



# Plotting a course

*Mariners know how to navigate from here to there and back again. But we seldom stop to wonder who figured out how to determine position in the middle of an ocean, who developed the concept of latitude or who invented the sextant.*

*To shed light on such mysteries, I constructed the following navigation history timeline.*

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*Photos courtesy of NOAA & Library and Archives Canada*

## 3500 B.C- A.D. 150

**c. 3500 B.C.–  
500 B.C.**

The Mesopotamians divide a circle into 360 degrees, a day into 24 hours, an hour into 60 minutes and a minute into 60 seconds.

**c. 700 B.C.**

Homer, Greek, tells of Odysseus navigating by the Great Bear.

**c. 660 B.C.**

The Greeks build the first navigational aid, a lighthouse at Sigeum.

**c. 240 B.C.**

Eratosthenes, Greek, calculates Earth's circumference with great accuracy.

**c. 150 B.C.**

Hipparchus, Greek, invents the astrolabe, the first instrument for taking sights on heavenly bodies. He also proposes a system of latitude and longitude.

**c. 120 B.C.**

Zhang Heng, Chinese, creates the first geographic grid for maps.

**c. A.D. 150**

In Alexandria, the Greek astronomer and mathematician Ptolemy lists latitudinal and longitudinal coordinates of 8,000 places on Earth. His maps depict Earth as a great landmass with small oceans.

## 12th century

**c. 1100**

In China, the first written account of the magnetic compass used as a navigational aid appears.

**1154**

Al-Idrisi, Arab, writes *Book of Roger*, a survey of all countries then known, and creates a rectangular world map.

## 14th century

**c. 1300**

European portolan charts of the Mediterranean and Black seas show compass directions. The compass card is divided into 32 points of direction.



# through history



## 15th century

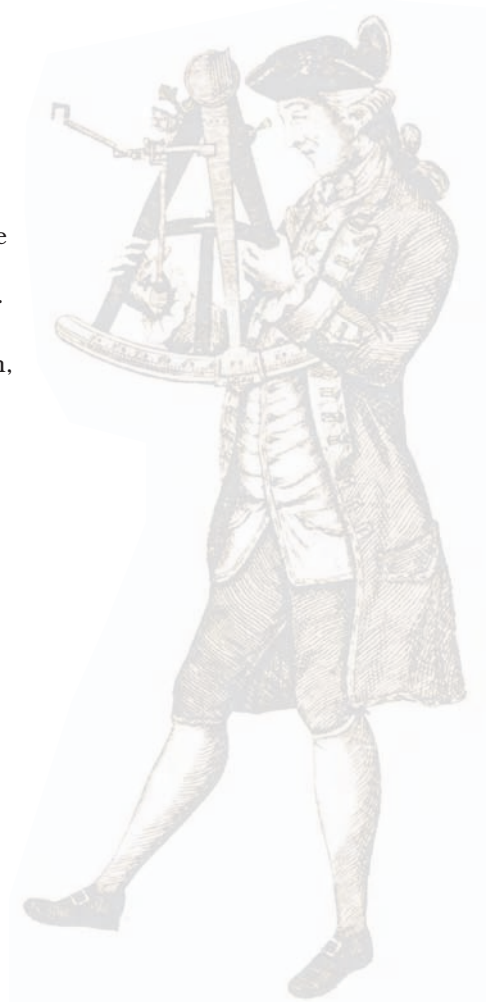
- 1406** A Latin translation of Ptolemy's *Geographia* begins to circulate in Europe.
- 1418** Prince Henry the Navigator of Portugal founds the first navigation academy at Sagres, Portugal, to collect navigational data and produce charts.
- 1436** Johannes Gutenberg, German, begins building the first European printing press that uses movable type, making printed maps available.
- 1464** Johann Muller, German, writes the first major exposition of trigonometry, enabling navigators to calculate the relationship of celestial bodies and the location of ships.
- c. 1470** The age of European exploration begins.
- c. 1480** The Portuguese compile latitude tables for the first navigation manual, which also tells how to determine latitude by sighting the noon sun.
- 1492** Martin Behaim, German, creates the oldest surviving terrestrial globe. Christopher Columbus, an Italian explorer sailing for Spain, discovers Earth's landmass is much smaller and its oceans are much larger than Ptolemy reckoned.

