




THE PROBLEM OF LONGITUDE

Geographic Coordinates

 [Add Place](#) [Latest Places](#) [Country List](#)
[Address → Lat Long](#) [Lat Long → Address](#)

Latitude Longitude Finder



Place Name

Latitude

Longitude

DMS Lat

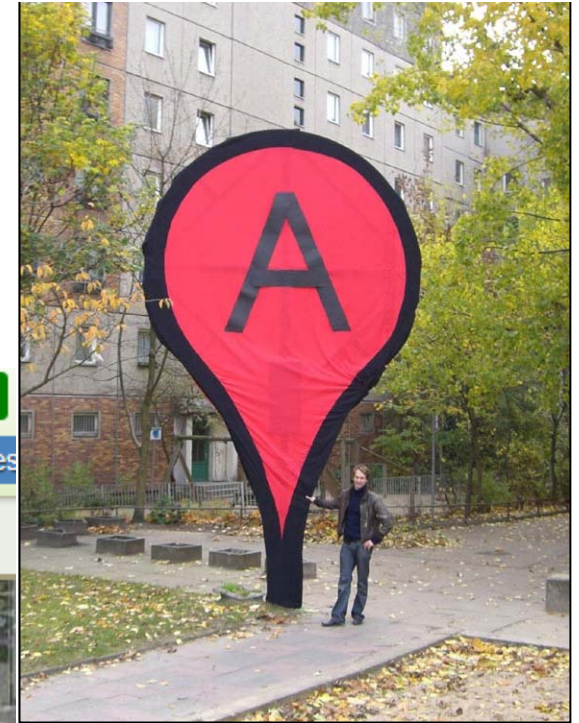
DMS Long

 169  63

Search place name or
Click on map to get lat long coordinates.

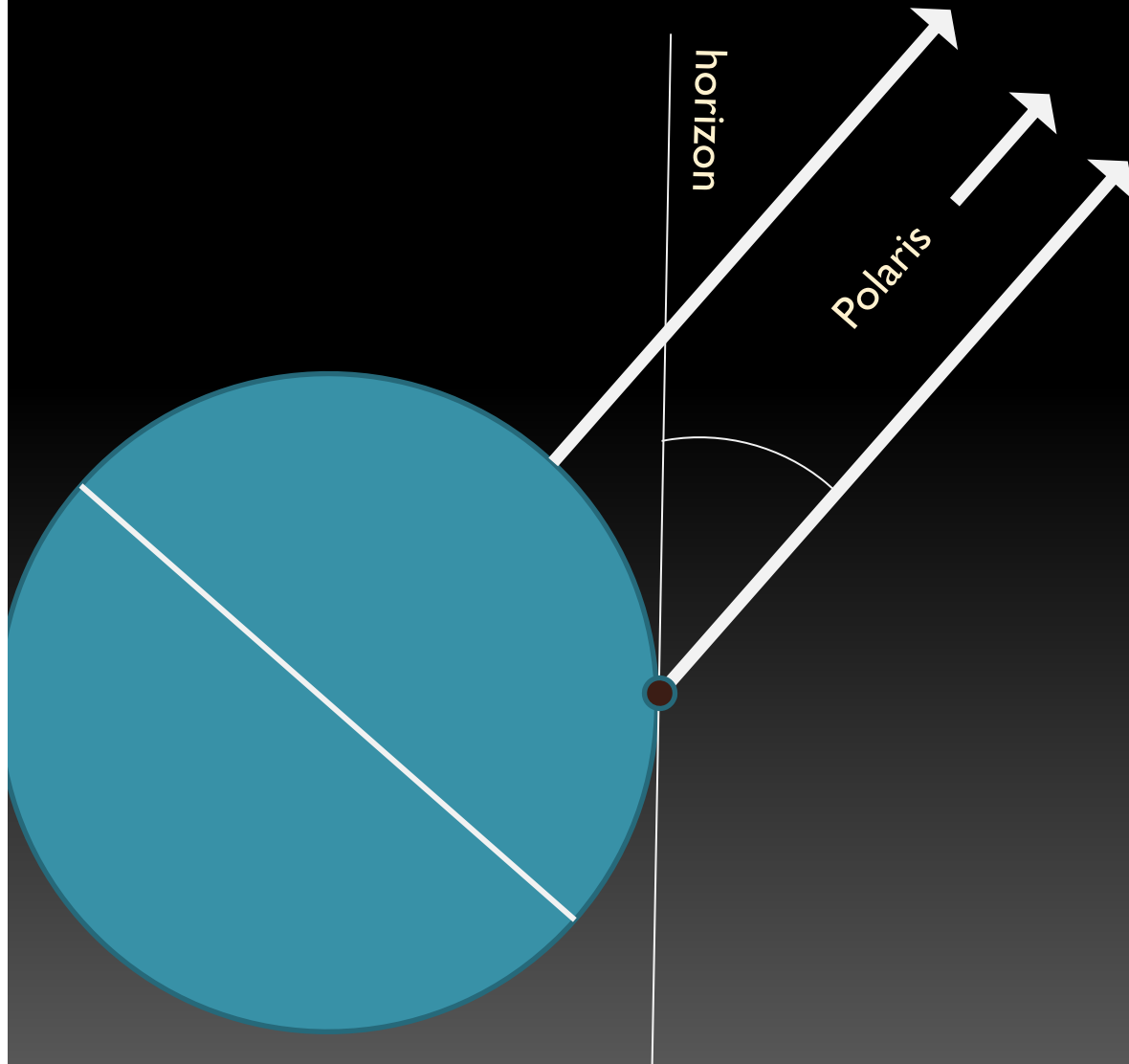
Map Mouse Over Lat & Long

Lat Long Map





Latitude





Longitude

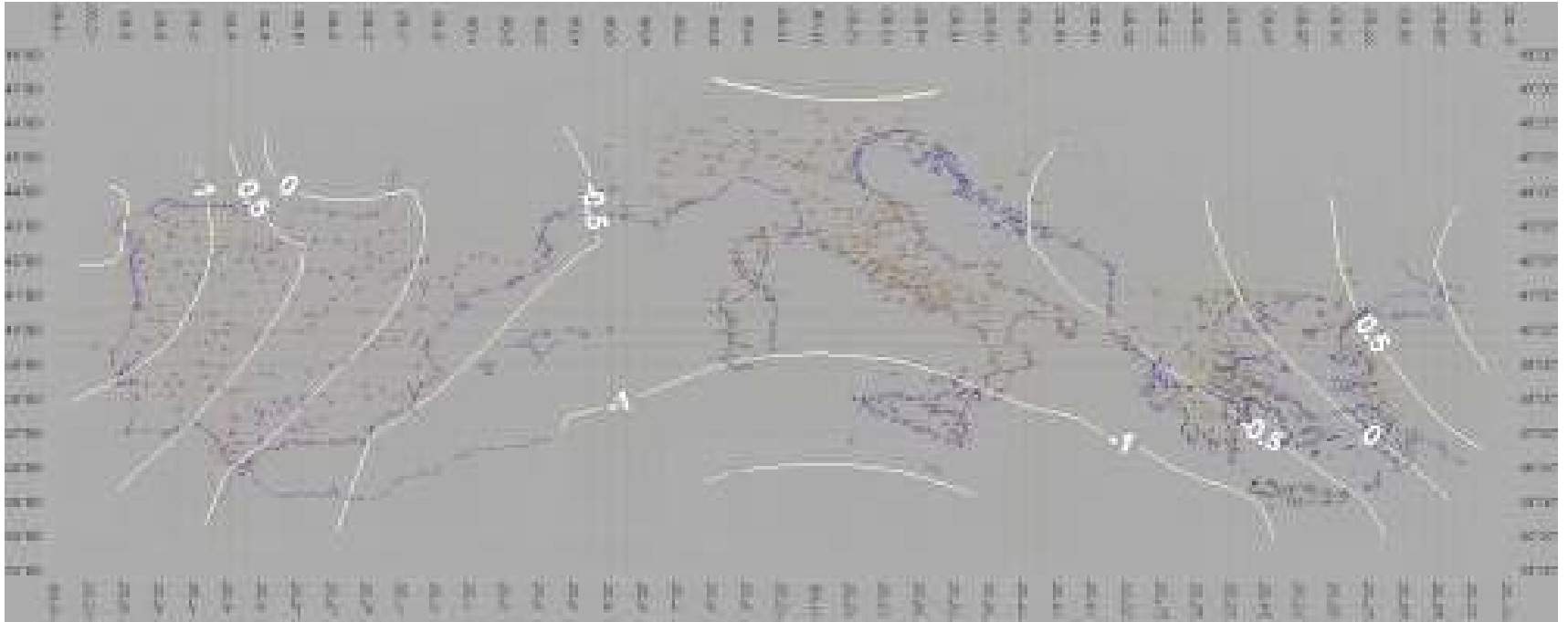


Viking
Navigation
(980-1450)



