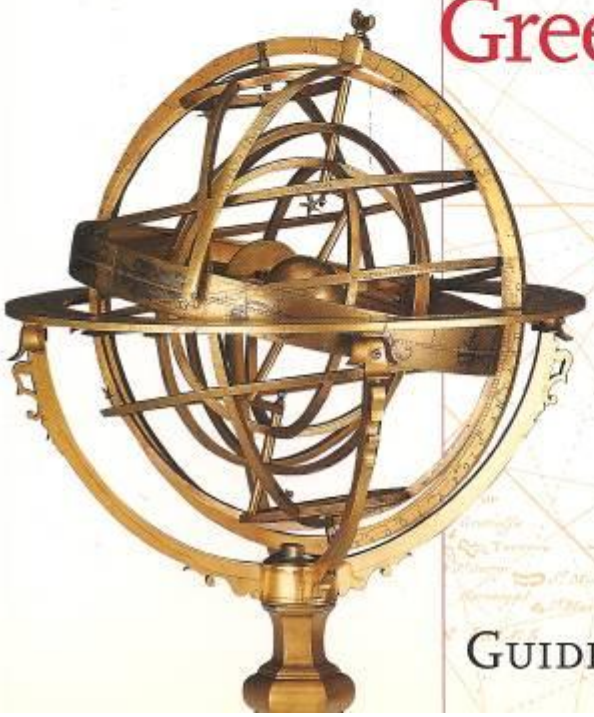
GREENWICH MERIDIAN 2000

The Old Royal Observatory Greenwich



Guide to the Collections

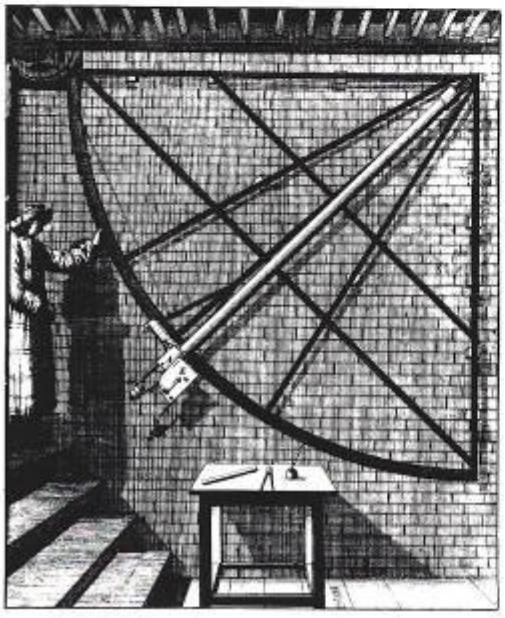
MARKING THE MERIDIAN

The Major Telescopes at the Observatory

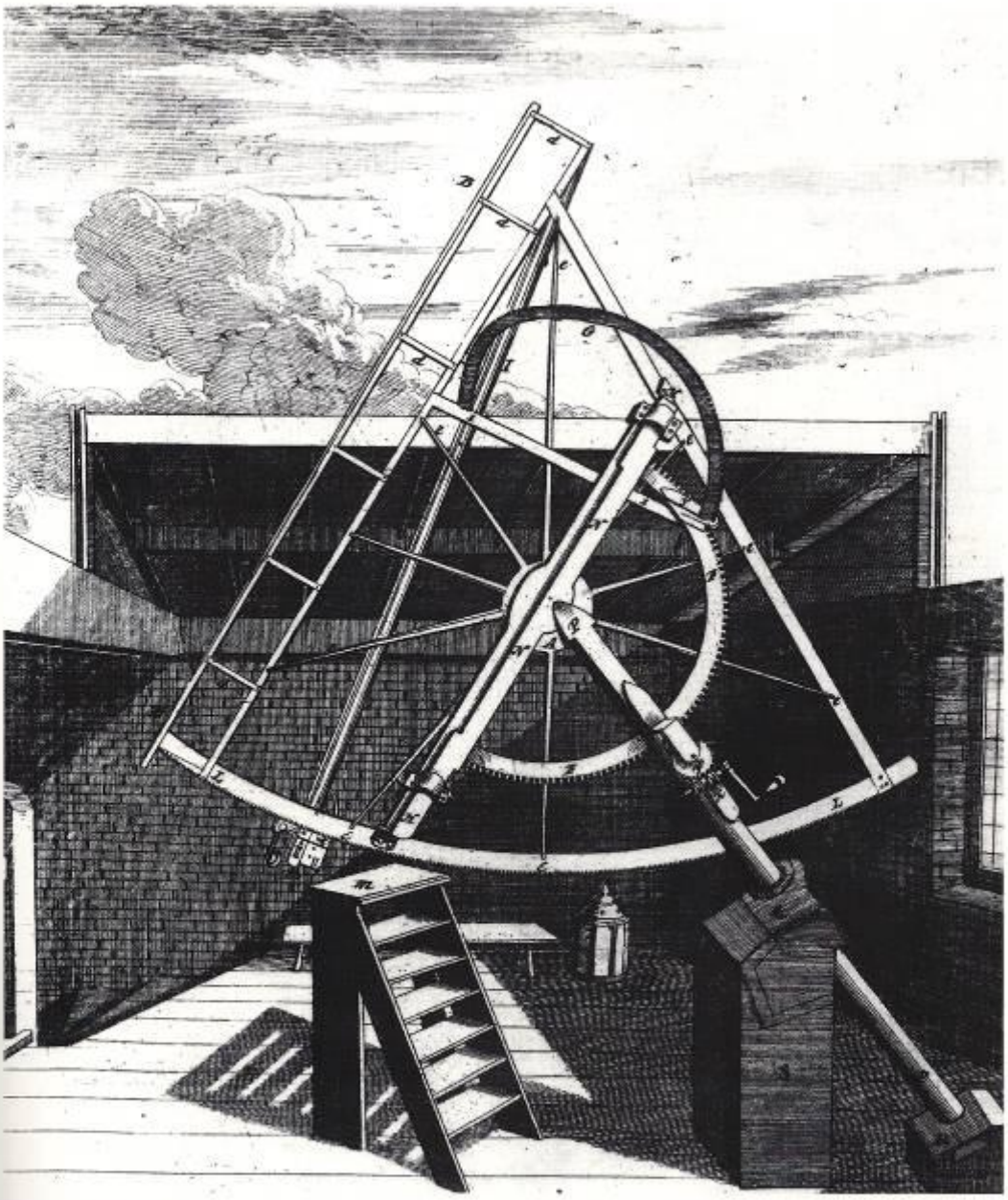
One of the unique aspects of the Observatory collections is the number of telescopes they contain that are important not only to the general history of astronomy but to the history of the Royal Observatory itself. Moreover, several of these telescopes are still on display in or near their original positions in the Meridian Building. The building, in fact, consists of a series of 'rooms' in which astronomical observing took place.

The Royal Observatory differs from many others in the fact that its primary task was positional astronomy – that is, observing and plotting the position of the stars in order to create an accurate and reliable map of the heavens. To do this, the astronomer needs to have one constant reference point from which to measure all of his observations. Given that the Earth rotates,

John Flamsteed's instruments – a sad tale
