



Morse code

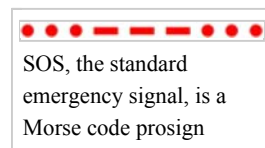
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Morse code is a method of transmitting text information as a series of on-off tones, lights, or clicks that can be directly understood by a skilled listener or observer without special equipment. It is named for Samuel F.

B. Morse, an inventor of the telegraph. The International Morse Code^[1] encodes the ISO basic Latin alphabet, some extra Latin letters, the Arabic numerals and a small set of punctuation and procedural signals (prosigns) as standardized sequences of short and long signals called "dots" and "dashes",^[1] or "dits" and "dahs", as in amateur radio practice. Because many non-English natural languages use more than the 26 Roman letters, extensions to the Morse alphabet exist for those languages.

Each Morse code symbol represents either a text character (letter or numeral) or a prosign and is represented by a unique sequence of dots and dashes. The duration of a dash is three times the duration of a dot. Each dot or dash is followed by a short silence, equal to the dot duration. The letters of a word are separated by a space equal to three dots (one dash), and the words are separated by a space equal to seven dots. The dot duration is the basic unit of time measurement in code transmission.^[1] To increase the speed of the communication, the code was designed so that the length of each character in Morse varies approximately inversely to its frequency of occurrence in English. Thus the most common letter in English, the letter "E", has the shortest code, a single dot.

Morse code is used by some amateur radio operators, although knowledge of and proficiency with it is no longer required for licensing in most countries. Pilots and air traffic controllers usually need only a cursory understanding. Aeronautical navigational aids, such as VORs and NDBs, constantly identify in Morse code. Compared to voice, Morse code is less sensitive to poor signal conditions, yet still comprehensible to humans without a decoding device. Morse is, therefore, a useful alternative to synthesized speech for sending automated data to skilled listeners on voice channels. Many amateur radio repeaters, for example, identify with Morse, even though they are used for voice communications.



In an emergency, Morse code can be sent by improvised methods that can be easily "keyed" on and off, making it one of the simplest and most versatile methods of telecommunication. The most common distress signal is SOS or three dots, three dashes, and three dots, internationally recognized by treaty.

International Morse Code	
1. The length of a dot is one unit. 2. A dash is three units. 3. The space between parts of the same letter is one unit. 4. The space between letters is three units. 5. The space between words is seven units.	
A • —	U • • —
B — • • •	V • • — —
C — — • •	W — • • •
D — • •	X — • — —
E •	Y — • — —
F • • — •	Z — — • •
G — • —	
H • • • •	
I • •	
J — • — —	
K — — • —	1 • — — — —
L — • — •	2 • • — — —
M — —	3 • • — —
N — •	4 • • • —
O — — —	5 • • • •
P — • — •	6 — • • • •
Q — — • —	7 — — • • •
R — • • •	8 — — — • •
S • • •	9 — — — — •
T —	0 — — — — —

Chart of the Morse code letters and numerals.^[1]

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Development and history

Beginning in 1836, the American artist Samuel F. B. Morse, the American physicist Joseph Henry, and Alfred Vail developed an electrical telegraph system. This system sent pulses of electric current along wires which controlled an electromagnet that was located at the receiving end of the telegraph system. A code was needed to transmit natural language using only these pulses, and the silence between them. Around 1837, Morse, therefore, developed an early forerunner to the modern International Morse code. Around the same time, Carl Friedrich Gauss and Wilhelm Eduard Weber (1833) as well as Carl August von Steinheil (1837) had already used codes with varying word lengths for their telegraphs.

In 1837, William Cooke and Charles Wheatstone in England began using an electrical telegraph that also used electromagnets in its receivers. However, in contrast with any system of making sounds of clicks, their system used pointing needles that rotated above alphabetical charts to indicate the letters that were being sent. In 1841, Cooke and Wheatstone built a telegraph that printed the letters from a wheel of typefaces struck by a hammer. This machine was based on their 1840 telegraph and worked well; however, they failed to find customers for this system and only two examples were ever built.^[2]

On the other hand, the three Americans' system for telegraphy, which was first used in about 1844, was designed to make indentations on a paper tape when electric currents were received. Morse's original telegraph receiver used a mechanical clockwork to move a paper tape. When an electrical current was received, an electromagnet engaged an armature that pushed a stylus onto the moving paper tape, making an indentation on the tape. When the current was interrupted, a spring retracted the stylus, and that portion of the moving tape remained unmarked.

The Morse code was developed so that operators could translate the indentations marked on the paper tape into text messages. In his earliest code, Morse had planned to transmit only numerals, and to use a codebook to look up each word according to the number which had been sent. However, the code was soon expanded by Alfred Vail in 1840 to include letters and special characters, so it could be used more generally. Vail estimated the frequency of use of letters in the English language by counting the movable type he found in the type-cases of a local newspaper in Morristown.^[3] The shorter marks were called "dots", and the longer ones "dashes", and the letters most commonly used were assigned the shorter sequences of dots and dashes. This code was used since 1844 and became known as *Morse landline code* or *American Morse code*.



Typical "straight key". This U.S. model J-38, was manufactured in huge quantities during World War II. The signal is "on" when the knob is pressed, and "off" when it is released. Length and timing of the dots and dashes are entirely controlled by the telegraphist.



Morse code receiver, recording on paper tape

	American (Morse)	Continental (Gerke)	International (ITU)
A	••	••••	••
B	••••	••••••	••••••
C	••••••	••••••	••••••
CH	••••••	••••••	••••••
D	••••	••••••	••••••
E	••	••	••
F	••••	••••••	••••••
G	••••	••••••	••••••
H	••••	••••••	••••••
I	••	••	••
J	••••	••••••	••••••
K	••••	••••••	••••••
L	••••	••••••	••••••
M	••••	••••••	••••••
N	••••	••••••	••••••
O	••••	••••••	••••••
P	••••	••••••	••••••
Q	••••	••••••	••••••
R	••••	••••••	••••••
S	••••	••••••	••••••
T	••	••	••
U	••	••	••
V	••••	••••••	••••••
W	••••	••••••	••••••
X	••••	••••••	••••••
Y	••••	••••••	••••••
Z	••••	••••••	••••••
1	••••	••••••	••••••
2	••••	••••••	••••••
3	••••	••••••	••••••
4	••••	••••••	••••••
5	••••	••••••	••••••
6	••••	••••••	••••••
7	••••	••••••	••••••
8	••••	••••••	••••••
9	••••	••••••	••••••
0	••••	••••••	••••••
0 (alt)	••	••	••

Comparison of historical versions of Morse code with the current standard. 1. American Morse code as originally defined. 2. The modified and rationalized version used by Gerke on German railways. 3. The current ITU standard.

In the original Morse telegraphs, the receiver's armature made a clicking noise as it moved in and out of position to mark the paper tape. The telegraph operators soon learned that they could translate the clicks directly into dots and dashes, and write these down by hand, thus making the paper tape unnecessary. When Morse code was adapted to radio communication, the dots and dashes were sent as short and long tone pulses. It was later found that people became more proficient at receiving Morse code when it is taught as a language that is heard, instead of one read from a page.^[4]

To reflect the sounds of Morse code receivers, the operators began to vocalize a dot as "dit", and a dash as "dah". Dots which are not the final element of a character became vocalized as "di". For example, the letter "c" was then vocalized as "dah-di-dah-dit".^{[5][6]} Morse code was sometimes facetiously known as "iddy-umpty", and a dash as "umpty", leading to the word "umpteen".^[7]

The Morse code, as it is used internationally today, was derived from a much refined proposal which became known as "Hamburg alphabet" by Friedrich Clemens Gerke in 1848. It was adopted by the Deutsch-Österreichischer Telegraphenverein (German-Austrian Telegraph Society) in 1851. This finally led to the International Morse code in 1865.

In the 1890s, Morse code began to be used extensively for early radio communication, before it was possible to transmit voice. In the late 19th and early 20th centuries, most high-speed international communication used Morse code on telegraph lines, undersea cables and radio circuits. In aviation, Morse code in radio systems started to be used on a regular basis in the 1920s. Although previous transmitters were bulky and the spark gap system of transmission

was difficult to use, there had been some earlier attempts. In 1910, the US Navy experimented with sending Morse from an airplane.^[8] That same year, a radio on the airship *America* had been instrumental in coordinating the rescue of its crew.^[9]

Zeppelin airships equipped with radio were used for bombing and naval scouting during World War I,^[10] and ground-based radio direction finders were used for airship navigation.^[10] Allied airships and military aircraft also made some use of radiotelegraphy. However, there was little aeronautical radio in general use during World War I, and in the 1920s, there was no radio system used by such important flights as that of Charles Lindbergh from New York to Paris in 1927. Once he and the *Spirit of St. Louis* were off the ground, Lindbergh was truly alone and incommunicado. On the other hand, when the first airplane flight was made from California to Australia in 1928 on the *Southern Cross*, one of its four crewmen was its radio operator who communicated with ground stations via radio telegraph.

Beginning in the 1930s, both civilian and military pilots were required to be able to use Morse code, both for use with early communications systems and for identification of navigational beacons which transmitted continuous two- or three-letter identifiers in Morse code. Aeronautical charts show the identifier of each navigational aid next to its location on the map.

Radiotelegraphy using Morse code was vital during World War II, especially in carrying messages between the warships and the naval bases of the belligerents. Long-range ship-to-ship communication was by radio telegraphy, using encrypted messages because the voice radio systems on ships then were quite limited in both their range and their security. Radiotelegraphy was also extensively used by warplanes, especially by long-range patrol planes that were sent out by those navies to scout for enemy warships, cargo ships, and troop ships.

In addition, rapidly moving armies in the field could not have fought effectively without radiotelegraphy because they moved more rapidly than telegraph and telephone lines could be erected. This was seen especially in the blitzkrieg offensives of the Nazi German Wehrmacht in Poland, Belgium, France (in 1940), the Soviet Union, and in North Africa; by the British Army in North Africa, Italy, and the Netherlands; and by the U.S. Army in France and Belgium (in 1944), and in southern Germany in 1945.

Morse code was used as an international standard for maritime distress until 1999 when it was replaced by the Global Maritime Distress Safety System. When the French Navy ceased using Morse code on January 31, 1997, the final message transmitted was "Calling all. This is our last cry before our eternal silence."^[11] In the United States the final commercial Morse code transmission was on July 12, 1999, signing off with Samuel Morse's original 1844 message, "What hath God wrought", and the prosign "SK".^[12]

As of 2015, the United States Air Force still trains ten people a year in Morse.^[13] The United States Coast Guard has ceased all use of Morse code on the radio, and no longer monitors any radio frequencies for Morse code transmissions, including the international medium frequency (MF) distress frequency of 500 kHz.^[14] However, the Federal Communications Commission still grants commercial radiotelegraph operator licenses to applicants who pass its code and written tests.^[15] Licensees have reactivated the old California coastal Morse station KPH and regularly transmit from the site under either this Call sign or as KSM. Similarly, a few US Museum ship stations are operated by Morse enthusiasts.^[16]

User proficiency

Morse code speed is measured in words per minute (wpm) or characters per minute (cpm). Characters have differing lengths because they contain differing numbers of dots and dashes. Consequently, words also have different lengths in terms of dot duration, even when they contain the same number of characters. For this reason, a standard word is helpful to measure operator transmission speed. "PARIS" and "CODEX" are two such standard words.^[17] Operators skilled in Morse code can often understand ("copy") code in their heads at rates in excess of 40 wpm.

In addition to knowing, understanding, and being able to copy the standard written alpha-numeric and punctuation characters or symbols at high speeds, skilled high speed operators must also be fully knowledgeable of all of the special unwritten Morse code symbols for the standard Prosigns for Morse code and the meanings of these special procedural signals in standard Morse code communications protocol.

International contests in code copying are still occasionally held. In July 1939 at a contest in Asheville, North Carolina in the United States Ted R. McElroy set a still-standing record for Morse copying, 75.2 wpm.^[18] William Pierpont N0HFF also notes that some operators may have passed 100 wpm.^[18] By this time, they are "hearing" phrases and sentences rather than words. The fastest speed ever sent by a straight key was achieved in 1942 by Harry Turner W9YZE (d. 1992) who reached 35 wpm in a demonstration at a U.S. Army base. To accurately compare code copying speed records of different eras it is useful to keep in mind that different standard words (50 dot durations versus 60 dot durations) and different interword gaps (5 dot durations versus 7 dot durations) may have been used when determining such speed records. For example, speeds run with the CODEX standard word and the PARIS standard may differ by up to 20%.

Today among amateur operators there are several organizations that recognize high-speed code ability, one group consisting of those who can copy Morse at 60 wpm.^[19] Also, Certificates of Code Proficiency are issued by several amateur radio societies, including the American Radio Relay League. Their basic award starts at 10 wpm with endorsements as high as 40 wpm, and are available to anyone who can copy the transmitted text. Members of the Boy Scouts of America may put a Morse interpreter's strip on their uniforms if they meet the standards for translating code at 5 wpm.

International Morse Code

Morse code has been in use for more than 160 years—longer than any other electrical coding system. What is called Morse code today is actually somewhat different from what was originally developed by Vail and Morse. The Modern International Morse code, or *continental code*, was created by Friedrich Clemens Gerke in 1848 and initially used for telegraphy between Hamburg and Cuxhaven in Germany. Gerke changed nearly half of the alphabet and all of the numerals, providing the foundation for the modern form of the code. After some minor changes, International Morse Code was standardized at the International Telegraphy



A commercially manufactured iambic paddle used in conjunction with an electronic keyer to generate high-speed Morse code, the timing of which is controlled by the electronic keyer. Manipulation of dual-lever paddles is similar to the Vibroplex, but pressing the right paddle generates a series of *dahs*, and squeezing the paddles produces dit-dah-dit-dah sequence. The actions are reversed for left-handed operators.

Congress in 1865 in Paris and was later made the standard by the International Telecommunication Union (ITU). Morse's original code specification, largely limited to use in the United States and Canada, became known as American Morse code or *railroad code*. American Morse code is now seldom used except in historical re-enactments.

Aviation

In aviation, instrument pilots use radio navigation aids. To ensure that the stations the pilots are using are serviceable, the stations all transmit a short set of identification letters (usually a two-to-five-letter version of the station name) in Morse code. Station identification letters are shown on air navigation charts. For example, the VOR based at Manchester Airport in England is abbreviated as "MCT", and MCT in Morse code is transmitted on its radio frequency. In some countries, during periods of maintenance, the facility may radiate a T-E-S-T code (**—** **.** **...** **—**) or the code may be removed which tells pilots and navigators that the station is unreliable. In Canada, the identification is removed entirely to signify the navigation aid is not to be used.^{[20][21]} In the aviation service, Morse is typically sent at a very slow speed of about 5 words per minute. In the U.S., pilots do not actually have to know Morse to identify the transmitter because the dot/dash sequence is written out next to the transmitter's symbol on aeronautical charts. Some modern navigation receivers automatically translate the code into displayed letters.

Amateur radio

International Morse code today is most popular among amateur radio operators, where it is used as the pattern to key a transmitter on and off in the radio communications mode commonly referred to as "continuous wave" or "CW" to distinguish it from spark transmissions, not because the transmission was continuous. Other keying methods are available in radio telegraphy, such as frequency shift keying.

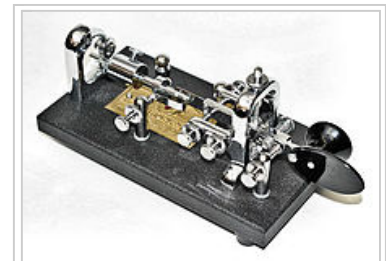
The original amateur radio operators used Morse code exclusively since voice-capable radio transmitters did not become commonly available until around 1920. Until 2003, the International Telecommunication Union mandated Morse code proficiency as part of the amateur radio licensing procedure worldwide. However, the World Radiocommunication Conference of 2003 made the Morse code requirement for amateur radio licensing optional.^[22] Many countries subsequently removed the Morse requirement from their licence requirements.^[23]

Until 1991, a demonstration of the ability to send and receive Morse code at a minimum of five words per minute (wpm) was required to receive an amateur radio license for use in the United States from the Federal Communications Commission. Demonstration of this ability was still required for the privilege to use the HF bands. Until 2000, proficiency at the 20 wpm level was required to receive the highest level of amateur license (Amateur Extra Class); effective April 15, 2000, the FCC reduced the Extra Class requirement to five wpm.^[24] Finally, effective on February 23, 2007, the FCC eliminated the Morse code proficiency requirements from all amateur radio licenses.

While voice and data transmissions are limited to specific amateur radio bands under U.S. rules, Morse code is permitted on all amateur bands—LF, MF, HF, VHF, and UHF. In some countries, certain portions of the amateur radio bands are reserved for transmission of Morse code signals only.

The relatively limited speed at which Morse code can be sent led to the development of an extensive number of abbreviations to speed communication. These include prosigns, Q codes, and a set of Morse code abbreviations for typical message components. For example, CQ is broadcast to be interpreted as "seek you" (I'd like to converse with anyone who can hear my signal). OM (old man), YL (young lady) and XYL ("ex-YL" – wife) are common abbreviations. YL or OM is used by an operator when referring to the other operator, XYL or OM is used by an operator when referring to his or her spouse. QTH is "location" ("My QTH" is "My location"). The use of abbreviations for common terms permits conversation even when the operators speak different languages.

Although the traditional telegraph key (straight key) is still used by some amateurs, the use of mechanical semi-automatic keyers (known as "bugs") and of fully automatic electronic keyers is prevalent today. Software is also frequently employed to produce and decode Morse code radio signals.



Vibroplex brand semiautomatic key (generically called a "bug"). The paddle, when pressed to the right by the thumb, generates a series of *dits*, the length and timing of which are controlled by a sliding weight toward the rear of the unit. When pressed to the left by the knuckle of the index finger, the paddle generates a single *dah*, the length of which is controlled by the operator. Multiple *dahs* require multiple presses. Left-handed operators use a key built as a mirror image of this one.

Other uses



A U.S. Navy signalman sends Morse code signals in 2005.

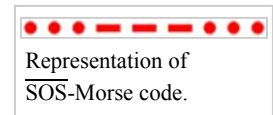
Through May 2013, the First, Second, and Third Class (commercial) Radiotelegraph Licenses using code tests based upon the CODEX standard word were still being issued in the United States by the Federal Communications Commission. The First Class license required 20 WPM code group and 25 WPM text code proficiency, the others 16 WPM code group test (five letter blocks sent as simulation of receiving encrypted text) and 20 WPM code text (plain language) test. It was also necessary to pass written tests on operating practice and electronics theory. A unique additional demand for the First Class was a requirement of a year of experience for operators of shipboard and coast stations using Morse. This allowed the holder to be chief operator on board a passenger ship. However, since 1999 the use of satellite and very high-frequency maritime communications systems (GMDSS) has made them obsolete. (By that point meeting experience requirement for the First was very difficult.) Currently, only one class of license, the Radiotelegraph Operator Certificate, is issued. This is granted either when the tests are passed or as the Second and First are renewed and become this lifetime license. For new applicants, it requires passing a written examination on electronic theory, as well as 16 WPM code and 20 WPM text tests. However, the code exams are currently waived for holders of Amateur Extra Class licenses who obtained their operating privileges under the old 20 WPM test requirement.

Radio navigation aids such as VORs and NDBs for aeronautical use broadcast identifying information in the form of Morse Code, though many VOR stations now also provide voice identification.^[25] Warships, including those of the U.S. Navy, have long used signal lamps to exchange messages in Morse code. Modern use continues, in part, as a way to communicate while maintaining radio silence.

ATIS (Automatic Transmitter Identification System) uses Morse code to identify uplink sources of analog satellite transmissions.

Applications for the general public

An important application is signalling for help through SOS, " **...-...-...**". This can be sent many ways: keying a radio on and off, flashing a mirror, toggling a flashlight, and similar methods. SOS is not three separate characters, rather, it is a prosign SOS, and is keyed without gaps between characters.^[26]



Some Nokia mobile phones offer an option to alert the user of an incoming text message with the Morse tone " **...-...-...**" (representing SMS or Short Message Service). In addition, applications are now available for mobile phones that enable short messages to be input in Morse Code.^[27]

Morse code as an assistive technology

Morse code has been employed as an assistive technology, helping people with a variety of disabilities to communicate. Morse can be sent by persons with severe motion disabilities, as long as they have some minimal motor control. An original solution to the problem that caretakers have to learn to decode has been an electronic typewriter with the codes written on the keys. Codes were sung by users; see the voice typewriter employing morse or votem, Newell and Nabarro, 1968.