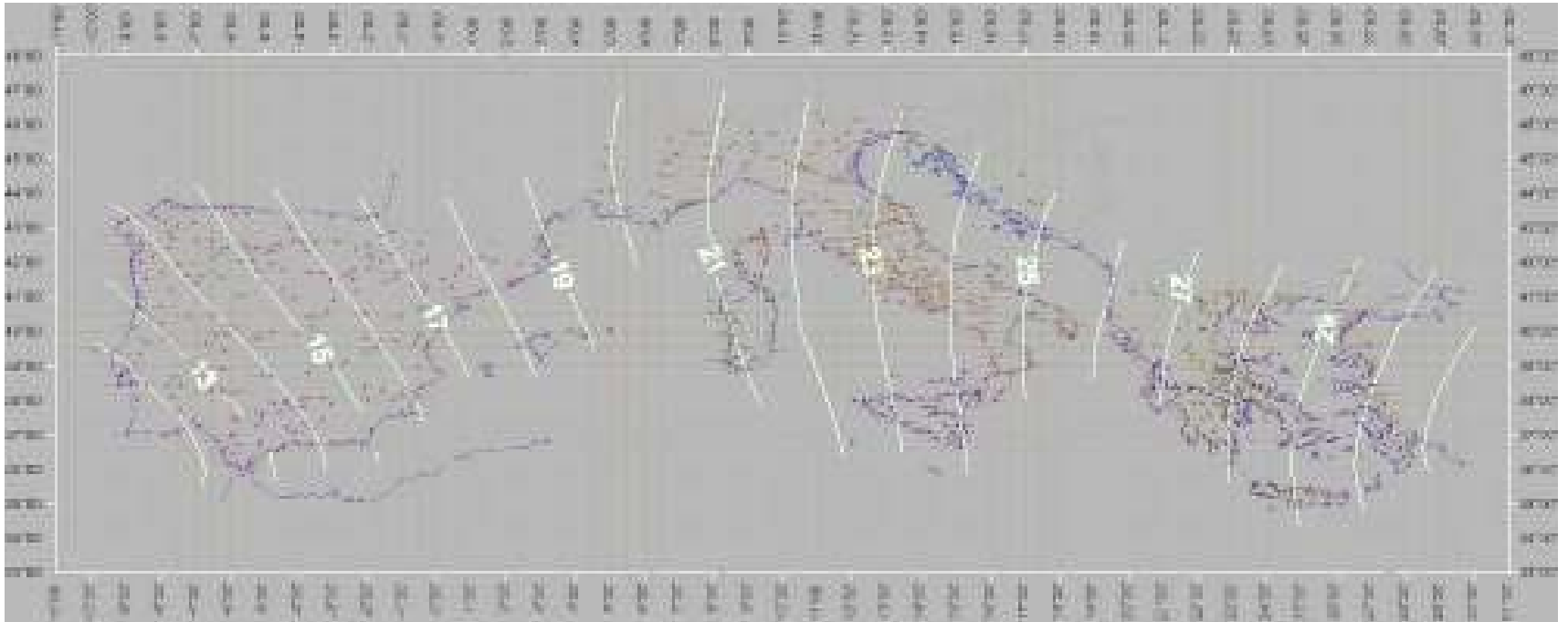
Ptolemy's Ecumene (1483AD/150AD)

Latitude

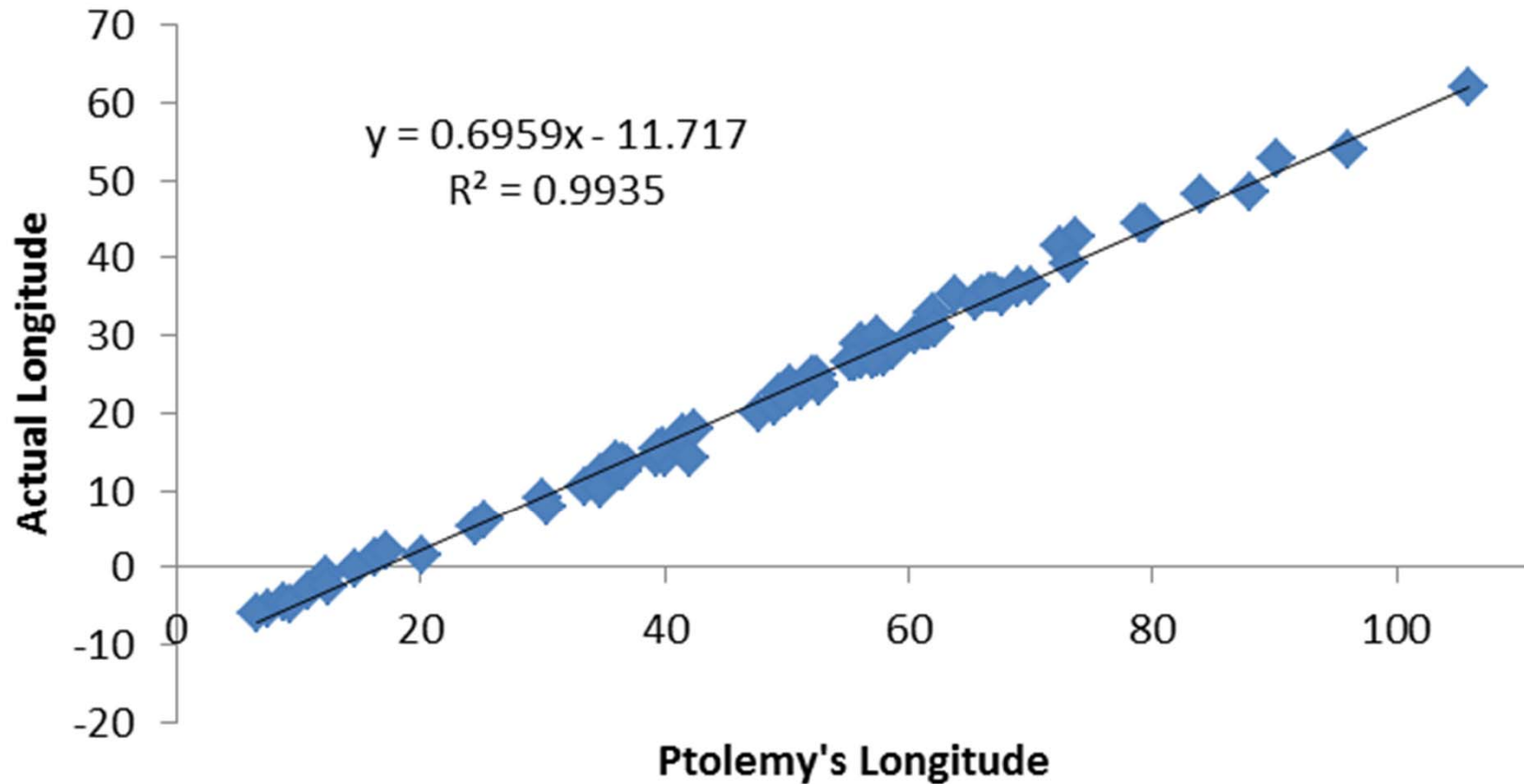


Spatial distribution of [error in] Ptolemy's Geographia (Tsorlini 2009)

