Official Publication of the
West Allis Radio Amateur Club

Hamtrix

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Volume 66, Issue 4 April, 2019

APRIL CLUB HAPPENINGS

NUT NET
3.985mhz
Monday-Saturday
8:15am CT
NUT NET
Breakfast
8:30am fourth
Tuesday
of the month

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

Sunshine Committee

If you know of a member who could use a bit of cheer or support,
Barb Garnier (KD9HPS) is now the Sunshine Committee Chair.
Contact her: 414-529-3536 or barbsewsblue@gmail.com.

Club Meeting

St. Peter's Episcopal Church,
7929 W. Lincoln Avenue, West Allis
April 9, 2019 7:00 PM
Paul KK1FF on a Arduino Auto start
Paul W9PCS LiFePOS4 Battery Project
Team Based Volunteer Support MWS MKE office
Tom W9TJK
Premeeting dinner
Johnny V's Classic Café, 1650 S. 84th St. at 5:00PM.

WARAC 2-meter net

Every Wednesday at 8pm
SEWFARS W9TJK Repeater 146.820 standard (-) offset
127.3 Hz CTCSS
if repeater down try 146.55 simplex

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The President's Shack April 2019

I'm looking out the window at N9KPH's garage roof and Whoa!! It's a robin bouncing around in the sunshine. I've also watched a couple of Brewer games. That is evidence enough for me that Spring has Sprung!! To think I was cross country skiing just a couple short weeks ago in the UP. What a welcome change.

I hope everyone had a great ham radio month. I'm all wound down from the WI QSO Party and am already thinking about next year. Better yet, I'm looking forward to getting outside and doing some ham radio in the park type events.

April also signals the start of Field Day planning. You can read about it a couple of pages back in this edition of Hamtrix. Long and short is we want your help to make this a great Field Day. Mercifully it is not that far off.

Of course the biggest reason to come to the meeting is to get your copy of the just published, brand spanky new Membership Directory. It has literally been year's in the making. At long last the "Trail of Tears" Membership Directory is finally complete, published and ready for you to take home. Oh yes!!!

Now for this month's programs::

Arduino Auto Start – Literally, how to use an Arduino to start your car. Why not, right? Paul, KK1FF, will fill us in on his nifty micro-processor hack. Geez, now that winter is almost over, where were you in December?

LiFePOS4 Battery Project – If you've been following along on the Nut Net mailing list than you know all about Paul, W9PCS's battery build. Well here is your chance to see it in person.

Team Based Volunteer Support for the NWS Milw Office – Tom, W9TJK will be our main presentation this month. He will be talking about his work with the NWS Sullivan Forecast Office and how amateur radio fits into this incredibly important operation. Should be great.

That's it. See you Tuesday! Don't forget the Johnny V's pre-meeting dinner, for those so inclined.

73's

MJ,WO9B

Check out our Facebook page!!! Start Posting!!!! https://www.facebook.com/WestAllisRAC/ • —• —••

From the editor

Spring is beginning to look like a real possibility! The grass may need cutting at some time. Of course talking to the morning nut net hams up north they are still measuring their snow in feet. Such is Wisconsin.

Found an interesting article on receiving info from the New Horizon satellite out past Pluto. Amazing what you can do with radio even over very long distances. Hope others are interested in maybe the ultimate QRP mode HI HI.

Mike WO9B, his son Matt and me survived our Wisconsin QSO party outing. This year was the best so far: in points, planning etc. We pulled into the Bosch eight minutes after the party ended! The roads were good in spite of weather reports the week before saying they would be otherwise.

Not much else, Ham radio wise, going on at this house. I have a couple of projects waiting for good weather and time. But what would a Ham be without projects on the back burner!

73 hope to see you all at the meeting.
Frank KA9FZR • —• —••

WARAC Meeting Minutes
March 12, 2019

Meeting called to order 7:03 pm. Attendance: 26 members, 2 visitors

Club business:
-Approval of January 2019 minutes
-January Board Meeting Synopsis (First Quarterly Meeting)
    -No more mail distribution of Hamtrix
    -Proof of 2019 Membership Directory presented
    -Fund raising at Sendik's Greenfield store scheduled for late May or early June, TBD
    -Equipment donations/sales
    -Web page/PayPal
    -Meeting location search
-Club Activities for coming year
    -Field Day June 22nd and 23rd
    -Midweek park activities (June, July, & August)
    -Park club meeting in August
    -POTA Activation, summer weekend TBD
-NA QSO Party, Chuck W9WLX
-Field Day Planning, Chuck, W9WLX
-SEWARC, first meeting 3/9/2019

