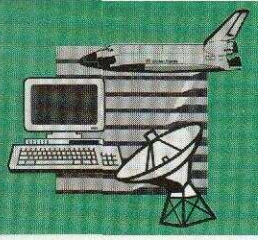
Technology Today

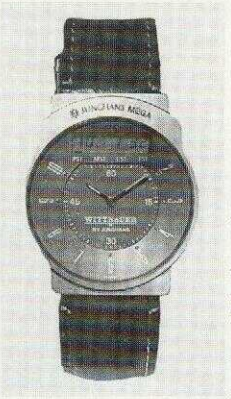


Alan J. Pierce

Ten Billionths of a Second

TWENTY-FIVE nations around the world have quantum mechanical oscillators, commonly referred to as atomic clocks. These clocks record time by measuring the frequency of cesium atoms. The accuracy advantage of these clocks over common household timepieces is the fact that they aren't affected by changes in air pressure, humidity, or temperature.

Since true measurement of time here on earth must reflect the rotational fluctuations of our spinning planet, a "leap second" is added to atomic clock measurements when necessary. The world standard set this way is called Coordinated Universal Time. The International Bureau of Weights and Measures in Paris, France, oversees this measurement.



Courtesy of The Sharper Image

"Atomic" watch

Until recently, only a broken watch with both hands frozen in place was likely to match Coordinated Universal Time, if only twice a day. For the past few years, however, a $6,000 watch, guaranteed accurate within ten billionths of a second without human intervention, has been available in Europe and Asia.

One model of this technology—the Mega Watch—is now selling in America at The Sharper Image, Lifestyle Fascination, and Fisher Scientific for about $1,000. (See photo.) It is made in Junghans, Germany, a place long famous for cuckoo clocks. In the future, we can expect more models, lower prices, design imitation, and technology licensing that could remove the need for anyone ever to set the time on a new watch,

The accuracy of this watch depends on the joining of watch, computer, and communications technology. Each watch contains a small radio receiver that is tuned to receive a time signal broadcast. The watch automatically resets its time to match the Coordinated Universal Time signal emanating from strategically located atomic clocks around the world.

Once a day, the Mega Watch turns on its radio receiver for a time check, and, if necessary, a chip in the watch automatically corrects the time, adjusts for daylight savings time, and even corrects the date. During a flight from New York to California, a simple press of a button will automatically change the time to match the local time zone. If you don't adjust the watch, it will correct itself when it runs its pre-programmed radio reception.

In 1994, Junghans watch technology couldn't be sold in the U.S. because, in New York or California, the watch radio receiver wasn't powerful enough to receive the atomic clock broadcast from Boulder, CO. This problem has now been solved. When the watch is out of range of an atomic clock, however, as during a flight between continents, its accuracy depends on its quartz watch movement.

Since two GOES weather satellites now relay the Boulder time signals, one can assume that a time transmission will soon be available to a low-power receiver anywhere on our planet. You can learn more about atomic clocks on the Internet. Start your search at http://www.boulder.nist.gov/doc-tour/atomic_clock.htm. There you can learn the significance of each part of a time string transmission. At http://physics.nist.gov/GenInt/Time/world.htm, you can follow hot links to a "walk through time."

Recalling the facts

1. What agency oversees Coordinated Universal Time?
2. How is Coordinated Universal Time determined?
3. How does the Mega Watch know that it needs to correct its time?
4. Can the Mega Watch currently keep the same level of accuracy at all locations on earth? TD

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