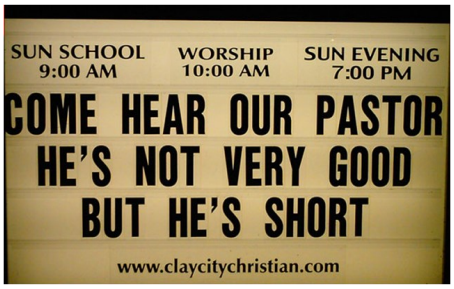
Wavelengths

Xenia Weather Amateur Radio Net Oct 2018
XWARN (W8XRN)

147.1650+ (123.0) (Analog Only)
443.1000+ (123.0) (Analog + System Fusion)

Meetings: 2nd Monday, 7:30PM, Greene Memorial Hospital (1141 N Monroe Dr, Xenia, OH) Herman Menapace Auditorium

President's Message



This is a busy time for events, so consider volunteering for some. At this coming meeting (Oct 8), nominations will be made for 2019 club officers to be elected at the November meeting. If you have an interest in serving as an XWARN officer, drop me a note at n8ado@arrl.net.

73 de N8ADO

Non-Compliant Radios

Bottom Line Up Front: Use your Baofengs at your own risk!

The FCC is warning that noncompliant VHF/UHF transceivers may not be imported, marketed, or sold in the US, nor may anyone use them. The FCC Enforcement Advisory (http://bit.ly/2P3y904), issued on September 24, follows an August 1 Citation and Order (http://bit.ly/2y95nns) to Amcrest Industries, LLC (formerly Foscam Digital Technologies, LLC), an importer and marketer of popular and inexpensive BaoFeng handheld transceivers, alleging that the company violated FCC rules and the Communications Act by illegally marketing unauthorized RF devices.

XWARN Tax-Exempt Status

We received a letter from the IRS basically saying they received our application. The letter says that applications using the long form may take up to 6 months before you hear back from them. That could be a determination letter, which is what we ultimately need. Or it could be a request for additional or clarifying information. We'll see. They sure cashed our check quickly, though. It was cashed the day it arrived at the IRS.

Club Contacts

- President, Bob Baker , N8ADO
  President@xwarn.net
- Vice President, Brett Boggs, NV8I
  Vicepresident@xwarn.net
- Secretary, Jason Bowman
  secretary@xwarn.net
- Treasurer, Steve Mackey, N8ILR
  Treasurer@xwarn.net
- Repeater Guru, Jim Simpson, WB8QZZ
  Technical@xwarn.net
- Web Master Josh Long, W8KDL
  webpresence@xwarn.net
- Membership, Phil Verret, KA8ZKR
  membership@xwarn.net
- XWARN Trailer / Public Service,
  Mike Crawford, KC8GLE
  trailer@xwarn.net or
  publicservice@xwarn.net
- Newsletter, Jason Bowman, WG8B
  newsletter@xwarn.net

Minutes: Sep 10, 2018

Bob opened the meeting at 1930 with the Pledge of Allegiance.

20 members were present.

Cracker Barrel

Richard Weis, Jim Beller motioned to approve the minutes. Motion approved unanimously.

Committee Reports

Membership. 46 members. No changes since last month.

Treasurer's Report. Income, expenses, and balances were read by the Treasurer. For further information, please contact the Secretary or Treasurer. Dick Bray, Jim Simpson motion to approve the Treasurer's Report. Approved unanimously.

Public Service. Air Force Marathon. Can still take volunteers but assignments will be off-base. Abi Khan. Saturday was a little crazy with a vandalized course. Jason published a lessons learned. No horses were lost on Sunday. Zero Prostate 5K walk/run, Sep ??? . Haven't heard from organizers. Little Miami Triathlon Oct 7. Need lots of help. Try to get Warren County hams involved. Bike MS cancelled due to hurricane rain and flooding along the bike path.

Trailer. Couple new antennas to replace broken and defective ones. Compressor very quiet. It's so quiet it could be used inside the trailer. Haven't tried it with the mast but will try this week. Anticipate no problems because has higher volume output.

Repeater. Still running. Haven't had chance to get antenna installed at Clifton Rd. 440 works but noisy. Bret didn't notice noise. Had 60Hz hum for a while. Someone must have changed power supply.

Website. No report.

Facebook. About 250 likes, about 1-2 new likes a week.

Mesh. Waiting for bill for recently approved work and installation. Discussed possibly of adding a mesh node at the Beavercreek robotics club building. But there is concern that the building isn't tall enough to support 2.4GHz WiFi mesh operations effectively.

Newsletter. As usual, Jason is looking for ideas.

Old Business

Tax-exempt status. Filed with IRS on Aug 29, 2018 . Filed form with Ohio that says we filed with IRS. This puts XWARN in a holding pattern relative to other filings with the state.

New Business

Nominations next month. Don't need a nominating process if incumbent running unopposed.

Program

(Continued on page 3)

Jason, WG8B, had a portable solar power and battery charger system on display and operating. Went over the basics of solar cells, solar charge controllers, and batteries for solar applications.

Next meeting Oct 8, 2018.

Meeting ended 2020

Jason Bowman, WG8B

Secretary, XWARN

Technician License Class Forming

A free Technician License class is being offered by the Dayton Amateur Radio Association (DARA). The entry level Technician License requires no previous technical knowledge and is open to all ages.

The class will be held at the DARA clubhouse located at 6619 Bellefontaine Road. in Huber Heights. Classes will meet from 7 to 9 p.m. Wednesday evenings starting Oct. 3 and running through Nov. 28. A companion text will be available for the discounted price of $25 at the class. The text (http://bit.ly/2DYhTg7) is also available from the publisher.

