

WWV to be Relocated

■ A target date of zero hours, July 1, 1966, has been set as the time for the first broadcast by the NBS high-frequency (short wave) radio station WWV from its new transmitters to be located at Fort Collins, Colo. WWV, at its present site at Greenbelt, Md., will go off the air at 0000 hours, July 1, 1966, and WWV, Fort Collins, Colo., will come on the air in its place simultaneously. The station, which is operated by the NBS Radio Standards Laboratory, broadcasts on a continuous basis, night and day, except for a silent period of four minutes each hour.

The Radio Standards Laboratory, a part of the NBS Institute for Basic Standards, establishes and disseminates the Nation's standards of electromagnetic measurement, including frequency and time.

The move is the culmination of a long-planned consolidation of NBS broadcast facilities which is designed to improve these services. It will result in a more efficient transmitter station and improved WWV reception for most of the country. A small group of users within about 25 miles radius of the Greenbelt location, who have been receiving WWV signals with very high accuracy because of their proximity to the station, may find the signal slightly degraded over the longer path. This problem is under study by RSL to determine whether a special auxiliary service is needed and can be provided.

WWV is the Bureau's oldest standard radio station. Together with short wave station WWVH, Maui, Hawaii, and two stations already located at Fort Collins (WWVB, low frequency and WWVL, very low frequency), WWV is one source of essential broadcast services provided by NBS to U.S. industry, the military services, the National Aeronautics and Space Administration, private and university research laboratories, and thousands of other private and governmental users.

In 1964, Congress appropriated \$970,000 to cover the costs of the move from Greenbelt, including the moving of some equipment, purchase of new equipment to replace obsolete items, and new construction required at Fort Collins.

In June 1965, a \$297,000 contract was awarded to Technical Materiel Corporation for the eight transmitters for the new station. Four of the high-power, high-frequency transmitters are designed at 20,000 W, and four medium-power, high-frequency transmitters at 5,000 W. One of each of these categories will be a standby transmitter, so that the station will actually have six transmitters in operation at any one time. Operating at half the maximum power rating, the main transmitters will broadcast at 5, 10, and 15 megahertz at 10 kW; and supplementary transmitters will broadcast at 2.5, 20, and 25 megahertz at 2.5 kW.

In September 1965, a \$7,024 contract for two monopole antennas and 88-foot steel towers for support was awarded to Collins Radio Company. These two general-purpose antennas will be effective over the entire frequency range (2.5 MHz to 25 MHz). They will permit the station to operate with only slightly reduced efficiency when any of the six special-purpose antennas or regular transmitters are out of order or are being serviced.

Also in September 1965, a \$7,075 contract was negotiated with the Rhon Manufacturing Co., Peoria, Ill., for the remaining six steel antenna towers, designed by the antenna section of the Central Radio Propagation Laboratory. They will range from 20 feet to 200 feet in height, and will be vertical, modified sleeve type, $\frac{1}{2}$ wave, dipoles. They will vary in height inversely as the frequency of the broadcast. For the 2.5 MHz broadcast, the 200-foot-high tower will be used; at 5 MHz, a 100-foot-high tower; at 10 MHz, a 50-foot-high tower; at 15 MHz, 33 feet; at 20 MHz, 25 feet; and at 25 MHz, a 20-foot-high tower. All antenna towers will be so positioned that there will be very little "shadowing" from other antennas. This provision in the layout design makes it possible to achieve nearly omnidirectional broadcasting.

All antennas will be fed by coaxial lines to achieve maximum reliability, ease of matching without special networks, and for greater protection from wind and ice. Power to be furnished by the Poudre Valley REA is being brought into the Fort Collins site by underground lines. Construction of the underground lines began in August 1965. Power will be fed from the Waverly substation from the northwest and from the Nunn substation to the northeast of the site. An emergency or stand-by cable will also be provided for the first time.

The transmitter building, also being specified by the RSL staff, is yet to be designed. The building will contain the eight transmitters as well as administrative space for the WWV staff of approximately twelve people who will come to Fort Collins as part of the move.