When John Flamsteed died in 1719, his widow removed all the telescopes and clocks from the Observatory, claiming they had been his personal property. Despite a threatened lawsuit by the Office of Ordnance, Mrs Flamsteed stuck by her claim. The result is that none of Flamsteed's astronomical instruments, shown in this engraving by Francis Place, can be traced after 1721.° *[A5192]*



Flamsteed's 10-foot mural quadrant, 1676
The 10-foot (305 cm) mural quadrant was designed by Robert Hooke, made by Thomson of London and had scales hand-divided by Flamsteed himself. The telescope, completed in May 1676, was soon abandoned as its complicated sighting mechanism proved rather dangerous to use. In a letter of July 1678, Flamsteed complains: 'I tore my hands by it and had like to have deprived Cuthbert [his assistant] of his fingers'. It then disappeared from the records and is known to us only through this engraving made by Francis Place in about 1676.° *[A7121]*



Flamsteed's 7-foot equatorial telescope, 1676
Flamsteed largely designed his 7-foot (213 cm) equatorial telescope himself. The framework was made by Edward Sylvester of the Tower of London and the wheelwork and indices by the well known clockmaker Thomas Tompion. But the instrument's downfall was its usefulness. Between 1676 and 1698, over 20,000 observations caused its gears and indices to become very worn and inaccurate. From an engraving by Francis Place, about 1676.*
[A5072]