## 16th century

- 1507** Martin Waldseemüller, German, writes "America" on a map of the continent; the name sticks. The map, now in the Library of Congress, identifies the Pacific Ocean as a distinct body of water.
- 1522** Ferdinand Magellan's crew completes the first circumnavigation of the globe. The log, accurately kept by Antonio Pigafetta, Italian, is one day short of local time, proving Earth is round.
- 1569** Gerhardus Mercator, Flemish, produces a map of the globe that depicts parallels that are more widely spaced at higher latitudes. Navigators can now draw straight lines that cross all meridians at the same angle. These rhumb lines represent a ship's constant compass direction.
- 1570** Abraham Ortelius, Flemish, produces the first modern atlas.

## 17th century

- c. 1600** Magnetic variations begin to appear on maps and tables.
- 1614** John Napier, Scottish, publishes the first table of logarithms, facilitating onboard calculation of trigonometric position.
- 1656** Christiaan Huygens, Dutch, invents the pendulum clock.
- 1686** Edmond Halley, English, produces the first weather map, which shows the direction of trade winds.





## 18th century

- 1700** Halley produces the first map showing variation of Earth's magnetic field.
- 1731** John Hadley, English, and Thomas Godfrey, American, working independently, invent the reflecting octant, a precise instrument for measuring the altitude of celestial bodies.
- 1735** John Harrison, English, builds the first accurate marine chronometer, enabling more precise determination of a ship's longitude.
- 1757** Under the direction of fellow Englishman John Campbell, John Bird elongates the arc of the octant to 60 degrees, the sextant of a circle.
- 1766** The first edition of English astronomer Nevil Maskelyne's annual *Nautical Almanac* appears. It contains tables of celestial positions for 1767 to help sailors determine location.

## 19th century

- 1802** Nathaniel Bowditch, American, publishes *The New American Practical Navigator*, which explains the principles and methods of sea navigation.
- 1803** Matthew Flinders, English, writes a paper explaining how to compensate for compass deviation caused by shipboard iron.
- 1837** Thomas Sumner, American, develops celestial line of position navigation to verify the accuracy of an assumed geographic fix.
- 1842** U.S. Navy Lt. Matthew F. Maury charts the direction of winds and ocean currents.
- 1884** Greenwich, England, is designated as the prime meridian by an international conference in Washington, D.C. The 24 time zones also are codified.
- 1897** Guglielmo Marconi, Italian, sends the first ship-to-shore radio signal.

## 20th century

- 1903** Herman Anschütz-Kaempfe, German, patents the gyrocompass.
- 1910** J.A.D. McCurdy, Canadian, sends the first air-to-ground telegraph message.
- 1919** Robert Watson-Watt, Scottish, patents a precursor to radar, a device using shortwaves to locate aircraft.
- 1933** P.V.H. Weems, American, compiles the first *Air Almanac*, used by aviators to navigate using celestial bodies.
- 1942** The United States begins building the first Long Range Navigation (LORAN) station.
- 1945** The U.S. National Bureau of Standards begins transmitting a standard time announcement in telegraphic code on radio station WWV, making precise determination of longitude possible.
- 1953** Charles S. Draper, American, develops the first fully inertial navigation system, which does not rely on outside signals.
- c. 1960** Seymour Cray, American, develops the first transistorized computer, enabling faster onboard calculations.
- 1964** Transit, launched by the U.S. Navy, begins offering continuous navigation satellite service.
- 1978** The U.S. Air Force launches the first Global Positioning System satellite.
- 1995** GPS becomes fully operational with 24 active satellites.