Morse code can also be translated by computer and used in a speaking communication aid. In some cases, this means alternately blowing into and sucking on a plastic tube ("sip-and-puff" interface). An important advantage of Morse code over row column scanning is that once learned, it does not require looking at a display. Also, it appears faster than scanning.

People with severe motion disabilities in addition to sensory disabilities (e.g. people who are also deaf or blind) can receive Morse through a skin buzzer..

In one case reported in the radio amateur magazine *QST*,^[28] an old shipboard radio operator who had a stroke and lost the ability to speak or write could communicate with his physician (a radio amateur) by blinking his eyes in Morse. Another example occurred in 1966 when prisoner of war Jeremiah Denton, brought on television by his North Vietnamese captors, Morse-blinked the word *TORTURE*. In these two cases, interpreters were available to understand those series of eye-blinks.

Representation, timing, and speeds

International Morse code is composed of five elements:^[1]

1. short mark, dot or "dit" (**.**): "dot duration" is one time unit long
2. longer mark, dash or "dah" (**—**): three time units long
3. inter-element gap between the dots and dashes within a character: one dot duration or one unit long
4. short gap (between letters): three time units long
5. medium gap (between words): seven time units long

Transmission

Morse code can be transmitted in a number of ways: originally as electrical pulses along a telegraph wire, but also as an audio tone, a radio signal with short and long tones, or as a mechanical, audible, or visual signal (e.g. a flashing light) using devices like an Aldis lamp or a heliograph, a common flashlight, or even a car horn. Some mine rescues have used pulling on a rope - a short pull for a dot and a long pull for a dash.

Morse code is transmitted using just two states (on and off). Historians have called it the first digital code. Morse code may be represented as a binary code, and that is what telegraph operators do when transmitting messages. Working from the above ITU definition and further defining a bit as a dot time, a Morse code sequence may be made from a combination of the following five-bit strings:

1. short mark, dot or "dit" (**.**): 1
2. longer mark, dash or "dah" (**—**): 111
3. intra-character gap (between the dots and dashes within a character): 0
4. short gap (between letters): 000
5. medium gap (between words): 0000000

Note that the marks and gaps alternate: dots and dashes are always separated by one of the gaps, and that the gaps are always separated by a dot or a dash.

Morse messages are generally transmitted by a hand-operated device such as a telegraph key, so there are variations introduced by the skill of the sender and receiver — more experienced operators can send and receive at faster speeds. In addition, individual operators differ slightly, for example, using slightly longer or shorter dashes or gaps, perhaps only for particular characters. This is called their "fist", and experienced operators can recognize specific individuals by it alone. A good operator who sends clearly and is easy to copy is said to have a "good fist". A "poor fist" is a characteristic of sloppy or hard to copy Morse code.

Timing

Below is an illustration of timing conventions. The phrase "MORSE CODE", in Morse code format, would normally be written something like this, where **—** represents dahs and **.** represents dits:

```

- - - - . . . . - - - - - - - - . . . .
M O R S E C O D E

```

Next is the exact conventional timing for this phrase, with **=** representing "signal on", and **.** representing "signal off", each for the time length of exactly one dit:

```

      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890123456789
M----- O----- R----- S---- E      C----- O----- D----- E
==.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=.=
^      ^      ^      ^      ^      ^      ^      ^
|      |      |      |      |      |      |      |
symbol space    dah dit    letter space    word space

```



A sample Morse code transmission

The text "Welcome to Wikipedia, the free encyclopedia that anyone can edit." sent as Morse code at 5 wpm.

Problems playing this file? See media help.



Morse code A through Z

"A B C D E F G H I J K L M N O P Q R S T U V W X Y Z" in Morse code at 8 wpm

Problems playing this file? See media help.

Spoken representation

Morse code is often spoken or written with "dah" for dashes, "dit" for dots located at the end of a character, and "di" for dots located at the beginning or internally within the character. Thus, the following Morse code sequence:

```

M   O   R   S   E           C   O   D   E
--  - - -  - - -  - - -  - - -  (space)  - - -  - - -  - - -  - - -

```

is orally:

Dah-dah dah-dah-dah di-dah-dit di-di-dit dit, Dah-di-dah-dit dah-dah-dah dah-di-dit dit.

There is little point in learning to read *written* Morse as above; rather, the *sounds* of all of the letters and symbols need to be learned, for both sending and receiving.

Speed in words per minute

All Morse code elements depend on the dot length. A dash is the length of 3 dots, and spacings are specified in number of dot lengths. An unambiguous method of specifying the transmission speed is to specify the dot duration as, for example, 50 milliseconds.

Specifying the dot duration is, however, not the common practice. Usually, speeds are stated in words per minute. That introduces ambiguity because words have different numbers of characters, and characters have different dot lengths. It is not immediately clear how a specific word rate determines the dot duration in milliseconds.

Some method to standardize the transformation of a word rate to a dot duration is useful. A simple way to do this is to choose a dot duration that would send a typical word the desired number of times in one minute. If, for example, the operator wanted a character speed of 13 words per minute, the operator would choose a dot rate that would send the typical word 13 times in exactly one minute.

The typical word thus determines the dot length. It is common to assume that a word is 5 characters long. There are two common typical words: "PARIS" and "CODEX". PARIS mimics a word rate that is typical of natural language words and reflects the benefits of Morse code's shorter code durations for common characters such as "e" and "t". CODEX offers a word rate that is typical of 5-letter code groups (sequences of random letters). Using the word PARIS as a standard, the number of dot units is 50 and a simple calculation shows that the dot length at 20 words per minute is 60 milliseconds. Using the word CODEX with 60 dot units, the dot length at 20 words per minute is 50 milliseconds.

Because Morse code is usually sent by hand, it is unlikely that an operator could be that precise with the dot length, and the individual characteristics and preferences of the operators usually override the standards.

For commercial radiotelegraph licenses in the United States, the Federal Communications Commission specifies tests for Morse code proficiency in words per minute and in code groups per minute.^[29] The Commission specifies that a word is 5-characters long. The Commission specifies Morse code test elements at 16 code groups per minute, 20 words per minute, 20 code groups per minute, and 25 words per minute.^[30] The word per minute rate would be close to the PARIS standard, and the code groups per minute would be close to the CODEX standard.

While the Federal Communications Commission no longer requires Morse code for amateur radio licenses, the old requirements were similar to the requirements for commercial radiotelegraph licenses.^[31]

A difference between amateur radio licenses and commercial radiotelegraph licenses is that commercial operators must be able to receive code groups of random characters along with plain language text. For each class of license, the code group speed requirement is slower than the plain language text requirement. For example, for the Radiotelegraph Operator License, the examinee must pass a 20 word per minute plain text test and a 16 word per minute code group test.^[15]

Based upon a 50 dot duration standard word such as PARIS, the time for one dot duration or one unit can be computed by the formula:

$$T = 1200 / W$$

Where: T is the unit time, or dot duration in milliseconds, and W is the speed in wpm.

High-speed telegraphy contests are held; according to the *Guinness Book of Records* in June 2005 at the International Amateur Radio Union's 6th World Championship in High Speed Telegraphy in Primorsko, Bulgaria, Andrei Bindasov of Belarus transmitted 230 morse code marks of mixed text in one minute.^[32]

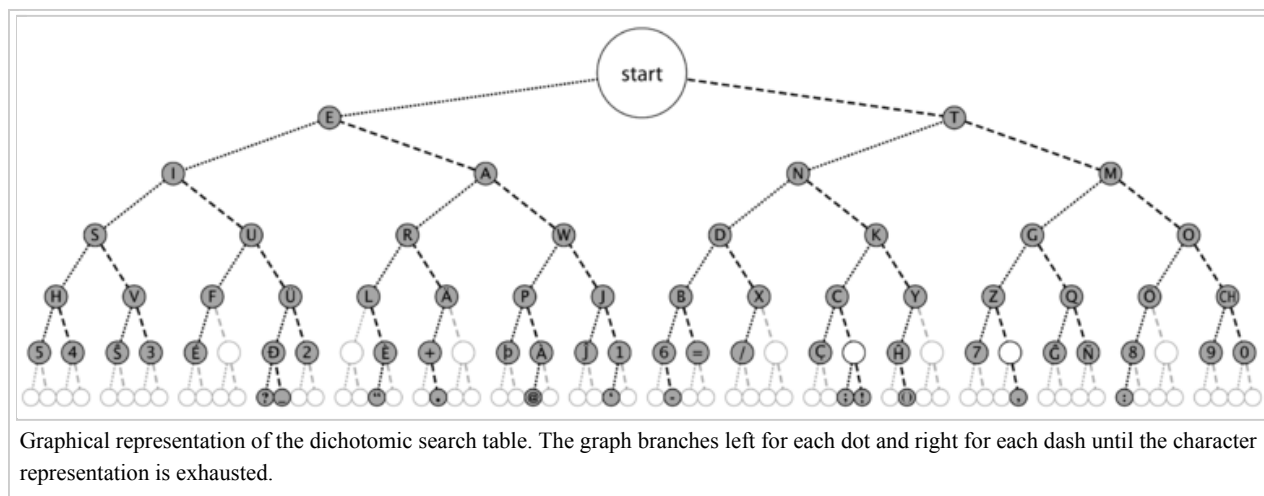
Farnsworth speed

Sometimes, especially while teaching Morse code, the timing rules above are changed so two different speeds are used: a character speed and a text speed. The character speed is how fast each individual letter is sent. The text speed is how fast the entire message is sent. For example, individual characters may be sent at a 13 words-per-minute rate, but the intercharacter and interword gaps may be lengthened so the word rate is only 5 words per minute.

Using different character and text speeds is, in fact, a common practice, and is used in the Farnsworth method of learning Morse code.

Alternative display of common characters in International Morse code

Some methods of teaching Morse code use a dichotomic search table.



Link budget issues

Morse Code cannot be treated as a classical radioteletype (RTTY) signal when it comes to calculating a link margin or a link budget for the simple reason of it possessing variable length dots and dashes as well as variant timing between letters and words. For the purposes of Information Theory and Channel Coding comparisons, the word *PARIS* is used to determine Morse Code's properties because it has an even number of dots and dashes.

Morse Code, when transmitted essentially, creates an AM signal (even in on/off keying mode), assumptions about signal can be made with respect to similarly timed RTTY signalling. Because Morse code transmissions employ an on-off keyed radio signal, it requires less complex transmission equipment than other forms of radio communication.

Morse code also requires less signal bandwidth than voice communication, typically 100–150 Hz, compared to the roughly 2400 Hz used by single-sideband voice, although at a lower data rate.

Morse code is usually heard at the receiver as a medium-pitched on/off audio tone (600–1000 Hz), so transmissions are easier to copy than voice through the noise on congested frequencies, and it can be used in very high noise / low signal environments. The transmitted power is concentrated into a limited bandwidth so narrow receiver filters can be used to suppress interference from adjacent frequencies. The audio tone is usually created by use of a beat frequency oscillator.

The narrow signal bandwidth also takes advantage of the natural aural selectivity of the human brain, further enhancing weak signal readability. This efficiency makes CW extremely useful for DX (distance) transmissions, as well as for low-power transmissions (commonly called "QRP operation", from the Q-code for "reduce power").

The ARRL has a readability standard for robot encoders called ARRL Farnsworth Spacing^[33] that is supposed to have higher readability for both robot and human decoders. Some programs like WinMorse^[34] have implemented the standard.

Learning methods

People learning Morse code using the **Farnsworth method** are taught to send and receive letters and other symbols at their full target speed, that is with normal relative timing of the dots, dashes, and spaces within each symbol for that speed. The Farnsworth method is named for Donald R. "Russ" Farnsworth, also known by his call sign, W6TTB. However, initially exaggerated spaces between symbols and words are used, to give "thinking time" to make the sound "shape" of the letters and symbols easier to learn. The spacing can then be reduced with practice and familiarity.

Another popular teaching method is the **Koch method**, named after German psychologist Ludwig Koch, which uses the full target speed from the outset but begins with just two characters. Once strings containing those two characters can be copied with 90% accuracy, an additional character is added, and so on until the full character set is mastered.

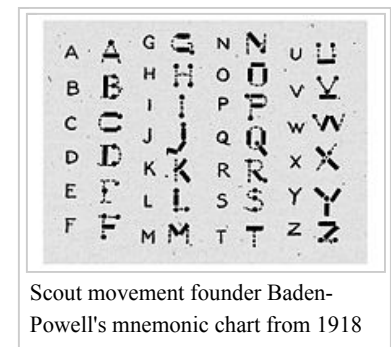
In North America, many thousands of individuals have increased their code recognition speed (after initial memorization of the characters) by listening to the regularly scheduled code practice transmissions broadcast by W1AW, the American Radio Relay League's headquarters station.

Mnemonics

Visual mnemonic charts have been devised over the ages. Baden-Powell included one in the Girl Guides handbook^[35] in 1918.

In the United Kingdom, many people learned the Morse code by means of a series of words or phrases that have the same rhythm as a Morse character. For instance, "Q" in Morse is dah-dah-di-dah, which can be memorized by the phrase "God save the Queen", and the Morse for "F" is di-di-dah-dit, which can be memorized as "Did she like it."

A well-known Morse code rhythm from the Second World War period derives from Beethoven's Fifth Symphony, the opening phrase of which was regularly played at the beginning of BBC broadcasts. The timing of the notes corresponds to the Morse for "V"; di-di-di-dah and stood for "V for Victory" (as well as the Roman numeral for the number five).^{[36][37]}



Letters, numbers, punctuation, prosigns for Morse code and non-English variants

Category	Character	Code
Letters	A, a	. _ _____
Letters	B, b	_ . . . _____
Letters	C, c	_ . _ . _____
Letters	D, d	_ . . _____
Letters	E, e	. _____
Letters	F, f	. . _ . _____
Letters	G, g	_ _ . _____
Letters	H, h _____
Letters	I, i	. . _____
Letters	J, j	. _ _ _ _____
Letters	K, k Prosign for "Invitation to transmit"	_ . _ _____
Letters	L, l	. _ . . _____
Letters	M, m	_ _ _____
Letters	N, n	_ . _____
Letters	O, o	_ _ _ _____
Letters	P, p	. _ _ . _____

Category	Character	Code
Letters	Q, q	— — • — _____
Letters	R, r	• — • _____
Letters	S, s	• • • _____
Letters	T, t	— _____
Letters	U, u	• • — _____
Letters	V, v	• • • — _____
Letters	W, w	• — — _____
Letters	X, x	— • • — _____
Letters	Y, y	— • — — _____
Letters	Z, z	— — • • _____
Numbers	0	— — — — — _____
Numbers	1	• — — — — _____
Numbers	2	• • — — — _____
Numbers	3	• • • — — _____
Numbers	4	• • • • — _____
Numbers	5	• • • • • _____
Numbers	6	— • • • • _____

Category	Character	Code

Numbers	7	---... _____
Numbers	8	---.. _____
Numbers	9	-----. _____
Punctuation	Period [.]	.-.-.- _____
Punctuation	Comma [,]	---..-- _____
Punctuation	Question Mark [?]	..-... _____
Punctuation	Apostrophe [']	.-----. _____
Punctuation	Exclamation Point [!] KW digraph	---.--- _____
Punctuation	Slash/Fraction Bar [/]	---... _____
Punctuation	Parenthesis (Open)	---.. _____
Punctuation	Parenthesis (Close)	---.- _____
Punctuation	Ampersand (or "Wait") [&] AS digraph Prosign for "Wait" Not in ITU-R recommendation	.-... _____
Punctuation	Colon [:]	---... _____
Punctuation	Semicolon [;]	---.-.. _____
Punctuation	Double Dash [=]	---.- _____
Punctuation	Plus sign [+]	_____

Category	Character	Code
		• — • — • _____
Punctuation	Hyphen, Minus Sign [-]	— • • • — _____
Punctuation	Underscore [_] Not in ITU-R recommendation	• • — • — _____
Punctuation	Quotation mark ["]	• — • • • _____
Punctuation	Dollar sign [\$] $\overline{\text{SX}}$ digraph Not in ITU-R recommendation	• • • — • — _____
Punctuation	At Sign [@] $\overline{\text{AC}}$ digraph	• — • — • _____
Prosigns	End of work	• • • — • — _____
Prosigns	Error	• • • • • • • _____
Prosigns	Invitation to Transmit Also used for K	— • — _____
Prosigns	Starting Signal	— • — • — _____
Prosigns	New Page Signal $\overline{\text{AR}}$ digraph Message separator Single-line display may use printed "+"	• — • — • _____
Prosigns	Understood Also used for $\hat{\text{S}}$	• • • — • _____
Prosigns	Wait also used for Ampersand [&]	• — • • • _____
Non-English extensions	À, à Shared by Å, Ȧ	• — • — • _____
Non-English extensions	Ä, ä Shared by Ȧ, Æ, Ȧ	• — • — _____
Non-English Extensions		• — • — • _____

Category	Character	Code
	Å, å Shared by Ä, Å	
Non-English extensions	Ǻ, ǻ Shared by Ä, Æ, Å	• — • — _____
Non-English extensions	Æ, æ Shared by Ä, Æ, Å	• — • — _____
Non-English extensions	Ć, ć Shared by Ć, Ć, Ç	— • — • • _____
Non-English extensions	Ĉ, ĉ Shared by Ć, Ć, Ç	— • — • • _____
Non-English Extensions	Ç, ç Shared by Ć, Ć, Ç	— • — • • _____
Non-English extensions	CH, ch Shared by CH, Ĥ, Š	— — — — _____
Non-English extensions	Ð, ð Shared by Ð, É, Ě Not to be confused with Eth (Ð, ð)	• • — • • _____
Non-English extensions	Đ, đ Not to be confused with D with stroke (Đ, đ)	• • — — • _____
Non-English extensions	É, é Shared by Ð, É, Ě	• • — • • _____
Non-English extensions	È, è Shared by È, Ĺ	• — • • — _____
Non-English extensions	Ě, ě Shared by Ð, É, Ě	• • — • • _____
Non-English extensions	Ĝ, ĝ _____	— — • — • _____
Non-English extensions	Ĥ, ĥ Shared by CH, Ĥ, Š	— — — — _____
Non-English extensions	Ĵ, ĵ _____	• — — — • _____
Non-English extensions	Ĺ, ĺ Shared by È, Ĺ	• — • • — _____

Category	Character	Code
Non-English extensions	Ń, ń Shared byacuteN, Ntilde	<div>---.---</div> <div></div>
Non-English extensions	Ñ, ñ Shared byacuteN, Ntilde	<div>---.---</div> <div></div>
Non-English extensions	Ó, ó Shared byacuteO, O-umlaut, O-slash	<div>----.</div> <div></div>
Non-English extensions	Ö, ö Shared byacuteO, O-umlaut, O-slash	<div>----.</div> <div></div>
Non-English extensions	Ø, ø Shared byacuteO, O-umlaut, O-slash	<div>----.</div> <div></div>
Non-English extensions	Ś, ś	<div>...---</div> <div></div>
Non-English extensions	Ŝ, ŝ Prosign for "Understood"	<div>...-. .</div> <div></div>
Non-English extensions	Š, š Shared byCH, H-acute, S-acute	<div>-----</div> <div></div>
Non-English extensions	Þ, þ	<div>.-... .</div> <div></div>
Non-English extensions	Ü, ü Shared byÜ, U-acute	<div>..---</div> <div></div>
Non-English extensions	Ǔ, ǔ Shared byÜ, U-acute	<div>..---</div> <div></div>
Non-English extensions	Ž, ž	<div>---... .</div> <div></div>
Non-English extensions	Ž, ž	<div>---...-</div> <div></div>

Prosigns

Prosigns for Morse code are special (usually) unwritten procedural signals or symbols that are used to indicate changes in communications protocol status or white space text formatting actions.

Symbol representations

The symbols **!**, **\$** and **&** are not defined inside the ITU recommendation on Morse code, but conventions for them exist. The **@** symbol was formally added in 2004.

Exclamation mark

There is no standard representation for the exclamation mark (!), although the \overline{KW} digraph (- . - . - . - .) was proposed in the 1980s by the Heathkit Company (a vendor of assembly kits for amateur radio equipment).

