What the Heck is Hell?

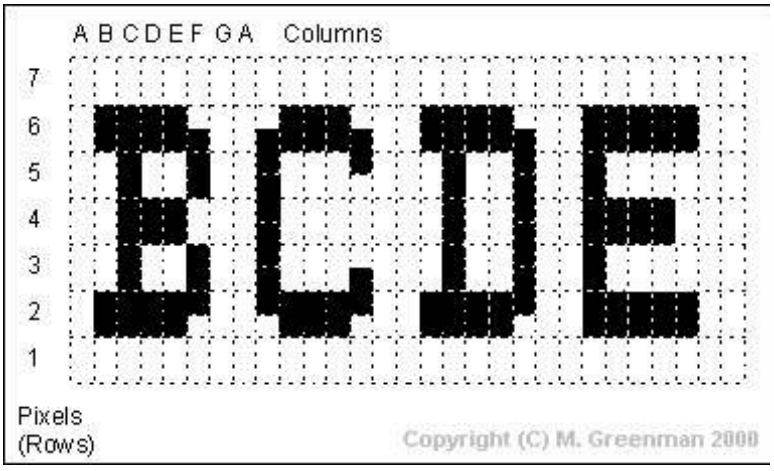
Among the top 5 soundcard data modes in popularity (especially in Europe), Hell, Feld Hell, or Hellschreiber is a member of the CW (Continuous Wave) family, as is the Morse code. Both Hell and Morse are called "fuzzy logic" modes. Fuzzy logic is what we instinctively use with sight, sound, or touch that would normally cause problems for machines/computers because of high noise, poor propagation, missing/corrupt data, inconsistent signal timing/spacing, or interpretation/contextual problems.

These types of signals are sent in specific patterns, but without any error correction, to any station that can hear them (one-to-many). The receiving station must try to figure out what has been sent, based on what has been received. We easily spot patterns, understand partial words, and can make interpretations, using our innate pattern recognition abilities. With Hell, double-lines of characters are printed on your screen, as they are received, and you decipher the meaning of the message, not the computer! The characters also have a slight hand printed slant to them.

Dr. Rudolf Hell (Germany) invented Hellschreiber, in 1929. It was a method of sending text over radio, very similar to the landline fax machines, of the time. However, the equipment used was smaller, lighter, and portable, because of Dr. Hell's design of the Hell character set, and means of transmitting them. Only upper case characters, and numbers are transmitted, using a fixed 7 by 7 dot matrix grid. Turn the transmitter on for a dot (black), and off for no dot (white).

By using on/off keying, Hell was originally transmitted/received using CW equipment, the very same gear used for the Morse code. During World War II, Germany army radio operators used Hellschreiber in the field (Feld, in German), for messaging, hence the term that we use today—Feld Hell, or just Hell.

If you speak German, you know that Hellschreiber translates into English as "Light writer," "Bright writer," or "Clear writer." All puns on Dr. Hell's name, but which describes Hellschreiber—perfectly!