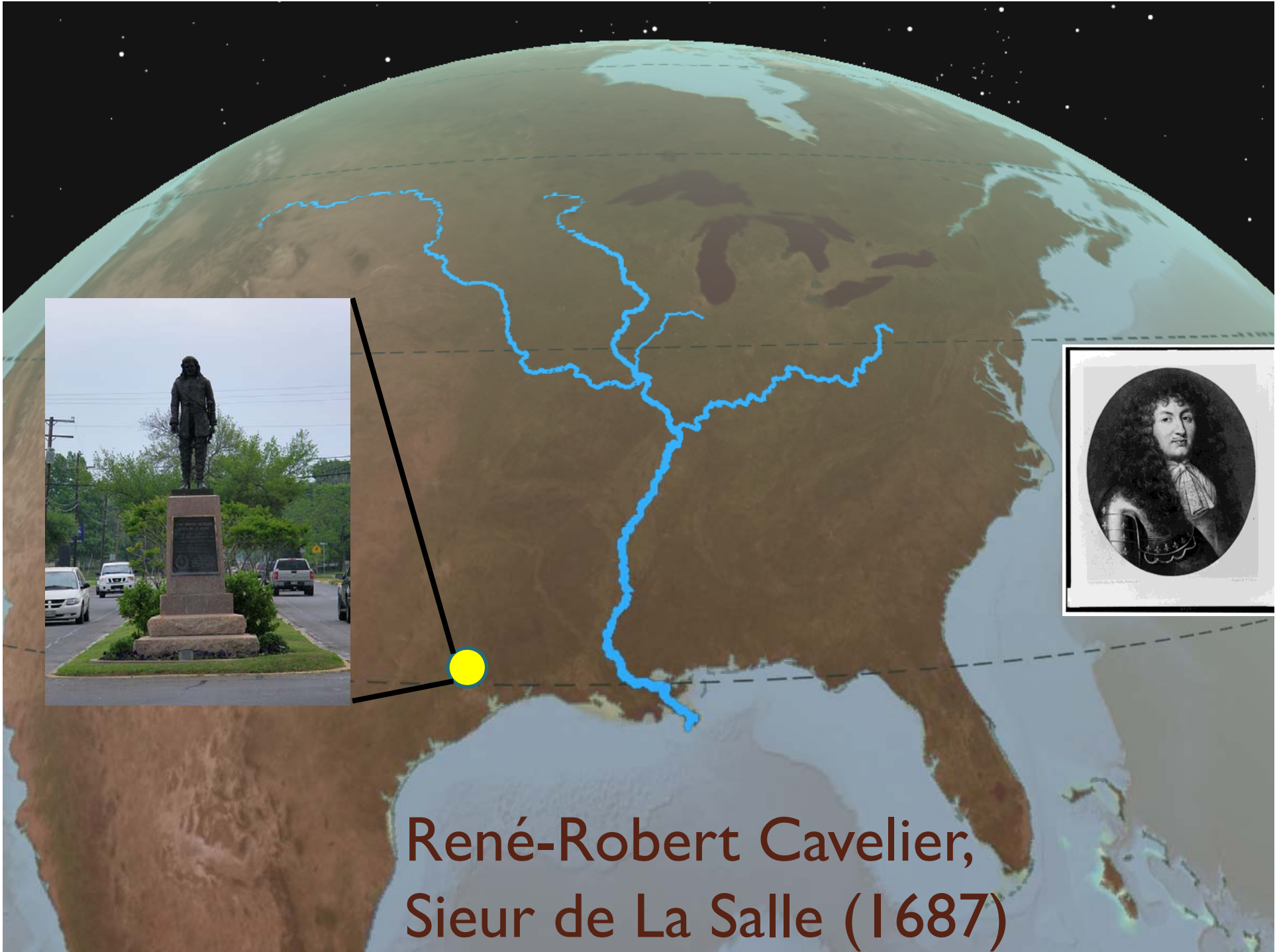
Longitude



Longitude Errors Explained (Russo 2013)



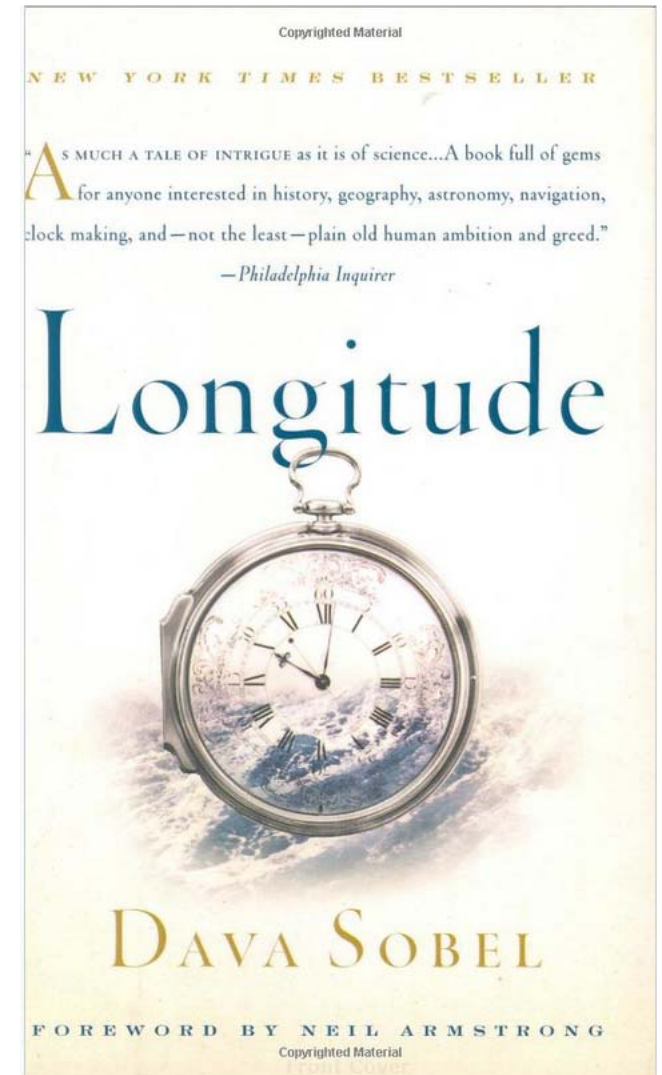
average error: 0.97 degrees



René-Robert Cavelier,
Sieur de La Salle (1687)

The Standard Tale

- John Harrison:
 - humble watchmaker
- Board of Longitude:
 - ivory tower astronomers
- Justice served only through royal appeal

