What is CW
and Why Does it Work so Well?

Morse code is cool, but that's not the only thing it has going for it. It's also a very efficient way to communicate on the ham bands.

In the lexicon of electronics, the acronym "CW" simply means *continuous wave*. It is a stream of radio frequency (RF) energy that never changes and never stops — at least not until you let go of the "transmit" switch. It is not modulated, which means that it carries no information.

Most of the energy in a CW signal is concentrated at just one frequency. If you turn on a transmitter and generate a CW signal at, say, 7.030 MHz, much of the RF energy will be centered at that frequency. If someone with a receiver tuned across 7.030 MHz, they might hear a tone like a musical note, stable and unchanging — like someone steadily blowing a whistle.

Our hypothetical listener will lose interest in this signal pretty quicky, though. After all, it communicates nothing other than its presence.

So how do we add information to a CW signal? The easiest way is to turn it on and off for specific lengths of time. We call the longer transmissions *dashes*, and the shorter transmissions are known as *dots*. Regardless of how fast the operator is sending, a proper dash transmission should always be three times longer than a dot. Rather than speaking in terms of dots and dashes, however, most hams say *dits* and *dahs*, because those words more accurately mimic the sounds that are heard on the air.

When our listener tunes into the 7.030 MHz signal, instead of hearing a continuous tone, they now hear a string of dits and dahs that sound like random beeps. But let's assume our listener is familiar with the coding scheme known as *International Morse*. They hear a dah followed by two dits, and they know that combination of sounds represents the letter **D**.

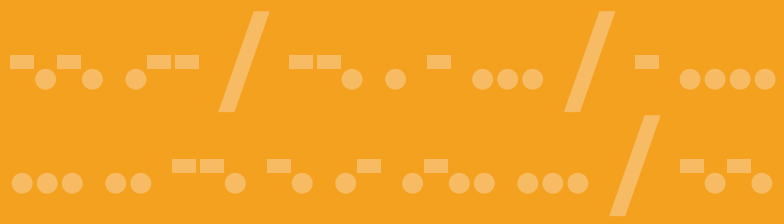
Next, our listener hears the following:

dit – dah (**A**)

dit – dit – dit – dah (**V**)

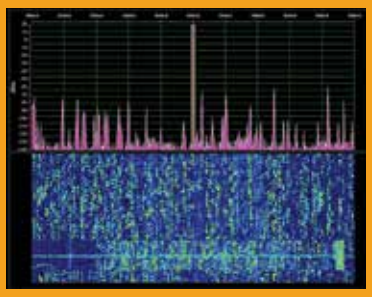
And finally, a single dit (**E**)

D-A-V-E — the operator is sending his name!



This is "Old Betsy," a spark transmitter designed and built more than 100 years ago by Hiram Percy Maxim, one of the founders of ARRL. It is on display today at station W1AW at ARRL Headquarters in Newington, Connecticut.

Modern CW transmitters can be very simple, such as this battery-operated Cricket transmitter available from the 4 State QRP Group at 4sqrp.com.



The happy chaos of a CW contest. Each pink spike represents a CW signal. In the greenish-blue display below the spikes, you'll notice what looks like a sea of tiny vertical blocks. The short blocks are *dits* and the longer blocks are *dahs*. In this snapshot of activity, more than 100 stations were competing within just 50,000 Hertz of spectrum!

The Debut of CW

In the earliest days of radio, Morse-coded signals were extremely crude, just buzzing noises that switched on and off. Because of the method used to create these signals, they were called *spark* transmissions. It is important to point out that these were not continuous waves; they were known as *damped waves*.

The portion of the electromagnetic spectrum that a signal occupies is called its *bandwidth* (measured in Hertz) and damped-wave signals were bandwidth hogs. These wide signals often caused severe interference.

Starting around 1920, hams began using radios that could generate signals comprised of continuous waves — CW. This innovative technology quickly proved to be vastly superior to spark. For instance, a CW signal could be heard at a much greater distance than a spark transmission. This was true for two reasons:

- The CW signal was extremely "narrow," with a bandwidth of only 50 Hertz or less. Unlike the damped waves of a spark station, its energy was highly concentrated at one frequency, rather than being spread over many frequencies.
- At the receiving end, the listener could use filtering techniques to block everything except the frequency the CW operator was using. This greatly reduced the effects of noise and interference. The signal could then be amplified and made louder, which made the CW signal much easier to understand.

CW Today

Morse-coded CW operating — simply referred to as *CW operating* — is more than 100 years old, but it remains quite popular. Despite all the digital technologies available to us today, CW is still highly effective for long-distance communication, even at low power levels.

CW is also very spectrum-efficient, and that's important in today's crowded radio environment. Thanks to its narrow bandwidth, many CW conversations can take place within a small slice of the electromagnetic spectrum. Consider the 2,500-Hertz bandwidth required for just ***one*** single sideband (SSB) voice signal; *dozens* of CW conversations could take place within that same bandwidth!

And CW has one more ace up its sleeve — it is the only non-voice communication mode that does not require a computer. You can send CW by using nothing more than a hand-operated switch (known as a *key*) to turn a transmitter on and off. When it is time to receive, a CW signal requires only your ears. In fact, the human brain has a remarkable ability to understand Morse code signals in conditions that would be impossible for a computer to handle.

Morse-coded CW may be old, but it is far from dead.