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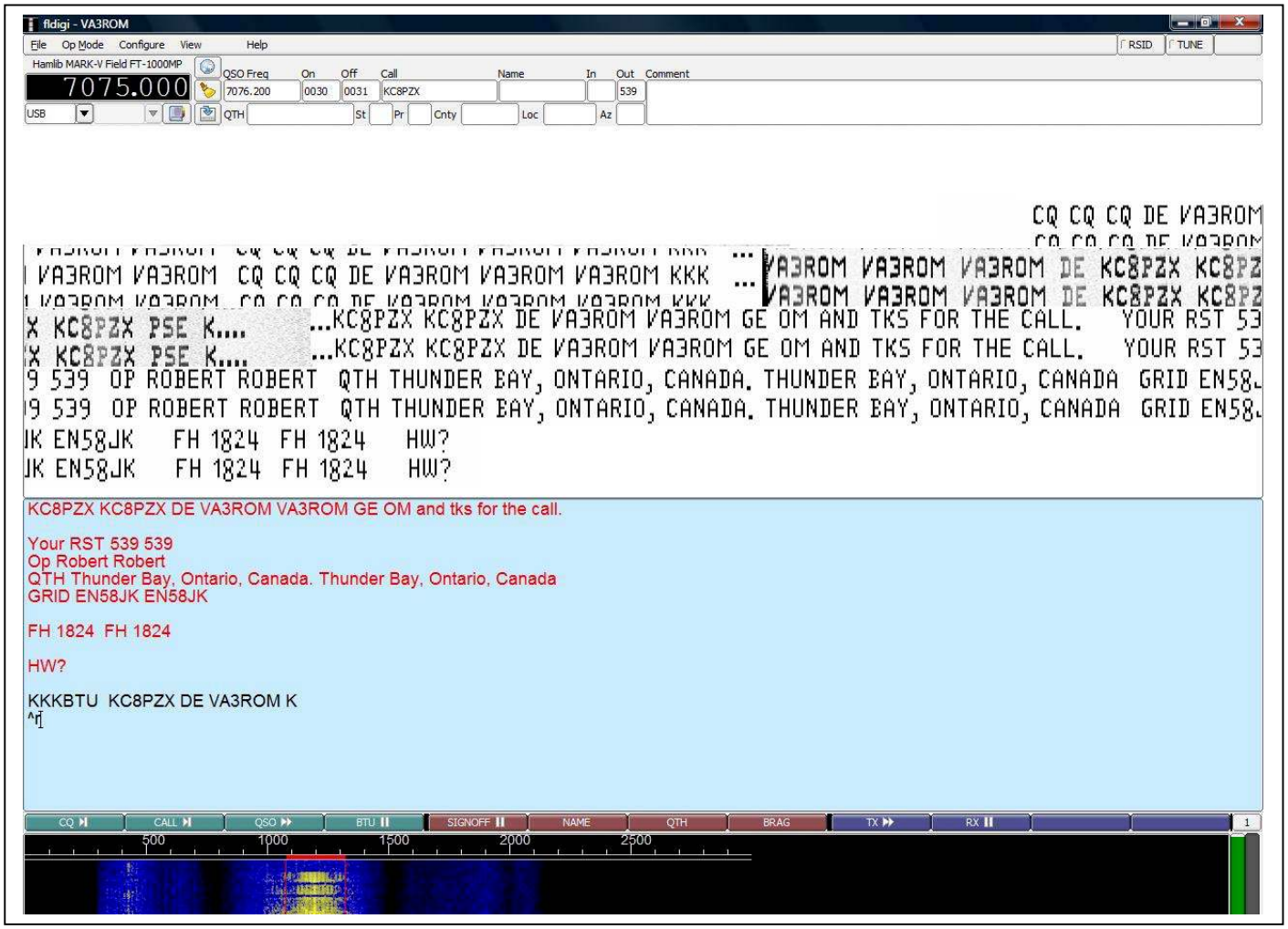
In this diagram, the 7 x 7 rectangles depict individual dot locations in the matrix. There are blank, non-transmitted picture elements (pixels) at the top and bottom of each character, and between characters. These are depicted as empty white rectangles. Transmitted (key down) pixels are shown in black. The transmitter duty cycle is quite low, only 22%. Another technical way to say this, is that the peak-to-average power ratio is very high, important in noisy situations.
150 characters are transmitted every minute. The effective data rate is 122.5 baud, about 25 WPM. The bandwidth used for soundcard Feld Hell is 245 Hz, which nicely fits into 250 Hz CW filters. The original CW transmitted bandwidth of Feld Hell was just 75 Hz!

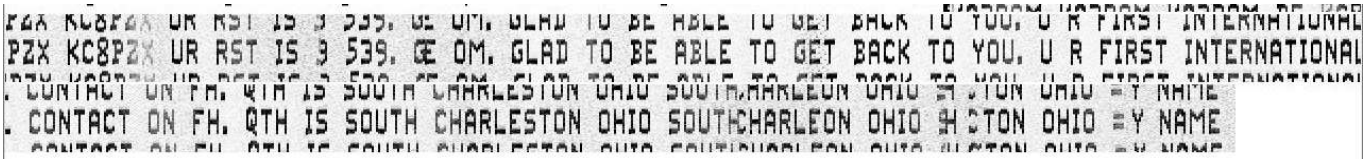
Feld Hell's weak points are with heavy fading of signals in unstable atmospheric conditions, and nearby carrier based signals. A good point is its ability to work in poor conditions when other data modes are useless. FM Hell is a weak signal mode, and MT Hell is excellent in high noise.

