W2MIL PRESENTS MORSE CODE

There are 3 versions of the Morse Code depicted below courtesy of Wikipedia:

Morse code is a method used in telecommunication to encode text characters as standardized sequences of two different signal durations, called *dots* and *dashes*, or *dits* and *dahs*. Morse code is named after Samuel Morse, one of the inventors of the telegraph.

International Morse code encodes the 26 basic Latin letters **A** through **Z**, one accented Latin letter (**É**), the Arabic numerals, and a small set of punctuation and procedural signals (prosigns). There is no distinction between upper- and lower-case letters. Each Morse code symbol is formed by a sequence of *dits* and *dahs*. The *dit* duration is the basic unit of time measurement in Morse code transmission. The duration of a *dah* is three times the duration of a *dit*. Each *dit* or *dah* within an encoded character is followed by a period of signal absence, called a *space*, equal to the *dit* duration. The letters of a word are separated by a space of duration equal to three *dits*, and words are separated by a space equal to seven *dits*. Until 1949, words were separated by a space equal to five *dits*.

Morse code can be memorized and sent in a form perceptible to the human senses, e.g. via sound waves or visible light, such that it can be directly interpreted by persons trained in the skill.

Morse code is usually transmitted by on-off keying of an information-carrying medium such as electric current, radio waves, visible light, or sound waves. The current or wave is present during the time of the *dit* or *dah* and absent during the time between *dits* and *dahs*.

Since many natural languages use more than the 26 letters of the Latin alphabet, Morse alphabets have been developed for those languages, largely by transliteration of existing codes.

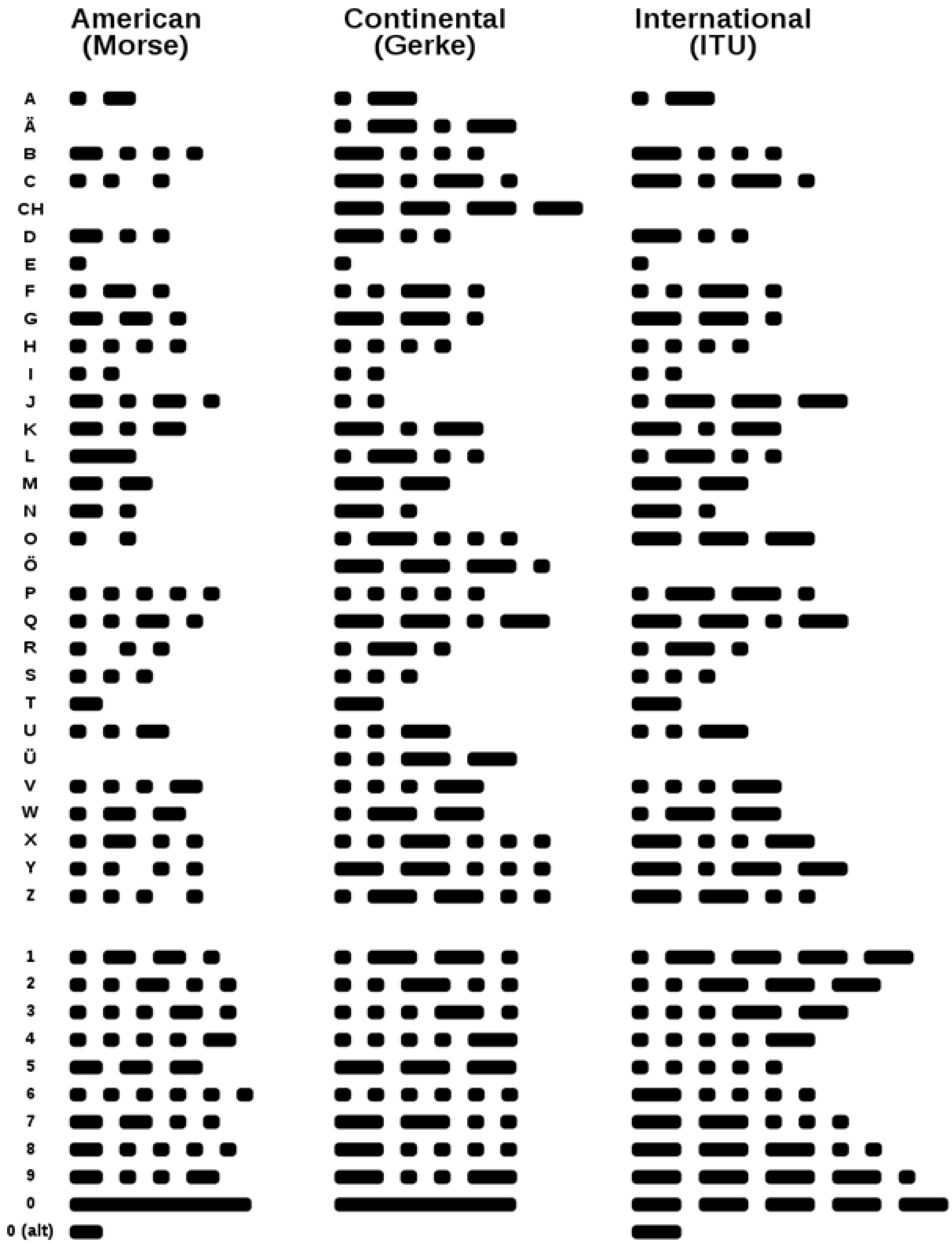
To increase the efficiency of encoding, Morse code was designed so that the length of each symbol is approximately inverse to the frequency of occurrence of the character that it represents in text of the English language.