While Morse code translation software prefers the Heathkit version, on-air use is not yet universal as some amateur radio operators in North America and the Caribbean continue to prefer the older \overline{MN} digraph (- - - . - .) carried over from American landline telegraphy code.

Currency symbols

- The ITU has never codified formal Morse Code representations for currencies as the ISO 4217 Currency Codes are preferred for transmission.
- The \$ sign code was represented in the Phillips Code, a huge collection of abbreviations used on land line telegraphy, as \overline{SX} .

Ampersand

- The representation of the & sign given above, often shown as \overline{AS} , is also the Morse prosign for **wait**. In addition, the American landline representation of an ampersand was similar to "ES" (. - . . .) and hams have carried over this usage as a synonym for "and" (WX HR COLD ES RAINY, "the weather here is cold & rainy").

Keyboard AT @

- On May 24, 2004 — the 160th anniversary of the first public Morse telegraph transmission — the Radiocommunication Bureau of the International Telecommunication Union (ITU-R) formally added the @ ("commercial at" or "commat") character to the official Morse character set, using the sequence denoted by the \overline{AC} digraph (- . - . - . - .).
- This sequence was reportedly chosen to represent "A[T] C[OMMERCIAL]" or a letter "a" inside a swirl represented by a "C".^[38] The new character facilitates sending email addresses by Morse code and is notable since it is the first official addition to the Morse set of characters since World War I.

Non-Latin extensions

For Chinese, Chinese telegraph code is used to map Chinese characters to four-digit codes and send these digits out using standard Morse code. Korean Morse code (<https://web.archive.org/web/20101109183046/http://homepages.cwi.nl/~dik/english/codes/morse.html>) uses the SKATS mapping, originally developed to allow Korean to be typed on western typewriters. SKATS maps hangul characters to arbitrary letters of the Latin script and has no relationship to pronunciation in Korean. For Russian and Bulgarian, Russian Morse code is used to map the Cyrillic characters to four-element codes. Many of the characters are encoded the same way (A, O, E, I, T, M, N, R, K, etc.). Bulgarian alphabet contains 30 characters, which exactly match all possible combinations of 1, 2, 3, and 4 dots and dashes. Russian requires 1 extra character, "bI" which is encoded with 5 elements.

Unusual variants

During early World War I (1914–1916), Germany briefly experimented with 'dotty' and 'dashy' Morse, in essence adding a dot or a dash at the end of each Morse symbol. Each one was quickly broken by Allied SIGINT, and standard Morse was restored by Spring 1916. Only a small percentage of Western Front (North Atlantic and Mediterranean Sea) traffic was in 'dotty' or 'dashy' Morse during the entire war. In popular culture, this is mostly remembered in the book *The Codebreakers* by Kahn and in the national archives of the UK and Australia (whose SIGINT operators copied most of this Morse variant). Kahn's cited sources come from the popular press and wireless magazines of the time.^[39]

Other forms of 'Fractional Morse' or 'Fractionated Morse' have emerged.^[40]

Decoding software

Decoding software for Morse code ranges from software-defined wide-band radio receivers coupled to the Reverse Beacon Network,^[41] which decodes signals and detects CQ messages on ham bands, to smartphone applications.^[42]

See also

- ACP-131
- CW Operators' Club
- Guglielmo Marconi
- High-speed telegraphy
- Hog morse
- Instructograph
- Morse code abbreviations
- Morse code mnemonics
- NATO phonetic alphabet
- Tap code
- Wabun code
- Wireless telegraphy
- Theodore Roosevelt McElroy

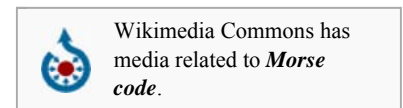
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External links

- Morse code (https://dmoztools.net/Recreation/Radio/Amateur/Morse_Code/) at DMOZ
- "Everyone Knows Morse" (<http://tvtropes.org/pmwiki/pmwiki.php/Main/EveryoneKnowsMorse>). *TV Tropes*.. Includes a list of uses and appearances of Morse Code in movies, television episodes, and other popular culture.
- Morse Code resources (http://www.dxzone.com/catalog/Operating_Modes/Morse_code/)
- Morse code MP3 practice files. (<http://starling.us/free/morse>) 200 hours of at increasing speeds plus an ASCII-to-CW file generator program.
- International Morse Code, Hand Sending (<https://www.youtube.com/watch?v=R-petiNdCIY>) US Army training video 1966.
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Categories: American inventions | Morse code | Latin-alphabet representations | 1848 introductions

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Q code

From Wikipedia, the free encyclopedia

The **Q code** is a standardized collection of three-letter message encodings, also known as a brevity code, all of which start with the letter "Q", initially developed for commercial radiotelegraph communication, and later adopted by other radio services, especially amateur radio. Although Q codes were created when radio used Morse code exclusively, they continued to be employed after the introduction of voice transmissions. To avoid confusion, transmitter call signs are restricted; while an embedded three-letter Q sequence may occur (for instance when requested by an amateur radio station dedicated to low-power operation), no country is ever issued an ITU prefix starting with "Q". The codes in the range QAA–QNZ are reserved for aeronautical use; QOA–QQZ for maritime use and QRA–QUZ for all services.

Contents

- 1 Early developments
- 2 Later usage
- 3 Breakdown by service
- 4 Amateur radio
 - 4.1 Q codes applicable for use in amateur radio
 - 4.1.1 Informal usage
 - 4.1.2 Humorous codes
- 5 Aviation
- 6 Maritime
- 7 See also
- 8 References
- 9 External links

Early developments

The original Q codes were created, *circa* 1909, by the British government as a "list of abbreviations... prepared for the use of British ships and coast stations licensed by the Postmaster General".^[*citation needed*] The Q codes facilitated communication between maritime radio operators speaking different languages, so they were soon adopted internationally. A total of forty-five Q codes appeared in the "List of Abbreviations to be used in Radio Communications", which was included in the Service Regulations affixed to the Third International Radiotelegraph Convention in London (The Convention was signed on July 5, 1912, and became effective July 1, 1913.)

The following table reviews a sample of the all-services Q codes adopted by the 1912 Convention:

First Twelve Q Codes Listed in the 1912 International Radiotelegraph Convention Regulations

Code	Question	Answer or Notice
QRA	What ship or coast station is that?	This is ____.
QRB	What is your distance?	My distance is ____.
QRC	What is your true bearing?	My true bearing is ____ degrees.
QRD	Where are you bound for?	I am bound for ____.
QRF	Where are you bound from?	I am bound from ____.
QRG	What line do you belong to?	I belong to the ____ Line.
QRH	What is your wavelength in meters?	My wavelength is ____ meters.
QRJ	How many words have you to send?	I have ____ words to send.
QRK	How do you receive me?	I am receiving (1-5) where 1 is unreadable and 5 is perfect.
QRL	Are you busy?	I am busy.
QRM	Are you being interfered with?	I am being interfered with.
QRN	Are the atmospherics strong?	Atmospherics are very strong.

Later usage

Over the years, modifications were made to the original Q codes to reflect changes in radio practice. In the original international list, QSW/QSX stood for "Shall I increase/decrease my spark frequency?", however, spark-gap transmitters were banned in the United States in the 1920s, rendering the original meaning of those Q codes obsolete. Over a hundred Q codes were listed in the *Post Office Handbook for Radio Operators* in the 1970s and cover subjects such as meteorology, radio direction finding, radio procedures, search and rescue, and so on.

Some Q codes are also used in aviation, in particular QNE, QNH and QFE, referring to certain altimeter settings. These codes are used in radiotelephone conversations with air traffic control as unambiguous shorthand, where safety and efficiency are of vital importance. A subset of Q codes is used by the Miami-Dade County, Florida local government for law enforcement and fire rescue communications, one of the few instances where Q codes are used in ground voice communication.^[1]

The QAA–QNZ code range includes phrases applicable primarily to the aeronautical service,^[2] as defined by the International Civil Aviation Organisation.^[3] The QOA–QQZ code range is reserved for the maritime service. The QRA–QUZ code range includes phrases applicable to all services and is allocated to the International Telecommunications Union.^[4] QVA–QZZ are not allocated.^[5] Many codes have no immediate applicability outside one individual service, such as maritime operation (many QO or QU series codes) or radioteletype operation (the QJ series).^[6]

Many military and other organizations that use Morse code have adopted additional codes, including the Z code used by most European and NATO countries. The Z code adds commands and questions adapted for military radio transmissions, for example, "ZBW 2", which means "change to backup frequency number 2", and "ZNB abc", which means "my checksum is abc, what is yours?"^[7]

Used in their formal "question/answer" sense, the meaning of a Q code varies depending on whether or not the individual Q code is sent as a question or an answer. For example, the message "QRP?" means "Shall I decrease transmitter power?", and a reply of "QRP" means "Yes, decrease your transmitter power". This structured use of Q codes is fairly rare and now mainly limited to amateur radio and military morse code (CW) traffic networks.

Breakdown by service

- QAA to QNZ - Assigned by the International Civil Aviation Organization (ICAO).
- QOA to QQZ - For the Maritime Services.
- QRA to QUZ - Assigned by the International Telecommunications Union (ITU).

Amateur radio

Selected Q codes were soon adopted by amateur radio operators. In December 1915, the American Radio Relay League began publication of a magazine titled *QST*, named after the Q code for "General call to all stations". In amateur radio, the Q codes were originally used in Morse code transmissions to shorten lengthy phrases and were followed by a Morse code question mark (·—··) if the phrase was a question.

Q codes are commonly used in voice communications as shorthand nouns, verbs, and adjectives making up phrases. For example, an amateur radio operator will complain about QRM (man-made interference), or tell another operator that there is "QSB on the signal" (fading); "to QSY" is to change your operating frequency. (See also Informal usage, below.)

Q codes applicable for use in amateur radio

Code	Question	Answer or Statement
QRA	What is the name (or call sign) of your station?	The name (or call sign) of my station is ...
QRG	Will you tell me my exact frequency (or that of ...)?	Your exact frequency (or that of ...) is ... kHz (or MHz).
QRH	Does my frequency vary?	Your frequency varies.
QRI	How is the tone of my transmission?	The tone of your transmission is (1. Good; 2. Variable; 3. Bad)
QRJ	How many voice contacts do you want to make?	I want to make ... voice contacts.
QRK	What is the readability of my signals (or those of ...)?	The readability of your signals (or those of ...) is ... (1 to 5).
QRL	Are you busy?	I am busy. (or I am busy with ...) Please do not interfere.
QRM	Do you have interference?	I have interference.
QRN	Are you troubled by static?	I am troubled by static.
QRO	Shall I increase power?	Increase power.
QRP	Shall I decrease power?	Decrease power.

QRQ	Shall I send faster?	Send faster (... wpm)
QRS	Shall I send more slowly?	Send more slowly (... wpm)
QRT	Shall I cease or suspend operation?/ shutoff the radio	I am suspending operation. /shutting off the radio
QRU	Have you anything for me?	I have nothing for you.
QRV	Are you ready?	I am ready.
QRW	Shall I inform ... that you are calling him on ... kHz (or MHz)?	Please inform ... that I am calling him on ... kHz (or MHz).
QRX	When will you call me again?	I will call you again at ... (hours) on ... kHz (or MHz)
QRZ	Who is calling me?	You are being called by ... on ... kHz (or MHz)
QSA	What is the strength of my signals (or those of ...)?	The strength of your signals (or those of ...) is ... (1 to 5).
QSB	Are my signals fading?	Your signals are fading.
QSD	Is my keying defective?	Your keying is defective.
QSG	Shall I send ... telegrams (messages) at a time?	Send ... telegrams (messages) at a time.
QSK	Can you hear me between your signals?	I can hear you between my signals.
QSL	Can you acknowledge receipt?	I am acknowledging receipt.
QSM	Shall I repeat the last telegram (message) which I sent you, or some previous telegram (message)?	Repeat the last telegram (message) which you sent me (or telegram(s) (message(s)) numbers(s) ...).
QSN	Did you hear me (or ... (call sign)) on .. kHz (or MHz)?	I did hear you (or ... (call sign)) on ... kHz (or MHz).
QSO	Can you communicate with ... direct or by relay?	I can communicate with ... direct (or by relay through ...).
QSP	Will you relay a message to ...?	I will relay a message to
QSR	Do you want me to repeat my call?	Please repeat your call; I did not hear you.
QSS	What working frequency will you use?	I will use the working frequency ... kHz (or MHz).
QST	-	Here is a broadcast message to all amateurs.
QSU	Shall I send or reply on this frequency (or on ... kHz (or MHz))?	Send or reply on this frequency (or on ... kHz (or MHz)).
QSW	Will you send on this frequency (or on ... kHz (or MHz))?	I am going to send on this frequency (or on ... kHz (or MHz)).
QSX	Will you listen to ... (call sign(s) on ... kHz (or MHz))?	I am listening to ... (call sign(s) on ... kHz (or MHz))
QSY	Shall I change to transmission on another frequency?	Change to transmission on another frequency (or on ... kHz (or MHz)).
QSZ	Shall I send each word or group more than once?	Send each word or group twice (or ... times).

QTA	Shall I cancel telegram (message) No. ... as if it had not been sent?	Cancel telegram (message) No. ... as if it had not been sent.
QTC	How many telegrams (messages) have you to send?	I have ... telegrams (messages) for you (or for ...).
QTH	What is your position in latitude and longitude (or according to any other indication)?	My position is ... latitude...longitude
QTR	What is the correct time?	The correct time is ... hours
QTU	At what times are you operating?	I am operating from ... to ... hours.
QTX	Will you keep your station open for further communication with me until further notice (or until ... hours)?	I will keep my station open for further communication with you until further notice (or until ... hours).
QUA	Have you news of ... (call sign)?	Here is news of ... (call sign).
QUC	What is the number (or other indication) of the last message you received from me (or from ... (call sign))?	The number (or other indication) of the last message I received from you (or from ... (call sign)) is ...
QUD	Have you received the urgency signal sent by ... (call sign of mobile station)?	I have received the urgency signal sent by ... (call sign of mobile station) at ... hours.
QUE	Can you speak in ... (language), - with interpreter if necessary; if so, on what frequencies?	I can speak in ... (language) on ... kHz (or MHz).
QUF	Have you received the distress signal sent by ... (call sign of mobile station)?	I have received the distress signal sent by ... (call sign of mobile station) at ... hours.

Informal usage

Some of the common usages of amateur radio codes, including in voice and writing, vary somewhat from their formal, official sense.

QRL? is the accepted form of the question, "Is this frequency in use (or busy)?", the reply to which is typically the letters^[8] "C" (dah di dah dit), "R" (di dah dit) or "Y" (dah di dah dah) which, in the Amateur radio tradition, are the Morse code shorthand for "Confirm", "Roger" or "Yes."

QSK - "I can hear you during my transmission" - refers to a particular mode of Morse code operating in which the receiver is quickly enabled during the spaces between the dits and dahs, which allows another operator to interrupt transmissions. Many modern transceivers incorporate this function, sometimes referred to as *full break-in* as against *semi-break-in* in which there is a short delay before the transceiver goes to receive.

QSO - A conversation or contact via amateur radio is often referred to as a QSO, while QSL cards are collected by both radioamateurs and shortwave listeners as confirmation of having received the signal of a particular station.

QSY - "Change to transmission on another frequency"; colloquially, "move [=change address]". E.g., "When did GKB (<http://www.qsl.net/gm3zdh/coast/uk/gka/closedown/final-msg.htm>) QSY from Northolt to Portishead....?"^[9]

QTH - "My location is..."; colloquially in voice or writing, "location". E.g., "The OCF [*antenna*] is an interesting build but at my QTH a disappointing performer."^[10]

QTHR - "at the registered address for my callsign", this is used mainly in the United Kingdom and former colonies. Since business may not be discussed on amateur radio, a ham who has personal equipment to sell might say something like "I have a spare Morse key old chap, please contact me QTHR". Not official but in common use;^[11] probably derived from "QTH" + "R" for "registered".

Humorous codes

There are also a few unofficial and humorous codes in use, such as QLF ("try sending with your LEFT foot"), QPP ("Hold on a minute, I drank a liter of water and need to use the bathroom."), and QSC ("send cigarettes", not the official meaning of "this is a cargo vessel"). In the question form, QNB?, is supposed to mean "How many buttons does your radio have?" A reply of the form QNB 45/15 means "45, and I know what 15 of them do." QSJ is sometimes used to refer to the cost of something - "I would like an FT9000 but it is too much QSJ". (QSJ actually means "What is the charge to be collected to ... including your internal charge?").

Note: *The ARRL codes (<http://www.arrl.org/files/file/Public%2520Service/fsd218.pdf>) QNA-QNZ overlap with International Civil Aviation Organization (ICAO) codes but have different meanings.*

Aviation

The majority of the Q codes have slipped out of common use; for example today reports such as QAU ("I am about to jettison fuel") and QAZ ("I am flying in a storm") would be voice or computerized transmissions. But several remain part of the standard ICAO radiotelephony phraseology in aviation.

Altimeter Settings

International Morse Code	
1. The length of a dot is one unit. 2. A dash is three units. 3. The space between parts of the same letter is one unit. 4. The space between letters is three units. 5. The space between words is seven units.	
A	U
B	V
C	W
D	X
E	Y
F	Z
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	
Q	
R	
S	
T	
	1
	2
	3
	4
	5
	6
	7
	8
	9
	0

Chart of the Morse code letters and numerals.^[8]

Code	Meaning	Sample use
QFE	Atmospheric pressure at sea level, corrected for temperature and adjusted to a specified datum such as airfield elevation. When set on the altimeter it reads height.	Runway in use 22 Left, QFE 990 millibars
QFF	Barometric pressure at a place, reduced to MSL using the actual temperature at the time of observation as the mean temperature.	
QNE	Atmospheric pressure at sea level in the International Standard Atmosphere (ISA), equal to 1013.25 mbar or hPa and used as reference for measuring the pressure altitude. When Flight Levels are used as an indication of altitude, 1013.25 hPa is used as mean sea level (QNH).	
QNH	Atmospheric pressure at mean sea level (may be either a local, measured pressure or a regional forecast pressure (RPS)). When set on the altimeter it reads altitude.	Request Leeds QNH

Radio Navigation

Code	Meaning	Sample use
QDM	Magnetic heading <i>to</i> a station	(callsign) request QDM (callsign) ^[12]
QDL	Series of bearings taken at regular intervals	
QDR	Magnetic bearing <i>from</i> a station	(callsign) request QDR (callsign) ^[12]
QFU	Magnetic bearing of the runway in use	Runway 22 in use, QFU 220 ^[13]
QGE	Distance	
QGH	Controlled Descent through Clouds (Royal Air Force use)	
QTE	True bearing <i>from</i> a station	True bearing, True bearing, (callsign) request QTE (callsign) ^[12]
QTF	Position in relation to a point of reference or in latitude and longitude	
QUJ	True bearing <i>to</i> a station	

Radio Procedures

Code	Meaning	Sample use
QGH	controller-interpreted DF let-down procedure, on UHF or VHF ^[14]	

Maritime

Q signals are no longer used in the maritime service, as Morse code is now very rarely used.

