Official Publication of the
West Allis Radio Amateur Club

Hamtrix

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Volume 62, Issue 8 August, 2015

AUGUST CLUB HAPPENINGS

NUT NET
3.985mhz
Monday-Saturday
8:15am CT

Milwaukee-Florida Net
Every Day on 14.290 Mhz
7:00AM - 9:15AM ET
6:00AM - 8:15AM CT

Club Meeting

St. Peter's Episcopal Church,
7929 W. Lincoln Avenue, West Allis
August 11, 2015 **7:00pm**

Program
Rig Control
Multiple presenters

Join us for a pre-meeting dinner
at Johnny V's Classic Cafe
1650 S 84th St at 5:00pm

Anniversary Awards Dinner
October 25, 2015

WARAC 2-meter net
Every Wednesday at 8pm
MATC repeater 147.045 standard offset
127.3 Hz CTCSS

Club jackets and hats!
Go to club Web site and click on
The GOLD MEDAL IDEAS block
For more info or click here

The President's Shack August *2015*

Whether you're interested in the digital modes that Gary, W9XT, talked about last month or preparing for the onset of another contest season, getting your computer and radio to work together is a big part of achieving success.

The **program topic for our August meeting will be Rig Control** - connecting radios and computers together to do cool things. This will be a multi-part program with short presentations by several of our members. We'll cover the basic principles involved in rig control as well as the use of some of the rig control products that are out there. Presenters will be Chuck Dellis, Steve Dryja, Mike Johnson and myself. This promises to be an interesting discussion. Be there!

As I write this, the **results of the 2015 Wisconsin QSO Party** are being finalized and will be announced at the upcoming meeting. Another reason to be there!

As Field Day 2015 fades into more distant memory, I want to again express **thanks to Chuck, W9WLX**, for a great job as **Field Day chairman** and for last month's wrap-up. Also, thanks again to all who participated!

Don't forget that **October 25** is the date of our **Anniversary Awards Dinner.** This year's committee, Frank Humpal, Paul Hass and Erwin von der Ehe, is putting this event together. Be sure to fill out and turn in your sign-up sheet

Proceeds from donated items sold at the South Milwaukee Swapfest will pay for more than 1/3 of a scholarship. Donations are greatly appreciated and thanks to donors and their families for thinking of us.

Also, hats off to several of our members who handle collection, storage and sales of donated material. John, K9IAC; Phil, W9NAW; George, AA9SR and Steve, NO9B are the members that have been handling most of this, with occasional help from others. A place to store donated material between swapfests is needed. Anyone that's able to help out with this or other aspects of handling donations, please contact one of these gentlemen.

As always, please bring your stories, on-air activities, travel experiences, etc. for the open discussion portion of our meeting. And don't forget our usual before-meeting dinner at **Johnny V's Classic Café, 1650 S. 84th St**. at 5:00PM.

See you at the meeting! Bring a friend!
Tom, K9BTQ

From the editor

Another month is here with a Hamtrix to get out. I had no ideas for an article so I thought I would see if I could come up with something to compliment our presentation at this month's meeting.

My involvement in digital modes is minimal I'm working on CW, the original digital mode, but that is it. I can see advantages to some of them. I'm surprised with the signal to noise ratios they are achieving with some of the modes. I'm also was surprised with some of the compromises needed to obtain that performance. The JT65 modes fascinate me I think more in how they overcome obstacles of weak signal work. The New Horizons Mission to Pluto must be using something similar to transmit the data back . With 12 watts power and even high gain antennas being 3 billion miles away it must make it into some record book for a watts to distance record!

My QRP 5 watts make it seem like high power.

Not much else happening. If anyone has an idea for an article for Hamtrix let me know.

Frank KA9FZR

WARAC General Meeting Minutes
July 14, 2015, 2015

Introduction
The meeting was called to order at 7:05 pm by President, Tom Macon, K9BTQ. Overall meeting attendance was 20 with 2 visitors.

Program
The evening's program topics included:
Field Day Recap 2016 presented by Chuck Dellis W9WLX
Digital Modes presented by Gary Sutcliffe, W9XT
Arduino Projects: Gary Sutcliffe reported a split in the Arduino Development group.

Business
Motion was made and accepted to approve the June meeting minutes as published in Hamtrix.

August's Program will be on computer rig control presented by several of our members and September will be a normal meeting PLUS a special opportunity to visit the Milwaukee Astronomical Society Tour.

Wisconsin QSO Party: Results are still pending.

Annual Awards Dinner: October 25th at Meyers Restaurant. Save the date.

Air Boss Demo: Phil showed off the Air Boss pneumatic antenna launcher.