Thus, the most common letter in English, the letter **E**, has the shortest code: a single *dit*. Because the Morse code elements are specified by proportion rather than specific time durations, the code is usually transmitted at the highest rate that the receiver is capable of decoding. Morse code transmission rate (*speed*) is specified in *groups per minute*, commonly referred to as *words per minute*.

1. The American Morse Code was used by certain entities in the 1800s such as the railroads.

2. The Continental Morse Code was used in Europe, specifically by Germany after it was developed by Fredrick Gerke. This was an attempt to fix many of the shortcomings of the American Morse Code.

3. The International Morse Code was adopted by the ITU (International Telegraph Union) to create an international standard that can be used by all countries. This is the predominate version of the Morse Code that exists today.


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

As an interesting note, you will hear the American Morse Code at the New Orleans train station in Disneyland. It is being sent continuously all day every day at the park. The code is sending the first two sentences of the original speech by Walt Disney the day that Disneyland was opened.

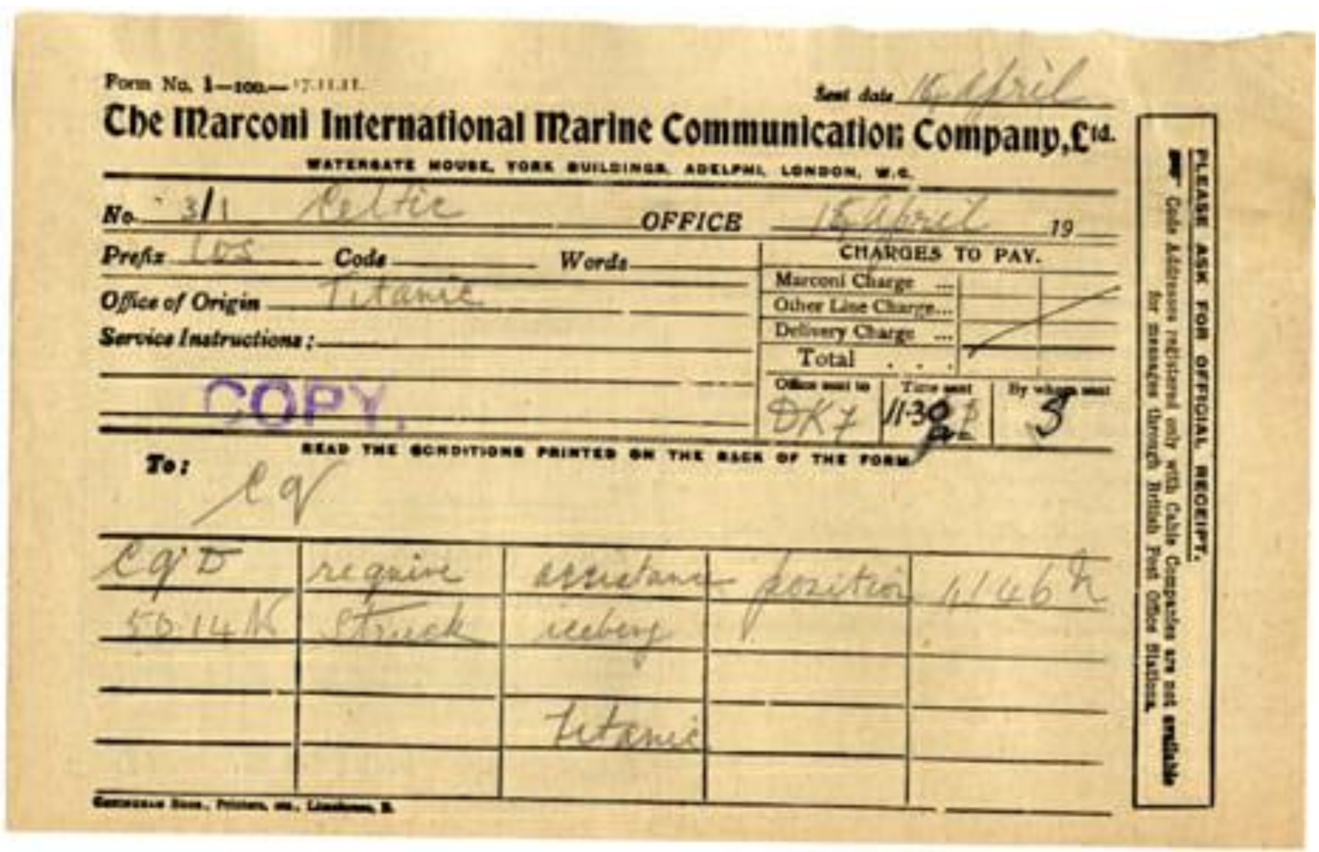
**"TO All WHO COME TO DISNEYLAND, WELCOME.
HERE AGE RELIVES FOND MEMORIES OF THE PAST,
AND HERE YOUTH MAY SAVOR THE CHALLENGE AND PROMISE OF THE FUTURE."**