See also

- ACP-131
- Ten-code
- Prosigns for Morse code
- International Code of Signals
- International maritime signal flags

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- ↑ ICAO PANS (Procedures for Air Navigation Services) Doc 8400: The ICAO Q Code.
- ↑ http://www.globalsecurity.org/military/library/policy/navy/nrtc/14244_ch4.pdf
- ↑ www.portland-amateur-radio-club.org.uk - Web site hosted by Freeola.com (<http://www.portland-amateur-radio-club.org.uk/resources/q-codes.pdf>)
- ↑ <http://kylami.homeip.net/qcodes.htm>
- ↑ ACP 131(E) (<http://www.armymars.net/ArmyMARS/DigitalOps/Resources/acp131-operating-sigs.pdf>), Communications Instructions - Operating Signals, March 1997. Chapter 2 contains a full list of 'Q' codes
- ↑ ***^a ^b*** "International Morse code Recommendation ITU-R M.1677-1" (<http://www.itu.int/rec/R-REC-M.1677-1-200910-I/>). *itu.int*. International Telecommunication Union. October 2009. Retrieved 23 December 2011.
- ↑ Post in the uk.radio.amateur newsgroup (<https://groups.google.com/d/msg/uk.radio.amateur/5LRgiCMoNcI/kObVDDoEi9gJ>) Dated 2010-08-21. Accessed 2013-08-04.
- ↑ Has anyone used a tuner with an Off Centre Fed Dipole? How well did it work? (http://www.amateur-radio-wiki.net/index.php?title=Has_anyone_used_a_tuner_with_an_Off_Centre_Fed_Dipole%3F_How_well_did_it_work%3F) Article on Amateur Radio Wiki. Accessed 2013-08-04.
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- ↑ ***^a ^b ^c*** <http://www.caa.co.uk/docs/33/CAP413.PDF>
- ↑ QFU on The Free Dictionary (<http://acronyms.thefreedictionary.com/QFU>)
- ↑ QGH on The Free Dictionary (<http://acronyms.thefreedictionary.com/QGH>)

External links

- Handbook for Wireless Telegraph Operators (<http://www.telegraph-office.com/pages/q-signals-1909.html>), October, 1909.
- Radio Laws and Regulations of the United States: Edition July 27, 1914 (<http://www.earlyradiohistory.us/1914reg.htm>). (Includes the 1912 London Radiotelegraphic Convention)
- List of Q codes (<http://www.kloth.net/radio/qcodes.php>)
- A resource for Morse Code operation in the amateur radio hobby (<http://cw.hfradio.org/>)

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Prosigns, Q Signals and CW Abbreviations Used in Amateur (Ham) Radio



Procedural Signals (Prosigns) for Morse Code

C Q - Calling any station (does any ham *not* know this one?)

AR - "+" over, end of message

K - go, invite any station to transmit

KN - "(" go only, invite a specific station to transmit

BK - invite receiving station to transmit

R - all received OK

AS - please stand by

SK - end of contact (sent before call)

CL - going off the air (clear)

Q Signals (or Q Abbreviations)

Q Signals take the form of a question only when each is followed by a question mark.

QRG - Will you tell me my exact frequency (or that of ____)?

Your exact frequency (or that of ____) is ____ kHz.

QRH - Does my frequency vary?

Your frequency varies.

QRI - How is the tone of my transmission?

The tone of your transmission is _____. (1. Good 2. Variable 3. Bad)

QRJ - Are you receiving me badly?

I can not receive you. Your signals are too weak.

QRK - What is the intelligibility of my signals (or those of ____)?

The intelligibility of your signals (or those of _____) is:

(1. Bad 2. Poor 3. Fair 4. Good 5. Excellent)

QRL - Are you busy?

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I am busy (or I am busy with ____). Please do not interfere.

QRM - Is my transmission being interfered with?

Your transmission is being interfered with ____.

(1. Nil 2. Slightly 3. Moderately 4. Severely 5. Extremely)

QRN - Are you troubled by static?

I am troubled by static ---. (1-5 as under QRM)

QRO - Shall I increase power?

Increase power.

QRP - Shall I decrease power?

Decrease power.

QRQ - Shall I send faster?

Send faster _____. (WPM)

QRS - Shall I send more slowly?

Send more slowly _____. (WPM)

QRT - Shall I stop sending?

Stop sending.

QRU - Have you anything for me?

I have nothing for you.

QRV - Are you ready?

I am ready.

QRW - Shall I inform ____ that you are calling on ____ kHz?

Please inform ____ that I am calling on ____ kHz.

QRX - When will you call me again?

I will call you again at ____ hours (on ____ kHz).

QRY - What is my turn?

Your turn is numbered ____.

QRZ - Who is calling me?

You are being called by ____ (on ____ kHz).

QSA - What is the strength of my signals (or those of ____)?

The strength of your signals (or those of ____) is ____.

(1. Scarcely perceptible 2. Weak 3. Fairly good 4. Good 5. Very good)

QSB - Are my signals fading?

Your signals are fading.

QSD - Is my keying defective?

Your keying is defective?

QSG - Shall I send ____ messages at a time?

Send ____ messages at a time.

QSK - Can you hear me in between your signals and if so, can I break in on your transmission?

I can hear you between my signals; break in on my transmission.

QSL - Can you acknowledge receipt?

I am acknowledging receipt.

QSM - Shall I repeat the last message I sent you, or some previous message?

Repeat the last message you sent me [or message(s) number(s) ____].

QSN - Did you hear me (or ____) on ____ kHz?
I did hear you (or ____) on ____ kHz.

QSO - Can you communicate with ____ direct or by relay?
I can communicate with ____ direct (or by relay through ____).

QSP - Will you relay to ____?
I will relay to ____.

QST - General call proceeding a message addressed to all amateurs and ARRL members.
This is in effect, "CQ ARRL".

QSU - Shall I send or reply on this frequency (or on ____ kHz)?
Send a series of Vs on this frequency (or on ____ kHz).

QSW - Will you send on this frequency (or on ____ kHz)?
I am going to send on this frequency (or on ____ kHz).

QSX - Will you listen to ____ on ____ kHz?
I am listening to ____ on ____ kHz.

QSY - Shall I change to to transmission on another frequency?
Change transmission to another frequency (or ____ kHz).

QSZ - Shall I send each word or group more than once?
Send each word or group twice (or ____ times).

QTA - Shall I cancel message number ____?
Cancel message number ____.

QTB - Do you agree with my counting of words?
I do not agree with your counting of words. I will repeat the first letter or digit of each word or group.

QTC - How many messages have you to send?
I have ____ messages for you (or for ____).

QTH - What is your location?
My location is ____.

QTR - What is the correct time?
The correct time is ____.

Common abbreviations for CW work

AA	- All after	PBL	- Preamble
AB	- All before	PSE	- Please
ABT	- About	PWR	- Power
ADR	- Address	PX	- Press

AGN	- Again	R	- Received as transmitted; Are
AM	- Amplitude Modulation	RCD	- Received
ANT	- Antenna	RCVR	- Receiver
BCI	- Broadcast Interference	RX	- Receiver
BCL	- Broadcast Listener	REF	- Refer to; Referring to; Reference
BK	- Break, Break in	RFI	- Radio frequency interference
BN	- All between; Been	RIG	- Station equipment
BUG	- Semi-Automatic key	RTTY	- Radio teletype
B4	- Before	SASE	- Self-addressed, stamped envelope
C	- Yes	SED	- Said
CFM	- Confirm; I confirm	SIG	- Signature; Signal
CK	- Ckeck	SINE	- Operator's personal initials or nickname
CL	- I am closing my station; Call	SKED	- Schedule

CLD	- Called	SRI	- Sorry
CLG	- Calling	SSB	- Single Side Band
CQ	- Calling any station	SVC	- Service; Prefix to service message
CW	- Continuous wave	T	- Zero
DLD	- Delivered	TFC	- Traffic
DLVD	- Delivered	TMW	- Tomorrow
DR	- Dear	TKS	- Thanks
DX	- Distance	TNX	- Thanks
ES	- And	TT	- That
FB	- Fine Business, excellent	TU	- Thank you
FM	- Frequency Modulation	TVI	- Television interference
GA	- Go ahead	TX	- Transmitter
GM	- Good morning	TXT	- Text
GN	- Good night	UR	- Your; You're
GND	- Ground	URS	- Yours
GUD	- Good	VFO	- Variable Frequency Oscillator

HI	- The telegraph laugh; High	VY	- Very
HR	- Here; Hear	WA	- Word after
HV	- Have	WB	- Word before
HW	- How	WD	- Word
LID	- A poor operator	WDS	- Words
MA	- Millamperes	WKD	- Worked
MILS	- Millamperes	WKG	- Working
MSG	- Message; Prefix to radiogram	WL	- Well; Will
N	- No	WUD	- Would
NCS	- Net Control Station	WX	- Weather
ND	- Nothing Doing	XCVR	- Transceiver
NIL	- Nothing; I have nothing for you	XMTR	- Transmitter
NM	- No more	XTAL	- Crystal
NR	- Number	XYL	- Wife
NW	- Now; I resume transmission	YL	- Young lady
OB	- Old boy	73	- Best Regards

OC	- Old chap	88	- Love and kisses
OM	- Old man		
OP	- Operator		
OPR	- Operator		
OT	- Old timer; Old top		



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RSQ Table – an Improved digital signal reporting system

READABILITY		
R5	95%+	Perfectly readable
R4	80%	Practically no difficulty; occasional missed characters
R3	40%	Considerable words distinguishable
R2	20%	Occasional words distinguishable
R1	0%	Undecipherable

STRENGTH	
S9	Very Strong trace
S7	Strong trace
S5	Moderate trace
S3	Weak trace
S1	Barely Perceptible trace

QUALITY	
Q9	Clean Signal - no visible unwanted sidebar pairs
Q7	One barely visible pair
Q5	One easily visible pair
Q3	Multiple visible pairs
Q1	Splatter over much of the spectrum

RSQ Readability

The new descriptive table has a corresponding range of percent readable text, consistent with the common practice of providing a percentage figure during a QSO or when responding to the inevitable “HW CPY?” at the end of an over. Currently, a % readable text figure is often provided to the other station to clarify its readability after the traditional RST report has been sent.

RSQ Strength

Most HF digital mode programs provide a broad band waterfall or spectrum receive display. As a result, it is common practice for operators to monitor and even decode multiple signals when working a narrow band digital station. Under these conditions, a visible measure of signal trace relative to noise is more meaningful than an S meter reading that averages the strength of all signals in the pass band.

RSQ Quality

The presence of additional unwanted trace modulation observed on the waterfall or spectrum indicates possible spurious emissions and provides a basis for assessing the quality of digital mode signals. The traditional RST Tone report being designed to evaluate CW signals for the presence of audible hum, key clicks, chirping etc is simply not relevant to digital modes.

AMATEUR RADIO GLOSSARY

JARGON, ABBREVIATIONS AND TERMINOLOGY

NOTE CAUTION:

**This is an informal listing of Ham Jargon -- The opinions of AC6V Only.
Not to be used as a definitive source.
Caveat Lector. Reader Beware! Applies as in all things.**

For [CW Abbreviations](#)

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You May Also Use CNTRL F Or Your Browser FIND Command To Locate Terms

A (Alpha)

A - Ampere - Unit of current measurement. Current is a measure of the electron flow through a circuit per unit of time. 6.24×10^{18} electrons moving past a point in one second, equals one ampere. Abbreviated as amps.

A Battery -- in early radio, batteries were the prime source of power - The A battery provided the filament voltage, the B-battery furnished the B+ or the Voltage to the plates of the tubes, and the C battery provided the grid-bias voltage for the tubes.

absorption - The reduction in a radio signal strength in the ionosphere.

AC - Alternating Current

access code - (Repeater Term) A code to activate a repeater function e.g. auto patch, link etc.. One or more numbers and/or symbols are keyed in with a telephone key pad and transmitted to the repeater.

A/D - Analog-to-Digital

Aerial - Used in the early days of radio - sometimes referring to an outdoor antenna. Still used in the UK.

AF - Audio Frequency 20 to 20,000 hertz, the human hearing range. Also abbreviation for Africa

AFC - Automatic frequency control. Used in FM receivers to prevent drift.

AFSK - Audio frequency shift keying (as opposed to frequency shift keying, FSK)

A-index - An index of the conditions of the Earth's magnetic field as measured at Boulder, Colorado. Propagation generally improves with lower measurement numbers. URL: [Propagation](#)

AGC - Automatic Gain Control. A feedback voltage in the receiver circuit to prevent fading

ALC - Automatic level control. A feedback voltage in the transmitter's output amplifier used to prevent amplifier overload. Also used as feedback from a linear amplifier back to the exciter to prevent overdriving.

alligator - A repeater that transmits further than it can receive, big mouth, small ears! Also used in reference to a repeater timer timeout. If you talk on the repeater too long, an internal timer will cut you off, and jargon for this is "The alligator got you!" Also in contesting circles to refer to a station (usually running high power and under noisy receive conditions) whose transmit signal is greater than their receive capability.

amateur - a person licensed to operate in the amateur bands.

amateur radio - A non-commercial radio service as set by a recognized cognizant government agency. In the USA, amateur radio is defined under part 97 of the FCC Rules and Regulations - See URL: [Part 97](#)

amateur service: a radio communication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

ampere (A) : the basic unit of electrical current. Current is a measure of the electron flow through a circuit per unit of time. 6.24×10^{18} electrons moving past a point in one second, equals one ampere. Abbreviated as amps.

AM - Amplitude Modulation See URL: [Modulation Modes](#)

A.M.- ante meridian (before noon).

AMSAT - Radio Amateur Satellite Corporation - See URL: [AMSAT](#)

AMTOR - Amateur Teleprinter Over Radio. A version of RTTY. - See URL: [AMTOR](#) Also used commercially as SITOR (Simplex Teleprinter Over Radio).

ANARC - Association of North American Radio Clubs. See [ANARC](#)

antenna: a device that intercepts or radiates radio frequency energy.

antenna farm - Ham's dream -- lotsa room for big, long, antennas

antenna tuner: Impedance-matching device that matches the antenna system input impedance to the transmitter, receiver, or transceiver output impedance.

appliance operator : Hams who neither build nor experiment with radio equipment, but merely operate commercial equipment, perhaps without understanding how it all works.

APRS - Automatic Packet Position Reporting System - See URL: [APRS](#)

ARA - Amateur Radio Association

ARC - Amateur Radio Club. Military Designation for Avionics (Aviation Radio Composite)

ARES - Amateur Radio Emergency Service - See URL: [ARES](#)

ARRL - American Radio Relay League , the national amateur radio organization in the USA - See URL: [ARRL](#)

ARQ - Automatic repeat request used in AMTOR.

ASCII - American Standard Code for Information Interchange. The ASCII 7-bit code represents 128 characters including 32 control characters.

ASR - Automatic send-receive. An RTTY terminal mode that allows message composition while receiving text from the another station.

ATT - Attenuator, often expressed in dB of reduction.

ATV - Amateur Television, also known as fast scan television - See URL: [ATV](#)

auroral propagation - Propagation above 30 MHz by means of refraction by highly ionized regions around the Earth's poles. See URL: [Propagation](#)

autopatch - (Repeater Term) a device that interfaces a repeater to the telephone system to permit repeater users to make telephone calls. Often just called a "patch."

AVC - Automatic Volume Control - A feedback scheme to level out the receiver audio volume.

AWG - American Wire Gauge - standard for describing the diameter of wire by which the wire size increases as the gauge number decreases.

B (Bravo)

B - Battery -- in early radio, batteries were the prime source of power - The A battery provided the filament voltage, the B battery furnished the B+ or the Voltage to the plates of the tubes, and the C battery provided the grid-bias voltage to the tubes.

balanced line: A feed line with two conductors having equal but opposite voltages, with neither conductor at ground potential.

balanced modulator: a mixer circuit used in a single-sideband suppressed-carrier transmitter to combine a voice signal and the RF carrier. The balanced modulator isolates the input signals from each other and the output, so that only the sum and the difference of the two input signals reach the output. The original carrier signal and the audio signal are suppressed.

balun - balance to unbalance , a device used to couple a balanced antenna to an unbalanced feed line (e.g., dipole to coax)

band - a range of frequencies allotted for a particular use (e.g., 20 Meter Band) [See Ham bands](#)

bandpass - range of frequencies permitted to pass through a filter or receiver circuit.

band-pass filter: a circuit that passes a range of frequencies and attenuates signals above and below this range

base -- a radio station located at a fixed location as opposed to a mobile. Used to identify the control location in a network of radio stations.

barefoot - transmitting with a transceiver alone and no linear amplifier

base loading - A loading coil at the bottom of an antenna to achieve a lower resonant frequency.

BAUD - The unit of digital-signal speed.

Baudot: a five-bit digital code used in teleprinter application.

BBC - British Broadcasting Corporation. [See BBC](#)

BBS - Bulletin Board System

BCI - Broadcast radio interference.

beam - an antenna that gives a directional beam pattern. See Yagi

beacon: A station that transmits one-way signals for the purpose of navigation, homing, and propagation condition determination. See URL: [Beacons](#)

Benton Harbor Lunch Box - A portable transceiver made by Heathkit Co. Band choices were 2, 6, or 10 meters - AM operation.

BFO - Beat frequency oscillator. Used to mix with the incoming signal to produce an audio tone for CW reception. A BFO is needed to copy CW and SSB signals.

Bird - nickname for satellite. Also a brand name of a high-end, high quality directional wattmeter.

birdie - Spurious signals produced in a receiver - usually a product of mixed intermediate frequencies within the radio.

bleed over- Interference caused by a station operating on an adjacent channel

bleeder resistor: a large-value resistor connected across the filter capacitor in a power supply to discharge the filter capacitors when the supply is turned off.

block diagram: a drawing using rectangles to represent major sections of electronic circuits. The diagram shows signal flow and the function of the sections.

BNC - Coax connector commonly used with VHF/UHF equipment -- Bayonet Niell-Concelman (standard connector type used on COAX cable, named for its inventors).\

BPL - BroadBand Over Power Lines

bps - Bits per second

BPSK - Binary Phase Shift Keying; digital DSB suppressed carrier modulation.

birdie: A false or spurious signal in a receiver inadvertently produced by the receiver's circuitry.

boat anchor - antique ham equipment -- So named because of weight and size. See [BoatAnchors](#)

bootlegger - Someone, usually not a Ham but a wannabe, making up a callsign, one usually not in the callbook, and getting on the air. Sometimes it is someone who already bought a radio, took the test and flunked, and then gets on the air anyway.

bounce - reflections of a radio wave off of an object, (e.g., the ionosphere or the moon)

breadboard - Early experimenters used a wood board or bread board to lay out circuits. Now used to describe an experimental layout on whatever media -- like PC boards.

break - (Repeater Term) used to interrupt a conversation on a repeater to indicate that there is an emergency or urgent message. If non-urgent, simply interject your callsign.

break break (Repeater Term) used to intercede in an existing conversation with emergency communications.

broadcasting: transmissions intended for the general public. Broadcasting is prohibited on the Amateur Radio Bands, other than QST's which are of interest to all Amateur Stations, example W1AW code practice transmissions.

bug - a semi-automatic mechanical code key

bunny hunt - (see "fox hunt") See [Fox Hunting](#)

bureau - International Amateur organizations set up to process QSL cards between countries. Provides an inexpensive way to send and receive QSL cards - See URL: [Bureaus](#)

burro - International QSL forwarding bureau.

Busted Call -- An incorrectly logged callsign

C (Charlie)

C- Battery -- in early radio, batteries were the prime source of power - The A battery provided the filament voltage, the B

battery furnished the B+ or Voltage to the plates of the tubes, and the C battery provided the grid-bias voltage to the tubes.

california kilowatt - a power setting above the legal limit

call book - a publication or CD ROM that lists licensed amateur radio operators See URL: [CALLBOOK](#)

calling frequency: A defacto standard frequency where stations attempt to contact each other. Example -- 146.52 is the USA National FM simplex calling frequency See [Calling Frequencies](#)

candy store -- ham term for the local Ham Radio Dealer. -- See [Ham Stores](#)

cans -- headphones

cap - capacitor (formerly condenser)

CAP - [Civil Air Patrol](#)

capacitor: an electronic component composed of two or more conductive plates separated by an insulating material. A capacitor stores energy in an electric field.

carrier - a pure continuous radio emission at a fixed frequency, without modulation and without interruption. Several types of modulation can be applied to the carrier, See AM and FM. See URL: [Modulation Modes](#)

carrier-operated relay (COR) - (Repeater Term) circuitry that causes the repeater to transmit in response to a received signal.

CATV - Cable Television (originally Community Television)

CATVI - Cable Television Interface.

CBA - Callbook Address

CC&R's - Covenants, Conditions, and Restrictions - an extensive set of rules drawn up by homeowner's associations and their lawyers which, among other things, typically restrict or completely prohibit a homeowner from having most forms of antennas on their property.

CCW - Coherent CW

center frequency - The unmodulated carrier frequency of an FM transmitter.

center loading - A loading coil at the center of an antenna to achieve a lower resonant frequency

centi: the metric prefix for 10^{-2} , or divide by 100.

channel - (Repeater Term) the pair of frequencies (input and output) used by a repeater.

chassis ground: the common connection for all parts of a circuit that connect to the negative side of the power supply.

chirp - Changes in the carrier frequency of a CW transmitter, resulting in a chirping sound

clear -- used to indicate a station is done transmitting

closed repeater - (Repeater Term) a repeater whose access is limited to a select group (see open repeater).

cloud warmer - an antenna which radiates most of the transmitted energy nearly straight up.