Program presentatios:
-Swapfest update, Erwin, WI9EV
-WI QSO Party, Tom Macon, K9BTQ
-ICOM 7300, disruptive tech, David, WB9OWN
-1.5 KW Amp, Don, K9AQ
-MN QSO Party Adventure, Mike J, WO9B

Operating and activities:
-Swapfests: Jefferson, March 18th, MAARS MRAC, March 23rd
-Stuff for sale? Phil, W9NAW 2 meter rigs available

Next Meeting: April 9, 2019
-National Weather Service Ham Radio Connection, Tom Kucharski, W9TJK
-Arduino Remote Starter, Paul, KK1FF

Call for adjournment, refreshments, eyeballing 8:13 pm

Repectfully submitted,
David/Barb Garnier • —• —••

Board Meeting, No board meeting for the month of March. • —• —••

Field Day Planning Meeting April 30th--Save the Date!

2019 Field Day planning meeting is scheduled for Tuesday, April 30. Our Field Day location will be the New Berlin site, unchanged from last year. I have verbal conformation from the City of New Berlin and I'm working on completing the paperwork.

The location of the planning meeting is:

St. Mary's Parish, Hales Corners
Tuesday April 30, 7 pm
9520 W. Forest Home Ave

The plan will be similar to last year, except with some additional emphasis on digital--FT8 and RTTY. The latest WSJT-X software now plays well with N1MM in contest mode. It has been working well for contests since early December. Looking forward to hearing all your ideas and moving the Field Day 2019 forward!

Hope to see you there! • —• —••

NUT NET NEWS

On the fourth Tuesday of every month, a group of "Nut Net" guys have breakfast at the Genesis Family Restaurant. We have been averaging about 10-12 hams along with a few of their wives. We all share stories and pictures on our electronic devices, talk about radio, maybe solve a problem or two, enjoy a very good breakfast among fun company. It would be great if other hams from the area were to come.

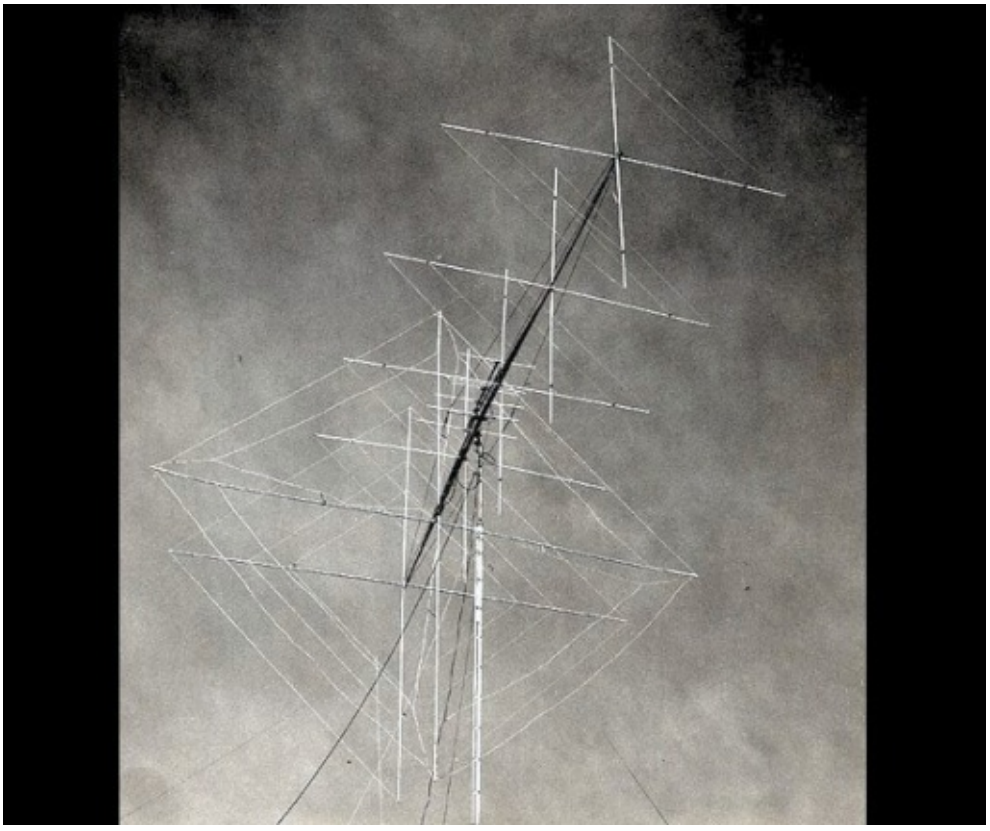
So, we are inviting other non "nut net" hams to join us. More importantly, it would be outstanding if more wives would come, too. After all, what is a better way to get to know other ham radio couples?