The WARAC Swap Fest Flyer is now available. Take some, put them up.

Scholarship Program: Still awaiting more info on the recipient for 2015. Sales at the So Milw Swapfest netted $600+ for the scholarship fund.

Reminder for the Wednesday evening 2 meter net. Everyone is welcome

The meeting was adjourned at 8:42 pm.

Respectfully submitted,
Mike Johnson, WO9B

WARAC Board Meeting

July 28, 2015

Howard Smith, WA9AXQ, called the meeting to order at 7:07 pm.

Present: Tom Macon, K9BTQ, Steve Dryja, NO9B, Howard Smith, WA9AXQ and Mike Johnson, WO9B.

Scholarship Award Update
ARRL official notification came through. ARRL explained the non-Wisconsin determination.

Field Day
A couple of QSL's have been received. Will forward to Chuck D for processing.

Swapfest 2016
Flyer is updated.

WI QSO Party
Close to being complete ready to publish.

Programs
Aug – Rig Control Presentation
Sept - Milwaukee Astronomical Society separate trip
Sep – 3-D Printing or LOTW
Oct – Elections, Panadaptor with Dongle
Nov –
Dec -

Future Program Ideas
Spotting – W9XT
FM38 Operations
DSP presentation
Yaesu Fusion System
Kreg Jig Fastener System
W5KUB –Possible for Nov
SO2R
AMSAT

Club Operations Manual
No updates this month.

2012 , 2013 and 2014 Audit
2012 & 2013 were packaged to Bill, N9KPH. Need complete by Aug Meeting.

Awards Dinner
No update.

Other Items
2 meter net continues and needs some more check-ins.
New Member Integration

Meeting was adjourned 8:42 pm.

Respectfully submitted,
Mike Johnson, WO9B
Secretary WARAC

While looking for something to fill the Hamtrix I thought I would look into what digital modes are available for Ham radio. I found this on WB8NUT's web page (http://wb8nut.com/digital/) I edited it for print. The web page included sound files of all modes and extra info. As with all things digital, it would not surprise me if some of these modes are no longer used and that new ones have been added. With our presentation being RIG Control thought this would be interesting. (*the editor*)

Digital Modes Information Page

Join the Fun!!

Communication technologies that are specifically designed to improve "live" HF keyboard operation can now be achieved which were previously only theory, too complex, or too costly to implement to be practical. Thanks to the generosity of radio amateurs (hams) with programming knowledge, and to the Internet, new and powerful communications tools are available to all hams. The evolution and wide spread use of the Personal Computer that include a digital sound card for Digital Signal Processing (DSP), is allowing radio amateurs to use these tools to develop new modes of digital communication. The distinguishing features of live HF digital operation today are the use of lower power, compact or indoor antennas and courteous operating techniques. This reverses the trend of several years ago.

Confusion over band space is the obvious down-side as new and old modes compete for space on the HF bands. Crowding on a single band like 20 meters is partly to blame for this issue. Fortunately, the new modes like MFSK16, are designed to improve performance for a wide range of operating conditions. This should allow for increased amateur radio band usage to relieve crowding and extend contact opportunities as propagation changes to favor different bands. These are really exciting times for all radio amateurs the use and enjoy all these new digital modes!

An Overview of Digital HF Radio Operating Modes

TOR is an acronym for Teleprinting Over Radio. It is traditionally used to describe the three popular "error free" communication modes - AMTOR, PACTOR and G-TOR. The main method for error correction is from a technique called ARQ (Automatic Repeat Request) which is sent by the receiving station to verify any missed data. Since they share the same method of transmission (FSK), they can be economically provided together in one Terminal Node Controller (TNC) radio modem and easily operated with any modern radio transceiver. TOR methods that do not use the ARQ hand-shake can be easily operated with readily available software programs for personal computers. For the new and less complex digital modes, the TNC is replaced by an on-board sound card in the personal computer.

AMTOR is an FSK mode that is hardly used by radio amateurs in the 21st Century. While a robust mode, it only has 5 bits (as did its predecessor RTTY) and can not transfer extended ASCII or any binary data. With a set operating rate of 100 baud, it does not effectively compete with the speed and error correction of more modern ARQ modes like Pactor. The non-ARQ version of this mode is known as FEC, and known as SITOR-B by the Marine

Information services.

PACTOR is an FSK mode and is a standard on modern Multi-Mode TNCs. It is designed with a combination of packet and Amtor Techniques. Although this mode is also fading in use, it is the most popular ARQ digital mode on amateur HF today and primarily used by amateurs for sending and receiving email over the radio. This mode is a major advancement over AMTOR, with its 200 baud operating rate, Huffman compression technique and true binary data transfer capability.