Halley's 8-foot iron mural quadrant and wall, 1725
Both Halley's and Bradley's 8-foot (244 cm) mural quadrants are mounted on a wall of nine massive stone blocks set into the bedrock of Greenwich Hill. Halley, who had made a name for himself studying the less well known stars of the southern celestial hemisphere, originally set his quadrant on the east side of the wall, roughly in line with Flamsteed's first Greenwich meridian and facing south. The design of Halley's quadrant provides a simple, strong and accurate instrument. Above the wall, the visitor can see remnants of the two viewing slots that were opened in the roof.
AST0970 (D5598)

Halley's 5-foot transit instrument, 1721
This 5-foot (153 cm) telescope is the earliest at the Observatory that can definitely be associated with its history. Instruments of this sort were a relatively recent invention and Halley's was possibly the first made in England. Lighter and less expensive than a mural quadrant, they had the disadvantage that they could easily become misaligned. Halley's transit instrument, however, proved useful and remained in service, with modifications, until 1750.
AST0979 (A2839)

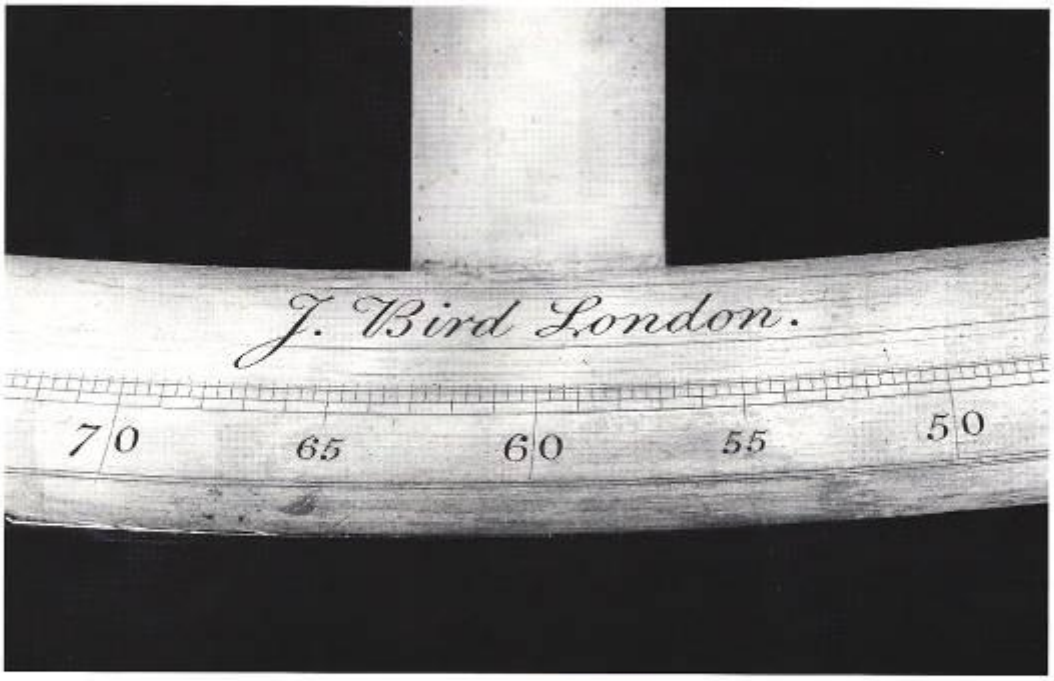
that required at least three people to participate in each observing session. Flamsteed also had a ten-foot mural quadrant, designed by Robert Hooke, but his best known instrument was the seven-foot mural arc which he used to compile his great star catalogue, the *Historia Coelestis Britannica*. Between 1689 and 1719, Flamsteed made some 28,650 recorded observations with this instrument. Flamsteed's well telescope has also disappeared, but its original position is marked in the south garden of the Observatory.

When Edmond Halley became the second Astronomer Royal in 1720, he entered an Observatory devoid of instruments. The Government had promised him £500 to buy new ones, but it was several years before the money materialized. On his arrival, Halley was also shocked to discover that Flamsteed's original observing room – in the corner of the garden behind Flamsteed House – was subsiding down the hillside to the south. When he finally received his money for equipment, nearly all of it had to be spent to build a new and permanent wall for his mural instruments, with only a little remaining for a new eight-foot iron mural quadrant to observe the southern sky. The matching eight-foot brass mural quadrant intended for making observations of the northern sky was not commissioned until 1750, by the third Astronomer Royal, James Bradley. Halley's quadrant remained in active use until August 1812 and Bradley's until August 1813. Both can still be seen in the Meridian Building mounted on Halley's original stone wall.

