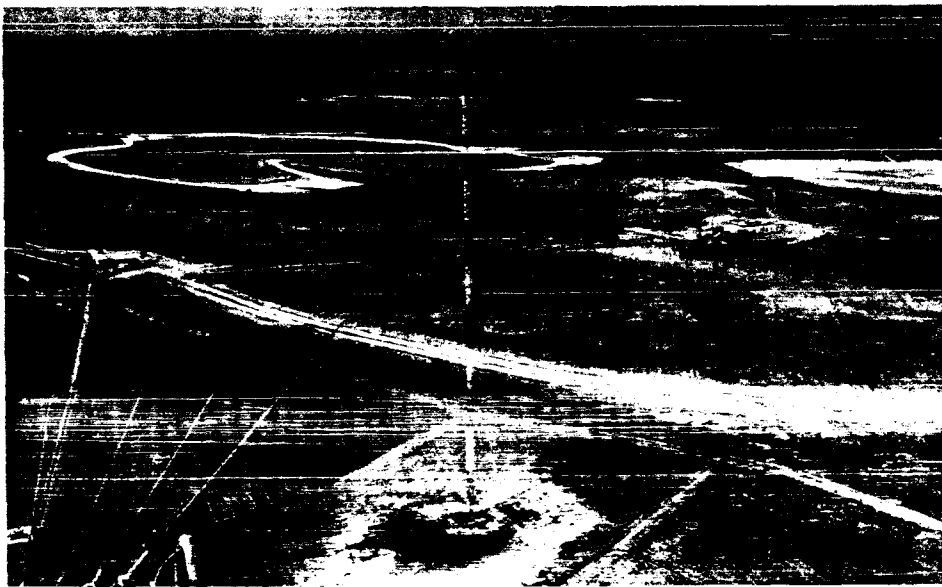


This photograph, taken 50 years ago, shows the original transmitting antenna towers used by WWV in Washington, D.C. The short antenna on the left was used for "shortwaves" while the antenna on the right was used for "the longer waves of their standard wave transmissions."

Goldenc



On March 6, 1923, NBS started regularly scheduled broadcasts. The broadcasts originated from WWV, a laboratory radio station located in the NBS radio building on Connecticut Avenue in Washington, D.C. The broadcasts brought order to a burgeoning radio industry that was threatening to strangle on self interference.

WWV AIDES PIONEER RADIO

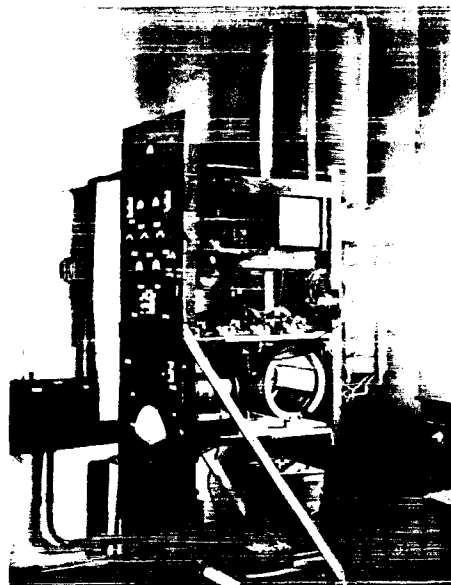
The early WWV broadcasts were appreciated from their start. This was typically expressed in a QST Magazine editorial, October 1924:

"Probably no radio station has ever rendered the American radio world so great a service as that of WWV in transmitting the standard wave signals. Before these signals began, both broadcasting and amateur waves were uncertain and often wavemeters disagreed violently. Since the signals began, those in the East have been able to make precision calibrations of their own wavemeters and pass the information on into the West."

The QST editorial was a sincere expression of appreciation from a troubled industry. Radio was the

From the top of a 400-ft. transmission tower at the Fort Collins site a portion of the WWV and WWVB-WWVL facilities can be seen. On the left is the WWVB-WWVL building and on the right the WWV building. A total of 380 acres encompass the facilities.

The original WWV transmitter was described in a 1924 magazine as a "1-kW continuous-wave set of the master-oscillator power-amplifier type especially designed to operate over a wide range of frequencies and to permit rapid change from one frequency to another." This photo was taken in 1923 at the NBS Washington, D.C. facility.



For 50 years, one of the country's most popular radio stations has been WWV. In spite of its sustained listenership, the station has no music, no commercials, and almost no talking. Its program consists of ticks, beeps, brief voice announcements, and frequency signals.

Anniversary of **WWV**

glamour industry of the age. Proliferation of commercial and amateur broadcasting stations was exponential. Regulation was minimal. For sheer lack of dependable standard frequencies, broadcasters were unable to calibrate their equipment and stay within their assigned frequencies. The result was static, garbling, and fading, a phenomenon which results from interfering radio waves cancelling each other. Thus, a fledgling industry was threatened with self-annihilation even before becoming firmly established. No wonder it welcomed the 1923 standard-frequency broadcasts of WWV as the greatest service to American radio and promptly embarked on a self-policing action using WWV standards!

NOW AND THEN

Today, on the golden anniversary of its first regularly-scheduled broadcasts, WWV occupies a 380-acre site near Fort Collins, Colo., with its own building, emergency power plant, and antenna field. It continues to broadcast standard frequencies. Fifty years ago, the

standard frequencies helped the broadcasting industry transmit primitive "radio telephony" to a select few with bulky receivers. Today, WWV serves a mature and well-ordered broadcast industry reaching virtually every home in America with video and sound.