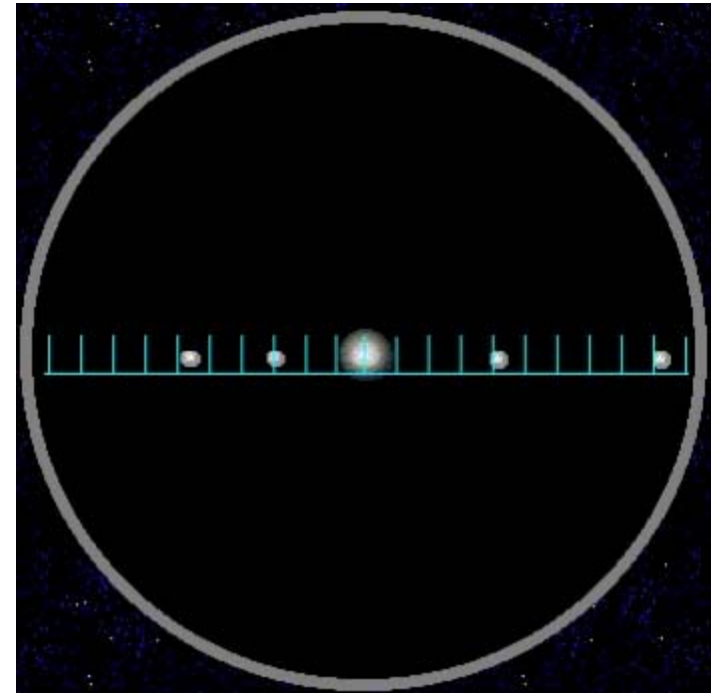




Outline

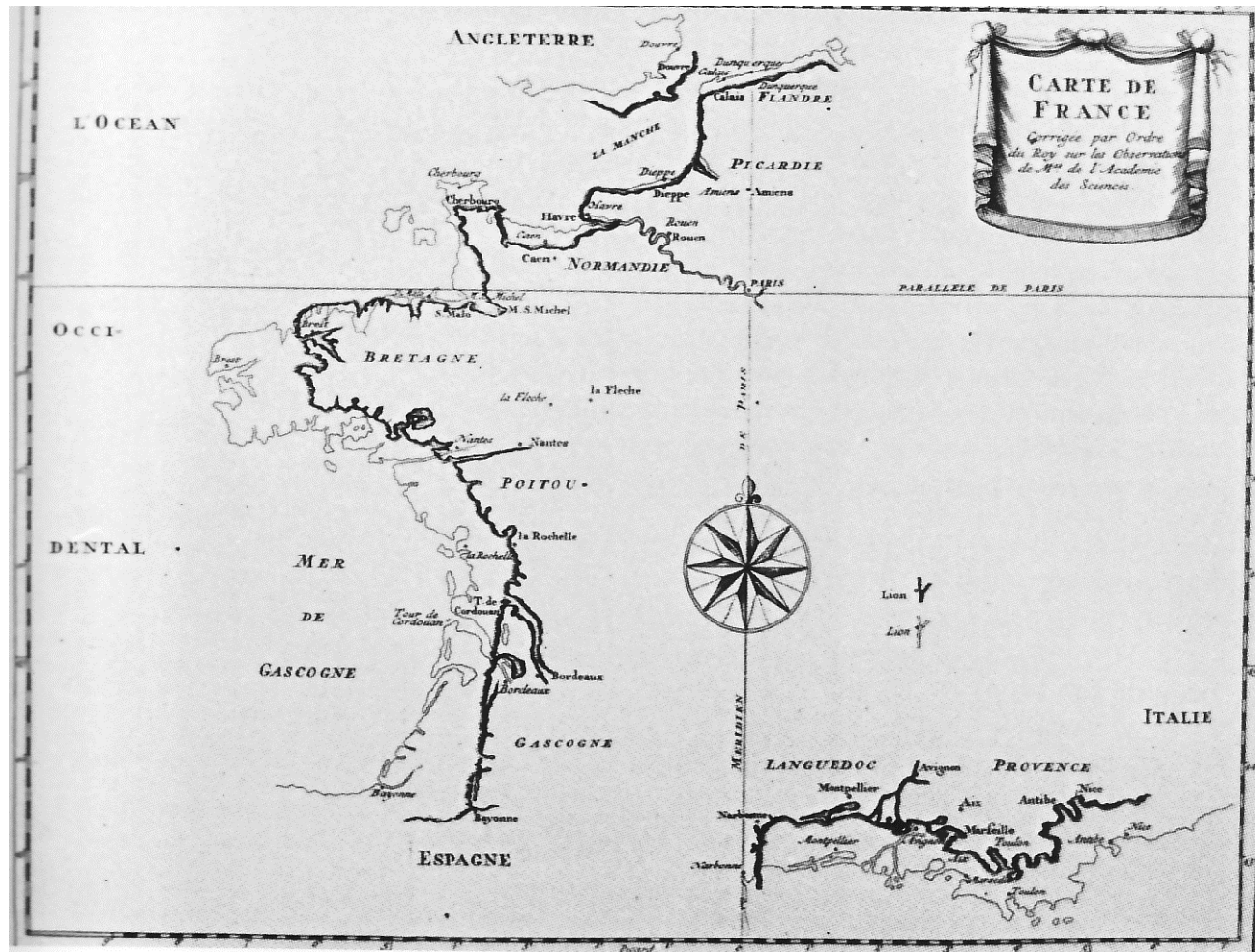
- Astronomical methods
- Harrison's chronometers
- Board of Longitude
- Lessons for the Modern era

Galileo and the Moons of Jupiter



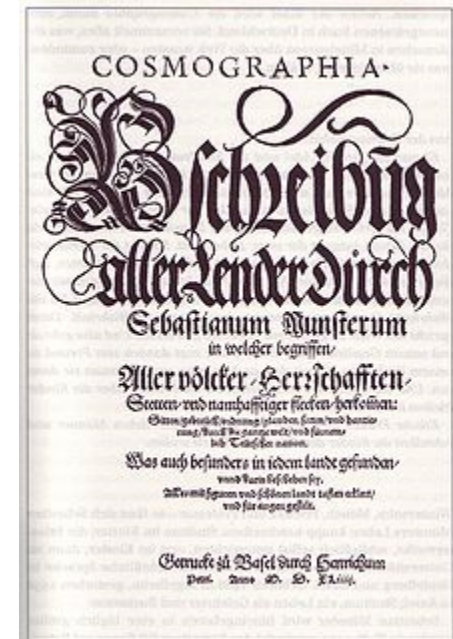
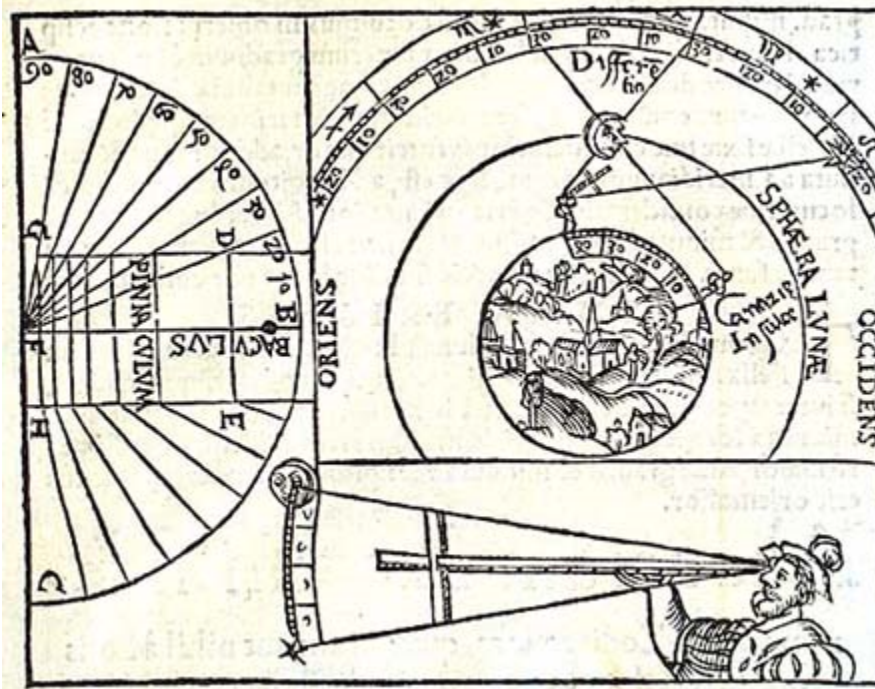
Celstone & Oil Bath





Revised Map of France
Jean Picard & Phillippe de La Hire, 1679

Lunar Distance Method



Lunar distance diagram
Cosmographia (Sebastian Münster, 16th century)

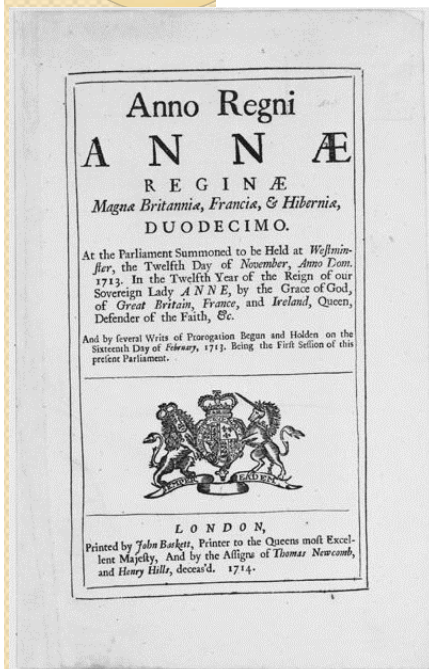
Scilly Islands Naval Disaster (1707)



Longitude Act of 1714

reward of up to £20,000

“to any such Person or Persons as shall Discover a proper Method of Finding the said Longitude... as soon as such method... shall have been Tried and found Practicable and Useful at Sea”



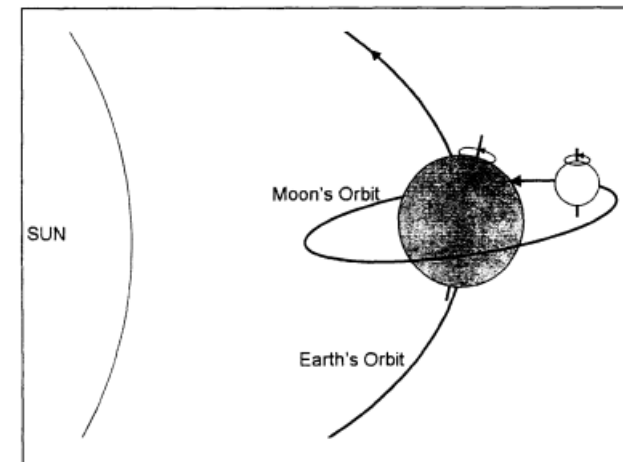
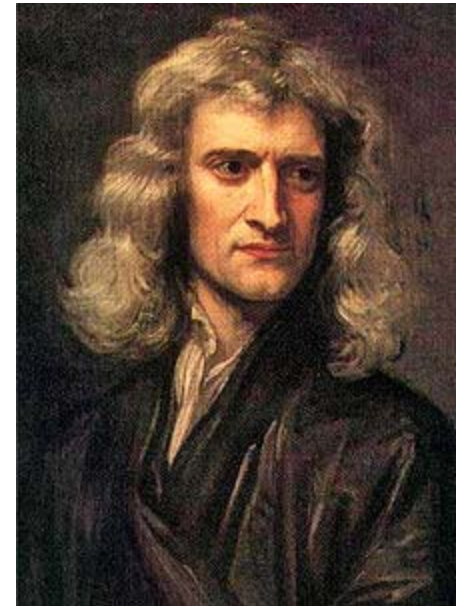
Isaac Newton & the Lunar Method

“Nothing but Astronomy is sufficient for this purpose.”

