Newcomers and Elmers Net: Digital Communications Part 2
12-8-13 Robert AK3Q

PACTOR

PACTOR is known as a *burst-mode* protocol, meaning that data is sent in bursts rather than in a continuous stream.
-- By sending the data in bursts, analyzing it for errors, and then sending back an acknowledgement code, PACTOR can be virtually error-free. It is highly sophisticated and, therefore, trusted by governments and military groups.
-- There are four versions of PACTOR (I,II,III, IV), and while there is soundcard software to decode basic PACTOR I, extra hardware is needed for the advanced modes or to transmit any version of PACTOR.
-- Another interesting feature of PACTOR is its integration with the Internet, allowing stations to use a combination of strategies to get the signal to its intended destination.

For listening purposes, software such as *MixW* can receive PACTOR 1, but PACTOR II and III & IV need specialized hardware from a company called *SCS* out of Germany.
-- These modems are fairly expensive, so most folks do not use them unless they have a specific need for the faster versions of PACTOR.
-- One common use of PACTOR is the messaging program *WinLink 2000* which is capable of sending E-mail, binary files, and weather bulletins around the world using linked radios and Internet hubs.
-- Since there are a number of HF stations around the world, at least one station should be reachable by radio for sending a message, and then the Internet forwarding capabilities of the system can forward it around the world to the receiving station, or hold it until the person retrieves it.

MFSK16

MFSK16 is an excellent long-distance mode, particularly for lower bands like 40 and 80 meters.
-- In addition to standard text handling, MFSK16 can also send simple images.
-- Recently the Voice of America (VOA) and other large radio broadcast stations have been experimenting with digital modes, and VOA tests have found MFSK16 to be the most reliable and readable across a wide spectrum of testers around the world.
-- I have been able to participate in some of these tests, and I have to say it is a lot of fun! (The idea behind the tests is a serious one: stations like VOA want to have emergency capabilities to get information out when propagation conditions might be poor for one reason or another, and digital

modes offer the best chance of getting the signals through the interference and/or normal propagation restrictions.)
-- FLDigi is an excellent program for MFSK16, as is MixW and MultiPSK.

Hellschreiber
Hellschreiber (or Hell for short) is actually an old mode of communication, much like a facsimile image, but it is indeed a digital mode.
-- It was developed in the 1920s, used extensively in WWII, and was used for commercial landline services until around 1980.
-- Today it is used by amateur radio folks in several iterations, the most popular being Feld-Hell, and found between 14.077 and 14.082 MHz, and the digital portion of 40 meters.
-- While not all that common, if you have software which will decode Hell you might enjoy trying it out.
-- Unlike other text modes, Hell looks a bit odd, more like a blurry image of the text rather than crisp letters
-- When there is interference Hell can be difficult to read, but it has something of its own error correction built in, in that each character is sent twice.

Part of the fun of the digital modes is trying them and seeing how well things can copy. For regular use if you decide to transmit in the digital modes, you no doubt will find one or two favorites.
-- For receiving purposes and for really using your radio to its fullest, you will want to try all of the modes you can, so have fun with Hellschreiber and RTTY and experience a modern take on a bit of history!

SSTV
Slow-Scan Television (SSTV) is an excellent mode to experiment with since there is regular activity daily on 14.230 MHz (analog signals) or 14.233 MHz (digital signals), both using Upper Sideband.
-- SSTV can be either an analog or a digital radio mode for sending still images, much like a fax machine, but with color. Depending on the quality of the signal the images can be pretty clear, or a bit grainy.
-- Sometimes they look like old scattered TV images (now almost a nostalgic thought since Digital TV has changed everything!), but if propagation is good, the images will be as well.

Analog modes rely on audio frequency shifting to send picture and color information, while digital imaging modes use DRM-type technology (Digital Radio Mondiale) and the JPEG2000 format.