In 1750, Bradley received a new telescope from John Bird, an eight-foot transit instrument, for which he built a 'New Observatory' on the eastern side of Halley's Quadrant Room. From the moment it was installed, this telescope became the principal meridian telescope of the Observatory and defined Bradley's Meridian, the new Longitude 0°. Bradley's Meridian

Till past 2 of the clock the sun was kept
from being seene by Flying cloudes,
but soone after wee got a glimpse of him ...

JOHN FLAMSTEED TO RICHARD TOWNELEY, OCTOBER 1677



Bradley's 8-foot brass mural quadrant, 1750 (detail)
Bradley's quadrant follows the same design as Halley's, the main difference being the metal used. After twenty years of use, the frame of Halley's iron quadrant had buckled under its own weight and become inaccurate. Bradley made his quadrant from brass, a lighter material, in order to overcome this problem. Bradley's quadrant also has an arc which has been hand-divided and signed by one of the great instrument makers of the day, John Bird, as shown in the picture.
AST0971 [B8286-6]

was used as the Prime Meridian for the first editions of *The Nautical Almanac* (from 1766) and for the land maps produced by the Ordnance Survey from 1791. In 1816, the sixth Astronomer Royal, John Pond, replaced Bradley's eight-foot transit instrument with a ten-foot one designed by Edward Troughton. Both of these are on display in the Meridian Building.

Between 1792 and 1806, Nevil Maskelyne, the fifth Astronomer Royal, made several attempts to acquire a mural circle. Mural circles are wall-mounted telescopes which have a full circle of rotation, allowing astronomers to do a number of tasks, including zenith observations to study the stars directly overhead. It took him more than six years to secure one, but its success prompted

Troughton's 10-foot transit instrument, 1816
In July 1816, Edward Troughton's 10-foot transit instrument replaced Bradley's earlier one, and reconfirmed Bradley's meridian as the Prime Meridian for the Observatory until December 1850. The telescope itself was regularly calibrated by taking sightings off a number of distant markers. In 1824, a granite obelisk was erected at Chingford, Essex, some 11 miles to the north. The Bradley Obelisk, as it is known, still stands.
AST0982 [D7061]

Bradley's 12½-foot zenith sector, 1727
This telescope was constructed by George Graham in 1727 for Bradley's personal use in studying the parallax of the star Gamma Draconis. When he was appointed third Astronomer Royal in 1747, Bradley only agreed to bring this instrument to Greenwich after the Government paid him the princely sum of £45 for it. With it he discovered two major phenomena: the aberration of light and the nutation (wobbling) of the Earth's axis. It was used at Greenwich until 1837.
AST0992 [D7167]

the seventh Astronomer Royal, Sir George Airy, to design his own. Airy intended to use his new circle not only for observing, but as the main transit instrument of the Observatory. It was erected in a newly built room, in a position exactly 19 feet (5.79 metres) to the east of Bradley's meridian. The first observations were made on 4 January 1851 and, with them, the Airy Transit Circle became the new co-ordinate for the Prime Meridian (Longitude 0°) of the Observatory and, by extension, for all the British navigational charts and the tables printed in *The Nautical Almanac*.

The Ordnance Survey objected greatly to having the Prime Meridian moved away from Bradley's original line on which all their work to date had been based.