Let's all mark our calendars (the date is April 23 at 8:30 AM) and come to the Nut Net breakfast. Genesis is located at the corner of Hwy 100 and Beloit Road, Greenfield.

See you there!

Phil, W9NAW

2 Apr 2019• —• —••



The driven element of this unique antenna was like a double-Z quad (like a swastika). It functioned on 40-meters as two 40-meter dipoles folded over and 90-degrees out of phase. The antenna contained two half-wave antennas on 15-meters that were 90-degrees out-of-phase and spaced a half-wave apart.

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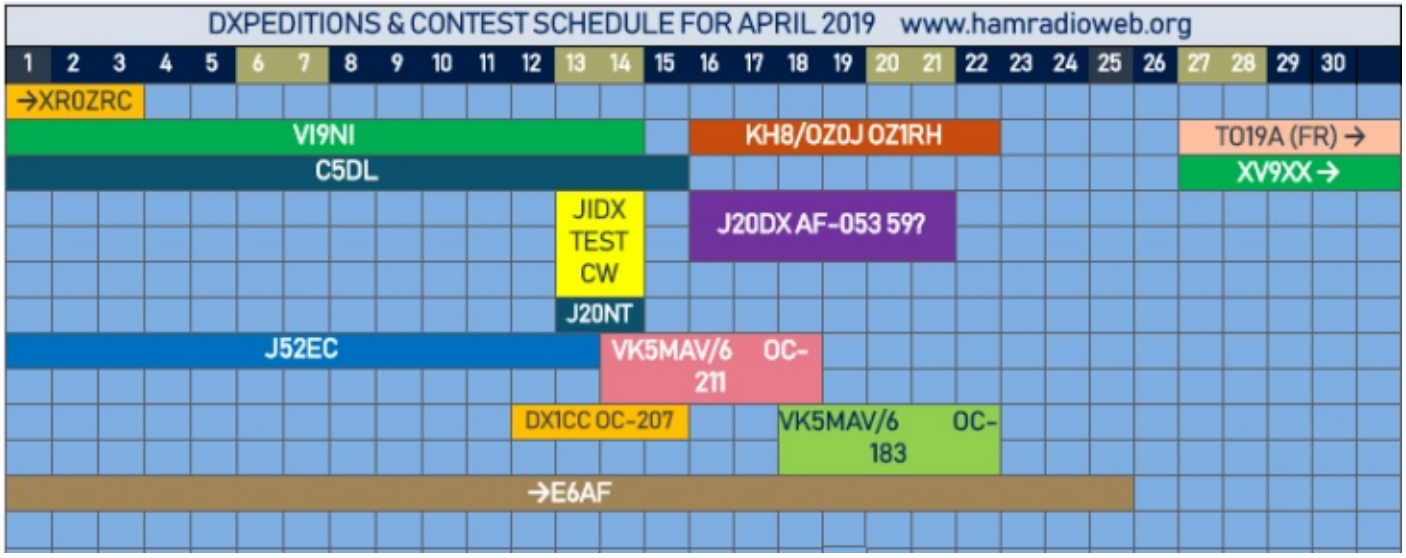
DX / CONTEST UPDATE

http://www.iz5cml.it/dxschedule

DX: Sunspots. We've got sunspots. The sun has been hanging around just a bit longer these days and the bands are playing just a bit better. No one said great, but at least there is life to them. Europe has been a regular on 20 M and 17 M. Africa pops up and even VK-land shows up in the late afternoon from time to time. The unfortunate Bouvet 3Z0I attempt was aborted, putting a hole in our DX plans for this month. Fortunately no one was hurt. Here is the list of current and expected operations for April. Go get 'em.