CMOS - Complementary-symmetry metal-oxide semiconductor.

coax, coaxial cable A type of wire that consists of a center wire surrounded by insulation and then a grounded shield of braided wire. The shield minimizes electrical and radio frequency interference. 50-ohm and 72 ohm characteristic impedances are typical. See [Coax Types](#)

code - usually refers to Morse code, but used for others such as baudot.

coil: a conductor wound into a series of loops. See also inductor

color code: a system in which numerical values are assigned to various colors. Colored stripes are painted on the body of resistors and other components to show their value. See [Color Code](#)

condenser - Old term for capacitor - basic unit is farads, which is generally too large so usually expressed in microfarads or picofarads. An electronic component composed of two or more conductive plates separated by an insulating material. A capacitor stores energy in an electric field.

controller: (Repeater Term) the control system within a repeater -- usually includes turning the repeater on-off, timing transmissions, sending the identification signal, controlling the auto patch and CTCSS encoder/decoder.

control operator - (Repeater Term) the Amateur Radio operator designated to "control" the operation of the repeater, as required by FCC regulations.

copy -- indication of how well communications are received. "I have a good copy on you"
also used as a question, as in "did you copy" - understand all"

copying -- used to indicate one is monitoring as in "I was copying the mail" which means
I was listening in on the conversation

core: the material used in the center of an inductor coil, where magnetic fields is concentrated.

courtesy beep - (Repeater Term) an audible indication that a repeater user may go ahead and transmit, usually resets the timer

coverage - (Repeater Term) the geographic area that the repeater provides communications.

CPS - Cycles Per Second, this terminology was replaced by "Hertz" (see "Hertz")

CQ - calling any amateur radio station, may be sent in CW, phone or some digital modes

CR - Carriage return

critical angle - The angle at which a radio signal is refracted in the ionosphere. Lower angles generally result in greater distance transmissions.

critical frequency: the highest frequency at which a vertically incident radio wave will return from the ionosphere. Above the critical frequency radio signals pass through the ionosphere instead of returning to Earth.

cross-band: the process of transmitting on one band and receiving on another.

CRT - Cathode-ray tube

crystal - a piezoelectric device that tends to resonate at a frequency dependent on its material, dimensions, and temperature

crystal filter - A network of piezoelectric crystals used to obtain high rejection of unwanted signals.

crystal oscillator: a device that uses a quartz crystal to keep the frequency of a transmitter constant.

CSCE - Certificate of Successful Completion of Examination (U.S.), a certificate certifying a person has successfully passed one or more of the amateur radio license examinations

CTCSS - (Repeater Term) abbreviation for continuous tone-controlled squelch system, a series of subaudible tones that some repeaters use to restrict access. See [CTCSS Codes](#)

current: a flow of electrons in an electrical circuit.

cutoff frequency - The frequency at which a filter will begin to reject signals.

CW - Continuous Wave, see carrier. In truth a continuous wave is an unmodulated, uninterrupted RF wave. However in common usage refers to Morse code emissions or messages which is an interrupted wave. See URL: [Modulation Modes](#)

cycles (cps) term used for measuring frequency prior to the term Hertz replaced it - hence kc, Mc, etc.

D (Delta)

dB - Decibel (1/10 of a Bel); unit for the ratio of two power measurements. - See URL: [decibel](#)

dBc - In terms of RF signals, dBc is Decibels relative to the carrier level.

dBd - Decibels above or below a dipole antenna.

dBì - Decibels above or below an isotropic antenna.

DC - Direct current

de -- Morse code for "from" e.g., AC6V de WA0PPP

deci: the metric prefix for 10⁻¹, or divide by 10.

delta-loop antenna: a variation of the cubical quad with triangular elements.

desense (desensitization): the reduction of receiver sensitivity due to overload from a nearby transmitter.

detector - the stage in a receiver in which the modulation (voice or other information) is recovered from the RF signal. Called a discriminator in FM

deviation - The change in the carrier frequency of a FM transmitter produced by the modulating signal.

deviation ratio - the ratio between the maximum change in RF-carrier frequency and the highest modulating frequency used in an FM transmitter. Also see modulation Index.

digipeater - A store-and-forward digital repeater which will receive and transmit a data packet on the same frequency.

dip meter - or grid dip meter -- a device used to determine the resonant frequency of an electronic circuit

diplexer - A frequency splitting and isolation device. Typically used to couple two transceivers to a single or dual band antenna, thus allowing one to receive on one transceiver and transmit on the other transceiver. Typical application 2M and 440MHz transceivers into a dual band antenna for satellite work. Thus typically an isolation device for use on 2 or more different bands.

dipole - the basic antenna consisting of a length of wire or tubing, open and fed at the center. The entire antenna is ½ wavelength long at the desired operating frequency. This antenna often used as a standard for calculating gain, dBd.

director - an element in front of the driven element in a Yagi or Quad and some other directional antennas.

doubling -- (Repeater Term) On a repeater if two stations transmit simultaneously, the signals mix in the repeater's

receiver and results in a raspy signal. FM has a characteristic whereby the stronger signals "captures" and over-rides the weaker one.

downlink - Channel used for satellite-to-earth communications.

double-pole, double-throw (DPDT) switch - switches two different circuit lines to two different points.

double-pole, single-throw (DPST) switch - switches two different circuit lines on or off.

DPSK - Differential Phase Shift Keying; a form of BPSK where only data transitions are transmitted.

D-region - D-layer: The lowest region of the ionosphere found approximately 25 to 55 miles above Earth; it fades away quickly after sunset and sometimes does not form at all on short winter days. The main impact of the D-layer on radio propagation is to absorb energy from signals passing through it. -- See URL: [Propagation](#)

driven element - antenna element that connects directly to the feed line.

dropping out - (Repeater Term) a repeater requires a minimum signal in order to transmit, when a signal does not have enough strength to keep the repeater transmitting, it "drops out"

DSP - Digital Signal Processing - allows for filtering, noise reduction, audio equalization, etc

DTMF - (Repeater Term) abbreviation for dual-tone multi-frequency, the series of tones generated from a keypad on a ham radio transceiver (or a regular telephone). Uses 2-of-7 or 2-of-8 tones; often referred to by Bell's trademark Touchtone. See [DTMF Tones](#)

dual-band antenna - antenna designed for use on two different Amateur Radio bands.

dummy load - a device which substitutes for an antenna during tests on a transmitter. It converts radio energy to heat instead of radiating energy. Offers a match to the transmitter output impedance.

Dupe - A duplicate contact -- As in Contesting

duplex - (Repeater Term) a communication mode in which a radio transmits on one frequency and receives on another (also see full duplex, half duplex, and simplex)

duplexer - (Repeater Term) a device used in repeater systems which allows a single antenna to transmit and receive simultaneously. Thus typically for isolation on a system on the same band.

DVM - Digital voltmeter

DX - (noun) distant station; (verb) to contact a distant station

DXer - An Amateur radio operator who actively pursues contacting distant and rare Amateur Radio stations. Also applied to Short Wave Listeners.

DXCC - Award offered by ARRL for contacting and confirming 100 or more different countries first introduced in 1937. DXCC is copyright ARRL and its use here is printed with permission of the ARRL. See [DXCC](#)

DXpedition - Radio expedition to remote and rare locations -- See [Current DX Operations](#)

dynamic range: How well a receiver can handle strong signals with overloading; any measure of over 100 decibels is considered excellent.

E (Echo)

earth ground - a circuit connection to a ground rod driven into the earth

Echolink Uses a network protocol called VoIP (Voice over IP). This program allows worldwide connections to be made between stations, from computer to station, or from computer to computer. There are more than 96,000 registered users in 128 countries worldwide! URL: [EchoLink](#)

ECSSB - Exalted-carrier single sideband.

Edison Effect - Thomas A. Edison discovered the electron flow from a glowing cathode to an anode in an evacuated glass bulb and was called the 'Edison-effect' This led to the development of the vacuum tube.

EEPROM - Electrically-erasable programmable read-only memory

E-layer: The region of the ionosphere found approximately 55 to 90 miles above Earth; it fades away a few hours after sunset. The main impact of the E-layer on radio propagation is to absorb energy from signals passing through it, although sporadic-E propagation makes possible distant communications on frequencies above 30 MHz. See URL: [Propagation](#)

EHF - Extremely High Frequency (30 - 300 GHz)

EIRP - Effective isotropic radiated power.

elephant - a repeater that receives further than it can transmit, big ears, small mouth!

ELF - Extremely Low Frequency (30 - 300 Hz)

elmer - a mentor; an experienced operator who tutors newer operators See URL: [ELMERS](#)

eleven meters - currently the CB band, once a Ham band

EME - Earth-Moon-Earth; using the moon as a passive reflector to establish a signal path; moonbounce. - See URL: [EME](#)

EMF Electromotive force; voltage.

EMI - Electromagnetic interference.

emission mode - the form of a radio emission, such as AM, FM, or single sideband - See URL: [Modulation Modes](#)

EMP - Electromagnetic pulse; a extremely high-energy magnetic field. Such as the current flow caused by a lightning strike or nuclear explosion.

ERP - Effective Radiated Power

E-skip - Sporadic E-layer ionospheric propagation see URL: [Propagation](#)

ether - Old theory for the medium once believed to conduct radio waves. The existence of the ionosphere is first discovered by the English physicist, Appellton in 1924.

Eu - Europe

eyeball - A face-to-face meeting between two ham radio operators.

F (Foxtrot)

FAA - Federal Aviation Administration (USA). See [FAA](#)

F-layer: The region of the ionosphere found approximately 90 to 400 miles above Earth and which is responsible for most long distance propagation on frequencies below 30 MHz. During the daytime (especially in summer), solar heating can cause the F-layer to split into two separate layers, the F1-layer and the F2-layer. See URL: [Propagation](#)

FAQ - Frequently Asked Questions

far field of an antenna - that region of the electromagnetic field surrounding an antenna where the field strength as a function of angle (the antenna pattern) is essentially independent of the distance from the antenna. In this region (also called the free-space region), the field has a predominantly plane-wave character. That is, locally uniform distributions of electric field strength and magnetic field strength are in a plane perpendicular to the direction of propagation.

Farnsworth - a method of sending Morse code characters. Example characters are sent at 13 words per minute but the spacing is adjusted so that the overall code speed is 5 words per minute.

fax - facsimile, a digital mode for transmitting images - See URL: [Modulation Modes](#)

FB - Fine Business, good, fine, OK

FCC - Federal Communications Commission, the governmental body in the U.S. which regulates the radio spectrum See URL: [FCC](#)

feedline - wire or cable connecting a radio to an antenna

FET - Field-effect transistor

field day - Amateur Radio activity in June to practice emergency communications.

field strength meter - a test instrument used to show the presence of RF energy and the relative strength of the RF field.

filter - A circuit or device that will allow certain frequencies to pass while rejecting others.

final - The last transmission by a station during a contact. Also the last amplifying stage of a radio transmitter.

fire bottle - any electronic vacuum tube

first personal - first name - CB jargon that has crept into Ham jargon - old timers shudder

fist - early spark transmitters showered the operator with sparks - so Marconi's key lever was lengthened and the padded end was beaten with the 'fist' of the operator to send dots and dashes. Also a CW ops' reference to another ops' keying characteristic

F.I.S.T.S. - An organization of CW enthusiasts. See [FISTS](#)

flat topping -- overmodulating so as to distort a waveform

flutter - Rapid variation in the signal strength of a station, usually due to propagation variations.

FM - Frequency Modulation - See URL: [Modulation Modes](#)

FOC - First Class CW Operators Club -- See [FOC](#)

fox hunt - a contest to locate a hidden transmitter - See URL: [FOXHUNT](#)

frequency - the rate of oscillation (vibration). Audio and radio wave frequencies are measured in Hertz. (cycles per second)

frequency coordinator - (Repeater Term) an individual or group responsible for assigning frequencies to new repeaters without causing interference to existing repeaters

FSK Frequency-shift keying. Modulating the transmitter by using the RTTY data signal to shift the carrier frequency. Mark and Space. See URL: [Modulation Modes](#)

FSTV - Fast-Scan TV. Same as commercial broadcast TV.

full-break in (QSK) - allows a station to break into the communication without waiting for the transmitting station to finish.

full duplex - a communications mode in which a radios can transmit and receive at the same time by using two different frequencies (see "duplex" and half duplex)

full gallon - (see gallon)

full quieting -- (Repeater Term) a phenomenon on FM transmissions where the incoming signal is sufficient to engage the receiver limiters - thus eliminating the noise due to amplitude fluctuations.

full-wave bridge rectifier - a full-wave rectifier circuit that uses four diodes and does not require a center-tapped transformer. Converts AC to DC

full-wave rectifier - a circuit basically composed of two half-wave rectifiers. The full wave rectifier allows the full ac waveform to pass through; one half of the cycle is reversed in polarity. This circuit requires a center-tapped transformer. Converts AC to DC

fuse - a thin metal strip mounted in a holder. When excessive current passes through the fuse, the metal strip melts and opens and protects the circuit. Fuses are rated in amperes and voltage and time to activate - fast blow or slow blow.

G (Golf)

gallon - slang for transmitter output power -- legally either 1000 watts CW or 1500 watts PEP

GaAs -- Gallium arsenide; used in high-speed semiconductors.

gain, antenna - an increase in the effective power radiated by an antenna in a certain desired direction, or an increase in received signal strength from a certain direction. This is at the expense of power radiated in, or signal strength received from, other directions.

GCR - General Certification Rule. Most award sponsors allow GCR in lieu of actually wanting to see your cards. You need to have the cards! GCR usually means getting the signatures of two witnesses who certify that you possess the cards and that the information you state on the application is correct.

GHz - gigahertz - billion (1,000,000,000) hertz (see Hertz)

giga - the metric prefix for 10⁹ or times 1,000,000,000.

GMRS - General Mobile Radio Service.

GOTA - Get on the Air -- A category in the annual ARRL Field Day event. The GOTA station may be operated by Novice, Technicians or generally inactive hams under their existing operating privileges, or under the direction of a Control Operator with appropriate privileges, as necessary. Non-licensed persons may participate under the direct supervision of an appropriate control operator. See URL: [ARRL FIELD DAY](#)

GPS - Global Positioning System -- See [GPS](#)

gray line - a band around the Earth that separates daylight from darkness. It is a transition region between day and night. One of the many types of propagation paths.

great circle route - The shortest path by radio between any two points on Earth.

green stamp - U.S. dollar bill sent along with a QSL card (instead of an IRC) to offset postage costs of a return card.

grid dip meter -- Test Equipment that causes a meter decrease (dip) when near resonant circuits

ground - Common zero-voltage reference point.

ground-plane antenna - a vertical antenna built with the central radiating element one-quarter-wavelength long and several radials extending horizontally from the base. The radials are slightly longer than one-quarter wave, and may droop toward the ground.

ground wave propagation - radio waves that travel along the surface of the earth, even beyond the horizon. See URL: [Propagation](#)

H (Hotel)

half duplex - (Repeater Term) a communications mode in which a radio transmits and receives on two different frequencies but performs only one of these operations at any given time (see "duplex" and "full duplex")

half-wave dipole - the basic antenna consisting of a length of wire or tubing, open and fed at the center. The entire antenna is ½ wavelength long at the desired operating frequency.

half-wave rectifier - a circuit that allows only half of the applied ac waveform to pass through it.

hand-held - (Repeater Term) a small, lightweight portable transceiver small enough to be carried easily; also called HT (for Handie-Talkie, a Motorola trademark).

hang time - (Repeater Term) the short period following a transmission that allows others who want to access the repeater a chance to do so; a courtesy beep sounds when the repeater is ready to accept another transmission.

ham - an amateur radio operator. See [Origins](#)

hamfest - ham festival, a social and commercial event at which hams meet to buy, sell, and swap equipment - See URL: [HamFests](#)

handle - A radio operator's name. Kinda unnecessary -- just say the name is. But lotsa old timers use handle.

harmonic - a signal at a multiple of the fundamental frequency. Also a slang term for the children of an Amateur.

HDTV - High Definition Television

HDX - Half-duplex. A communication system in which stations take turns transmitting and receiving.

Hertz - the standard unit used to measure frequency (one Hertz equals one complete cycle per second)

HF - High Frequency - 3 MHz to 30 MHz

hi hi - ha ha (laughter)

"hi hi" is the Morse equivalent of a laugh as in Morse it sounds like someone chuckling ("hehhehhehheh hehheh"). That is ditditditdit dit dit --- or dot dot dot dot dot dot. You really have to listen to it sent in Morse to appreciate its laugh like sound. It is most commonly used in CW (Morse Code), but has carried over to voice as well. Many CW expressions have carried over to voice -- such as 73 (Best Regards) and 88 (love and Kisses), etc. The origin probably dates back before radio to the telegraph days. And since Hams used Morse long before voice became practical-- the sound of the Morse characters HI HI was used to resemble a laugh sound. In some sense it is equivalent of a smiley. It's onomatopoeic -- that is the naming of a thing or action by a vocal imitation of the sound associated with it (as *buzz*, *hiss*) The definitive answer might be found in the "Dodge's The Telegraph Instructor Manual" circa 1850 to 1900. However, I have never been able to find a copy of this document. Wish I could as it would help to see the transitions from telegraph to radio usage. So that is my best guess -- based on what old time telegraphers have told me

high-pass filter - a filter designed to pass high frequency signals, while blocking lower frequency signals.

homebrew - term for home-built, noncommercial radio equipment.

hop - communication between stations by reflecting the radio waves off of the ionosphere.

horizontally polarized wave - an electromagnetic wave with its electric lines of force parallel to the ground.

HT - (Repeater Term) Handi-Talkie - a small hand held radio

Hz - (see Hertz)

I (India)

I ([intensity](#)) symbol for current in an electric circuit, measured in Amperes

IARU - International Amateur Radio Union - worldwide ham radio organization whose members consist of the official radio society from each participating country. See [IARU](#)

IC - Integrated circuit.

ID -- Identification, as announcing station callsign at intervals specified by Part 97 of the FCC Rules and Regulations.

IF - Intermediate Frequency -- Intermediate frequency, resultant frequency from heterodyning the carrier frequency with an oscillator, mixing incoming signals to an intermediate frequency enhances amplification, filtering and the processing signals. Desirable to have more than one IF.

image - A false signal produced in a superheterodyne receiver's circuitry.

impedance: The opposition to the flow of electric current and radio energy; it is measured in ohms (symbol is Z). For best performance, the impedance of an antenna, the feedline, and the antenna connector on a radio should be approximately equal.

inductance - a measure of the ability of a coil to store energy in a magnetic field.

inductor - an electrical component usually composed of a coil of wire wound on a central core. An inductor stores energy in a magnetic field.

input frequency - (Repeater Term) the frequency of the repeater's receiver (and your transceiver's transmitter).

intermod - Short for "intermodulation," this means false or spurious signals produced by two or more signals mixing in a receiver or repeater station.

intermodulation distortion (IMD) -- (Repeater Term) the unwanted mixing of two strong RIF signals that causes a signal to be transmitted on an unintended frequency.

I/O - Input/Output

ionosphere - The electrically charged region of the Earth's atmosphere located approximately 40 to 400 miles above the Earth's surface that refracts radio signals.

IOTA - Islands On The Air - See URL: [IOTA](#)

IRC - International Reply Coupon: A coupon that can be purchased at post offices which can be exchanged in foreign countries for return postage for a surface mail letter to the country that issued the coupon. [See IRC's](#)

IRLP Radio Linking Project. Uses a network protocol called VoIP (Voice over IP). There are now nearly 800+ repeaters around the world connected by the internet through the Amateur radio internet radio linking project, 24 hours per day, 7 days a week. URL: [IRLP](#)

isotropic - Theoretical "Single Point" antenna used calculate gain.

ITU - International Telecommunications Union, the body which specifies worldwide guidelines concerning the use of the electromagnetic spectrum for communications purposes. [See ITU](#)

J (Juliet)

J antenna (J pole) - a mechanically modified version of the zepp (zeppelin) antenna. It consists of a half-wavelength radiator fed by a quarter-wave matching stub. This antenna does not require the ground plane that ¼-wave antennas do to work properly.

jam - cause intentional interference

JFET - Junction field-effect transistor.