These days, Hell, and its many variations, use computer software and soundcards to create the CW on/off keying effect. Each transmission starts/ends with 3 short tones to help identify it. The sound of Feld Hell is hard to describe; I call it “frog with a sore throat.” Each line of text is printed twice (but not transmitted twice) to help with decoding, especially under marginal conditions. Thee are free, dedicated programs, that only do the Hell modes, such as IZ8BLY Hellschreiber http://tinyurl.com/b6wrvn, and multi-mode programs, like FLDIGI http://www.w1hkj.com/Fldigi.html, which is also free. Soundcard data modes are interesting, and offer more flexibility for handi-hams http://www.handiham.org/, over voice only modes. Low power is used (25 watts, or less, is normal), and most programs can run on older computers. Interfaces are easy enough to make or buy.

Acoustic coupling a computer microphone to radio speaker, or using an audio patch cord from radio audio out to computer line in/microphone in, works very well for receiving the various data modes.



Screen capture of my QSO (conversation) with Paul Webb, KC8PZX, using FLDIGI. Standard Morse code operating procedures, abbreviations, and the Q-codes are used. Dial frequency was 7075 kHz (USB [upper sideband] for soundcard data modes); frequency shifted using a 1200 Hz tone. Bandwidth of the signal is 245 Hz. The waterfall (blue/yellow) display assists in tuning to a signal (just point and click with the mouse), and displays either frequency, or tone offsets. FLDIGI is customizable, and can directly control many radios (with a serial interface), which makes logging, mode switching, and tuning, very easy. FLDIGI has many soundcard data modes (and their variations), such as PSK, MFSK, Hell, THOR, Throb, Olivia, MT63, Domino, RTTY, and the Morse code. It also supports many operating systems such as Linux, Free-BSD, OS X, and Windows XP to Vista.



This is a snippet of some of Paul's transmission. Notice how Hell prints double text lines, and because of band conditions, how the lines are offset. The characters can fade, and change intensity, having two lines, and using our "fuzzy logic" pattern recognition ability, we can easily "decode" the text. This is the literal meaning of "reading the mail." Anyone can "listen" to the two of us "talking," because Hell is a one-to-many, asynchronous mode, just like APRS. Paul is a 24-year old electrical engineer. My oldest data mode contact, to date, was with an 85-year old retired merchant mariner. I'm right in the middle, age wise. Now, if an octogenarian can become a "digihead," so can anyone!

Many of the soundcard data modes have Internet user support groups, and online clubs that you can join. The Feld Hell club is free to join, and has no annual fees! They'll issue you an FH number (good for life), that is used in various club contests and communications with other club members. For more information you can visit http://sites.google.com/site/feldhellclub/.

If you've noticed the word "free" showing up a bit, that's just the nature and spirit of amateur radio, and that surprises a lot of people! There are commercial programs available, but I've found that the free ones are just as good, if not better.

YouTube™ has many amateur radio instructional videos. Randy Hall, K7AGE, has created several on the soundcard data modes, such as this "Hellish" one http://tinyurl.com/b2ekkv. He does tend to use "hamspeak," being a ham, so you may want to view them more than once, or twice.

Hell has several new variations, developed in the past 10 years, to overcome some of the previously noted problems. Therein lies the another problem, with all the data modes. There are so many variations, and more keep coming (over 50+), as mathematical algorithms improve, and computers become more powerful. Too much choice can be a bad thing, sometimes. So, stick to the base modes, such as regular Feld Hell, when just starting out

Finally, Murray Greenman, ZL1BPU, graciously allowed the use of some of his material for this article. There is more on Hell modes at http://tinyurl.com/d6l2m2, and http://tinyurl.com/dle4ug.

The following frequency ranges have Hellschreiber (Feld Hell) activity.

1805 - 1810 kHz
1837 - 1839 kHz

3582 - 3589 kHz

7030 - 7040 kHz
7067 - 7069 kHz
7074 - 7078 kHz

10135 - 10145 kHz

14075 - 14079 kHz

18101 - 18107 kHz

21063 - 21070 kHz

24920 - 24925 kHz

28100 - 28110 kHz

Note that many data modes share the same frequency ranges. Using a multi-mode program, such as FLDIGI, makes the job of "hunting" easier.

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