Contests: April offers up bunches of state QSO party events. MI, NE, FL, MS, ND and GA are all in play this month. There are a couple of interesting contests for both Texas and Florida Parks on the Air. Might be well worth a dial spin. Finally, a brand new event: FT8 DX Contest. How about that?

Full Contest Schedule check: http://www.contestcalendar.com/index.html

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Special Event Corner

April, 2019

By Bill Reed/N9KPH

Here's a summary of some of the events that may be of interest during April and early May. There are MANY other special events going on during this period. See this ARRL web page for more information: http://www.arrl.org/special_events/search/page:1/model:Event

State QSO Parties

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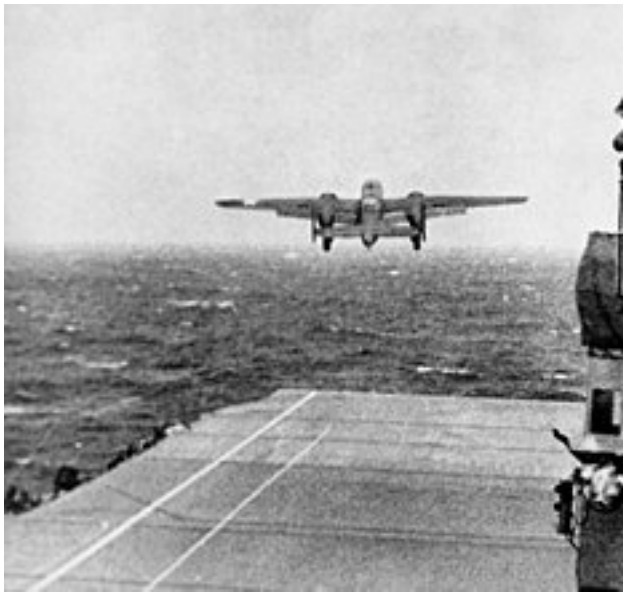
Georgia – 4/13 to 4/14
New Mexico – 4/13 to 4/14
North Dakota – 4/13 to 4/14
Michigan – 4/20 to 4/21
Nebraska – 4/20 to 4/21
Florida – 4/27 to 4/28
AZ, CT, ID and IN, ME, MA, MT, NV, NH, OR, RI, UT, VT, WA and WY – 5/4 to 5/5
Arkansas – 5/11 to 5/12



General Interest Events:

• 04/13/2019 | **USS Midway Museum Ship Special Event: Doolittle Raid**

Apr 13, 1600Z-2300Z, NI6IW, San Diego, CA. USS Midway (CV-41) Museum Ship. 14.320 7.250; PSK31 on 14.070. QSL available.

• 04/27/2019 | **Commemorating the Louisiana Purchase**

Apr 27-May 5, 0000Z-2359Z, W5L, West Monroe, LA. North East Louisiana Amateur Radio Club. 18.150 14.275 7.225 3.850. QSL. W5LA, 111 Eagle Lake Dr., West Monroe, LA 71291. www.nelarc.org/2019-W5L

• 04/27/2019 | **W1BSA (Boy Scouts of America)**

Apr 27, 1400Z-2000Z, W1BSA, Fall River, MA. 14.259 7.259. QSL. USTNR club will be operating from the Battleship USS Massachusetts BB59. From Fall River, MA. On the air April 27, 2019 from 1000-1600 as W1BSA. The Scouts stay overnight on the ship Friday and on Saturday nights. We will put some of the Scouts on the air. Our website is ne1pl.org QSL cards from W1BSA use the website for QSL information. ne1pl.org

• 05/03/2019 | **Old Timer's Day**

May 3-May 6, 1400Z-2000Z, W4T, Dickson, TN. Dickson County Amateur Radio Club. 14.327 7.275. QSL. WWW.WC4DC.ORG

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From the NAQCC News March 2019 edition.
Makes QRP look like a high power station. HI HI

VOYAGER RADIO ANALYSIS

BY RON , K4RHG

NASA's New Voyager spacecraft was launched January 19, 2006 with a mission to explore Pluto and objects in the Kuiper Belt. On January 1, 2019 the spacecraft rendezvoused with Ultima Thule, the first object humankind has ever encountered in the Kuiper Belt. As New Voyager passed Ultima Thule the spacecraft was 6.62 billion kilometers from the earth. Radio signals took 6.13 hours to reach the earth. (Voyager 1 has travelled much farther, 21.7 billion kilometers, since it was launched in 1977, but did not pass near a known Kuiper Belt object.)