The balance of the speech states:
Disneyland is dedicated to the ideals, the dreams and hard facts that have created America…With the hope that it will be a source of joy and inspiration to all the world.
July 17, 1955

The entire speech can be viewed and is recorded for posterity in a gold-colored plaque at the base of the flagpole in town square at Disneyland.

If you wish to see more interesting things about Disneyland, please visit the website:
https://dizbuff.com

Another interesting note in history radio was the time the message sent by the Titanic on April 14, 1912, when it struck an iceberg and began to sink. The message was sent via the primitive radios used in those days. The actual message received is depicted below:



Form No. 1—100.—7.11.11.

Sent date 15 April

The Marconi International Marine Communication Company, Ltd.

WATERGATE HOUSE, YORK BUILDINGS, ADELPHI, LONDON, W.C.

No. 3/1 Celtic OFFICE 15 April 19

Prefix CDS Code Words

Office of Origin Titanic

Service Instructions:

COPY.

CHARGES TO PAY.	
Marconi Charge	
Other Line Charge	
Delivery Charge	
Total	

Office sent to	Time sent	By whom sent
DK7	1130	3

READ THE CONDITIONS PRINTED ON THE BACK OF THE FORM.

To: CQ

CQD	require	assistance	position	41.46 N
50.14 W	struck	iceberg		
		Titanic		

PLEASE ASK FOR OFFICIAL RECEIPT.

Code Addresses registered only with Cable Companies are not available for messages through British Post Office Stations.

"Require assistance…struck iceberg" Figure 1
(Courtesy: Museum of the History of Science, Oxford)

The nearest ship was the "Californian" which never heard the message because they had turned off the radio for the night as it was anchored 19 miles away.

The ship “Californian” could have rescued everyone on the Titanic if they had heard the message from the Titanic. The ship that responded was “The Carpathia” which was 58 miles away and took 2 hours to arrive. By that time, many of the passengers of The Titanic had already perished.

The person who worked at The Marconi International Maritime Communication Company, Ltd. that picked up this message and attempted to bring it to the attention of the authorities was David Sarnoff, a Russian immigrant.

David eventually left the company and even though he had a limited education, eventually became the president of RCA, which was the Radio Corporation of America because he had the foresight to see how important radio would become to the everyday lives of the United States of America and the people of the world.

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 *dah*.

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 *dits* and *dahs* within a character): 0
4. short gap (between letters): 000
5. medium gap (between words): 0000000

Note that the marks and gaps alternate: *Dits* and *dahs* are always separated by one of the gaps, and that the gaps are always separated by a *dit* or a *dah*.

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 *dahs* or gaps, perhaps only for 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.

Cable code

The very long time constants of 19th and early 20th century submarine communications cables required a different form of Morse signaling. Instead of keying a voltage on and off for varying times, the dits and dahs were represented by two polarities of voltage impressed on the cable, for a uniform time.

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
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789

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

```
===.===...===.===.===...=.===.=...=.=.=...=.......==
=.=.===.=...===.===.===...===.=.=...=
  ^              ^    ^      ^            ^
  |             dah  dit     |            |
symbol space              letter space    word space
```

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 spoken (or sung):

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 *dah* is the length of 3 dits (with no gaps between), and spacings are specified in number of *dit* lengths. An unambiguous method of specifying the transmission speed is to specify the *dit* duration as, for example, 50 milliseconds.

Specifying the *dit* 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 *dit* lengths. It is not immediately clear how a specific word rate determines the *dit* duration in milliseconds.

Some method to standardize the transformation of a word rate to a *dit* duration is useful. A simple way to do this is to choose a *dit* 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 *dit* 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 *dit* units is 50 and a simple calculation shows that the *dit* length at 20 words per minute is 60 milliseconds.

Using the word **CODEX** with 60 dit units, the dit 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. The FCC 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.

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 like the requirements for commercial radiotelegraph licenses.

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.[31]

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

where: *T* is the unit time, or *dit* 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.