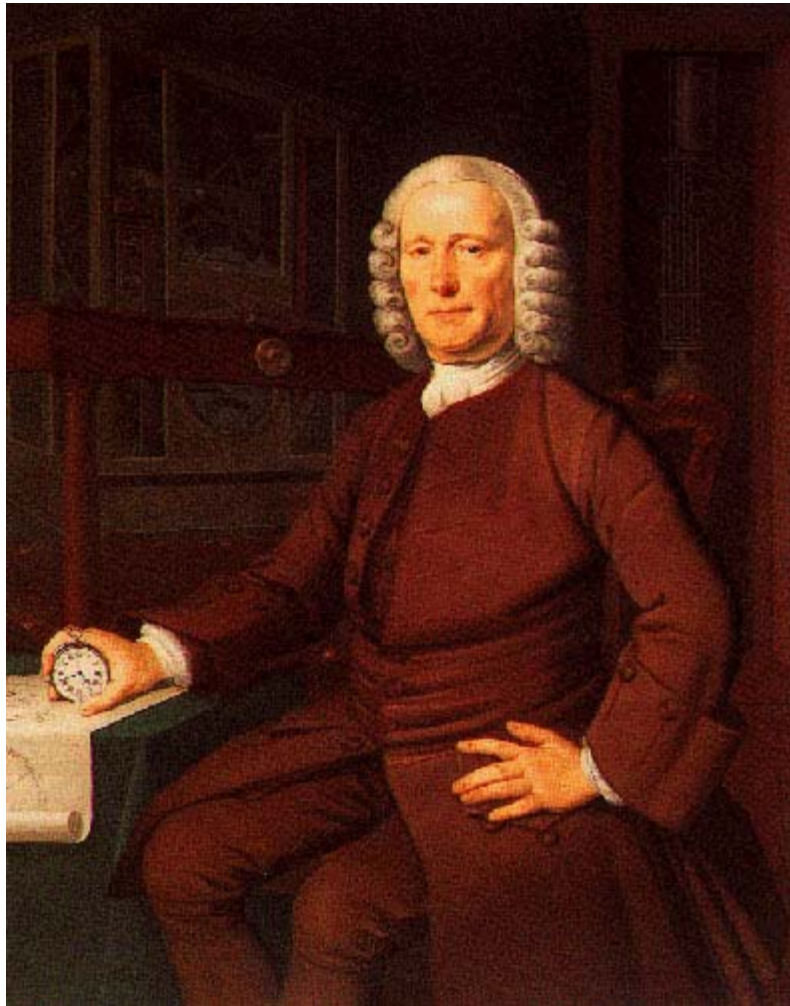
- Isaac Newton

“His head never ached but with his study on the moon”

- John Machin, on Isaac Newton



John Harrison



born 1693



Brocklesby Park Turret Clock (1720)

Lincolnshire'. *Horological Journal*, vol. 96, no. 1146 (March 1954), pp. 156-9, and vol. 96, no. 1147 (April 1954), pp. 234-6. This date was based on a statement by James Harrison (1767-1835), the grandson of John Harrison's brother James, that the clock was built 'about 1727' (letter dated 6 February 1829 to *Mechanics' Magazine*, vol. 11, no. 304 [1829], p. 264). However, I think that this date is untenable and that the clock was probably installed around 1722, soon after the completion of the stable building.

15. *Lignum vitae* (*Guaiacum officinale/G. sanctum*), an extremely dense hardwood about 70 per cent heavier than oak and heavier than water, is found in the Caribbean and South America. The dark heart-wood, easily distinguished from the pale sap-wood, contains natural resins that never dry out, making it an excellent bearing material. It is immensely strong and can be worked well when turned on a lathe. Traditionally, it was these properties that were exploited, from use as the bearing material for the stern gland on the propeller shaft on ships, to sheaves in pulley blocks aboard ships where it was used principally for its strength, to the fine turnings and carvings beloved of the English Victorians.

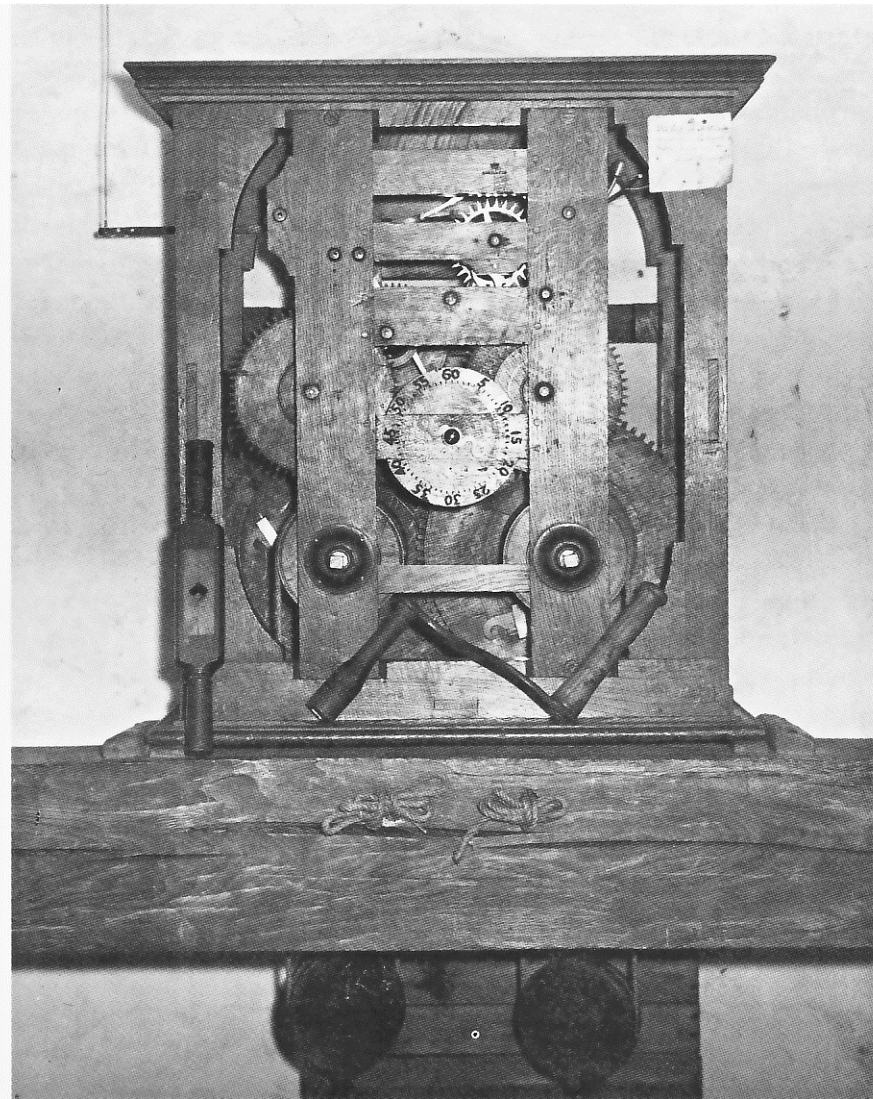
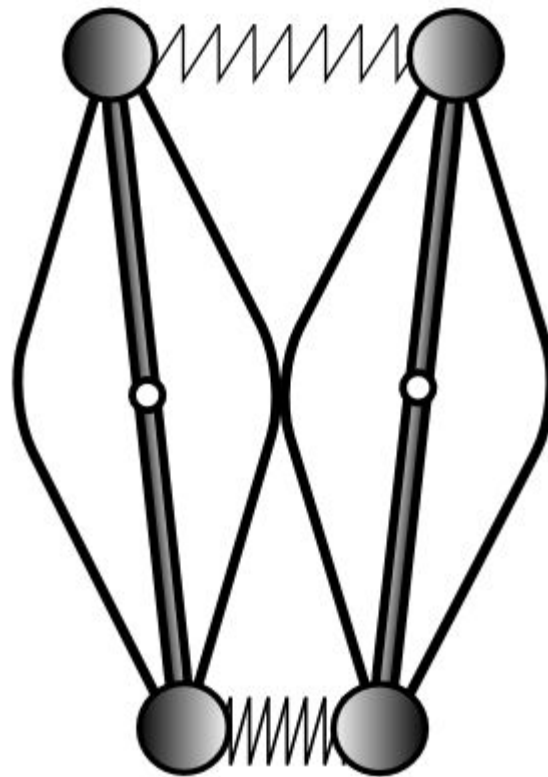
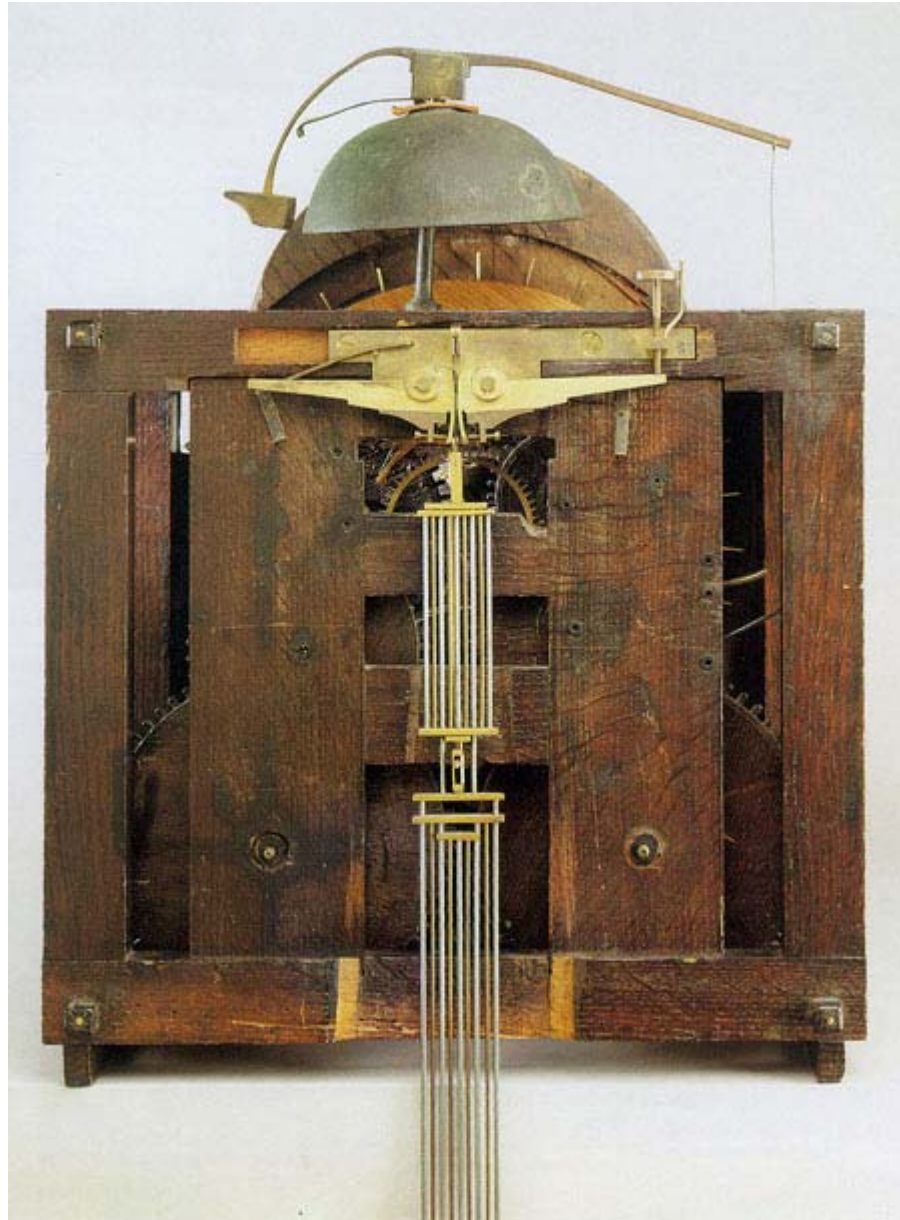