The radio technology used to transmit between the earth and New Horizon is incredible. It's interesting to compare these radio transmissions with a low-power transmission made by radio amateurs. We'll do this by calculating the radio link budget for New Voyage and a low power, long distance amateur radio transmission. A simplified link budget between a transmitter and a receiver can be calculated as follows:

$Prx = Ptx + Gtx - Lfs + Grx$

Where Prx is power at the receiver input (dBm), Ptx is transmitter output power (dBm), Gtx is the transmitter antenna gain relative to an isotropic antenna (dBi), Lfs is the free space loss incurred by the signal propagating though space (dB), and Grx is the receiver antenna gain (dBi). There are other losses such as transmission line and connector losses, but they're relatively small so we won't consider them.

New Horizon uses a 2.1 meter high gain antenna (HGA) to communicate with NASA's Deep Space Network composed of a family of large dish antennas located in Goldstone, California; Madrid, Spain; and Canberra, Australia. For our analysis we'll only consider Goldstone. New Horizon's HGA has a beam width of only 0.3 degrees, slightly more than half the width of the moon, so must be precisely aimed towards earth.

Our amateur radio analysis is based on an actual April 26, 2015 exchange between K4RHG located in Naples, Florida and AX3MH in Briar Hill, Australia. These are the specifications needed to calculate the Link Budget:

Station	Ptx	Freq (GHz)	Ant Radius (m)	Distance (km)
New Horizon	12	8.4	2.1	6.62 Billion
Goldstone	25,000	7.2	35	6.62 Billion
K4RHG => AX3MH	5	0.014	long wire- 130 ft	15,477

We first convert Ptx measured in watts to dBm which is transmitter power measured in decibels relative to one milliwatt. That calculation is dBm = 10 · log (milliwatts). Computing we get 40.8 dBm for New Horizon, 74.0 dBm for Goldstone and 37.0 dBm for K4RHG.

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Next we calculate the antenna gains where dBi = 10 · log (4 · π · A R · η / λ 2). Here A R is the physical aperture area of the antenna calculated as π · r2, η is the antenna's aperture efficiency assumed to be 0.7 for all antennas, and λ is the wavelength measured in meters. Note that gain decreases with the square of the wavelength, and hence increases with the square of the frequency. Computing we get 49.8 dBi for New Horizon and 72.9 dBi for Goldstone. K4RHG transmits into a simple long wire antenna with an estimated gain of 2.0 dBi. We'll also assume the same antenna is located in Australia. Finally we calculate the free space loss. A radio signal emanating from a point source propagates through space as a spherical wave front. Since the surface area of a sphere is equal to 4 · π · r2 the signal is dispersed over a surface area proportional to the square of the distance from the source. This
dispersion reduces the signal's intensity.

Lfs may be calculated as 20 · log (4 · π · d · f/c) where d is the distance between the transmitter and receiver in meters, f the frequency in Hertz and c the speed of light in meters per second. Note that loss increases with frequency. This yields 306.01 dBi when Goldstone is transmitting to New Horizons, 307.35 dBi when New Horizons is transmitting to Goldstone, and 139.16 dBi when K4RHG is transmitting to AX3MH.

We can now calculate the link budgets and signal strength at the receiver input (assuming 50 ohm input impedance).

					--- Signal at Rcvr input ---		
	Prx	Gtx	Lfs	Grx	dBm	watts	microvolts
Goldstone => New Horizon	40.79	49.81	-307.35	72.91	-109.3	1.2E-14	0.76
New Horizon => Goldstone	73.98	72.91	-306.01	49.81	-143.8	4.1E-18	0.01
K4RHG => AX3MH	36.99	2.0	-139.16	2.0	-98.2	1.5E-13	2.76

With the Goldstone site transmitting an estimated 25,000 watts the New Horizon receiver has it relatively easy with an input signal of 0.76 microvolts. Interestingly, that's well within the range of an Elecraft KX3 transceiver which has a measured input sensitivity of 0.09 microvolt using its preamplifier (assuming it could receive gigahertz signals which it can't). But as impressive as a 15,477 kilometer amateur radio exchange is running only five watts its signal strength at 2.76 microvolts is well above New Horizon's if my calculations are anywhere close to accurate.

