



calculate the time difference between their laboratories' clocks. In these experiments precision of a nanosecond (one billionth of a second) has been achieved, and the goal of the experiments is the transfer of the accuracy of the laboratory primary standard to radio navigation systems, where one billionth of a second is equivalent to one foot.

These methods of satellite time comparison are an improvement on current procedures, which involve transportation of portable clocks between laboratories or the use of the Loran-C radio navigation system. The Loran chain is a series of stations which spans the North Atlantic between the U.S.A. and Europe. Pulsed Loran signals, synchronized with the USNO time scale, provide a communication link for time laboratories and seagoing traffic alike.

In addition to its work with other standards organizations, the time and frequency laboratory provides many services to Canadians at home. For example, a telephone time service, reached by dialing Ottawa numbers (613) 745-1576 (English language) or (613) 745-9426 (French language), is available to the general public. Round the clock, recorded voice messages provide the time of day at 10-second intervals, "NRC Eastern Standard Time, 16 hours, 31 minutes and 40 seconds." Time is also sent by direct telephone line from the main time laboratory to other government departments, the House of Commons and the Canadian Broadcasting Corporation. Another service enables distant users to synchronize their commercial clocks with NRC time using a telephone link and a special electronic code. Finally, voice recordings as well as coded time signals are broadcast continuously by short wave over station CHU in Ottawa.

What's in store for timekeeping in the future? "Everyone agrees on the second and the 24-hour day as the standard of time," says Mungall. "Of course there are still some problems with unwieldy numbers, for example 86,400 seconds in a day, or with months having anywhere from 28 to 31 days. But scientists now get around such difficulties by using decimal fractions of days in a Modified Julian Date system. For example, noon in Ottawa on March 15, 1979, measured to the nearest second would be written as MJD 43947.70833." □

Wally Cherwinski

In years gone by, mechanical clocks like this one set the time standard for society. (Photo: Bruce Kane, NRC)

Autrefois l'heure de référence était donnée par des horloges mécaniques comme celle-ci. (Photo: Bruce Kane, CNRC)