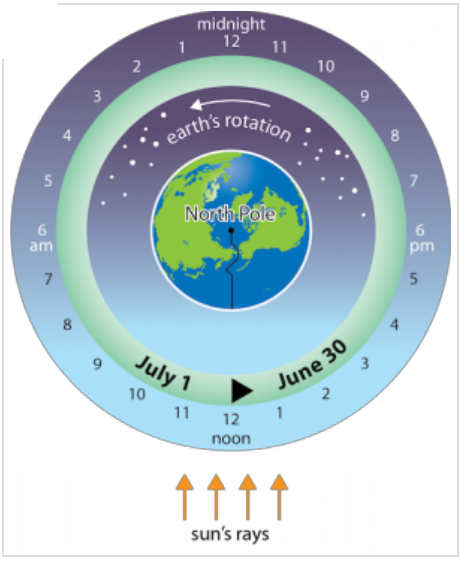

Fig. 1.15 (A) A north polar view of earth showing the international date line and time.

Image by Byron Inouye

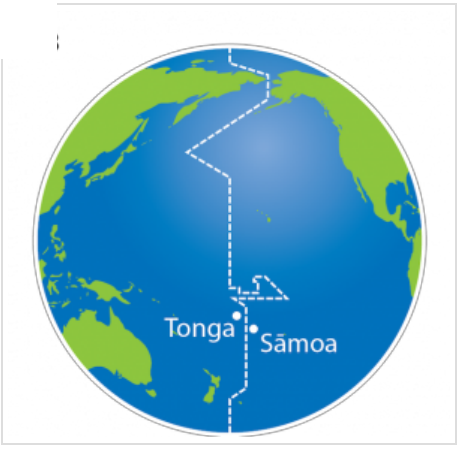

Fig. 1.15 (B) Tonga and Sāmoa lie on opposite sides of the international date line.

Image by Byron Inouye

Travelers who cross the dateline heading west lose a day, but travelers who cross the dateline going east gain a day. When traveling east across the dateline, it is actually possible to arrive at your destination earlier than when you left!

For practical purposes, the international date line has been adjusted to allow certain land areas to remain together in the same day and time zones. For example, the extreme eastern tip of Russia, which juts into the Bering Strait, was kept in the easternmost time zone, whereas the U.S.-owned Aleutian Islands were kept as part of the westernmost time zone (see Fig. 1.15 B).

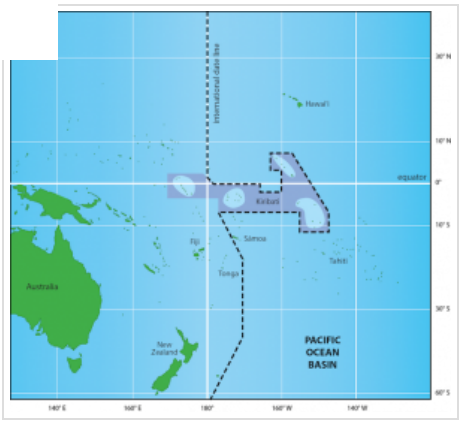

Fig. 1.16. A close-up view of the international date line around Kiribati.

Image by Byron Inouye

In another example, the country of Kiribati (pronounced KIRR-i-bas) drastically changed the date line in 1995 so that the entire country could be on the same day at the same time. Before this, the western part of Kiribati, where the capital lies, would be 22 hours ahead of the eastern portion of the county. Now eastern Kiribati and Hawai'i, which are located close to the same longitude, are a whole day apart (see Fig. 1.16).

WEIRD SCIENCE

Weird Science: The Prime Meridian and Time Zones

Location

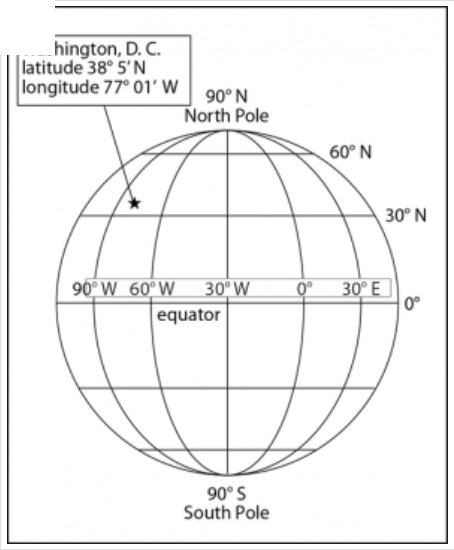

Fig. 1.17. Lines of latitude and longitude form a global grid system. Any point on earth can be located by specifying its latitude and longitude, including Washington, DC, which is pictured here.

Image by Byron Inouye

Lines of latitude and longitude form an imaginary global grid system, shown in Fig. 1.17. Any point on the globe can be located exactly by specifying its latitude and longitude. This system is essential for ships at sea that cannot locate their positions using landmarks or coastal navigational aids such as buoys or channel markers. This system is just as useful for people on land when hiking, driving, or surveying an environment.

To locate a point on a globe exactly, degrees of latitude and longitude are further subdivided into minutes and seconds. In latitude and longitude measurements, minutes and seconds do not refer to time. Instead, they refer to parts of an angle. But, like with time, there are 60 minutes in a degree (just as there are 60 minutes in an hour). Similarly, there are 60 seconds in a minute of time and 60 seconds in a minute of longitude or latitude.

1 **degree** (1°) = 60 minutes (60′)

1 **minute** (1′) = 60 seconds (60″)

Fig. 1.18. The USS Arizona and its memorial, located at Pearl Harbor in Honolulu, Hawai'i, marks the resting place of sailors killed on December 7, 1941 from a surprise Japanese aerial attack.

The latitude and longitude readings of a place are called its spherical coordinates. For example, the coordinates of the location of the USS Arizona Memorial in Pearl Harbor (Fig. 1.18) are "latitude 21 degrees, 21 minutes, and 54 seconds north; longitude 157 degrees, 57 minutes, and zero seconds west." This is written as "21° 21' 54" N, 157° 57' 0" W".

Image courtesy of PH3 Jayme Pastoric, United States Navy (retrieved from Wikipedia)

COMPARE-CONTRAST-CONNECT

Compare-Contrast-Connect: Converting Decimal Degrees to Degrees, Minutes, and Seconds

ACTIVITY

Activity: Locating Points on a Globe

Make a globe marked with reference lines of latitude and longitude.

ACTIVITY

Activity: Mapping the Globe

Make three maps of a globe: an orthographic-projection map, a cylindrical-projection map, and an equal-area map.

Latitude and Longitude Use

If the latitude and longitude coordinates of a location are known, it can be pinpointed on a map or globe. Knowing the spherical coordinates of a location is useful for people when hiking, diving, or surveying an environment. Sophisticated navigational aids use latitude and longitude to give directions when driving and flying. The spherical coordinate system is essential for ships at sea that cannot locate their positions using landmarks or coastal navigation aids like buoys or channel markers.

Nautical Miles and Knots

In addition to using latitude and longitude to specify location, marine and air navigators also use the nautical mile as their unit of length or distance. A nautical mile is approximately one minute of latitude along a line of longitude, a distance of 1.85 kilometers. Navigators describe the speed of ships and airplanes in knots. Meteorologists also describe wind speeds in knots. One knot is equal to one nautical mile per hour.

1 **nautical mile** = 1.85 km

1 **knot** = 1 nautical mile/hour

ACTIVITY

Activity: Pacific Scavenger Hunt

Complete a location scavenger hunt using a map of the South Pacific ocean basin.

FURTHER INVESTIGATIONS

Further Investigations: Locating Points on a Globe