Canada Adopts Atomic Time

By T. P. JONES, O.L.S.

Some interesting changes have recently been made to radio time signals. They took effect on January 1, 1973, when a switch was made to atomic time.

For the preceding ten years or so, time signals had been derived from a cesium atomic clock, but one whose output frequency had been offset from its internal frequency to maintain an approximation to mean solar time, or modified Universal Time (UT1). Scientists and others who worked with Atomic Time were required to perform a small computation to convert from universal time.

Serves Dual Purpose

The recent change serves a dual purpose. The atomic second, which is official, is available directly, and the time transmission also serves as a frequency standard.

It does mean, though, that those members of our Association who require "Universal Time" to better than 0.7 of a second, will now have to make an adjustment. The adjustment, however, is an easy one, and need not cause dismay.

In fact it was a condition of acceptance of this new system by surveyors and navigators that the differences between the emitted signal and Universal Time should be transmitted in the form of a simple code along with the atomic time signals.

At present, atomic time gains about one second a year on universal time.

In order to compensate for this annual drift, a "leap second" will be introduced into atomic time in the last minute of either June 30 or December 31.

From Old to New

To get the system started, a negative time step of 0.1077577 second was introduced, so that 1971, December 31, 23h 59m 60.1077577s old time became exactly 1972 January 1, Oh Om Os new time. It affected directly the CBC time signal which is broadcast over the network at 1:00 p.m. Ottawa time, and also Station CHU, the official National Research Council radio station which operates continuously on the three frequencies 3330, 7335, and 14670 kHz, giving seconds markers and a recorded bilingual announcement of time each minute of the 24 hours.

These broadcast times are now called "Co-ordinated Universal Time" (or U.T.C.), and the differences between these signals and Universal Time will not exceed 0.7 second.

Leap Seconds

The whole-second changes to the broadcast signals, as I mentioned before, will be known as "leap seconds", either positive or negative, depending upon whether a second is added to U.T.C., or subtracted from it. Leap seconds will be announced by the Bureau International de L'Heure (B.I.H.) about two months in advance of the proposed change. It will not be necessary for us to know of these announcements provided we can read the correction codes properly.

The codes consist of a group of the N.R.C. radio station CHU second markers, which are identified by having the centre portion removed, resulting in a group of split markers. The number of split markers indicate the number of tenths of seconds separating the mean solar second and the atomic second. DUT1 (difference) — UT1 (modified Universal Time) — UTC (Co-ordinated Universal Time).

If the split markers commence with the first second of each minute, Universal Time is ahead of Atomic Time; if they are delayed until the ninth second, Universal Time is behind Atomic Time.

Canada's Contribution

Much of the foregoing was supplied to me by Mr. Malcolm M. Thomson, of the Time and Frequency Section, Division of Physics, at the National Research Council here in Ottawa. He also informs me that Canada contributes to the decisions of the Bureau International de L'Heure. In fact, we hold a prominent place, because within the Earth Physics Branch of the Department of Energy, Mines and Resources are two of the most modern instruments for measuring earth rotation, and within the Physics Division at N.R.C. is one of the few laboratory - built cesium atom standards, which are used to determine the length of the atomic second.

The N.R.C. time scale, based on the N.R.C. cesium frequency standard, agrees with the B.I.H. mean time scale to within a few micro-seconds per year.