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Earth's time lords make new year wait a second

FROM JAMES BONE IN NEW YORK

WAIT just one second before you break into song with *Auld Lang Syne*. 2006 is arriving late.

This year's countdown on December 31 should go: "3-2-1-1 . . . Happy New Year!" The world's timekeepers have decreed that we should add a "leap second" on the stroke of midnight to resynchronise our clocks with astronomical time.

The extra second before the New Year starts will be shown on the most accurate clocks as 23:59:60.

The time change has been decreed by the International Earth Rotation and Reference Systems Service, based at the Paris Observatory, which regulates Co-ordinated Universal Time (UTC).

The goal is to keep "clock time", as recorded by unvarying atomic clocks, within 0.9 seconds of astronomical time, or "Sun time", which is tied to the slowing rotation of the Earth.

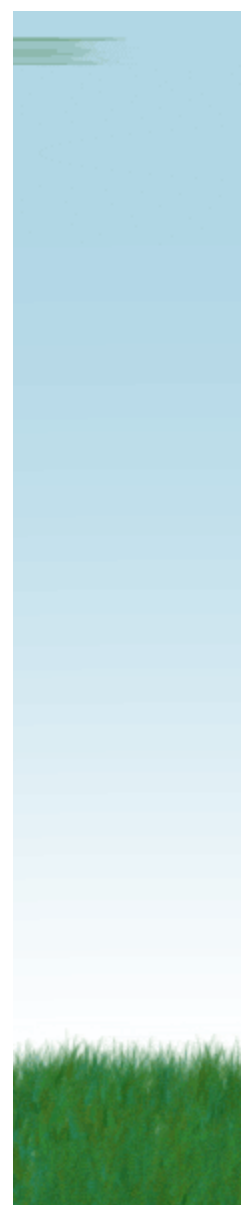
UTC, like Greenwich Mean Time (GMT), is based on when the Sun arrives due south at the Greenwich Meridian, the zero line of longitude. But super-accurate caesium atomic clocks get out of sync with the rotation of the Earth.

Most people will not have to worry about setting back their clocks, but the change does have far-reaching implications in an increasingly technological world.

"Quite frankly, one second out of any of our lives for our normal everyday activities has no effect," said Tom O'Brian, of the Time and Frequency Division of the US National Institute of Standards and Technology.

"But, whether we realise it or not, everyone is using very accurate time — much more accurate than one second — for anything from synchronising cellphone calls to using GPS.

"Showing up to a dinner at your friend's house, you do not need very accurate time," he said. "But to call your friend to make the



arrangement, you probably do.”

To allow businesses and local governments to keep accurate time, the US Government broadcasts a time signal from a radio station near its observatory in Colorado. Even the traffic lights in Los Angeles are synchronised to this emission.

There have been 22 leap seconds inserted since the current system of atomic time-keeping began in 1972, but this is the first one for seven years.

The change is controversial, with some experts pushing for the leap second to be abolished because it causes unpredictable and potentially dangerous disruptions in precision software applications used to run mobile phone networks, air traffic control and power grids.

The US delegation to the International Telecommunication Union has proposed that the maximum difference between UTC and solar time be increased from 0.9 seconds to one hour, making a further adjustment unnecessary for hundreds of years. But others insist that “clock time” should closely track “Sun time” as it has done since the days of the sundial.

The ITU working group studying the question decided to postpone any decision in an effort to build a consensus. “The forthcoming leap second just prior to January 1, 2006, provides an opportunity to further document current problems,” the working group said.

The Royal Astronomical Society has argued for greater debate about possible changes. Mike Hapgood, the society’s secretary, said the US position reflected pressure from the precision timing industry in America as well as from writers of software, who do not want to have to account for unpredictable changes. But he said astronomers like clocks to reflect the actual rotation of the Earth on its axis, so they know where to point their telescopes.

“When we are using time, it is a way of telling us what the spin of the Earth is. One day is one spin of the Earth,” he said. “For us, we want to know where the Earth is spinning. If you have a star in space or a satellite, you need to know where to point to it.”

A STITCH IN TIME

- Since 1967 a second has been defined by the vibration of the caesium-133 atom. One second equals 9,192,631,770 periods of the chosen vibration
- Although this was chosen to be as near as possible to Earth seconds, the Earth’s rotation is not as regular as the caesium atom
- Since 1972 22 leap seconds have been introduced, usually at midnight on December 31 but sometimes at the end of June
- If the rotation of the Earth accelerated — because of changes in fluid circulation in the core, for example — a second would be subtracted

- This possibility is hinted at by the long wait since the last leap second, in 1999
- Without correction, in 1,000 years the estimated difference would be an hour

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