However, Uli Altvater (AG0X) and Coyle Schwab (N9WEX) pointed out in an earlier draft a free space loss model is inappropriate for earth-bound, amateur radio transmissions. A better analysis would use the excellent Voice of America Coverage Analysis Program located at http:www.voacap.com . This model predicts earth-based propagation based on transmitter power, antenna type, mode, frequency and atmospheric parameters. Assuming five watts, dipole antennas at 10 meters (the model doesn't support long wire antennas), 20 meters, CW, default atmospheric parameters and a transmission between Naples, Florida and Briar Hill, Australia on January 6, 2019 the model predicted a -122 dBm signal at the receiver input. This corresponds to 0.18 microvolt, just barely above the KX3's measured sensitivity. We can assume propagation was significantly better the day of the actual exchange.

The New Horizon transmitter only runs 12 watts so Goldstone, 6.62 billion miles distant, has a huge challenge receiving the tiny signal, about a millionth of a millionth of a millionth of a watt. New Horizon encodes data transmissions back to earth using turbo coding, a relatively new method now widely used in

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mobile communications. The code's redundancy expands signal bandwidth by a factor of six, but allows data rates approaching Shannon's theoretical channel capacity limit expressed as:

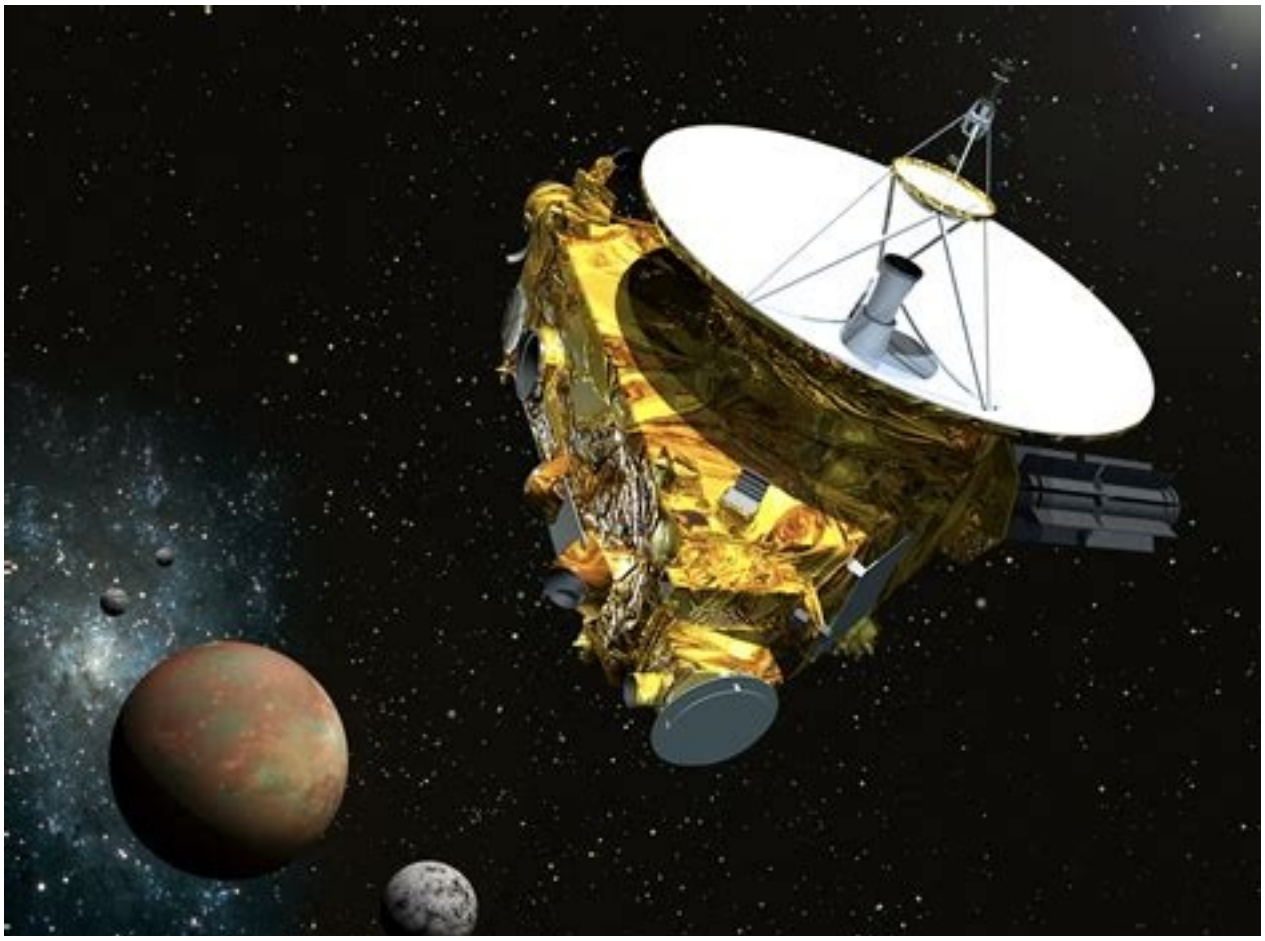
Bits per Second = Bandwidth · Log 2 (1 + (Signal Power / Noise Power))

