New Time Rules

A small change in the regulations controlling standard time signals, such as those broadcast by National Bureau of Standards radio stations, WWV, WWVH and WWVB, went into effect on January 1, 1975.

Mainly of interest to those who must make astronomical determinations of their position on earth, the change extends the allowable difference between atomic time and sun time—that is, between the time scales known as "UTC" and "UT1"—from 0.7 second to 0.9 second.

UTC (Coordinated Universal Time) is the internationally coordinated time scale used around the world for most timekeeping purposes and is generated by reference to atomic standards. UT1 is a form of astronomical time referred basically to the rotation of the earth and is used primarily by navigators, geodesists and others needing to determine their position on the earth's surface by astronomical observations.

Owing to the irregular rotation rate of the earth, UT1 and UTC do not usually coincide. The difference between them prior to January 1, 1975, was not permitted to exceed $\pm$ 0.7 second, and this tolerance was maintained through the insertion (or subtraction) of leap seconds in UTC. The recent change in tolerance, to $\pm$ 0.9 second, permits greater flexibility in assigning the dates of the leap second. Now, it will be more likely that leap seconds will occur only on June 30 or December 31. Users will not be affected by this change, if they are not sensitive to the original $\pm$ 0.7 second tolerance.

Concurrent with the above change, another operating rule was adopted to allow leap seconds, when necessary, to occur on March 31 and September 30. First preference, however, will still be given to the June 30 and December 31 dates when practical.

The change in tolerance between UT1 and UTC obliges a small change in the way time broadcast stations code the information about the current difference (DUT1) into their broadcasts. DUT1 is given to the nearest 0.1 second and represents the quantity: (UT1—UTC) $\pm$ 0.1 second. The new code is basically the same as the old one, except that it now accommodates DUT1 values up to $\pm$ 0.8 second. (Extension to $\pm$ 0.9 second was considered unnecessary because of the $\pm$ 0.1 second uncertainty of DUT1.).

Thus, since January 1, 1975, the emphasized seconds pulses indicating magnitude of DUT1 have occurred on the first through eighth seconds after the minute marker (indicating positive values of DUT1) or on the ninth through sixteenth seconds (indicating negative values). The number of emphasized pulses gives the sign. For example, if emphasized pulses are heard on the 9th, 10th, 11th and 12th seconds, DUT1 $\pm$ —0.4 second $\pm$ 0.1 second, and the UTC broadcast is 0.4 $\pm$ 0.1 second early with respect to UT1. Pulses from WWV and WWVH are emphasized by doubling.

The above changes were authorized by "Recommendation 460 (1974 revision)," approved by International Study Group 7 and enacted by the International Radio Consultative Committee (CCIR) in July 1974 at Geneva. □

1975 Arrived Late

THE new year was a little late again this year. The delay was caused when a "leap second" was added to the world's time scale between the very end of December 31, 1974, and the very beginning of January 1, 1975.

At that time, scientists at the National Bureau of Standards laboratories in Boulder, Colo., stopped a precision clock for exactly one second while scientists in precision time laboratories around the world did the same. Thus a "leap second" was added to the time scale.

Leap seconds were invented in 1972 when people increased their reliance on the atomic clock instead of the earth as the primary timekeeping device. The reason for the change is the unpredictable and slowing rotation of the earth. This requires that clocks based on the earth's rotation incorporate the same variations—making hours, minutes and seconds vary in length according to the erratic rotation of earth.

Atomic clocks tick off hours, minutes and seconds of essentially the same length—a condition that is not only an academic advance but also an absolute necessity for technical developments such as space travel and sophisticated communication and navigation systems.