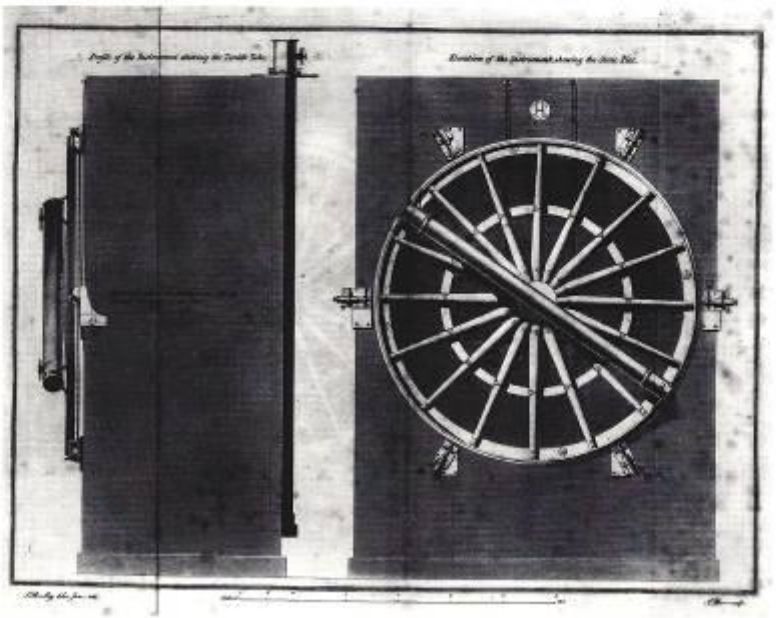
The Airy Transit Circle, 1850
Constructing Airy's huge transit circle was a major undertaking. The engineering was carried out by Ransomes & May of Ipswich and Troughton & Sims constructed both the optical parts (including the 8⅞-inch [206 mm] object lens) and the main body, but the instrument was designed almost wholly by Airy himself. As the transit circle was not wall mounted, repeated use often meant that the telescope fell out of true vertical alignment. To remedy this it was re-aligned (or collimated) weekly. From 1854, a recording apparatus, or chronograph, was introduced to record its observations on a rolling drum of graph paper.
AST0991 [D7064]

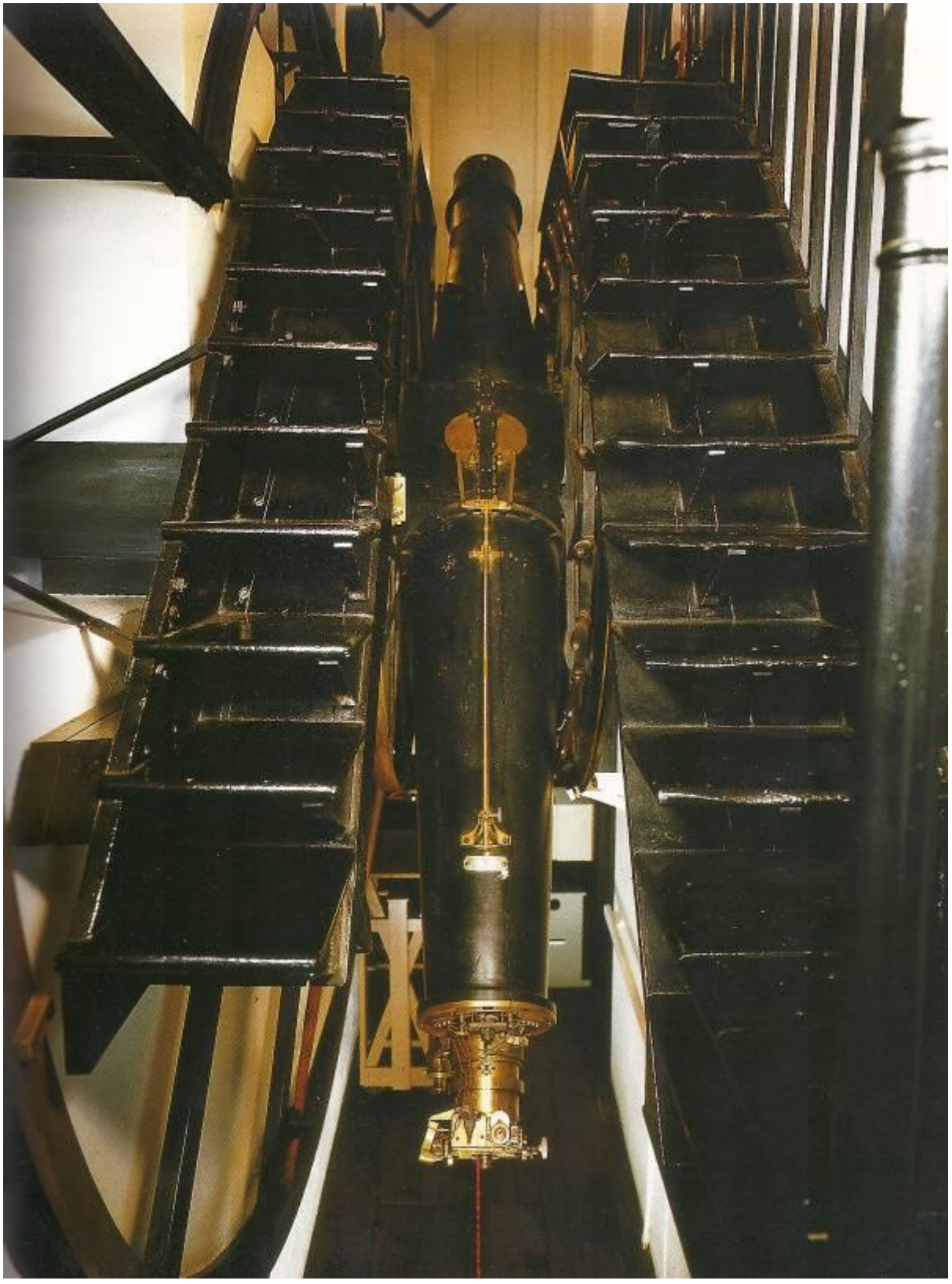
In 1884, therefore, when Airy's meridian was voted as the Prime Meridian of the World at the International Meridian Conference in Washington DC, the Ordnance Survey announced that, from that moment, Britain would have two official meridians: one which was recognized internationally for astronomy and navigation, and one which served as the basis for all of Britain's land maps. This remains largely the situation today.