Established in Washington, D.C., in 1923 as the first U.S. standard frequency station, WWV has grown from a 1 kW station on selected frequencies in the range 125 kHz to 7600 kHz (serving only a score or so of users and offering, at first, only standard frequency broadcasts) to today's 10- and 1-kW broadcasts on six standard frequencies, offering eight distinct services to a vast listening audience. It probably has more listeners than any other station in the world today.

In 1937 other services were added to the frequency broadcasts: standard musical pitch at 440 hertz (A above middle C); seconds pulses (based on Naval Observatory Time); standard time intervals (based on

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Norman Ramsey, Noted Physicist, Appointed to Visiting Committee

■ Secretary of Commerce John T. Connor recently announced the appointment of Dr. Norman F. Ramsey to be a member of the Statutory Visiting Committee of the Bureau. Dr. Ramsey is an atomic physicist of note, and a professor of physics at Harvard University.

The Statutory Visiting Committee was set up by the act of Congress which established the National Bureau of Standards in 1901. The act requires the Secretary of Commerce to appoint five eminent scientists to study the technical program and facilities of the Bureau each year and to advise him on the efficiency of the Bureau's operations and the condition of its equipment.

These scientists serve for a term of 5 years. Other present members of the Committee are: Dr. E. R. Piore, Vice President, Research and Engineering, International Business Machines Corporation, Chairman; Dr. Frederick Seitz, President, National Academy of Sciences; Dr. Elmer W. Engstrom, President, Radio Corporation of America; and Dr. Paul C. Cross, President, Mellon Institute.

The new appointee has made important contributions to an unusually large number of scientific fields, ranging from molecular properties to elementary particles.

Of special interest to the National Bureau of Standards is Dr. Ramsey's invention and development of the hydrogen maser, which holds promise of becoming the most accurate time standard yet devised.

Dr. Ramsey has been a trustee of the Carnegie Endowment for Peace since 1960. During the same period, he has also been a member of the Atomic Energy Commission general advisory committee. In 1960, he received the E. O. Lawrence award and medal, given

by the Commission for "outstanding contributions to the development, use, and control of atomic energy . . ." In 1947, Dr. Ramsey was given the Presidential Award of Merit for radar development work.

Dr. Ramsey has served in a science advisory capacity to numerous organizations and officials, including NATO, U.S. Department of Defense, the Air Force, and the Secretary of War; and as a consultant to the Office of Scientific Research and Development, and the National Defense Research Committee.

He has been a trustee of Brookhaven National Laboratory since 1952; he headed its physics department in 1946 and 1947. Prior to these dates he was a group leader at Los Alamos, 1943-45. Dr. Ramsey was director of Harvard's nuclear laboratory from 1948 to 1950, and again in 1952.

Dr. Ramsey holds the A.B. and Ph. D. (physics) degrees from Columbia University. He also earned M.A. and D.Sc degrees from Cambridge University, and was awarded an honorary M.A. by Harvard in 1947. He has held several fellowships: the Tyndall (Columbia), the Kellett (Cambridge), a Guggenheim, and one in the department of terrestrial magnetism at Carnegie Institution.

Prior to joining the Harvard faculty in 1947, Dr. Ramsey had taught at Columbia University and the University of Illinois.

Dr. Ramsey is a fellow of the American Academy of Arts and Sciences and the American Physical Society. He is a member of the American Philosophical Association, National Academy of Sciences, American Mathematics Society, New York National Academy of Sciences, Sigma Xi, and Phi Beta Kappa.

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what today would be considered a very crude oscillator with an accuracy of only 2 parts in 10^7 , as compared to today's accuracy of one part in 10^{11} ; and ionosphere bulletins (radio propagation disturbances).

In 1950, 600 Hz modulation was added (used by power companies to regulate their 60 Hz current), as were time announcements in voice each five minutes.

In July 1957, geophysical alerts were added, and in October 1957, the reference for the broadcast carrier frequencies was changed from a Naval Observatory

specification to the atomic frequency standard established and maintained at the Boulder Laboratories.

Today, WWV continues to provide services at six standard radio frequencies, including standard audio frequencies (at 1000, 600, and 440 Hz), musical pitch, time intervals (1 second, 1 minute, 1 hour, etc.), time signals (Universal Time), time (UT2) corrections, time code, radio propagation forecasts, and geophysical alerts. No reduction is expected in these services when the station is moved to Fort Collins.