Figure 6. Movement of the turret clock at Brocklesby Park, Lincolnshire, England. Courtesy of the Earl of Yarborough.

Linked Pendulum Balance Mechanism



Gridiron Pendulum



Cycloidal Cheeks

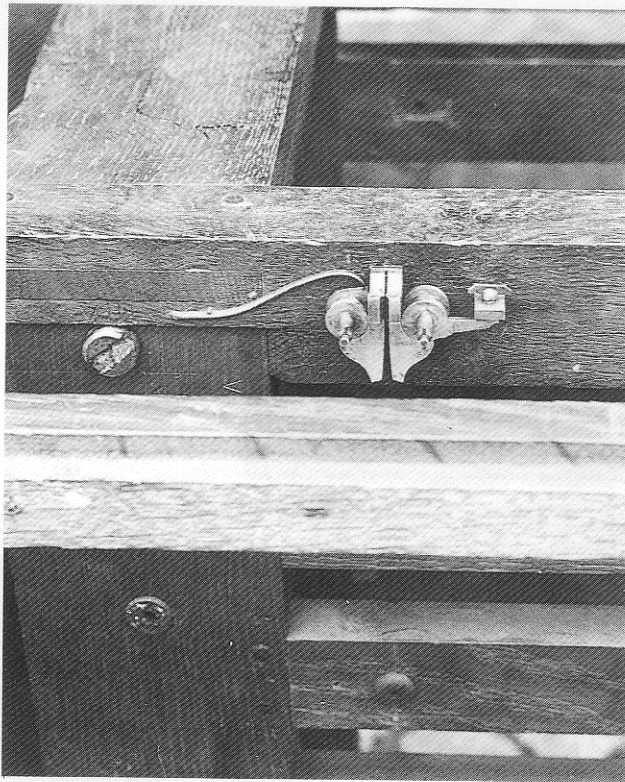
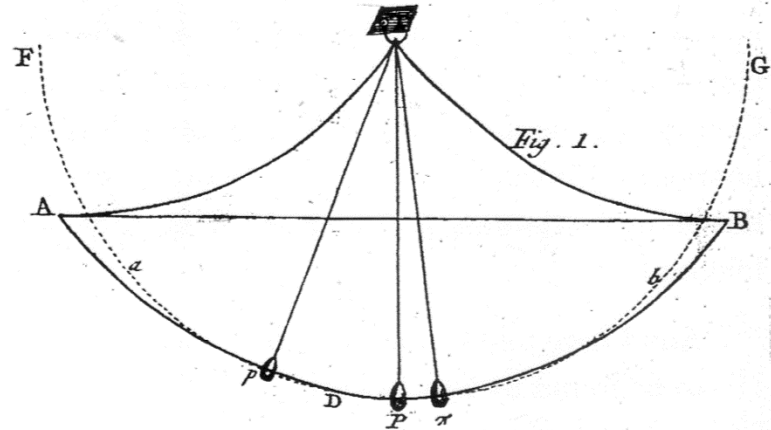


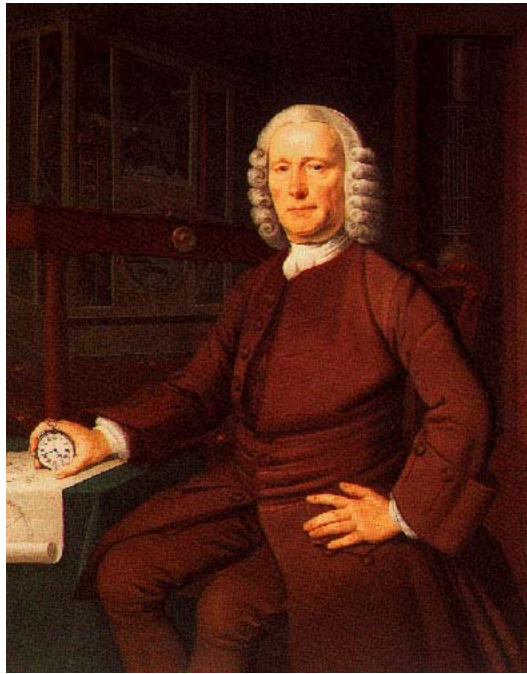
Figure 11. Pendulum suspension cheeks of the Brocklesby Park turret clock. Courtesy of the Earl of Yarborough.



