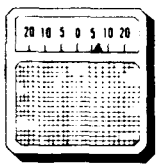

STANDARDS AND CALIBRATION

COMMERCIAL TELEVISION AIDS NBS STANDARD BROADCASTS

In a continuing effort to upgrade the accuracy and precision of NBS time and frequency broadcasts, Bureau scientists and engineers have borrowed from commercial television in Denver, Colo., and from Czechoslovakian know-how.

Television broadcasts from Denver TV stations are now a key element in the chain of controls for precision and accuracy of the Nation's time and frequency broadcasts. With this new system the clock that controls the broadcasts from station WWV in Fort Collins, Colo., may be kept within a millionth of a second of the atomic clock in Boulder.

In the new U.S. technique a television synchronizing pulse on the TV carrier wave is used. The system was adapted from a Czechoslovakian experiment [1] and put into operation by John Milton, electronics engineer in the Bureau's Frequency and Time Broadcast Services Section in Boulder, which operates four NBS radio stations.

The system works this way. A commercial TV set is operated at the NBS atomic-clock end in Boulder, and another at the NBS broadcast-station end in Fort Collins. Both TV sets are tuned to the same Denver TV channel, so that they both receive the same program. TV signals (the "program") are carried by a very high frequency radio wave called a "carrier wave."

Both TV sets are connected to sensitive electronic equipment which records the arrival of periodic pulses on the carrier wave. The "synch pulses" are a known distance apart and are easily identified by electronic devices which "tag" them as they arrive at the location of each recording device. In the present case, the distance from crest to crest of succeeding pulses is about 11.8 miles.

The sensitive equipment records the time of arrival of these pulses at the "atomic clock" in Boulder and at the radio stations in Fort Collins. The time delay between the TV transmitter near Denver and the Boulder and Fort Collins receivers is accurately known to a tenth of a millionth of a second. From this information NBS scientists calculate the time difference between two clocks—the atomic-clock at Boulder and the one at Fort Collins which controls the radio broadcasts. Once the difference is known, even if it is only a few millionths of a second, corrections may be made to synchronize the Fort Collins radio station clock with the atomic clock in Boulder.

The absolute accuracy of the measurement is conservatively set at plus or minus a millionth of a second, but the day-to-day precision often approaches plus or minus one-tenth of a millionth of a second.

This is the most accurate synchronization system yet employed by the Bureau in Boulder (or by anyone else so far as is known). However, further research is being conducted to provide an even more accurate system for keeping NBS time and frequency broadcasts as close to the atomic clock as possible.

THREE STATES RECEIVE WEIGHTS AND MEASURES STANDARDS

North Carolina, Pennsylvania, and Wisconsin became the latest States to receive new sets of weights and measures standards under a program to replace the standards of all 50 States. The sets include standards of both the customary and metric measurement systems.

On February 25, A. V. Astin, NBS Director, presented a set to Governor Robert W. Scott of North Carolina in a ceremony at the State Weights and Measures Laboratory in Raleigh. Dr. Astin presented another set on March 3 to Governor Raymond P. Shafer at the Pennsylvania State Weights and Measures Laboratory in Harrisburg. On March 7, L. M. Kushner, NBS Deputy Director, presented a set to Wisconsin Governor Warren P. Knowles at the State Weights and Measures Laboratory in Madison.

CALIBRATION FEES RISE IN JULY

Because of increasing costs of operation, calibration work completed after June 30, 1969, will be invoiced at fees approximately ten percent higher than those quoted for current work. A revision of the Fee List, Part 8 of NBS Special Publication 250, *Calibration and Test Services of the National Bureau of Standards*, will appear in July, effective on work completed after date of issuance.

NBS Special Publication 250 (1968 edition, with revisions to date) is available at $1.75 per copy from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. By returning the postcard accompanying each copy of SP 250, the purchaser can be placed on the mailing list to receive, without cost and as they are issued, copies of the *NBS Measurement Users Bulletin*. The *Bulletin* provides informal news about calibration and test services, a check list of changes in the services, and, when necessary, inserts that supplement or replace portions of SP 250.

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