WWV – Over a Hundred Years of Broadcasting by WB5YYQ

Like many hams, I was first introduced to radio via short wave listening. Back in the late 60's, I would listen to stations around the globe such as the BBC, Voice of America, Radio Australia, Deutche Welle, or the Armed Voices Radio broadcasts. Sadly, many of those are no longer broadcasting on shortwaves due to either budget cuts or the popularity of streaming over the internet. However, there are some stations that are still active today.

If you tune across the shortwave bands, you will likely come across the transmissions of time signals. At one point there were about a dozen time stations operating in different countries, but I'm not sure how many of those are still on the air. You are more likely to hear only these three stations: WWV, WWVH, and CHU. In the United States, WWV in Fort Collins, Colorado, and WWVH in Hawaii currently operate on 2.5, 5, 10, 15, and 20 Mhz. In Canada, CHU in Ottawa operates on 3.33, 7.85, and 14.67 Mhz. It's a good practice to save these frequencies to your radio memory, as they are an excellent & quick indication of propagation conditions. The US stations are operated by the National Institute of Standards and Technology formerly known as the National Bureau of Standards. CHU is operated by the National Research Council of Canada.

These stations broadcasts time and frequency information 24 hours per day, 7 days per week to millions of listeners. WWV and WWVH signals provide time announcements, standard time intervals, standard frequencies, corrections to astronomical time, a Binary Coded Decimal time code which is broadcast on a 100 Hz subcarrier, and geophysical alerts. They also broadcast special signals for ionosphere propagation studies.

Broadcasting for over a hundred years, WWV was licensed in 1919, but didn't go on the air until May 1920 from Washington, DC, broadcasting Friday evening music concerts from 8:30 to 11 pm, on a frequency of about 600 kHz with a power output of 50 watts. This was in the very early days of radio broadcasting; the first commercial radio broadcast station didn't go on the air until six months later; that was KDKA in Pittsburgh; they went on the air in November of 1920.

On December 15, 1920 WWV began assisting the Department of Agriculture in the distribution of market news to farm bureaus and agricultural organizations. A 2 kW spark transmitter was used to broadcast 500 word reports, called the Daily Market Marketgram on 750 kHz. The operating radius was about 200 miles out of Washington, DC. These broadcasts continued until April 15, 1921.

By December 1922, it was decided that the station's purpose would be the transmission of standard frequency signals. The first tests were conducted on January 29th and 30th of 1923, and included the broadcast of frequencies from 200 to 545 kHz. By May of 1923, WWV was broadcasting frequencies from 75 to 2000 kHz on a weekly schedule. The accuracy of the transmitted frequency was quoted as being "better than three-tenths of one per cent." The output power of the station was 1 kW.
There were numerous changes in both the broadcast schedule, format, and frequency of WWV throughout the 1920's.

In January 1931, the station was moved from Washington, DC to the nearby city of College Park, Maryland. A 150 W transmitter operating at 5 MHz was initially used, but the power was increased back to 1 kW by the following year. A new device, the quartz oscillator, made it possible to dramatically improve the output frequency of WWV. Quartz oscillators were first used at WWV in 1927, and by 1932 allowed the transmitted frequency to be controlled to less than 2 parts in 10 million.

The station moved again in December 1932, this time to a 25 acre Department of Agriculture site near Beltsville, Maryland. By April of 1933, the station was broadcasting 30 kW on 5 MHz, and 10 and 15 MHz broadcasts (20 kW output power) were added in 1935. The 5 MHz frequency was chosen for several reasons, including "its wide coverage, its relative freedom from previously assigned stations, and its convenient integral relation with most frequency standards." The 10 and 15 MHz frequencies were chosen as harmonics, or multiples of 5 MHz. WWV continues to use all of these frequencies today, as well as another harmonic (20 MHz), and a sub-harmonic (2.5 MHz).

The Beltsville area was the home of WWV until December 1966 (although the location name for the broadcast was changed to Greenbelt, Maryland in 1961). During the years in Beltsville, many interesting developments took place. A fire destroyed the station in November 1940, but the standard frequency equipment was salvaged and the station returned to the air just 5 days later using an adjacent building. An act of Congress in July 1941 provided $230,000 for the construction of a new station, which was built about 3 miles south of the former site and went on the air in January 1943. The 2.5 MHz broadcasts began in February 1944, and are still used as a convenient way to reach the population nearest the radio station. Transmission on 20, 25, 30, and 35 MHz began in December 1946. The 30 and 35 MHz broadcasts were discontinued in January 1953 and the 25 MHz broadcast was stopped in 1977. With the exception of an almost 2-year interruption (1977-78), the 20 MHz broadcasts have continued to this day.

Much of the current broadcast format also took shape during the Beltsville years. The 440 Hz musical tone (A above middle C) was added to the broadcast in August 1936, at the request of several music organizations. The second pulses were added in June 1937, and the geophysical alert messages began in July 1957. And as quartz oscillator technology improved, so did the frequency control of the broadcast. The transmitted frequency was routinely kept within 2 parts in 10 billion of the national standard by 1958.

For many decades prior to digital frequency displays on receivers, ham operators would use WWV to calibrate their tuning dials.

WWV's most well known feature, the announcement of time, also began during the Beltsville years. A standard time announcement in telegraphic code was added in October 1945, and voice announcements of time began on January 1, 1950. The original voice announcements were at 5-minute intervals. It is interesting to note that WWV continued to broadcast local time at the transmitter site until 1967.

WWVH began operation on November 22, 1948 on the island of Maui, in the then territory of Hawaii. It operates on 5, 10, and 15 Mhz. Over the years, the original site was threatened by eroding coastline, and in 1971, a new site was completed on the island of Kauai.

In 1966, the decision was made to move WWV to its current location, near Fort Collins, Colorado, sharing the 390 acre site of the Low Frequency station WWVB which had gone on the air in July 1963. WWVB operates on 60 kHz, and provides automatic time syncing for millions of consumer clocks and watches. This site was about 50 miles from the Boulder laboratories where the national standards of time and frequency were kept. The proximity to Boulder and the use of atomic oscillators at the transmitter site would make it possible to control the transmitted frequency to within 2 parts in 100 billion, a factor of ten improvement. Today, the station's frequency is controlled to within 1 part in 10 trillion.

At 0000 UTC on December 1, 1966 the Greenbelt, Maryland broadcast was turned off and the new transmitter at Fort Collins was turned on. In April 1967 the station began broadcasting Greenwich Mean Time (GMT) instead of local time, and began its current format of using Coordinated Universal Time (UTC) in December 1968. The time announcements were made every minute, instead of every 5 minutes, beginning in July 1971. Since WWV and WWVH operate on the same frequencies, a male voice is used for WWV and a female voice for WWVH. The formats are the same, but the stations have different schedules. For example the geophysical alerts for WWV are at the 18th minute of each hour, and the 45th minute for WWVH.

Many new features and programming changes have been added to the stations broadcast over the past few decades, and the current stations schedules can be found at the web site, www.nist.gov.
And believe it or not, they still have a telephone number you can call to get the time of day.

Excerpts from www.nist.gov, ARRL Handbooks, and QST "The Heartbeat of the Shortwaves" (March 2022).