Grasshopper Escapement



To London (1730)



John Harrison

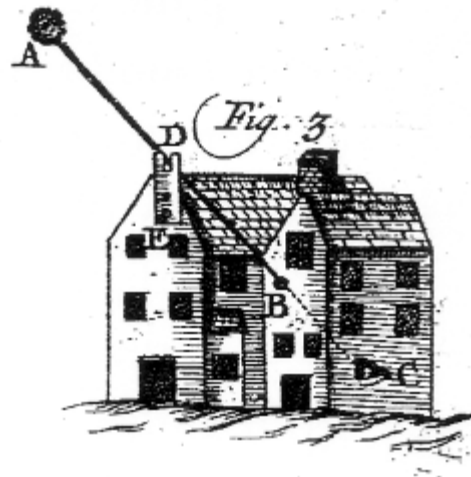


Edmund Halley

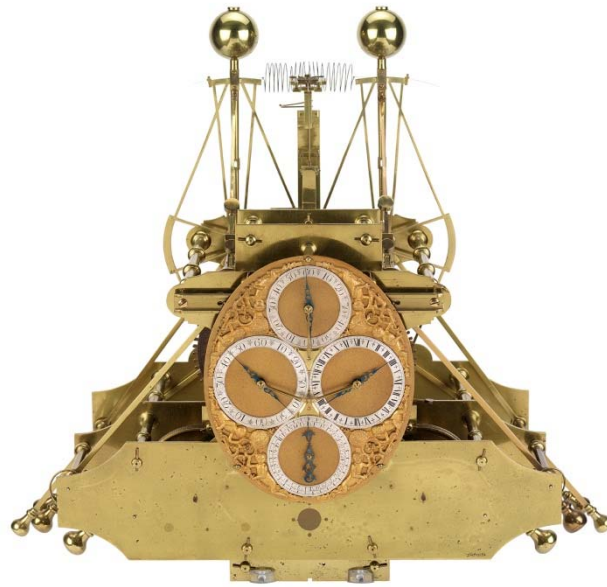


George Graham

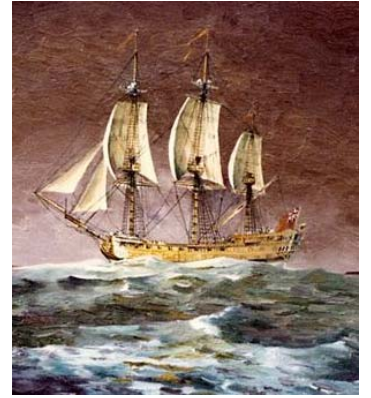
Experimentation



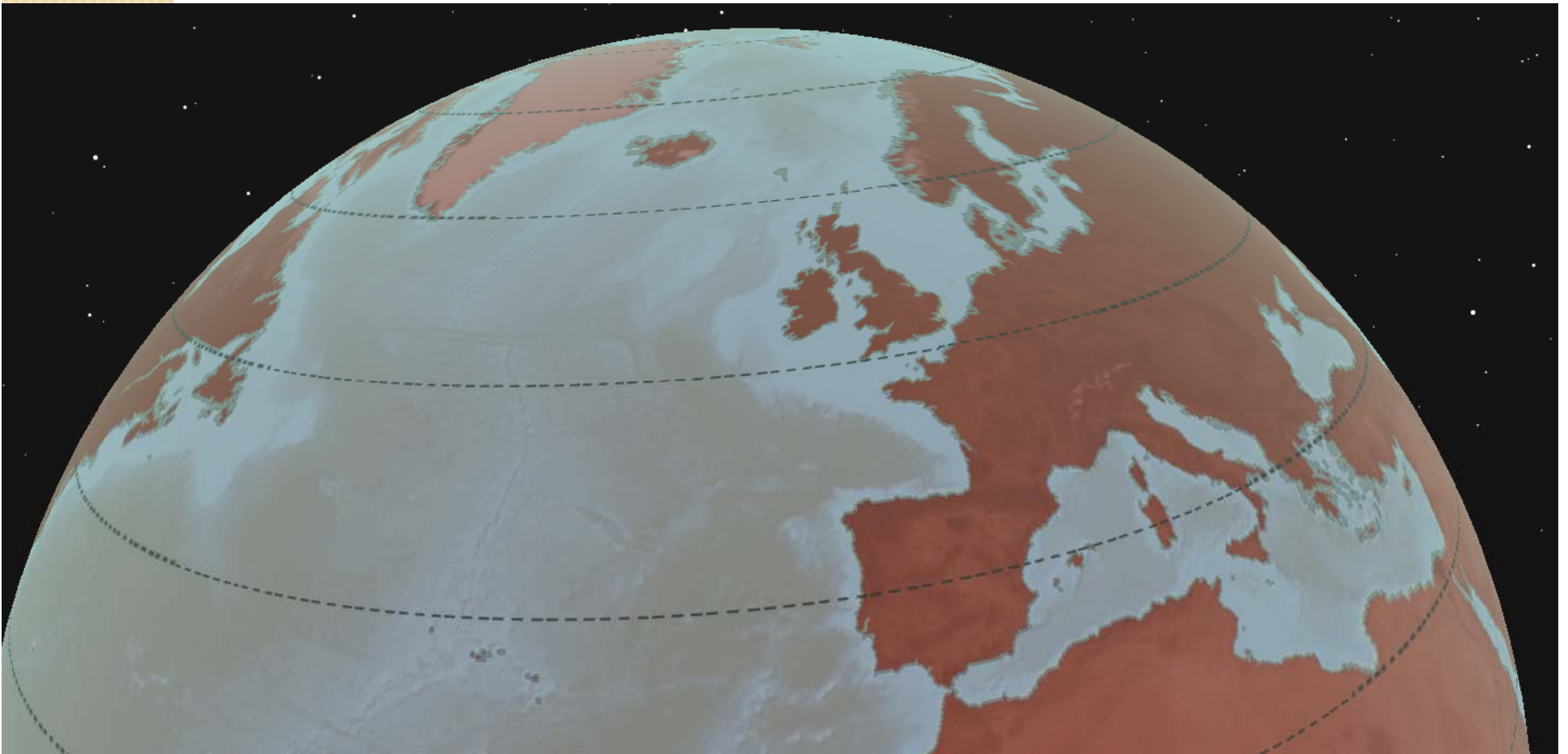
H1 (1735)



First Trial (1736)