JOTA - Jamboree on the Air -- an annual event in which about 500,000 Scouts and Guides all over the world make contact with each other by means of amateur radio. See URL: [ARRL JOTA](#)

jug -- Large transmitting tubes, klystrons, magnetrons

jury rig -- Fix in an unorthodox manner

K (Kilo)

kc - (see "kilocycles")

kilo - the metric prefix for 10³, or times 1,000

K- index - A measure of the Earth's magnetic field as measured at Boulder, Colorado. Propagation conditions improve with lower measurement numbers. See URL: [Propagation](#)

kerchunking - activating a repeater without identifying or modulating the carrier.

key - (noun) any switch or button, usually refers to a telegraph or Morse code key

key - (verb) to press a key or button

keyer - Electronic device for sending Morse Code semi-automatically; connects to a key (see above). Dits are sent by pressing one paddle of the key, dahs sent by pressing the other one paddle.

key up - (Repeater Term) to turn on a repeater by transmitting on its input frequency.

key up - (verb) to activate a transmitter or repeater

kilocycles - thousand cycles per second. Replaced by kiloHertz (kHz)

kilohertz - one thousand hertz (see "hertz")

L (Lima)

ladder line -- an open wire transmission line -- 600, 450 ohm characteristic impedances are typical.

landline -- ham slang for telephone (lines)

LCD - Liquid Crystal Display

LED - Light-emitting diode

LF - Low Frequency - 30 kHz to 300 kHz

lid - a poor operator, one who does not follow proper procedures or sends sloppy morse code.

limiter - (Repeater Term) a stage of an FM receiver that clips the tops of the FM signal thus makes the receiver less sensitive to amplitude variations and pulse noise.

linear - an amplifier used after the transceiver output. So named for its purity of amplification. Linear, in the mathematical sense, means that what comes out is directly proportional to what goes in. As far as linear amps go, if you double the input, the output is doubled and so on. This does not generate any additional frequency byproducts. If the amp is nonlinear, sums, differences and all combinations of those are generated also.

line-of-sight propagation - the term used to describe propagation in a straight line directly from one station to another.

load - an electrical device which consumes, converts, or emanates energy

local oscillator (LO) - a receiver circuit that generates a stable, pure signal used to mix with the received RF to produce

a signal at the receiver intermediate frequency (IF).

long path - short path -- in degrees - the direct great signal bearing path between two locations. Long path is the reciprocal bearing.

lollipop - ham term for an Astatic D-104 microphone

LORAN - Long Range Aid to Navigation.

lower - One who experiments at very low frequencies (typically 1750 Meters, which is 160-190 kHz and can be used under FCC Part 15).

low-pass filter - a filter that allows signals below the cutoff frequency to pass through and attenuates signals above the cutoff frequency.

LSB - Lower Side Band - See URL: [Modulation Modes](#) - the common single-sideband operating mode on the 40, 80, and 160 meter amateur bands.

LW - Long Wave 150 - 300 KHz

M (Mike)

mA milliamper (1/1,000 ampere)

machine - a repeater

magnetic mount or mag-mount - (Repeater Term) an antenna with a magnetic base that permits quick installation and removal from a motor vehicle or other metal surface.

mA/h - milliamper per hour

making the trip -- jargon for "successfully transmitting a readable message"

MARS - Military Affiliate Radio System, military affiliated amateurs who provide free communications for overseas GIs and other Federal services. MARS operators are licensed under DOD. Established 1948.

matchbox - Normally called an Antenna Tuner. Impedance-matching device that matches the antenna system input impedance to the transmitter, receiver, or transceiver output impedance.

MC - (see megacycles)

MCW - Modulated Continuous Wave, a fixed audio tone modulates a carrier, older method of sending Morse code - See URL: [Modulation Modes](#)

mega - the metric prefix for 10^6 , or times 1,000,000.

megacycles - million cycles per second. This terminology has been replaced by MegaHertz (MHz)

megahertz - million hertz (see Hertz)

meteor scatter - ionized trails of meteors used as a reflecting media See URL: [Propagation](#)

MF - Medium Frequency - (300-3,000 kHz)

mic (mike) - microphone - a device that converts sound waves into electrical energy.

micro - the metric prefix for 10^{-6} , or divide by 1,000,000.

microwave - the region of the radio spectrum above 1 giga hertz (GHz).

mil 1/1000 of an inch. Also mill a special typewriter used by radio operators in copying messages

milli - the metric prefix for 10^{-3} , or divide by 1,000.

mixer - a circuit that takes two or more input signals, and produces an output that includes the sum and difference of those signal frequencies.

mW - milliwatt (1/1,000 watt)

mobile - an amateur radio station installed in a vehicle - a mobile station can be used while in MOTION. A portable station is one that is designed to be easily moved from place to place but can only be used while stopped.

mode - (see emission mode)

modem - short for modulator/demodulator. A modem modulates a radio signal to transmit data and demodulates a receive signal to recover transmitted data.

modulate - create a radio emission so that it contains information (voice, Morse code, music, binary, ascii)- See URL: [Modulation Modes](#)

modulation Index - (Repeater Term) the ratio between the maximum carrier frequency deviation and the audio modulating frequency at a given instant in an FM transmitter.

MOSFET - Metal-oxide-semiconductor-field-effect transistor

motorboating -- an undesirable low frequency feedback resulting in a motorboat sound on the audio

MUF - Maximum Usable Frequency, a measure of the highest frequency that will support transmissions off of the ionosphere.

multimode transceiver - transceiver capable of SSB, CW, AM, and FM operation.

mV - millivolt (1/1,000 volt)

MW - Medium Wave - 300 - 3000 kHz. Also used for the AM broadcast band - 530-1710 kHz

N (November)

NB - Narrow band. Also noise Blanker

NBFM - narrow band FM

NCS - Net Control Station

near field of an antenna - the region of the electromagnetic field immediately surrounding an antenna where the reactive field dominates and where the field strength as a function of angle (antenna pattern) depends upon the distance from the antenna. It is a region in which the electric and magnetic fields do not have a substantial plane-wave character, but vary considerably from point-to-point.

negative - no, incorrect

negative copy - unsuccessful transmission

negative feedback - the process in which a portion of the amplifier output is returned to the input, 180 degrees out of phase with the input signal. Improves linearity and reduces distortion.

negative offset - the repeater input frequency is lower than the output frequency.

net - A group of stations that meet on a specified frequency at a certain time. The net is organized and directed by a net control station, who calls the net to order, recognizes stations entering and leaving the net, and authorizes stations to transmit.

NiCad - Nickel Cadmium, generally refers to a type of rechargeable battery

nickels -- used on DX nets as a signal report 5x5

NiMH - Nickel Metal Hydride, generally refers to a newer type of rechargeable battery

NODE - A remotely controlled TNC/digipeater - used as a connect point in packet radio.

NPN - A type of transistor that has a layer of P-type semiconductor material sandwiched between layers of N-type semiconductor material.

NTS - National Traffic System - an amateur radio relay system for passing messages.

NTSC - National Television System Committee (NOT National Television Standards Committee) - USA and others TV Standards.

NVIS - near-vertical-incidence-skywave, a propagation mode where signals are reflected back down from directly overhead. Useful for relatively short-distances, overcoming the limitations of the usual "skip-zone" distance" (See Skip Zone)

O (Oscar)

OC - Oceania

odd split - unconventional frequency separation between input and output frequencies.

offset - (Repeater Term) In order to listen and transmit at the same time, repeaters use two different frequencies. On the 2 metre ham band these frequencies are 600 kilocycles/second (or 600 kilohertz) apart. As a general rule, if the output frequency (transmit) of the repeater is below 147 Mhz then the input frequency (listening) is 600 kilohertz lower. This is referred to as a negative offset. If the output is above 147 Mhz then the input is 600 kilohertz above. This is referred to as a positive offset.

Ohm - The fundamental unit of resistance. one Ohm is the resistance offered when a potential of one Volt results in a current of one Ampere.

old man (OM) - friendship term, friend, pal or buddy

OM - (see old man)

OO - Official Observer volunteer who monitors the Amateur Bands for infractions

open repeater - (Repeater Term) a repeater whose access is not limited.

OSCAR - Orbiting Satellite Carrying Amateur Radio.

oscillate - vibrate, generate an AC or other periodic signal

oscilloscope - an electronic test instrument used to observe wave forms and voltages on a cathode-ray tube. Displays time on the X-axis and amplitude on the Y-axis, Z-axis is intensity of the CRT spot.

OT - old timer - been around ham radio for a long time

OTC - Old Timer's Club

OTS - Official Traffic Station

output frequency - (Repeater Term) the frequency of the repeater's transmitter (and your transceiver's receiver).

over - used during a two way communication under difficult copy - to alert the other station that you are returning the communication back to them. Other terms are Cambio (change), microphone to you, and in CW the letter K is used as an invitation to transmit. Not necessary on 2 Meter FM repeaters, as the courtesy beep serves this function.

P (Papa)

P-P Peak-to-peak; as in peak-to-peak voltage

PA - Power amplifier

packet cluster - A Network of automated packet radio stations for disseminating DX and contest reports

packet radio - a system of digital communication whereby information is transmitted in short bursts. The bursts

("packets") also contain callsign, addressing and error detection information.

paddle - Morse code key

PAL - Phase Alteration Line. Television standard used in parts of Europe.

parallel circuit - an electrical circuit in which the electrons follow thru more than one path in going from the negative supply terminal to the positive terminal.

parallel-conductor feed line - feed line constructed of two wires held at a constant distance apart; either incased in plastic or constructed with insulating spacers placed at intervals along the line.

parasitic beam antenna - another name for the beam antenna.

parasitic element - part of a directive antenna that derives energy from mutual coupling with the driven element. Parasitic elements are not connected directly to the feed line.

parasitic - Oscillations in a transmitter on frequencies other than the desired one; these can produce spurious signals from the transmitter.

path noise - (Repeater Term) A term used in repeaters to indicate that the signal is so weak that the limiters have not engaged thus noise on the signal will be heard -- this is referred to as path noise and sometimes as (incorrectly) White Noise (See Same)

PBBS - Packet Bulletin Board System

PC - Printed Circuit

PCM - pulse code modulation based on the Shannon's communication theory or "information theory" that describes his "sampling theorem"

PEP - Peak envelope power - the average power of a signal at its largest amplitude peak.

peak-inverse-voltage (PIV) - the maximum voltage a diode can withstand when it is reverse biased (not conducting).

personal - first name - as in "the personal here is Bob" -- CB jargon that has crept into Ham jargon - old timers shudder

phase - the time interval between one event and another in a regularly recurring cycle.

phase modulation - varying the phase of an RF carrier in response to the instantaneous changes in an audio signal.

phone - voice modulation - See URL: [Modulation Modes](#)

phone patch - A connection between a two-way radio unit and the public telephone system.

PIC - PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Programmable Interface Controller".

picket fencing - (Repeater Term) A condition experienced on VHF and above where a signal rapidly fluctuates in amplitude causing a sound akin to rubbing a stick on a picket fence. If a repeater user's signal isn't strong enough to maintain solid access to the machine's input (such as when operating from a vehicle passing beneath underpasses or through hilly terrain), the signal would be hard to copy because of a pronounced, rapid fluttery or choppy characteristic.

pico - the metric prefix for 10^{-12} , or divide by 1,000,000,000,000.

pileup - multiple stations calling a DX or contest station

PIN Positive-intrinsic-negative (transistor or diode)

ping jockey - Slang for meteor-scatter operator

pirate - Station using an existing callsign and illegally operating on the air

PL - (Repeater Term) Private Line (same as CTCSS)-- low frequency audio tones used to alert or control receiving stations. PL, an acronym for Private Line, is Motorola's proprietary name for a communications industry signaling scheme call the Continuous Tone Coded Squelch System, or CTCSS. It is used to prevent a repeater from responding to unwanted signals or interference. Tone is an electronic means of allowing a repeater to respond only to stations that encode or send the proper tone. Any station may be set up to transmit this unique low frequency tone that allows the repeater to operate. Also used during the AutoPatch mode. [See PL](#)

PLL - Phase-lock loop

PM - Phase Modulation, similar to Frequency Modulation - See URL: [Modulation Modes](#)

P.M. - Post Meridian (after noon).

PNP - a type of transistor that has a layer of N-type semiconductor sandwiched between layers of P-type semiconductor material.

pole-pig - another name for a step down transformer used by power transmission companies. Some surplus units can be reverse wired and used as the transformers in a Ham radio high voltage supplies.

portable - A **mobile** is a amateur radio station installed in a vehicle - a mobile station can be used while in MOTION. A portable station is one that is designed to be easily moved from place to place but can only be used while stopped. Portable operation is away from the home base station.

positive offset - (Repeater Term) the repeater input frequency is higher than the output frequency.

pot - Potentiometer - Continuously variable resistor often used for adjusting levels, as in volume control.

PRB - Private Radio Bureau, administers Amateur services

product detector - A receiver circuit consisting of a beat frequency oscillator and additional circuitry for enhanced reception of SSB signals.

PROM Programmable read-only memory

propagation - the means or path by which a radio signal travels from a transmitting station to a receiving station - See URL [Propagation](#)

PSK31 - A digital transmission mode -- Phase Shift keying with 31.25 baud rate - See [PSK31](#)

PTO Permeability tuned oscillator

PTT - Push To Talk, the switch in a transmitter circuit that activates the microphone and transmission circuitry

pull the plug -- shut down the station

Q (Quebec)

Note that many Hams use Q-Signals verbally, but they originated in CW communications, QTH is "my Location", "QSY is change frequency", etc -- See [Q-Signals](#)

Q - A figure of merit for tuned circuits. For antennas, the Q is inversely proportional to useable bandwidth, with reasonable SWR.

quad - A directional antenna consisting of two one-wavelength "squares" of wire placed a quarter-wavelength apart.

Q-signals - a set of three-letter codes which are used by amateurs as abbreviations. Commonly used on both CW and phone. See URL: [Q-Signals](#)

QCWA - Quarter Century Wireless Association -- requires 25 years of amateur service for membership.

QRP - Low power operation, usually 5 watts output or 10 watts input power. See [QRP operation](#)

QSL - to acknowledge receipt. Commonly used to indicate "I understand", "I copied your transmission (or report) all OK". Also used as a term for sending cards by mail to confirm a two way contact with a station, such as QSL via the bureau. (See BURRO or bureau). See URL: [QSLing](#)

QSL Manager - A person, usually an Amateur Radio operator, who manages the receiving and sending of QSL cards for a managed station). A QSL Manager is needed because the managed station either has difficulty handling the volume of incoming QSL cards, or the station is geographically located such that it is difficult or impossible for that station to accept and/or send QSL cards. It is very common for "rare" DX stations and DXpeditions to have a QSL Manager.

QSO - two way conversation

Quagi -- an antenna constructed with both quad and yagi elements

R (Romeo)

RADAR - Radio detection and ranging.

RAC - Radio Amateurs of Canada, a national amateur radio organization in Canada - See [leagues](#)

RACES - Radio Amateur Civil Emergency Service - See [Emergency Pages](#)

radio check - query from a station desiring a report on his stations signal strength and audio quality

ragchewing - chatting informally via radio

RAM - Random Access Memory

R/C - Radio-control

RCC Rag Chewers Club

rcvr - receiver

RDF - Radio Direction Finding

reactance - the opposition to current that a capacitor or inductor creates in an ac circuit.

reading the mail - to listen to a QSO without participating

reflector - (1. an element behind the driven element in an Yagi and some other directional antennas. (2. IRLP Reflector -- a server that allows multiple nodes (repeaters) to be linked together at the same time. (3. a mail list that forwards news to the subscribers, e.g., DX Reflector, Contest Reflector.

refract - to bend. Electromagnetic energy is refracted when it passes through a boundary between different types of material much as light is refracted as it travels from air into water or from water into air.

repeater - A repeater is a receiver/transmitter that listens for your transmission and re-transmits it. Repeaters usually enjoy the advantage of height and power to extend the range of your transmission. Repeaters listen on one frequency and transmit on another. The separation between these two frequencies is referred to as the Offset. See [Repeater Operation](#)

repeater directory - an annual ARRL publication that lists repeaters in the US, Canada and other areas. See [ARRL Repeater Directory](#)

resonance - A condition where $X_c = X_L$, establishing a resonant circuit - used for selectivity (parallel circuit) or a maximum impedance circuit (series)

reset applies to when a repeater timer is reset back to zero and normally occurs when the carrier of the transmitter drops.

Rettysnitch - A fictional torture device for bad hams.

RF - Radio Frequency, emissions in the radio portion of the electromagnetic spectrum

RFI - Radio Frequency Interference

RG - As in RG-8 Coax -- RG = (1) Radio Guide or (2) Radio Group as opposed to Electrical Group or Telephone Group

rice box - equipment made in Japan or the Orient

rig - a radio (transmitter, receiver, or transceiver)

RIT - Receiver incremental tuning. Also known as a Clarifier

RMS - Root mean square

roger -- I understand - Received 100% In CW "R" -- See [Origins](#)

roger beep - a dit-dah-dit sent at the end of a transmission

ROM - Read-only memory

rotor - (see "rotator")

rotator - a device attached to an antenna mast which rotates it so that the antenna can point in different directions. Years ago this device was simply called a "rotor"

Rover - A station that operates from several grid squares or counties during a contest

RS-232 Computer interface standard set by the Electronics Industries Association (EIA).

RST - "Readability, Signal, and Tone", a three-digit report indicating how well an operator's emissions are being received.

See [RST System](#)

RTMA - Radio Television Manufacturers Association.

RTTY - radio teletype - A form of digital communications.

rubber duck - A shortened flexible antenna used with hand-held scanners and transceivers.

rx - receiver, receive

S (Sierra)

SAREX - Shuttle Amateur Radio EXperiment, communicating with astronauts in space. See [SAREX](#)

SASE - Self-addressed, stamped envelope

SEC - Section Emergency Coordinator

SECAM Séquentiel Couleur Avec Mémoire (French Color TV Standard)

selectivity - Ability of a receiver to reject signals adjacent to tuned signal.

sensitivity - A receivers ability to receive weak signals.

separation or **split** the difference (in kHz) between a repeater's transmitter and receiver frequencies. Repeaters that use unusual separations, such as 1 MHz on 2 m, are sometimes said to have "oddball splits."

series circuit - an electrical circuit in which all the electrons must flow through every part of the circuit. There is only one path for the electrons to flow.

SFI - Solar Flux Index - See [Propagation](#)

shack - Ham station operating area

SHF - Super High Frequency 3 - 30 GHz

short path -- in degrees - the direct great signal bearing path between two locations. Long path is the reciprocal bearing.

signal - a radio emission

silent key - a deceased amateur operator

simplex - a communications mode in which a radio transmits and receives on the same frequency

SINAD - Signal to noise and distortion ratio

single-pole, double-throw (SPDT) switch : a switch that connects one center contact to one of two other contacts.

single-pole, single-throw (SPST) switch : a switch that only connects one center contact to another contact.

SINPO - A reporting system used by radio hobbyists to indicate how well a station was received: S=Strength, I=Interference, N=Noise, P=Propagation, O=Overall

SITOR-A - Simplex teleprinting over radio system, mode A

SITOR-B - Simplex teleprinting over radio system, mode B (FEC mode)

SK - Silent Key, an amateur term for indicating that a ham has passed away. Also one of the prosigns -- meaning "end of contact", See prosigns at URL: [Prosigns](#)

skip zone - dead zone, too far for ground wave propagation and too near for sky wave propagation

skyhook - antenna

sky wave propagation - the transmitting of radio waves which reflect off of the ionosphere - See [Propagation](#)

slim - Someone pretending to be a DX station, usually rare, that is supposed to be on the air. For example, someone in southern Argentina pretending to be on Heard Island

slop jar - an electrolytic rectifier - electrolytic rectifiers were common in the late '20s and early '30s. One "cell" consisted of two strips of dissimilar metals in a caustic potash (lye) solution. Many cells were needed for a high voltage supply.

SM - Section Manager

S-Meter - Signal Strength Meter -- See S-Units at URL: [S-Units](#)

S/N - Signal-to-noise ratio

spark gap - an early transmitter design which used electrical sparks to generate radio frequency oscillations

spectrum - the electromagnetic spectrum or some portion of it

speech processor - A circuit that increases the average level of the modulating signal applied to a transmitter.

splatter - a type of interference to stations on nearby frequencies. Splatter occurs when a transmitter is overmodulated.

split or separation - (Repeater Term) the difference (in kHz) between a repeater's transmitter and receiver frequencies.