For example, a 10 kilohertz channel with a signal to noise ratio of one has a maximum theoretical bit rate of 10,000 bits per second. A signal to noise ratio of 0.05, more typical of a deep space probe, reduces the rate to 700 bits per second.

It's interesting that the bit transmission rates during New Horizon's entire mission can be closely estimated before launch since the variables used in the calculation are known. The largest factor, of course, is the Free Space Loss which is easily calculated for any point on the spacecraft's mission. NASA estimated the data rate upon reaching Ultima Thule would be about 800 bits per second. At that rate it will take about 20 months to transmit the data the spacecraft collected on its fly-by of Ultima Thule.

References:

The RF Telecommunications System for the New Horizons Mission to Pluto
The New Horizons Spacecraft
New Horizon Press Kit
NASA Deep Space Network website
Voice of America Coverage Analysis Program

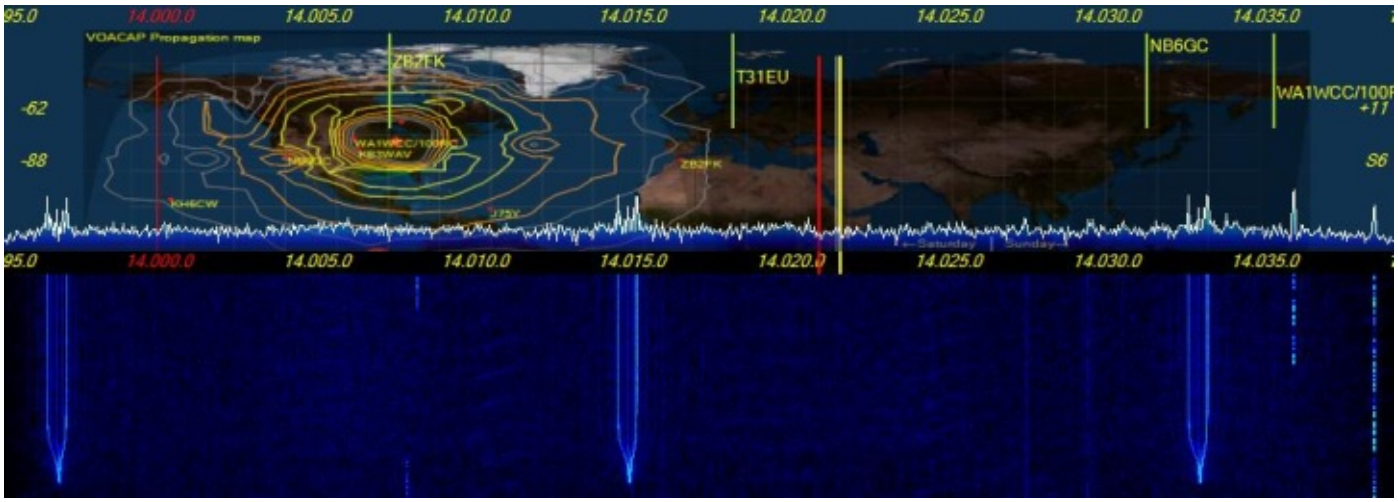


FURNACE RFI

By Mike Johnson, WO9B

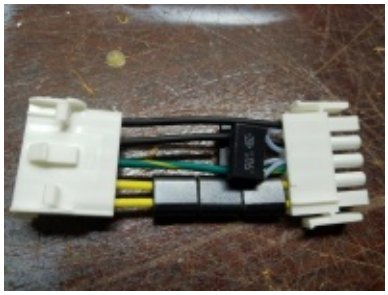
I've reently gotten on a kick to chase down and eliminate the various noises, carriers and other unwanted clutter that populates my HF waterfall. Overall, I did not believe I had too much noise at my QTH. Our power lines are all underground and lack of street lights has generally resulted in a decent background noise level for an urban QTH. My 20 M noise level usually hovered around S4 to S5. Not terrible, but at the same time not great. I actually considered myself above average with these numbers.