The original WWV transmitter broadcast a number of standard frequencies from 200 to 545 kilocycles per second (kilohertz) with an accuracy of 1 part in 10,000 and transmitter power of 1 kilowatt. Today's WWV broadcasts range from 100 cycles per second (hertz) to 25 million cycles per second (megahertz), with an accuracy of a few parts in 10,000 billion and up to 10 kilowatts transmitter power.

Original broadcasts were made between 11 p.m. and 1:15 a.m. eastern standard time, after commercial stations left the air. This guaranteed no interference, which was the principal problem of the radio industry during that era, and allowed users a chance to calibrate their wavemeters. Today, WWV broadcasts around the clock.

Early WWV broadcasts, with accuracy controlled by a wavemeter,

were more-or-less dependably received east of the Mississippi, and were reported to have been heard as far away as England and Italy. Today, WWV broadcasts reach throughout the world. The Pacific Ocean area is supplemented by a sister station, WWVH on the Hawaiian Island of Kauai, which NBS added to its broadcasting system in 1948.

TODAY'S SERVICES

In addition to providing services which parallel the original WWV broadcasts (standard frequencies), WWV now provides audio tones of 440 and 600 hertz for the musical and electrical industries respectively; 1-second time ticks; time-of-day voice announcements; time corrections to maintain proper earth-atomic time relationships; official announcements of the Federal Government; radio-propagation forecasts; geophysical alerts and summaries of selected geophysical events during the past 24-hour period; weather information for the Atlantic area; and time of the year information in minutes, hours, and days. *turn page*

WWV continued

FIVE SITES IN 50 YEARS

WWV standard broadcasts came from the NBS grounds in Washington, D.C., for nearly 8 years; until January 1931, when frequency transmissions began from a new location in College Park, Md., northeast of Washington.

After 2 years at College Park, the transmitter was moved to a 25-acre site at the Experimental Farm of the Department of Agriculture in Beltsville, Md., northeast of Washington, D.C. January 1943 was moving time again for WWV, this time to a site 3 miles south, but still with a Beltsville address.

There in its new facility, WWV served the nation with time and frequency broadcasts during the critical years of World War II. Many a veteran navigator of an airplane or ocean vessel nostalgically recalls the welcome sound of the monotonous format of WWV broadcasts which helped him guide his vessel through the trackless and hostile foreign territories. It was a reassuring sound emanating from a small brick building at Beltsville with blackout curtains covering the windows. The wavemeter standard had long since been replaced by the tuning fork and the tuning fork had now been replaced by three quartz crystals buried in a concrete vault 25 feet below the surface of the ground. There temperature and humidity were constant and the crystals provided time and frequency signals of unprecedented accuracy.

In the late 1950's, the growing city of Greenbelt encroached on Beltsville and the address of the WWV site was changed to Greenbelt. NASA's Greenbelt Space Center was crowding WWV and finally became owner of the site. The equipment was obsolete and the location was far from the new NBS time and frequency control

center, the Radio Standards Physics Division at Boulder, Colo. A new site was selected for WWV about 7 miles north of Fort Collins, Colo., (50 miles from Boulder) where there was no industrial crowding and the highly conductive soil of an ancient lake bed provided an ideal transmitting site. In addition, this central location provides more uniform coverage of the continental United States.

Transmissions from the Fort Collins site began at 5 p.m., December 1, 1966 (zero hours Greenwich time). Transmission from the new site brought an immediate and dramatic increase in accuracy; for though the atomic clock in Boulder had become the primary standard of frequency and time for NBS in 1957, the new station at Fort Collins was first to have commercial cesium oscillators at the transmitter site. This addition allowed daily comparisons with the atomic clock.

1940 FIRE STOPS WWV FOR 5 DAYS

Throughout its history, WWV scheduled broadcasts have only rarely been interrupted. One interruption occurred on November 6, 1940, when a fire broke out at the (Beltsville) station and almost entirely destroyed it. However, frequency generating equipment was salvaged from the basement of the burned building. An adjacent building, not damaged by the fire, contained a small transmitter. By coupling the two, NBS engineers had WWV back on the air November 11 with no loss of accuracy, although announcements were temporarily made by Morse code.

"By keeping in touch with users, NBS has kept WWV broadcasts relevant to their needs," Peter P. Vezbicke, Section Chief for frequency broadcast services within the NBS Time and Frequency Division related. For instance, the most used service of WWV is time-of-day information. This need holds true

not only for navigators, but also for transportation, telephone and broadcasting companies, radio amateurs, and just plain people who want to know the proper time of day. In response to time-of-day demands, WWV now broadcasts Greenwich time voice announcements once each minute. A simple conversion for listeners in every time zone gives each his proper time. Those without shortwave receivers can call by telephone (303/499-7111) and hear the broadcast any time, day or night. Approximately one-half million calls per year are received.

USERS "TUNE-IN" WWV

Major users tune their receivers to one of six standard carrier frequencies: 2.5, 5, 10, 15, 20, or 25 megahertz. Identical information is simultaneously broadcast on each frequency. Accurate time and frequency information users include spacecraft-tracking stations, civilian and military aircraft and ships, commercial radio and television broadcasters, seismographers, geologists, astronomers, electric-power distributors, manufacturers of musical instruments, and scientific laboratories. In fact, almost all time references within the United States can ultimately be traced to WWV services.

WWV'S FUTURE

Will WWV survive another 50 years? Who knows?

"The National Bureau of Standards is currently engaged in perfecting alternate forms of dissemination which might make standard shortwave broadcasts obsolete," says James A. Barnes. Barnes is Chief of the NBS Time and Frequency Division. Until alternate methods are perfected, John Stanley, WWV's Chief Engineer, and his dedicated crew at the Fort Collins site will continue the service which has survived 50 years of wars, depressions, moves, and fire.