Repeaters that use unusual separations, such as 1 MHz on 2 m, are sometimes said to have "oddball splits."

split - DX stations often operate split -- that is transmitting on one frequency and listening at a different frequency or range of frequencies. This avoids congestion on the DX transmit frequency.

sporadic-E - Random patches of intense ionization that form in the E-layer of the ionosphere and refract higher frequency signals that normally cannot be refracted by the ionosphere.

SPST - Single Pole Single Throw (switch)

spurs - Spurious Signals - Undesired signals and frequencies in the output of a transmitter.

SQL - Squelch - A circuit that mutes the receiver when no signal is present, thereby eliminating band noise

squelch tail - (Repeater Term) A brief bit of noise heard between the end of a radio transmission and the reactivation of the receiver's squelch circuit.

SSB - Single Side Band - See URL: [Modulation Modes](#)

SSBSC - Single side band - suppressed carrier.

SSN - Sunspot Number -- See [Propagation](#)

SSTV - Slow Scan Television

straight key - a non-electronic Morse code key with one paddle

stub - A transmission line 'stub' is a length of transmission line that is open or shorted at one end. It is effectively a capacitor or inductor, depending on length, and can be used to achieve a match [VSWR = 1:1] if connected at a selected point in the basic transmission line.

superheterodyne - a radio receiver scheme which beats or heterodynes a second radio frequency to the incoming radio signals. The combined frequencies form an intermediate (IF) third frequency. Aids in selectivity characteristics.

SW - Short Wave

SWL - Short Wave Listening -- See [SWL](#)

SWR - Standing Wave Ratio, a measure of how much radio energy sent into an antenna system is being reflected back to the transmitter. See [SWR](#)

SWR meter - a device used to determine the Standing Wave Ratio of an antenna system

synch. detection - Synchronous detection is an ingenious method of processing an AM signal to improve audio quality and reduce interference from adjacent stations.

T (Tango)

TCXO - Temperature-compensated crystal oscillator.

telegraphy - the transmission of information in Morse code format - See URL: [Modulation Modes](#)

telephony - the transmission of information in voice format - See URL: [Modulation Modes](#)

third-party communications - messages passed from one amateur to another on behalf of a third person.

third-party communications agreement - an official understanding between the United States and another country that allows amateurs in both countries to participate in third-party communications. See [3rd Party Agreements](#)

TI - Talk-In Frequency

ticket - slang for an amateur radio license

timer - repeaters often incorporate a timer or transmit time limiter to control the length of a single transmission from a user. The time limit is set by the repeater owner.

time-out - Excessively long transmission on a repeater causing the repeater's timer circuit to stop further transmissions (Slang - the alligator gottcha)

tone pad an array of 12 or 16 numbered keys that generate the standard telephone dual tone multifrequency (*DTMF*) dialing signals. Resembles a standard telephone keypad. (see autopatch)

TOR - Telex over radio.

TNC - Terminal Node Controller, a device which interfaces a computer to a transceiver and performs a function similar to a modem

TNC - Threaded Niell-Concelman (standard connector type used on Coax cable, named for its inventors).

top band -- 160 Meter Ham Band (highest number meter band)

TP - test point

traffic - a message or messages sent by radio

transceiver - a radio that both transmits and receives

triplexer -- see diplexer.

tropospheric ducting - Propagation of signals above 30 MHz via bending and ducting along weather fronts in the lowest layer of the Earth's atmosphere, the troposphere.

TRX - Transceiver

TTL Transistor-Transistor Logic

TV - Television

TVI - Television interference

twisted pair - ham slang for telephone or telephone lines

two-tone test - A method of testing a side-band transmitter by feeding two audio tones into the microphone input of the transmitter and observing the output on an oscilloscope.

tx - transmit, transmitter

U (Uniform)

UHF - Ultra High Frequency 300 - 3000 MHz

Uncle Charlie - The FCC

unun - "unbalance - unbalance", a device which couples an unbalanced antenna of one impedance to an unbalanced feed line of another impedance

uplink - Channel used for earth-to-satellite communications.

URL - Universal Resource Locator

USB - Upper Side Band the common single-sideband operating mode on the 20, 17, 15, 12, and 10 meter HF amateur bands, and all the VHF and UHF bands.

UTC - Coordinated Universal Time, the time (expressed in 24-hour format) at the 0-degree Meridian, which passes through Greenwich, England.

utility stations - Stations other than broadcast, or amateur stations; these stations are not intended to be heard by the public. They include aircraft communications, radiotelephone, marine, embassy, and military communications.

V (Victor)

V - Volt (unit of electromotive force {EMF}).

VA - Volt Amperes - measure of apparent power. (Note true power is I squared x R)

VAC - Volts Alternating Current.

varactor diode - a component whose capacitance varies as the reverse bias voltage is changed.

VCO - Voltage-controller oscillator

VDT - Video-display terminal

VE - Volunteer Examiner, a person authorized to administer examinations for amateur radio licenses

VEC - Volunteer Examiner Coordinator, an amateur radio organization empowered by the FCC to recruit, organize, regulate and coordinate Volunteer Examiners.

VFO - Variable Frequency Oscillator

velocity factor - the speed at which radio waves travel in a particular feedline, expressed as a percent of the speed of light

VHF - Very High Frequency 30 - 300 MHz

VIS - Vertical Interval Signaling. Digital encoding of the transmission mode in the vertical sync portion of an SSTV image.

VLf - Very Low Frequency 3 - 30 KHz

VMOS - Vertical metal-oxide semiconductor

VOA - Voice Of America.

VOM - Volt-ohm-meter

VOX - Voice Operated Transmit

VSWR - Voltage standing wave ratio

VTVM - Vacuum tube voltmeter

VXO - Variable crystal oscillator

W (Whiskey)

WAC - Worked All Continents award from the IARU, administered by ARRL. See [WAC](#)

wallpaper - QSL cards, awards, special event certificates

WARC - World Administrative Radio Conference -- See [Note 1](#)

WARC Bands - An expression to indicate the bands allocated in 1979 -- 17M, 12M and 30M

WAS - Worked All States award from ARRL for confirmed contact with each of 50 states. See [WAS](#)

WAZ - Worked All Zones award from CQ magazine for confirmed contact with each of 40 zones. See [CQ Awards](#)

WEFAX - Weather facsimile, reconstructed satellite images and photographs. See [WEFAX](#)

WFWL -- DXing term used when the validity of a DX station is in doubt. **Work First Worry Later**"

white noise (Repeater Term) is a scientific term used to describe a spectrum of broad band noise generated in a receiver's detector and sampled to control the receiver's squelch. This term is often incorrectly used in repeater work to describe the sounds heard when the received transmission is noisy and hard to understand, usually attributed to a weak signal and the repeater receiver limiters are not engaged.

wilco - Will comply

wireless - radio (As opposed to wired - telegraph)

Wouff Hong -the Wouff Hong was a weapon against poor operating dreamed up by old time QST author, "The Old Man" (later discovered to be Hiram Percy Maxim, W1AW, himself). See [Wouff Hong](#)

work - To communicate with another radio station, a valid two way contact

WPM - Words per minute; as in Morse code or typing speed

WSJT - "Weak Signal communication, by K1JT". A software package for meteor scatter and EME communications - See [WSJT](#)

WWV - National Bureau of Standards radio station (time signals). See [NIST](#) NIST = National Institute of Standards and Technology for the USA

WWVB - NIST radio station (broadcasts time signals).

WWVH - NIST radio station (broadcasts time signals- Hawaii).

WX - weather

X (X-ray)

XCVR- Transceiver

XFMR - Transformer

XIT - Transmit Incremental Tuning control; allows for slightly changing the transmit frequency while leaving the receive frequency the same. Useful for split operations.

XTAL - Crystal

XVTR - Transverter -- configures a transceiver to operate on other bands

XYL - Ex-Young Lady, wife

Y (Yankee)

Yagi - 1926 Hidetsugu Yagi and Shintaro Uda invent the "beam" antenna array. A directional antenna consisting of a dipole and two additional elements, a slightly longer reflector and a slightly shorter director. Electromagnetic coupling between the elements focuses maximum power (or reception) in the direction of the director.

YL - Young Lady, any female amateur radio operator or the significant other of a amateur.

Z (Zulu)

zed - a phonetic for letter "Z"

zero beat - Adjust the frequencies of two signals so that they are exactly equal and in phase

Zepp antenna - The end-fed 'zepp' antenna was simply a weighted wire reeled down and up from early lighter-than-Zeppelin air-ships.

Zulu - Coordinated Universal Time. Also the phonetic for the letter Z

NUMBERS 0-9

Ø Slashed Zero - distinguishes a ZERO from the letter "O". Resolves ambiguity in callsigns like "KØOF". Press Alt0216 on your PC numeric keyboard.

73 - Best regards

88 - Love and kisses

807 - Deceptive Ham term for a beer. Also a popular transmitting tube of the mid 1900's

NOTE 1. During the period of 1910 to about 1990 the member nations of International Telecommunication Union (ITU) (note there is no s on telecommunication) would from time to time hold a World Administrative Radio Conference (WARC). These conferences make major changes in the Radio Regulations (RR) that have the force of treaty. There was no specific time schedule for these conferences. Sometimes there would be 10 or more years between conferences, and there would be so much work, they would last for several months. Similar world conferences were held for telephone and telegraph matters.

In the late 1980's the major players in the affairs of the ITU realized that its working structure was outdated to deal with rapidly changing technology, and that a better plan would to have the radio conferences at very specific time intervals of 4 years, with a very specific agenda. This new plan took was approved by a Plenipotentiary Assembly of all ITU member

nations and put in effect in the early 1990s. A number of additional organizational changes were made to provide for more effective conference preparatory work. At this time the CCIR (Consultative Committee for International Radio) was renamed the ITU Radiocommunication Sector (ITU-R). The CCITT (telephone/telegraph) was renamed the ITU Telecommunication Standardization Sector. The word "Administrative" was dropped from the WARC so the new abbreviation is just "WRC."

Each of the two ITU sectors are further divided into Study Groups dealing with specific areas. For example ITU-R Study Group 6 covers broadcasting, SG-8 with all the mobile radio services including marine, aeronautical, land mobile, and amateur. Study Group 1 covers general spectrum management technology.

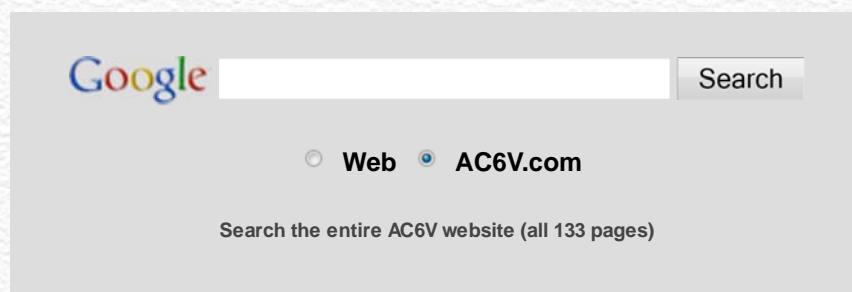
More information can be obtained by visiting the www.itu.int.

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NATO phonetic alphabet

Not to be confused with **International Phonetic Alphabet**.

The **International Radiotelephony Spelling Alphabet**

CHARACTER	MORSE CODE	TELEPHONY	PHONIC (PRONUNCIATION)
A	• —	Alfa	(AL-FAH)
B	— •••	Bravo	(BRAH-VOH)
C	— • — •	Charlie	(CHAR-LEE) or (SHAR-LEE)
D	— ••	Delta	(DELL-TAH)
E	•	Echo	(ECK-OH)
F	•• — •	Foxtrot	(FOKS-TROT)
G	— — •	Golf	(GOLF)
H	••••	Hotel	(HOH-TEL)
I	••	India	(IN-DEE-AH)
J	• — — —	Juliett	(JEW-LEE-ETT)
K	— • —	Kilo	(KEY-LOH)
L	• — ••	Lima	(LEE-MAH)
M	— —	Mike	(MIKE)
N	— •	November	(NO-VEM-BER)
O	— — —	Oscar	(OSS-CAH)
P	• — — •	Papa	(PAH-PAH)
Q	— — • —	Quebec	(KEH-BECK)
R	• — •	Romeo	(ROW-ME-OH)
S	•••	Sierra	(SEE-AIR-RAH)
T	—	Tango	(TANG-GO)
U	•• —	Uniform	(YOU-NEE-FORM) or (OO-NEE-FORM)
V	••• —	Victor	(VIK-TAH)
W	• — —	Whiskey	(WISS-KEY)
X	— •• —	Xray	(ECKS-RAY)
Y	— • — —	Yankee	(YANG-KEY)
Z	— — ••	Zulu	(ZOO-LOO)
1	• — — — —	One	(WUN)
2	•• — — —	Two	(TOO)
3	••• — —	Three	(TREE)
4	•••• —	Four	(FOW-ER)
5	•••••	Five	(FIFE)
6	— ••••	Six	(SIX)
7	— — •••	Seven	(SEV-EN)
8	— — — ••	Eight	(AIT)
9	— — — — •	Nine	(NIN-ER)
0	— — — — —	Zero	(ZEE-RO)

FAA radiotelephony alphabet and Morse code chart

bet, commonly known as the **ICAO phonetic alphabet**, sometimes called the **NATO alphabet** or **spelling alphabet** and the **ITU radiotelephonic** or **phonetic alphabet**, is the most widely used radiotelephonic **spelling alphabet**. Although often called “phonetic alphabets”, spelling alphabets are not associated with **phonetic transcription** systems such as the **International Phonetic Alphabet**. Instead, the **International Civil Aviation Organiza-**

tion (ICAO) alphabet assigned codewords **acrophonically** to the letters of the **English alphabet**, so that critical combinations of letters and numbers can be pronounced and understood by those who exchange voice messages by radio or telephone regardless of language barriers or the quality of the communication channel.^[1]

The 26 code words in the **NATO phonetic alphabet** are assigned to the 26 letters of the English alphabet in **alphabetical order** as follows: Alfa, Bravo, Charlie, Delta, Echo, Foxtrot, Golf, Hotel, India, Juliett, Kilo, Lima, Mike, November, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Uniform, Victor, Whiskey, X-ray, Yankee, Zulu.

1 International adoption

After the phonetic alphabet was developed by the International Civil Aviation Organization (ICAO)^[2] (see **history** below) it was adopted by many other international and national organizations, including the **North Atlantic Treaty Organization (NATO)**, the **International Telecommunication Union (ITU)**, the **International Maritime Organization (IMO)**, the **American Federal Aviation Administration (FAA)**, the **Alliance for Telecommunications Industry Solutions (ATIS)**, and the **International Amateur Radio Union (IARU)**.

It is a subset of the much older **International Code of Signals (INTERCO)**, which originally included visual signals by flags or flashing light, sound signals by whistle, siren, foghorn, or bell, as well as one, two, or three letter codes for many phrases.^[3] The same alphabetic code words are used by all agencies, but each agency chooses one of two different sets of numeric code words. NATO uses the regular English numeric words (Zero, One, with some alternative pronunciations), whereas the IMO provides for compound numeric words (Nadazero, Unaone, Bissotwo...). In practice these are used very rarely, as they frequently result in confusion between speakers of different languages.

1.1 NATO

An alternative name for the ICAO spelling alphabet, “NATO phonetic alphabet”, exists because it appears in Allied Tactical Publication ATP-1, Volume II: *Allied Maritime Signal and Maneuvering Book* used by all allied navies of NATO, which adopted a modified form of the *International Code of Signals*. Because the latter allows

messages to be spelled via flags or **Morse code**, it naturally named the code words used to spell out messages by *voice* its “phonetic alphabet”. The name *NATO phonetic alphabet* became widespread because the signals used to facilitate the naval communications and tactics of NATO have become global.^[4] However, ATP-1 is marked *NATO Confidential* (or the lower *NATO Restricted*) so it is not available publicly. Nevertheless, a NATO unclassified version of the document is provided to foreign, even hostile, militaries, even though they are not allowed to make it available publicly. The spelling alphabet is now also defined in other unclassified international military documents.^[5] The NATO alphabet appeared in some United States Air Force Europe publications during the Cold War. A particular example was the Ramstein Air Base, Telephone Directory published between 1969 and 1973 (currently out of print). The American and NATO versions had differences and the translation was provided as a convenience. Differences included Alfa, Bravo and Able, Baker for the first two letters.

1.2 History

The ICAO developed this system in the 1950s in order to account for discrepancies that might arise in communications as a result of multiple alphabet naming systems coexisting in different places and organizations.^[6]

In the official^[7] version of the alphabet, the non-English spellings Alfa and Juliett are used. *Alfa* is spelled with an *f* as it is in most European languages because the English and French spelling *alpha* would not be pronounced properly by native speakers of some other languages – who may not know that *ph* should be pronounced as *f*. *Juliett* is spelled with a *tt* for French speakers, because they may otherwise treat a single final *t* as silent. In some English versions of the alphabet, one or both of these may have their standard English spelling.^[8]

2 Code words

The final choice of code words for the letters of the alphabet and for the digits was made after hundreds of thousands of comprehension tests involving 31 nationalities. The qualifying feature was the likelihood of a code word being understood in the context of others. For example, *football* has a higher chance of being understood than *foxtrot* in isolation, but *foxtrot* is superior in extended communication.^[9]

The pronunciation of the code words varies according to the language habits of the speaker. To eliminate wide variations in pronunciation, recordings and posters illustrating the pronunciation desired by the ICAO are available.^{[9][10]} However, there are still differences in pronunciation between the ICAO and other agencies, and the ICAO has conflicting Roman-alphabet and IPA transcrip-

tions. Also, although all codes for the letters of the alphabet are English words, they are not in general given English pronunciations. Assuming that the transcriptions are not intended to be precise, only 11 of the 26—*Bravo, Echo, Hotel, Juliet(t), Kilo, Mike, Papa, Quebec, Romeo, Whiskey*, and *Zulu*—are given English pronunciations by all these agencies, though not always the same English pronunciations.

2.1 Letters

2.2 Digits

2.3 Pronunciation

Pronunciations are somewhat uncertain because the agencies, while ostensibly using the same pronunciations, give different transcriptions, which are often inconsistent from letter to letter. The ICAO gives a different pronunciation for IPA transcription and for respelling, and the FAA also gives different pronunciations depending on the publication consulted, the *FAA Aeronautical Information Manual* (§ 4-2-7), the *FAA Flight Services manual* (§ 14.1.5), or the *ATC manual* (§ 2-4-16). ATIS gives English spellings, but does not give pronunciations or numbers. The ICAO, NATO, and FAA use modifications of English numerals, with stress on one syllable, while the ITU and IMO compound pseudo-Latinate numerals with a slightly different set of modified English numerals, and with stress on each syllable. Numbers 10–99 are spelled out (that is, 17 is “1–7” and 60 is “6–0”), while for hundreds and thousands the English words *hundred* and *thousand* are used.^{[8][10][12][13][14][22]}

The pronunciation of the digits 3, 4, 5, and 9 differs from standard English – being pronounced *tree*, *four*, *fife*, and *niner*. The digit 3 is specified as *tree* so that it is not pronounced *sri*; the long pronunciation of 4 (still found in some English dialects) keeps it somewhat distinct from *for*; 5 is pronounced with a second “f” because the normal pronunciation with a “v” is easily confused with “fire” (a command to shoot); and 9 has an extra syllable to keep it distinct from German *nein* ‘no’.

Only the ICAO prescribes pronunciation with the IPA, and then only for letters.^[10] Several of the pronunciations indicated are slightly modified from their normal English pronunciations: /ˈælfə, ˈbrɑːˈvo, ˈʃɑːli, ˈdelta, ˈfɔkstrət, ɡəlf, ˈliːmə, ˈɔska, siˈera, ˈtæŋɡo, ˈuːnɪfɔrm, ˈvɪktə, ˈʃæŋki/, partially due to the substitution of final *schwas* with the *ah* vowel; in addition, the intended distinction between the short vowels /o a ɔ/ and the long vowels /oː αː ɔː/ is obscure, and has been ignored in the consolidated transcription above. Both the IPA and respelled pronunciations were developed by the ICAO before 1956 with advice from the governments of both the United States and United Kingdom,^[23] so the pronunciations of both **General American English** and **British Received Pronun-**

ciation are evident, especially in the **rhotic and non-rhotic accents**. The respelled version is usually at least consistent with a rhotic accent ('r' pronounced), as in **CHAR LEE**, **SHAR LEE**, **NO VEM BER**, **YOU NEE FORM**, and **OO NEE FORM**, whereas the IPA version usually specifies a non-rhotic accent ('r' pronounced only before a vowel), as in 'tʃɑ:li, 'ʃɑ:li, no'vembə, and 'ju:nifɔ:m. Exceptions are **OSS CAH**, **VIK TAH** and 'u:nifɔ:m. The IPA form of *Golf* implies it is pronounced *gulf*, which is not either General American English or British Received Pronunciation. Different agencies assign different stress patterns to *Bravo*, *Hotel*, *Juliett*, *November*, *Papa*, *X-ray*; the ICAO has different stresses for *Bravo*, *Juliett*, *X-ray* in its respelled and IPA transcriptions. The mid back [ɔ] vowel transcribed in *Oscar* and *Foxtrot* is actually a low vowel in both Received British and General American, and has been interpreted as such above. Furthermore, the pronunciation prescribed for “whiskey” has no initial [h], although some speakers in both General American and RP pronounce an [h] (or [ɹ]) here, and an initial [h] (or [ɹ]) is categorical in Scotland and Ireland.