The largest telescope at the Observatory is the 28-inch visual refractor, also known as the Great Equatorial Telescope from the fact it is mounted on a so called 'equatorial mounting'. This means that the axis of the support points directly towards the northern celestial pole. The telescope was ordered from Sir Howard Grubb of Dublin in 1885, when it was decided that the Merz 12-inch refractor located in the south-east Equatorial Dome was no longer sufficient. In order to fit the new telescope into the existing building, the covering dome had to be modified from a drum-shape to the distinctive 'onion' design that visitors can see today. The new telescope was first used in 1894 and its 28-inch-diameter (71 cm) object glass was so superb that the telescope became an essential tool for observing double stars (pairs of stars whose orbits are so closely linked that they often look like single stars). Today, the 28-inch refractor remains in full working order, though it now has computer-assisted tracking and a camera that can be added to the eyepiece to allow the image it captures to be seen on a television monitor.

Kristen Lippincott, Director, Old Royal Observatory

Troughton's 6-foot mural circle, 1810
Commissioned from Edward Troughton, with the optical parts by Peter and John Dollond, this 6-foot (183 cm) mural circle was first used in 1812. Thanks to its scale of 360°, it dispenses with the need for a plumb line in order to find an accurate 0°. At first, it did not appear sturdy or stable enough to function as a reliable transit instrument but, after new clamping was added in 1822, it was so versatile that all the other telescopes paled by comparison. The upper picture on page 91 shows the circle on the far wall.
AST0973 [B8230]





The 28-inch refracting telescope, 1885–93

Twice in its history, observations with the 28-inch refractor have been disturbed. The first time was during World War I. Then, in 1939, the valuable object glass was sent to a place of safety during World War II. This was just as well, since the Observatory was damaged by bombing and in 1944 the covering of the dome itself was stripped off by a V1 flying bomb. In 1947, the telescope was dismantled and sent to Herstmonceux, leading the departure of the astronomers from Greenwich. It was fully operational there from 1957 to 1970, but was then 'retired' and sent back to Greenwich to mark the Observatory's 300th anniversary in 1975.

AST0932 (D5614)

The Earth, that is sufficient
I do not want the constellations any nearer,
I know they are very well where they are
I know they suffice for those who belong to them.

WALT WHITMAN (1819–1892), *SONG OF THE OPEN ROAD*

The telescopes at Herstmonceux Castle
When the Royal Greenwich Observatory moved to Herstmonceux Castle in the 1950s, a number of the larger telescopes left Greenwich with it. For example, a 13-inch (33 cm) astrographic refractor made by Grubb of Dublin in 1888 (which had been used to generate information for the famous star-map, the international *Carte du Ciel*) was moved to Herstmonceux in 1958 and set within a 22-foot hemispherical dome. Similarly, a 26-inch (66 cm) photographic refractor, made by Grubb in 1896, was mounted in Dome E at Herstmonceux in 1957. The Yapp 36-inch (91.5 cm) reflector, built in 1932, was used at Greenwich for spectroscopy, or the study of the chemical composition of stars. It was moved to Herstmonceux in 1958. *(B640)*

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