G-TOR (Golay -TOR) is an FSK mode that offers a fast transfer rate compared to Pactor. It incorporates a data inter-leaving system that assists in minimizing the effects of atmospheric noise and has the ability to fix garbled data. G-TOR tries to perform all transmissions at 300 baud but drops to 200 baud if difficulties are encountered and finally to 100 baud. (The protocol that brought back those good photos of Saturn and Jupiter from the Voyager space shots was devised by M.Golay and now adapted for ham radio use.) GTOR is a proprietary mode developed by Kantronics. Because it is only available with Kantronics multi-mode TNCs, it has never gained in popularity and is rarely used by radio amateurs.

PACTOR II is a robust and powerful PSK mode which operates well under varying conditions. It uses strong logic, automatic frequency tracking; it is DSP based and as much as 8 times faster then Pactor. Both PACTOR and PACTOR-2 use the same protocol handshake, making the modes compatible. As with the original Pactor, it is rarely used by radio amateurs since the development of the new PC based sound card modes. Also, like GTOR, it is a proprietary mode owned by SCS and only available with their line of multi-mode TNC controllers.

CLOVER is a PSK mode which provides a full duplex simulation. It is well suited for HF operation (especially under good conditions), however, there are differences between CLOVER modems. The original modem was named CLOVER-I, the latest DSP based modem is named CLOVER-II. Clovers key characteristics are band-width efficiency with high error-corrected data rates. Clover adapts to conditions by constantly monitoring the received signal. Based on this monitoring, Clover determines the best modulation scheme to use.

RTTY or "Radio Teletype" is a FSK mode that has been in use longer than any other digital mode (except for morse code). RTTY is a very simple technique which uses a five-bit code to represent all the letters of the alphabet, the numbers, some punctuation and some control characters. At 45 baud (typically) each bit is 1/45.45 seconds long, or 22 ms and corresponds to a typing speed of 60 WPM. There is no error correction provided in RTTY; noise and interference can have a seriously detrimental effect. Despite its relative disadvantages, RTTY is still popular with many radio amateurs. This mode has now been implemented with commonly available PC sound card software.

PSK31 is the first new digital mode to find popularity on HF bands in many years. It combines

the advantages of a simple variable length text code with a narrow bandwidth phase-shift keying (PSK) signal using DSP techniques. This mode is designed for "real time" keyboard operation and at a 31 baud rate is only fast enough to keep up with the typical amateur typist. PSK31 enjoys great popularity on the HF bands today and is presently the standard for live keyboard communications. Most of the ASCII characters are supported. A second version having four (quad) phase shifts (QPSK) is available that provides Forward Error Correction (FEC) at the cost of reduced Signal to Noise ratio. Since PSK31 was one of the first new digital sound card modes to be developed and introduced, there are numerous programs available that support this mode - most of the programs available as "freeware".

HF PACKET (300 baud) radio is a FSK mode that is an adaption of the very popular Packet radio used on VHF (1200 baud) FM amateur radio. Although the HF version of Packet Radio has a much reduced bandwidth due to the noise levels associated with HF operation, it maintains the same protocols and ability to "node" many stations on one frequency. Even with the reduced bandwidth (300 baud rate), this mode is unreliable for general HF ham communications and is mainly used to pass routine traffic and data between areas where VHF repeaters maybe lacking. HF and VHF Packet has recently enjoyed a resurgence in popularity since it is the protocol used by APRS - Automatic Position Reporting System mostly on 2 meter VHF and 30 meter HF.

HELLSCHREIBER is a method of sending and receiving text using facsimile technology. This mode has been around along time. It was actually developed by Germany prior to World War II! The recent use of PC sound cards as DSP units has increased the interest in Hellschreiber and many programs now support this new...well I mean, old mode. The single-tone version (Feld-Hell) is the method of choice for HF operation. It is an on-off keyed system with 122.5 dots/second, or about a 35 WPM text rate, with a narrow bandwidth (about 75 Hz). Text characters are "painted" on the screen, as apposed to being decoded and printed. Thus, many different fonts can be used for this mode including some basic graphic characters. A new "designer" flavor of this mode called PSK HELL has some advantage for weak signal conditions. As with other "fuzzy modes" it has the advantage of using the "human processor" for error correction; making it the best overall mode for live HF keyboard communications. Feld-Hell also has the advantage of having a low duty cycle meaning your transmitter will run much cooler with this mode.