-- Software such as EasyPAL and DIGTRX can translate these digital images, while many digital software suites will include software to render the analog images.
-- There are a number of programs able to decode these images, and it is fun watching them develop on the screen.
-- The only real hiccup in the process is identifying in which mode the analog images are being sent—Scottie is by far the most popular, but there are several common modes.
-- Sometimes the person sending the image will alert the receiving person concerning the mode, but often not. A little experimentation will usually hit on the right mode.

Olivia, Throb, and MT63
These three modes have also be a part of the VOA testing I mentioned above, and they are used sporadically around the amateur bands.
-- Olivia is a very robust mode, but not particularly fast, while MT63 is a very wide signal (almost as wide as voice SSB) but with really good forward error correction.
-- You can hear MARS groups using MT63 regularly outside of the amateur bands, as well as on the low bands.

WSPR and JT65
-- stands for Weak Signal Propagation Reporter, and JT65 – where the "JT" stands for Joe Taylor, K1JT, the brain and brawn behind the programs.
-- While both programs are digital modes intended for weak signal work, there are some major differences.
-- WSPR is not a "chat" mode, but rather a beaconing system. It takes the concept of the NCDXF beacon system and puts it, quite literally, in your back yard.
-- Your station generates a signal every few minutes that is monitored and recorded by other WSPR users around the globe.
-- Then, a few seconds after you have finished transmitting the signal (including your call sign, location, and power level), you can see where in the world your signals are being received right now, as well as how strong they are being received.
-- The WSPRnet web site provides a simple user interface for querying the database, a mapping facility, and many other features.
-- you can now know, with certainty, and almost instantly, where in the world your signal is going and how well it is getting there.

JT65 was originally designed for Earth-Moon-Earth (EME, or "Moonbounce") communications, but a few years ago the idea arose to try it out on the noisy HF bands to see how it would fare.

-- a special version of JT65 is available, optimized for the HF bands, JT65-HF, written and released by another Joe, Joe Large, W6CQZ.

The JT65 protocol is a structured one, in which only 13 characters are sent in each exchange.

The proper sequence of a JT65 QSO (at least on HF) -
Assume I see VE3ODZ calling CQ and I engage in a QSO with him it would run something like the following:
CQ VE3ODZ FN03 1 – VE3ODZ is calling CQ
VE3ODZ W6CQZ CM87 2 – I answer VE3ODZ with my call sign and grid
W6CQZ VE3ODZ -13 3 – VE3ODZ answers my call with a report (-13)
VE3ODZ W6CQZ R-08 4 – I acknowledge my report (R) and send his (-08)
W6CQZ VE3ODZ RRR 5 – VE3ODZ acknowledges my report (RRR)
VE3ODZ W6CQZ 73 6 – I end the QSO with a 73
W6CQZ VE3ODZ 73 7 – VE3ODZ ends the QSO with a 73

That's it. The 'perfect' JT65 QSO. Call signs exchanged, locations (grids) exchanged, signal reports exchanged and confirmed with R- and RRR and lastly a QSO ended with the 73 messages.

JT65 has a broader bandwidth than WSPR at 200 Hz, and is slightly less sensitive, but it can convey information twice as fast as WSPR and is very capable of detecting signals well below the audible threshold and displaying them with perfect copy.
-- being an FSK mode (Frequency Shift Keying), it is resistant to many natural and manmade sources of interference.
-- additional modes have been developed for the other end of the spectrum, LF work, with very slow repeated copy to allow for error correction from static/noise common in LF signals

VHF/UHF
"Digital" Modes like APRS (Automatic Packet Reporting System), WSJT for moonbounce and meteor scatter, ALE (Automatic Link Establishment) and others are common on VHF and above frequencies, and most can be run without a lot of extra equipment/cost.

--DStar is a digital mode capable of transmitting both voice and data at the same time, but it does require some rather costly hardware, usually in the range of $300 or more.
--There are several other modes like DStar available, but so far these are rather few and far between. However, check with local radio clubs to see what is in common use in your area.