6 months ago we purchased a spanky new washing machine and my first thought was, well, there goes the RFI neighborhood. I was pleasantly surprised that a ton of RFI did not suddenly appear. But, I was on alert none the less. Sometime, a few months back I noticed a correlation with one of my familiar waterfall interference patterns that has been around for sometime. Here is a picture of it:



By pure chance I happened to notice the 18 kHz pattern happened when the exhaust vapors were coming out of my exterior furnace vents. Once I had made the connection between the noise and the furnace, I couldn't believe I had missed it for the past 3 years. But what to do?

I decided to talk to my furnace dealer. I have a Lennox high efficiency furnace and my internet research indicated that Lennox had a history of working with hams to solve RFI problems. That indeed has proven to be very true. With very little prodding they have made an RFI filter available free of charge.



It is just what you'd expect. Some ferrites on the control wiring and bypass capacitors between the voltage lines and the neutral. Everything in the furnace is modular connectors, so this little deal literally plugs in. Unfortunately, the one shown has the wrong connector for my furnace, so they will have to make a return trip. Still the effort was appreciated and the filter is well made.

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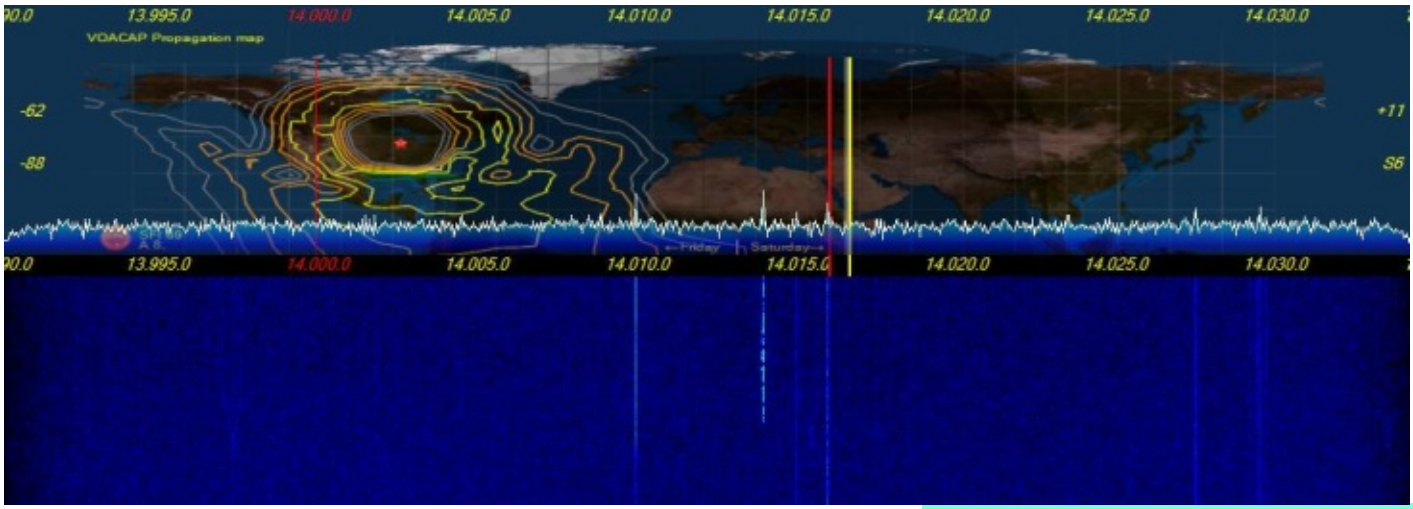
I am not sure how long the turn around time is for round two, and being anxious for a solution, I decided to try a temporary fix using some Type 31 ferrite beads I had laying around. Access is very straightforward through the removable furnace panel. It took 5 minutes and they were in place.

What a difference it makes. The RFI pattern on the waterfall is barely noticeable. This has been well worth the effort.



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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.