MT63 is a new DSP based mode for sending keyboard text over paths that experience fading and interference from other signals. It is accomplished by a complex scheme to encode text in a matrix of 64 tones over time and frequency. This overkill method provides a "cushion" of error correction at the receiving end while still providing a 100 WPM rate. The wide bandwidth (1Khz for the standard method) makes this mode less desirable on crowded ham bands such as 20 meters. A fast PC (166 Mhz or faster) is needed to use all functions of this mode. MT63 is not commonly used by amateurs because of its large bandwidth requirement and the difficulty in tuning in an MT63 transmission.

THROB is yet another new DSP sound card mode that attempts to use Fast Fourier Transform technology (as used by waterfall displays). THROB is actually based on tone pairs with several

characters represented by single tones. It is defined as a "2 of 8 +1 tone" system, or more simply put, it is based on the decode of tone pairs from a palette of 9 tones. The THROB program is an attempt to push DSP into the area where other methods fail because of sensitivity or propagation difficulties and at the same time work at a reasonable speed. The text speed is slower than other modes but the author (G3PPT) has been improving his MFSK (Multiple Frequency Shift Keying) program. Check his web site for the latest developments.

MFSK16 is an advancement to the THROB mode and encodes 16 tones. The PC sound card for DSP uses Fast Fourier Transform technology to decode the ASCII characters, and Constant Phase Frequency Shift Keying to send the coded signal. Continuous Forward Error Correction (FEC) sends all data twice with an interleaving technique to reduce errors from impulse noise and static crashes. A new improved Varicode is used to increase the efficiency of sending extended ASCII characters, making it possible to transfer short data files between stations under fair to good conditions. The relatively wide bandwidth (316 Hz) for this mode allows faster baud rates (typing is about 42 WPM) and greater immunity to multi path phase shift. A second version called MFSK8 is available with a lower baud rate (8) but greater reliability for DXing when polar phase shift is a major problem. Both versions are available in a nice freeware Windows program created by IZ8BLY.

JT65 is intended for extremely weak but slowly-varying signals, such as those found on troposcatter or Earth-Moon-Earth (EME, or "moonbounce") paths. It can decode signals many decibels below the noise floor, and often allows amateurs to successfully exchange contact information without signals being audible to the human ear. Like the other digital modes, multiple-frequency shift keying is employed. However unlike the other digitalmodes, messages are transmitted as atomic units after being compressed and then encoded with a process known as forward error correction (or "FEC"). The FEC adds redundancy to the data, such that all of a message may be successfully recovered even if some bits are not received by the receiver. (The particular code used for JT65 is Reed-Solomon.) Because of this FEC process, messages are either decoded correctly or not decoded at all, with very high probability. After messages are encoded, they are transmitted using MFSK with 65 tones. Operators have also begun using the JT65 mode for contacts on the HF bands, often using QRP (very low transmit power usually less than 5 watts). While the mode was not originally intended for HF use, its popularity has resulted in several new programs being developed and enhancements to the original WSJT in order to facilitate HF operation.

Olivia was developed by Pawel Jalocha and is a ham radio digital mode designed to work in difficult (low s/n ratios plus multipath propagation) conditions on HF bands. The signal can be decoded even when it is 10-14 db below the noise floor (i.e. when the amplitude of the noise is slightly over 3 times that of the signal). It can also decode well under other noise, QSB, QRM, flutter caused by polar path propagation and even auroral conditions. Currently the only other digital modes that match or exceed Olivia in sensitivity are some of the WSJT program modes that include JT65A and JT65-HF which are certainly limited in usage and definitely not true conversation capable.

The standard Olivia formats (bandwidth/tones) are 125/4, 250/8, 500/16, 1000/32, and 2000/64. However the most commonly used formats in order of use are 500/16, 500/8, 1000/32, 250/8, and 1000/16. This can cause some confusion and problems with so many formats and so many other digital modes. After getting used to the sound and look of Olivia in the waterfall, though, it becomes easier to identify the format when you encounter it. About 90% of all current Olivia activity on the air is one of the 2 formats : 500/16 and 1000/32.

DominoEX is a digital mode using MFSK (Multi-Frequency Shift Keying), used to send data (for example, hand-typed text) by radio. MFSK sends data using many different tones, sent one at a time. Each tone element ('symbol') can carry several bits of data. Most other digital modes uses each tone to represent only one bit. Thus the symbol rate is much lower for the same data rate when MFSK is used. This is beneficial, since it leads to high sensitivity with good data rate and modest bandwidth. More importantly, low symbol rates are less effected by multi-path reception timing effects.

Therefore MFSK is ideal for HF operation since it has good noise rejection and good immunity to most propagation distortion effects which adversely affect reception of other modes. MFSK is already used on HF by modes such as MFSK16, ALE, THROB and Olivia, but DominoEX improves on the MFSK types of modes by employing an Incremental Frequency Keying strategy. DominoEX is also a reasonably narrow-band mode along the lines of MFSK16 or RTTY.