3 Prior alphabets

The first internationally recognized spelling alphabet was adopted by the **ITU** during 1927. The experience gained with that alphabet resulted in several changes being made during 1932 by the ITU. The resulting alphabet was adopted by the International Commission for Air Navigation, the predecessor of the **ICAO**, and was used for civil aviation until World War II.^[23] It continued to be used by the IMO until 1965:

Amsterdam, Baltimore, Casablanca, Denmark, Edison, Florida, Gallipoli, Havana, Italia, Jerusalem, Kilogramme, Liverpool, Madagascar, New York, Oslo, Paris, Quebec, Roma, Santiago, Tripoli, Upsala, Valencia, Washington, Xanthippe, Yokohama, Zurich

British and American armed forces had each developed their spelling alphabets before both forces adopted the ICAO alphabet during 1956. British forces adopted the **RAF radio alphabet**, which is similar to the phonetic alphabet used by the **Royal Navy** during World War I. At least two of the terms are sometimes still used by UK civilians to spell words over the phone, namely *F for Freddie* and *S for Sugar*.

The U.S. adopted the **Joint Army/Navy Phonetic Alphabet** during 1941 to standardize systems among all branches of its armed forces. The U.S. alphabet became known as *Able Baker* after the words for A and B. The United Kingdom adapted its RAF alphabet during 1943 to be almost identical to the American Joint-Army-Navy (JAN) one.

After World War II, with many aircraft and ground personnel from the allied armed forces, “Able Baker” continued to be used for civil aviation. But many sounds were unique to English, so an alternative “Ana Brazil” alphabet was used in Latin America. But the **International Air Transport Association (IATA)**, recognizing the need for a single universal alphabet, presented a draft alphabet to the ICAO during 1947 that had sounds common to English, French, Spanish and Portuguese. After further study and modification by each approving body, the revised alphabet was implemented on 1 November 1951 for civil aviation (but it may not have been adopted by any military):^[23]

Alfa, Bravo, Coca, Delta, Echo, Foxtrot, Golf, Hotel, India, Juliett, Kilo, Lima, Metro, Nectar, Oscar, Papa, Quebec, Romeo, Sierra, Tango, Union, Victor, Whisky, Extra, Yankee, Zulu

Problems were soon found with this list. Some users believed that they were so severe that they reverted to the old “Able Baker” alphabet. To identify the deficiencies of the new alphabet, testing was conducted among speakers from 31 nations, principally by the governments of the United Kingdom and the United States. Confusion among words like *Delta*, *Nectar*, *Victor*, and *Extra*, or the unintelligibility of other words during poor receiving conditions were the main problems. After much study, only the five words representing the letters C, M, N, U, and X were replaced. The ICAO sent a recording of the new *Radiotelephony Spelling Alphabet* to all member states in November 1955.^{[16][9]} The final version given in the **table above** was implemented by the ICAO on 1 March 1956,^[23] and the ITU adopted it no later than 1959 when they mandated its usage via their official publication, *Radio Regulations*.^[24] Because the ITU governs all international radio communications, it was also adopted by all radio operators, whether military, civilian, or **amateur**. It was finally adopted by the IMO in 1965. During 1947 the ITU adopted the compound number words (*Nadazero*, *Unaone*, etc.), later adopted by the IMO during 1965.

4 Usage

A spelling alphabet is used to spell parts of a message containing letters and numbers to avoid confusion, because many letters sound similar, for instance “n” and “m” or “f” and “s”; the potential for confusion increases if static or other interference is present. For instance the message “proceed to map grid DH98” could be transmitted as “proceed to map grid Delta-Hotel-Niner-Ait”. Using “Delta” instead of “D” avoids confusion between “DH98” and “BH98” or “TH98”. The unusual pronunciation of certain numbers was designed to reduce confusion.

In addition to the traditional military usage, civilian industry uses the alphabet to avoid similar problems in the

transmission of messages by telephone systems. For example, it is often used in the retail industry where customer or site details are spoken by telephone (to authorize a credit agreement or confirm stock codes), although ad hoc coding is often used in that instance. It has been used often by information technology workers to communicate serial/reference codes (which are often very long) or other specialised information by voice. Most major airlines use the alphabet to communicate **Passenger Name Records** (PNRs) internally, and in some cases, with customers. It is often used in a medical context as well, to avoid confusion when transmitting information.

Several letter codes and abbreviations using the spelling alphabet have become well-known, such as **Bravo Zulu** (letter code BZ) for “well done”,^[25] **Checkpoint Charlie** (Checkpoint C) in Berlin, and **Zulu Time** for **Greenwich Mean Time** or **Coordinated Universal Time**. During the Vietnam War, the U.S. government referred to the Viet Cong guerrillas and the group itself as VC, or Victor Charlie; the name “Charlie” became synonymous with this force.

5 Variants

5.1 Aviation

- “Delta” is replaced by “Data”, “Dixie” or “David” at airports that have a majority of **Delta Air Lines** flights, such as **Hartsfield-Jackson Atlanta International Airport**, in order to avoid confusion because “Delta” is also Delta’s callsign.^[26]

5.2 Telegrams

- As early as 1928, the U.S. public was taught^[27] to use the following list when composing telegrams:

Adam, Boston, Chicago, Denver, Edward,
Frank, George, Henry, Ida, John, King, Lin-
coln, Mary, New York, Ocean, Peter, Queen,
Roger, Sugar, Thomas, Union, [Victor?],
William, X-Ray, Young, Zero

5.3 Other

Many unofficial spelling alphabets are in use that are not based on a standard, but are based on words the transmitter can remember easily, including **first names**, **states**, or **cities**. The **LAPD phonetic alphabet** has many first names. The **German spelling alphabet** (“**Deutsches Funkalphabet**” (literally “**German Radio Alphabet**”)) also uses first names. Also, during the Vietnam war, soldiers used ‘Cain’ instead of ‘Charlie’ because ‘Charlie’ meant Viet Cong (Charlie being short for Victor Charlie, the NATO alphabet spelling of the initials VC).

6 Additions in other languages

Certain languages’ standard alphabets have letters, or letters with diacritics (e.g., **umlauts**, **rings**, **tildes**), that do not exist in the English alphabet. If these letters have two-letter **ASCII** substitutes, the ICAO/NATO code words for the two letters are used.

6.1 Spanish

In **Spanish** the word “Ñoño” (dull) is used for ñ.

6.2 German and Swedish

In **German**, **Alfa-Echo** (ae) may be used for “ä”, **Oscar-Echo** (oe) for “ö”, **Sierra-Sierra** (ss) for “ß”, and **Uniform-Echo** (ue) for “ü”.^[28] The same applies to “ä” and “ö” in **Swedish**, though **Ärlig** and **Östen**, from the Swedish spelling alphabet, are also used; similarly, **Åke** may be used for “å”.^[29]

6.3 Danish and Norwegian

In **Danish** and **Norwegian** the letters “æ”, “ø” and “å” have their own code words. In Danish **Ægir**, **Ødis** and **Åse** represent the three letters,^[30] while in Norwegian the three code words are **Ægir**, **Ørnulf** and **Ågot** for civilians and **Ærlig**, **Østen** and **Åse** for military personnel.^[31]

6.4 Czech

Czech “ů”, historically **uo**, is **Uniform-Oscar** (uo).

6.5 Finnish

In **Finnish** there are special code words for the letters **å**, **ä** and **ö**. **Åke** is used to represent **å**, **Äiti** is used for **ä** and **Ölly** for **ö**. These code words are used only in national operations, the last remnants of the **Finnish radio alphabet**.^[32]

6.6 Estonian

Estonian has 4 special letters, **õ**, **ä**, **ö** and **ü**. **Õnne** represents **õ**, **Ärni** for **ä**, **Ööbik** for **ö** and **Ülle** for **ü**.

6.7 Malay

Malay replaces letter “L” with “London”, since the word “Lima” in Malay means number 5 (five).

7 See also

- Greek spelling alphabet
- International Code of Signals (includes flag representations)
- LAPD phonetic alphabet
- List of military time zones
- PGP word list
- Procedure word
- Q code
- Russian spelling alphabet
- Spelling alphabet
- Ten-code
- Voice procedure

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- [15] Service de l'Information Aéronautique, *Radiotéléphonie*, 2nd edition, 2006
- [16] The audio recording, available on airwaysmuseum.com does not follow the details of the ICAO transcription. Apart from the dual pronunciations of *Charlie* and *Uniform*, the speaker uses the normal English pronunciations of the code words.
- [17] The ITU and ICAO (romanized) transcribe this as /nɔːˈvembər/ *naw-**VEM**-bər*, presumably an error.
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- [19] The pronunciation “fife” is required. Failure to use this pronunciation has resulted in ‘5’ being misheard as ‘9’. (McMillan, 1998, “Miscommunications in Air Traffic Control”)
- [20] Transcribed as if it were /ˈnɪnər/ ***NIN**-ər*, but this pronunciation is never used.
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9 External links

- Public ICAO site
- “NATO Declassified - The NATO Phonetic Alphabet”. North Atlantic Treaty Organization.

10 Text and image sources, contributors, and licenses

10.1 Text

- NATO phonetic alphabet** *Source:* https://en.wikipedia.org/wiki/NATO_phonetic_alphabet?oldid=783360089 *Contributors:* Damian Yerrick, Tobias Hoevekamp, The Eoppt, LC~enwiki, Bryan Derksen, Zundark, Stephen Gilbert, AstroNomer, Mark, SimonP, Heron, Xoder, Frecklefoot, Edward, Patrick, Michael Hardy, Zocky, Dreamword, Menchi, Ixfd64, Tregoweth, Egil, Looxix~enwiki, Ahoerstermeier, J-Wiki, Angela, TraxPlayer, Kaihsu, Wolfstu, Cherkash, Smack, Denny, Timwi, Nedward, Ed Cormany, Darac, Bjh21, WhisperToMe, DJ Clayworth, Markhurd, Bhs, Tpbradbury, Furrykef, Head, Philopp, Wernher, Flockmeal, Slawojarek, JorgeGG, Denelson83, Rogper~enwiki, Nufy8, Robbot, Sander123, KeithH, Netizen, Modulatum, Hadal, Insom, Wikibot, Wereon, Seth Ilys, Filemon, Adam78, Matt Gies, Sbonds, Netoholic, Tom harrison, Mark.murphy, Marcika, Bfinn, Wwoods, Henry Flower, Markus Kuhn, Joe Kress, Jdavidb, Prosilas, AlanI, SarekOfVulcan, Quandaryus, Beland, Quarl, ShakataGaNaI, Mzajac, Alobodig, Mikko Paananen, 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Palica, Behun, Graham87, Elvey, DePiep, Zoz, Nanami Kamimura, Tizio, Koavf, Misternuvistor, Chipuni, Davidp, SpNeo, Mbutts, NeonMerlin, Ttwarig, Sapien, FlaBot, Mollman~enwiki, Nihilres, GünüX, Ewlyahoom, Wars, ChongDae, Vilcxjo, Brendan Moody, Rrenner, Atitarev, Jmkprime, Kmanoj, Glenn L, Acefitt, Chobot, Sharkface217, Bornhj, DVdm, Banaticus, Roboto de Ajvol, The Rambling Man, YurikBot, Wavelength, Hairy Dude, Phantomsteve, Petiatil, Xihr, IByte, Gaius Cornelius, Pseudomonas, Curtis Clark, WulfTheSaxon, Wiki alf, Howcheng, Haranoh, Wateryguy, Ke4djt, Russellcunning, Brandon, Eugrus, MarkAb, Epa101, Acetic Acid, Goodeye, Deeday-UK, Richardcavell, FF2010, Yonidebest, 21655, Ballchef, Arthur Rubin, SMCandlish, Ekespe, Petri Krohn, Red Jay, Fram, Aiodysey, David Biddulph, HansM, Diagraph01~enwiki, Kf4bdy, SaulPerdomo, AndrewWTaylor, Octavian X, A bit iffy, SmackBot, WilliamThweatt, YellowMonkey, TheBilly, Bggoldie~enwiki, Deon Steyn, Oppiki, Luckykitty89, Michael Dorosh, Ozone77, HalfShadow, Gilliam, Hmains, Joey Snitch, Teemu08, Bluebot, Kharker, Agateller, NCurse, Anthonzi, DennisTheTiger, JackyR, Snori, Kaid100, Mm3guy, Ashawley, Chlewbob, Al-Kadafi, Rrburke, Kevinpurcell, Wes!, FreakyFly-Bry, Khoikhoi, Ctifumdope, Steven X, Khukri, Savidan, B jonas, Hoof Hearted, PetesGuide, Dave-ros, Dcamp314, Weregibil, The PIPE, Hockachu, Jgrimmer, Sarfa, Ohconfucius, M adler, Red zenith, Hotspur23, MilborneOne, GCW50, PowerCS, IronGargoyle, Saseigel, 16@r, Evampire, SQGibbon, Jmgonzalez, Godfrey Daniel, Majormajor, Technopaladin, Zepheus, DI2000, Norm mit, Iridescent, Haytom, Kibethblade, JoeBot, Alan Joe Skarda, Md2perpe, Tawkerbot2, Vanisaac, DKqwerty, Wethackrey, Mgavr, JForget, Daggerstab, Stadler981, CmdrObot, Wafulz, Sangild, Lighththead, R9tgokunks, Palendrom, ShelfSkewed, Henkm, MeekMark, Incalculable, Musicalantonio, TJDay, Cydebot, Future Perfect at Sunrise, Mato, SithiR, Gogo Dodo, Borislutskovsky, Jsanchezd, Mspringer141, Christian75, Roberta F., DumbBOT, Teratornis, Chris Henniker, Garik, Dagrak, JodyB, PamD, ManN, Wikid77, James086, Merbabu, Hugo Zorrilla, Heroeswithmetaphors, Rishirajan, Temers, AntiVandalBot, Fedayee, Seaphoto, AnemoneProjectors, Jj137, Jaws317, Corkster, DARTHShrine, Vistor, Myanw, DOSGuy, JAnDbot, Deepstblu, Defective, MER-C, Seddon, IrrTJMc, Kacela, Magioladitis, Connormah, Bongwarrior, Nihilus Shadow, Buckshot06, WikkanWitch, Uv1234, Arthuran, BilCat, Mike Payne, Cpl Syx, Lollerkeet, Gabrielmcc, MartinBot, Major Bloodnok, Naohiro19, Corrosion20, Darlock, R'n'B, Kateshortforbob, Andy0101, RockMFR, Pharaoh of the Wizards, Hans Dunkelberg, Louislee007, Kid shellei, Choihei, BluesEtude, BigAlPhillips, McSly, Lizzie Harrison, NewEnglandYankee, Fredster2004, Morthanley, Dcs315, 83d40m, BostonRed, KylieTastic, RVJ, Ntrval, OneHappyHusky, X!, VolkovBot, ABF, Philip Trueman, Mike Cline, TXiKiBoT, HS2JFW, Clarince63, Corvus cornix, BwDraco, Redtooth700, LeaveSleeves, Amog, Companyr, Cuboidal, Ultratone85, Haseo9999, Planet-man828, Jjdmk, SieBot, Tiddly Tom, Typric, Bentogoa, Happysailor, Quest for Truth, Flyer22 Reborn, Tapshah, Tip-toety, Radon210, Neutralhomer, Masgatothaca, MyrddinE, JSprung, Prestonmag, Oxymoron83, Hello71, RiseDarthVader, DeeJay6, Thejokster, Bodhi Peace, Pexise, Prichmond, Geoff Plourde, Pinkadelica, Denisarona, Asday85, ClueBot, Vrmiguy, The Thing That Should Not Be, Jagun, Supertouch, Mcorenia, Garyzx, Cptmurdok, Mild Bill Hiccup, Niceguyedc, LizardJr8, Shovon76, Piledhigheranddeeper, Cross Reference, ElSaxo, Excirial, Osanne, Parfitta, FloulI, Freudian19, XLinkBot, Roxy the dog, Nathan Johnson, BodhisattvaBot, Jovianeye, Oldtimerocker, Wykesy, Badgernet, Common Good, RyanCross, Alexhuddart, Addbot, Tcnv, Tgkprog, TheNeutroniumAlchemist, No-homers48, Ronhjones, Martindo, CanadianLinuxUser, Skyezx, AndersBot, Albuseer, Tide rolls, Lightbot, Willondon, Teles, Zorrobot, J. Johnson, KEN, Krukouski, Everyme, Yobot, Legobot II, Boulevardier, Ferridder, Gms, WizardOfOz, AnomieBOT, Six words, Galoubet, Piano non troppo, Law, RandomAct, Mahmudmasri, Giants27, MaterialsScientist, Crinklybob, TalkChat, Scooller~enwiki, Xqbot, Bobsh-moot, Sionus, CMunk, 4twenty42o, Non-alc, Heimuk, Nmeier23, Лев Дубовой, Omnipaedista, BrutalDeluxe, A.amitikumar, Youandmeaintnothingbutmamals, Chrise4286, Frescobot, Franzw, Coroboy, Mxiip, Everlasting Winner, Cannolis, AlecTR, Pinethicket, I dream of horses, Jonesey95, Calmer Waters, Phionexx, A8UDI, Jschnur, MastiBot, JohnVK2JWA, Discographer, Btucker01, Matzpersson, Bigbth, Lotje, Vrenator, Aoidh, Reaper Eternal, Specs112, Smiller385, Some Wiki Editor, Reach Out to the Truth, Jbusnengo, Skmacksler, Onel5969, Bento00, Dancingpuppygal, Viniciusmc, Zujine, Santamoly, Allisonh12, AmericanLeMans, RA0808, Tommy2010, Free Great Palestine, Dcirovic, Cegalegolog99, Sirius 128, Thecheesykid, Tiraiof-Characene, Hazard-SJ, Access Denied, H3IIBot, Dispersedoubt, Kilopi, Brandmeister, Co.die96, L Kensington, Ridonculoid, Holbenilord, Orange Suede Sofa, RichmondAtty, DASHBotAV, Feather-Pluma, 28bot, Utaj, Woolfy123, ClueBot NG, Smtchahal, Gareth Griffith-Jones, XoravaX, Loginnigol, MadKingRalph, Lukas Tobing, Paul Gaskell, Cool Å2, Bentbiker, JonC95, Tholme, Calabe1992, Whatwhat1234, BG19bot, Sprinkler21, Dumbbell1023, Hz.tiang, Billy-bobbobcat, Crocodilesareforwimps, Dred05m, P!!SAM!, Wiki-Pharaoh, Duxwing, HTML2011, MeanMotherJr, NotMiserable, Globe Trekker, ~riley, Openalldoors, Paket09, Guitarzach, MarchOrDie, John Burns909, Ueutyi, Burninthruthesky, Lfdder, JamesMoose, Wuzh, Holmsse, Hclarkie, MAintenance, I17michmcd, Bearboar, GaryGMason, Rgbypoet, Rbpltr, Mvpo666, Ca2james, Valeatory, Lukas1231, Krookjy, Peetiedawn88, Eurodyne, Eric0928, Shadow010201, Ira Leviton, Unihedro, Nac Mac Chrome, Treuiller, Mcb133aco, Visionious, Winterysteppe, Argoniansrule, Tkarpuj, Edit Your Mum, Entranced98, GreenC bot, Cptcod23, Chrissyad, Jonbspeck, Sopho12, Coastguard335 and Anonymous: 1202

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