

**ONE SECOND in
20 MILLION
YEARS**

Clock Accuracy

Mechanical Watch	± 1 minute in a month
Quartz Electrical Watch	± 1 second in a year
Ceasium Atomic Clock	± 1 second in 20 million year

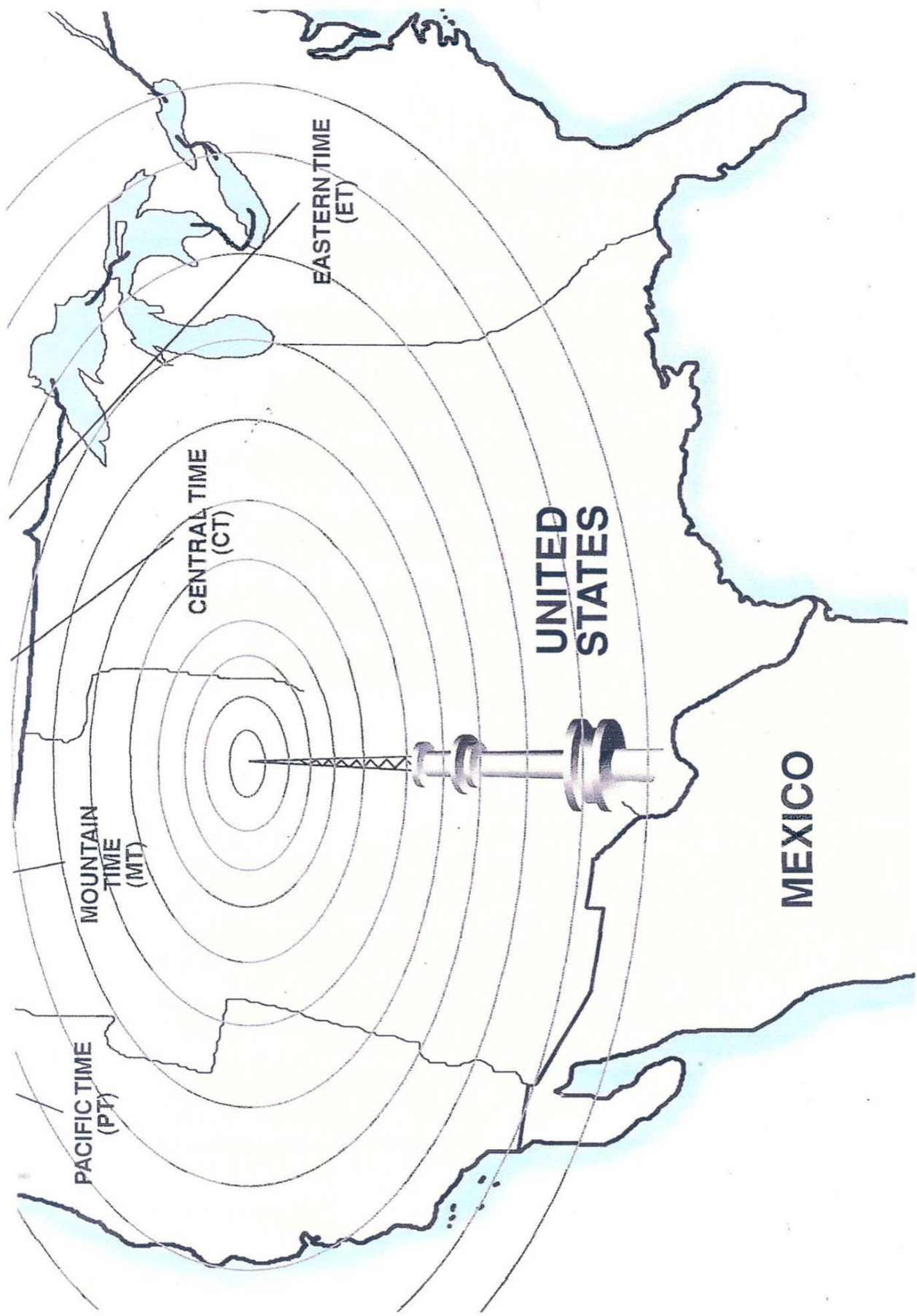
Atomic Clock

The **Cesium atomic clock**

(model NIST-F1, circa 2000)

is *accurate* to

**ONE SECOND in
20 MILLION
YEARS**



PACIFIC TIME (PT)

MOUNTAIN TIME (MT)

CENTRAL TIME (CT)

EASTERN TIME (ET)

UNITED STATES

MEXICO

A team of atomic physicists continually measures every second of every day to an accuracy of ten billionths of a second per day. These physicists have created an international standard, measuring a second as 9,192,631,770 vibrations of a cesium 133 atom in a vacuum. This atomic clock regulates the WWVB radio transmitter located in Fort Collins, Colorado, where the exact time signal is continuously broadcast throughout the United States at 60 kHz to take advantage of stable longwave radio paths found in that frequency range. Radio waves at these low frequencies use the earth and the ionosphere as a wave-guide and follow the curvature of the earth for long distances.

SI Definition of a Second

1 **second** = duration of

9,192,631,770 periods

of the natural oscillation of a
Caesium-133 atom.

Synchronization Application 2: Global Positioning System (GPS)

It is now possible to pinpoint the location of any site on earth to within **a few inches** via triangulation of signals from 4 Navstar satellites (out of 24) orbiting the earth at an altitude of 12,500 miles. Each satellite carries a small **atomic clock** whose signal is used to synchronize with a low-accuracy clock built into every GPS receiver navigation system.