A narrow-band application of MFSK presents some challenges. The main problem is that radio transceivers with high stability and tuning accuracy are usually required, since very small frequency steps are used for example when ompared with RTTY. MFSK is also prone to interference from data arriving from different ionospheric paths, and like many modes, it is prone to interference from fixed carriers within the data passband. Forward Error Correction (FEC) can be deployed to reduce errors, but such modes can become slow and difficult to operate or the modes consume an excessive an excessive amount of bandwidth. With DominoEX, a different approach was taken, concentrating on perfecting the design for best Near Vertical Incidence Signal or NVIS reception without requiring FEC. All the inherent MFSK problems are also avoided or much reduced.

DominoEX uses a series of new techniques to counter the general limitations of MFSK. To avoid tuning problems, IFK (Incremental Frequency Keying) is used, where the data is represented not by the frequency of each tone, but by the frequency difference between one tone and the next, an equivalent idea to differential PSK. An additional technique, called Offset Incremental Keying (IFK+) is used to manage the tone sequence in order to counter inter-symbol interference caused by multi-path reception. This gives the mode a great improvement in robustness.

Like Olivia above, there are several variations of the DominoEX mode: DominoEX4, DominoEX5, DominoEX8, DominoEX11, DominoEX16 and finally DominoEX22. The higher the number the faster the speed of transmission so difficult conditions it may be wise to use the slower speed, while good conditions might allow for faster speeds.

Contestia is a digital mode directly derived from Olivia but not quite as robust. It is more of a compromise between speed and performance. It was developed by Nick Fedoseev, UT2UZ who

is also one of the key developers of the MixW Mult-digital mode software application used by many hams. Contestia sounds almost identical to Olivia, can be configured in as many ways, but has essentially twice the speed.

Contestia has 40 formats just like Olivia. The formats vary in bandwidth (125,250,500,1000, and 2000hz) and number of tones used (2,4,8,16,32,64,128, or 256). The most commonly used formats right now seem to be 250/8, 500/16, and 1000/32.

So just how well does Contestia perform under very weak signal conditions. Surprisingly well as it handles QRM, QRN, and QSB very easily. It decodes below the noise level but experience has shown that Olivia still outperforms Contestia depending on which variation of the modes are used. However, Contestia is twice as fast as Olivia on a given variation of each respective mode. It is an excellent weak signal, conversational, QRP, and long distance digital mode. When using it for keyboard to keyboard conversation under fair to good conditions, it can be more preferable to many hams than Olivia because of the faster speed.

Contestia get it's increased speed by using a smaller symbol block size (32) than Olivia (64) and by a using 6-bit decimal character set rather than 7-bit ASCII set that Olivia does. Because it has a reduced character set and does not print out in both upper and lower case. Some traffic nets might not want to use this mode because it does not support upper and lower case characters and extended characters found in many documents and messages. For normal digital chats that does not pose any problem, but also because of these limitations, Contestia has not seen much use and is more of a novelty mode.

Ham Radio on the Internet
(click on red web address)

Anyone can submit websites for this column. I'll check them out and include them. The editor

A commercial use for supercaps. My first exposure to supercaps was as a replacement for batteries used to keep memory alive--- actually worked very good.
http://www.rdmag.com/articles/2015/08/maxwell-technologies-incs-engine-start-module-giving-your-engine-boost?et_cid=4715965&et_rid=353748193&location=top

Probably the only computer that is corruption free is one turned off in a box in the attic.
http://www.rt.com/usa/311597-new-virus-wreck-apple-computers/

Pictures from the international space station stitched together to a high definition view of the inside.
http://esamultimedia.esa.int/multimedia/virtual-tour-iss/?

Interesting article on a new camera at the space station. Also a video of how micro gravity affects water.
http://www.wirelessdesignmag.com/news/2015/07/red-epic-dragon-camera-captures-riveting-images-space-station?et_cid=4698399&et_rid=353748193&location=top

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See our Web Page or contact us for more information on

- WARAC Memorial Scholarships
- Wisconsin QSO Party
- Midwinter Swapfest
- Worked all Wisconsin Counties Award
- Amateur Radio Classes

WARAC holds meetings on the second Tuesday of each month and board meetings on the fourth Tuesday of each month. Meetings are held at 7:00 PM at:

St Peter's Episcopal Church
7929 W. Lincoln Avenue
West Allis, WI

Entry is off the alley at the rear of the church. A wheel chair ramp and chair-lift are available.