H.M.S. Centurion

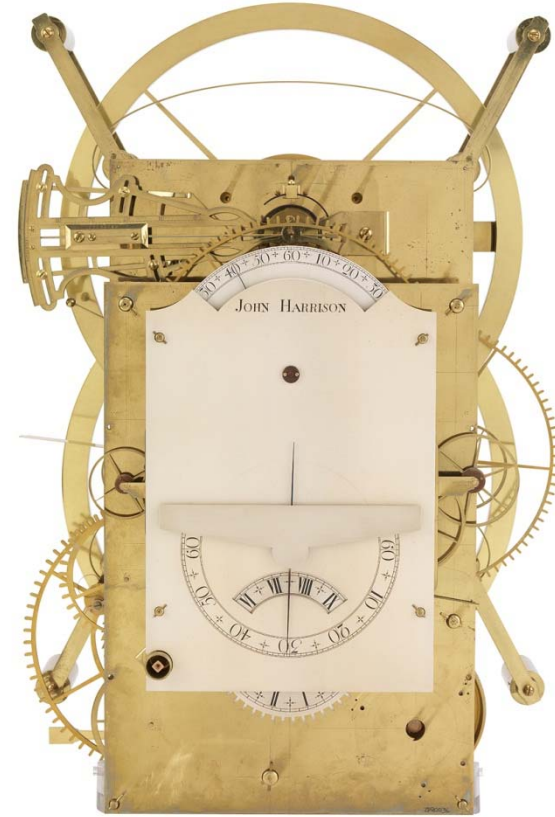


H2

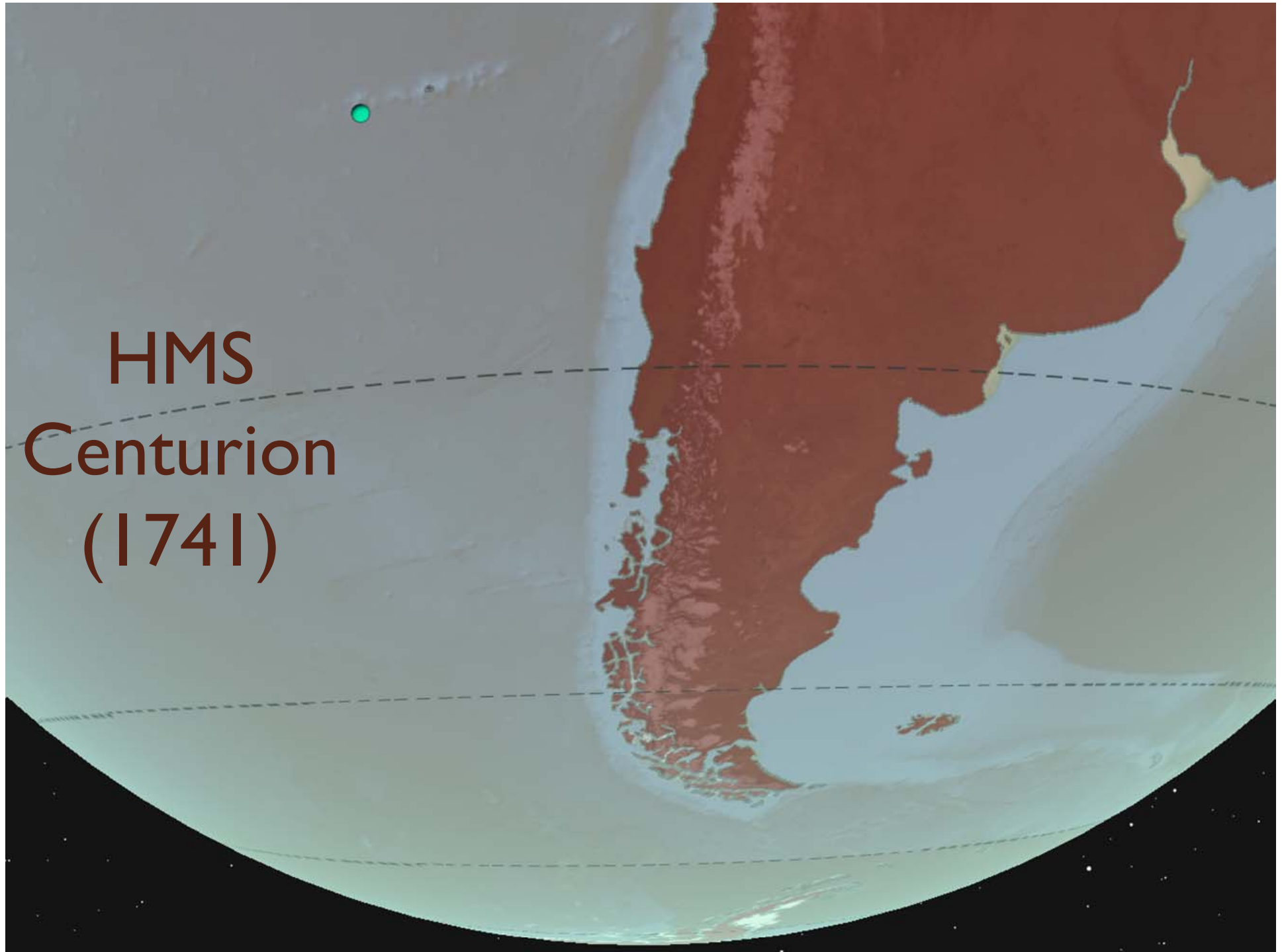


1739

H3



1757



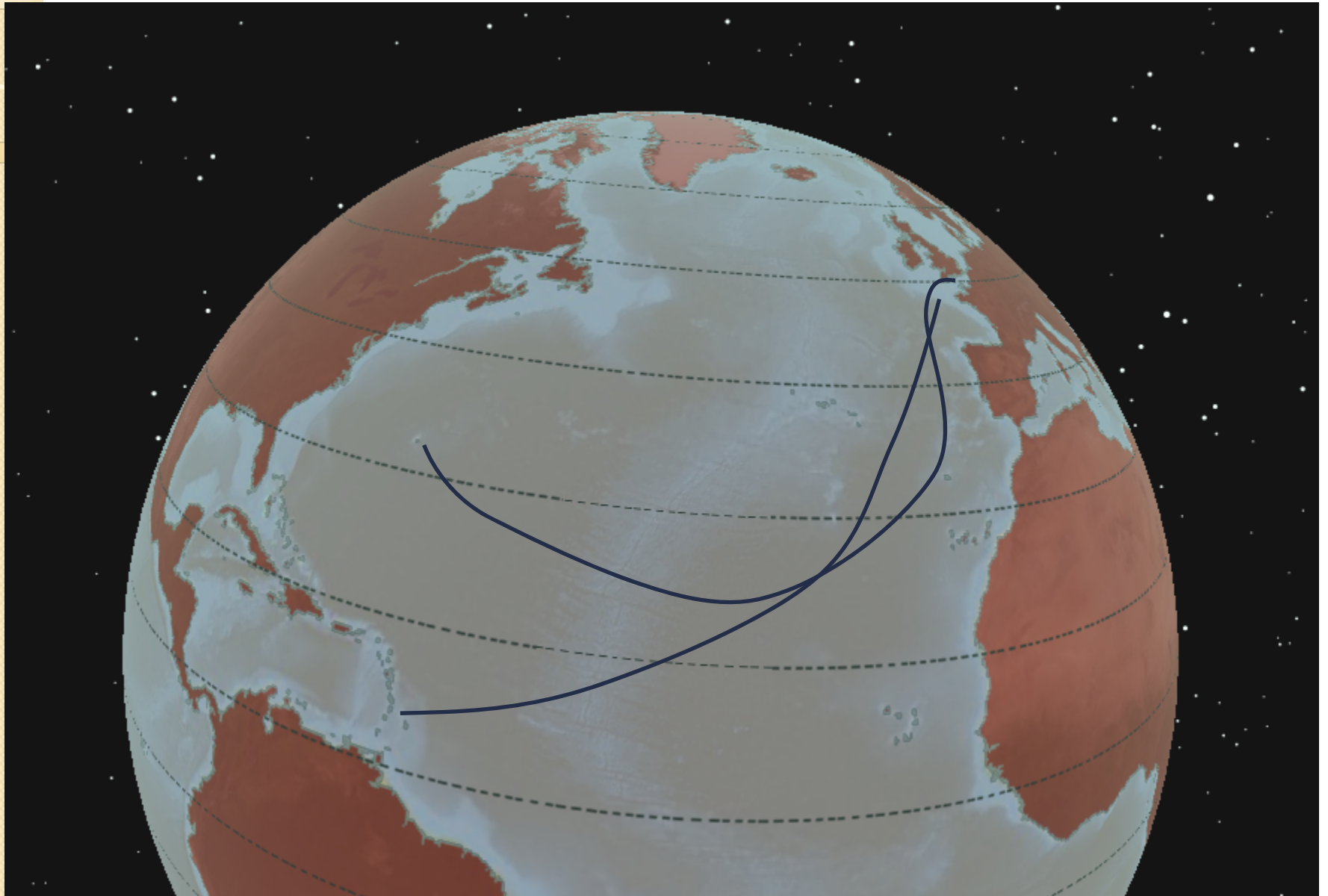
HMS
Centurion
(1741)

H4



1759

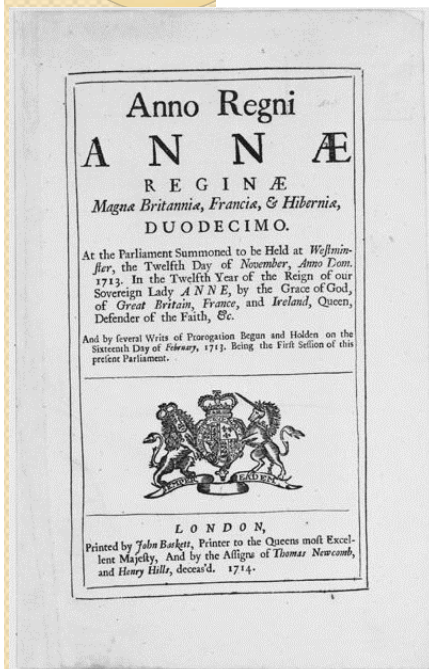
Jamaica, Barbados



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Legacies of the Longitude Story

- Astronomical observatories
- Age of scientific exploration
- British Empire
- Bootstrap experimentation
- Accurate maps (!)



Questions Remain

- Was Harrison unfairly treated by the Board of Longitude?
- How should the government administer prizes for scientific achievements?

Questions?

Figure 31. Lt.-Comdr. Rupert T. Gould with
Harrison's timekeeper in 1920. Gould devoted about fifteen
years of his life to the restoration of
Harrison's timekeepers. Courtesy of the
National Maritime Museum, Greenwich.

