironmonger, died when John was barely three. In 1652 his father married Elizabeth Bate, who died two months after the birth of their daughter, Katherine, in 1654. The family were relatively wealthy, having moved to Denby during the Civil War.

John Flamsteed was a sickly child. This illness - chronic arthritis of his knees and ankles, weakness in his legs, and frequent headaches - persisted throughout his life. A modern diagnosis by a local doctor, Frazer Binnie, suggests that it might have been rheumatic fever - a common illness, tending to recur in different joints.

EDUCATION

Flamsteed was educated at Derby Free School in St. Peter's Churchyard, Derby. Today it is a shop premises. His father discouraged studies, he said, because it only aggravated his son's illness. And in 1661, he withdrew the 14 year-old Flamsteed from school. However, Flamsteed later wrote that he suspected his father had different, more personal motives. None the less, he studied at home, teaching himself Latin and reading mathematical books - both of which proved useful in his later career.

He calculated accurately the solar eclipses of 22 June 1666 and 25 October 1668. Flamsteed sent works, including the fixing of the stars by the moon, to the Royal Society, a national academy of science, founded by Charles II in 1660. On being sent to London around Easter 1670, he met and befriended Sir Jonas Moore, His Majesty's Surveyor of Ordnance, whose influence would change his life forever.

FLAMSTEED'S LATER LIFE

5 June 1674	Takes his degree at Cambridge.
2 Feb 1675	Designing to take holy orders in Derbyshire - having been ordained a deacon - Sir Jonas Moore invites Flamsteed to stay with him in London. He accepts.
4 Mar 1675	Appointed by royal warrant "The King's Astronomical Observator", the first Astronomer Royal, with an allowance of £100 a year.
22 June 75	Warrant for the Observatory at Greenwich granted.
10 Aug 1675	Flamsteed lays the foundation stone of the Observatory. The building was covered in by Christmas.
8 Feb 1676	Admitted a Fellow of the Royal Society.
10 July 1676	He moves into the observatory to live there with his two servants, T Smith and C Denton.
1677	Flamsteed begins to measure the distances in the heavens with the sextant.
12 Dec 1680	Flamsteed observes for the first time a great comet which is generally held by others - including Isaac Newton - to be two comets. Despite a long dispute, Newton agrees in 1685 that Flamsteed was right after all.
1684	Elevated to the priesthood, Flamsteed is appointed rector of the small village of Burstow, in Surrey (near today's Gatwick Airport), worth about £158 a year. He remains rector until his death.
8 Mar 1688	Flamsteed's father dies and is buried in St Werburgh's Church, Derby.
10 Aug 1691	Newton suggests in a letter that Flamsteed publish his observations - lighting the fuse that would lead to their infamous quarrel.
23 Oct 1692	Flamsteed marries Margaret, daughter of Rudolph Cooke. They have no children.
31 Dec 1719	Flamsteed dies at 9.38pm of a strangury - a very painful disease of the urinary organs.
12 Jan 1720	Flamsteed is buried at Burstow. The place is unmarked although a later installed brass plate reads, "Flamsteed was buried in the chancel of this Church."

DENBY IN THE TIME OF FLAMSTEED

by pupils of Denby Free School

John Flamsteed had three siblings who all died young. His mother, Mary, died when he was three years old. Children in the mid-17th and early 18th century were lucky to survive to any great age. For example, Jane Massie, the founder of Denby Free School, was one of 14 children, seven of whom died as young children.

This period of history was before the industrial revolution, and Denby was very much a rural community although some families worked in the local mines. Mostly they were farm labourers, often with a second cottage industry of weaving, knitting or stocking-making.

Everyone kept farm animals: maybe a few chickens, sheep, goats or pigs to help them survive. They grazed these on Denby Common to the East of the village. Their rented cottages were built of local stone or wood, and thatched. Water was collected from the well or pump and heated over the open fires. Candles were used to light the houses. There were some cottages clustered near the church, then there were Tavern Cottages and Copper Yard nearer the Common.

EDUCATION IN DENBY

There was no education in the village except through the church. For centuries St Mary's church (access times are displayed on church notice boards) was a chapel of Horsley parish, the poorest in Derbyshire. In 1728 it became a separate parish with the Lowe family becoming patrons. The village school was also established in 1728, nine years after John Flamsteed died. Jane Massie was born when John Flamsteed was 16. She recognised the need for a school in the village, and in her will left money for "erecting and procuring a free school in Denby to teach boys and girls to read and write."

A WORKING LIFE

Domestic life for the ordinary people carried on day in - day out. People worked to survive. Women, girls, children and babies stayed home cooking, weaving, preserving food, brewing, baking and washing. The men and the boys went to work, often in terrible conditions, in the fields or down the mines. Children worked on the farms, picking stones to stop them breaking the plough, potato and crop picking, harvesting, or in the mines opening the trap doors, rummaging for coal. Employers were happy to use children as they were cheap to employ yet they were expected to work a full 12-hour day.