A free license exam is scheduled for 7 p.m. Wednesday Dec. 5 at the DARA clubhouse. The exam is open to anyone regardless of participation in the class.

For more information about the class, please contact Chris Jebens KZ8XU by email at kz8xu@yahoo.com or by phone (9 a.m. to 9 p.m.) at 937-474-2971 and leave a message if no answer.

XWARN Mission

The mission of the Xenia Weather Amateur Radio Net (XWARN) amateur radio club is to conduct weather spotting nets during severe weather and other communication services for the City Of Xenia and all other Greene County communities.

In this capacity, we are set up to provide communication services as required to the Greene County Ohio Public Service Agencies and other local government entities. The communications services provided to the supported agencies may be for emergency purposes or to simply enhance their communications abilities. On an as needed basis XWARN provides similar services to various government entities of our surrounding counties.

Additionally, XWARN provides communications support to various community organizations in support of marathons, 5K runs, 10K runs, bicycle events, etc. to provide health and safety assistance to the participants and sponsors of said events.

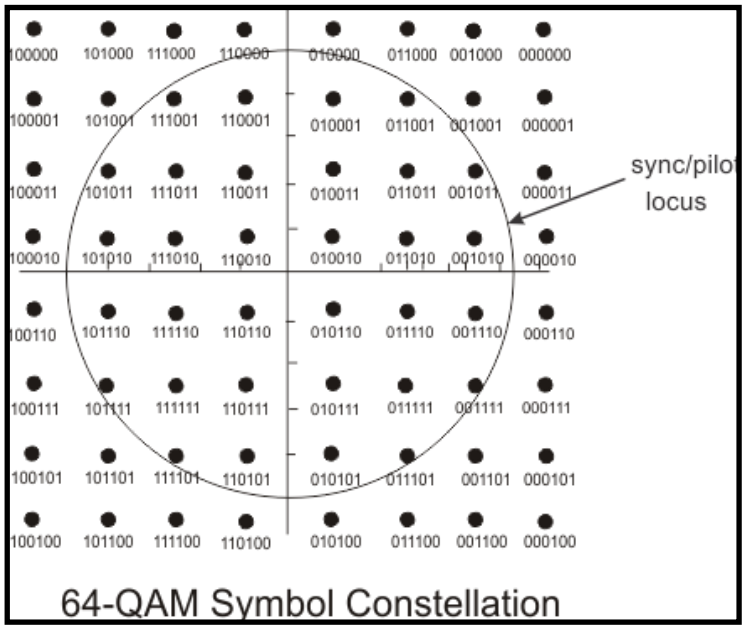
In support of these goals, XWARN operates and maintains amateur radio repeaters and other equipment in Greene County.

PACTOR 4

Twice in the past couple of months, the FCC has granted waivers allowing the use of PACTOR 4 for hurricane relief efforts. Not really being an HF guy — actually, I've never been on HF in spite of holding an extra class license — I started digging into why. First, a little background on PACTOR.

PACTOR takes aspects of packet radio and combines it with an older technology called AMTOR. AMTOR is essentially RTTY with error correction. AMTOR can also use automatic repeat requests (ARQ). With ARQ, the receiver passes information back to the transmitter, sometimes a checksum, that determines whether a packet was dropped or a decoding error occurred. If so, a new packet is sent. AMTOR has largely been replaced with modes such as PSK31.

There are currently four generations of PACTOR. Only the first is open. Later generations are proprietary. However, each new generation of PACTOR has greatly increased the data rate possible. How does it do this? Using modern modulations techniques, which is the crux of the waiver issue.



Back in the 1970s, the FCC made the mistake of confusing symbol rate and bandwidth resulting in Part 97.307(f). This section describes symbol rate limits for certain modes on HF. These rates are 300 baud below 10m (except for 60m) and 1200 baud in the 10m band.

Before we go on, we really need to explain a symbol. In terms of a radio transmission, a symbol is any change in amplitude, frequency, amplitude, or pulse width of a waveform.

Higher order modulations (more than one bit represented per symbol) coupled with increasingly better shaping filters — thank you, Joseph Fourier — have meant that more bits and symbols could be packed into the same bandwidth, or the same number of bits and symbols could be used to decrease the required bandwidth.

The rest of the world has simply recognized that bandwidth is the thing to pay attention to when trying to manage interference — the whole goal of the FCC regulations or so they say. The FCC has even recognized in a Notice of Proposed Rule Making a couple of years ago that symbol rate is no longer an appropriate way to manage interference.

In fact, the FCC went a step further and seemed to suggest that there should be no bandwidth limitations even though ARRL only asked for the same 2.8KHz bandwidth that phone uses. Half of the amateur radio community was like, "right on", and the other half was like, "this is the end of the world". The latter half were worried about a lack of bandwidth restrictions negatively impacting narrowband modes.

So back to the original point. To better support hurricane relief efforts, the FCC has temporarily waived symbol rate restrictions for stations participating in the response using PACTOR 4.

But the story doesn't end there. In researching this article, I came across another ham who pointed out (http://bit.ly/2Rl3Qn5) that one of ARRL's favorite past times is to respond to any public comment period with how PACTOR 4 would single-handedly save the world if the FCC would just remove the symbol rate restriction. If ARRL thinks being disingenuous is a good long term strategy, I personally think they are sadly mistaken. The bit rates between PACTOR 3, which is currently allowed in the US, and PACTOR 4 simply aren't large enough to warrant this claim. After all, PACTOR 4 is only about as good as an old 5kbps modem. Think 1994! That isn't to say that we shouldn't have PACTOR 4 but that ARRL may be going about it the wrong way.

PACTOR 4 and Modern Digital Modulation

For the rest of this article, I'd like to talk about some of the technology that has allowed ever increasing bitrates for digital modes in general, including PACTOR 4.

(Continued on page 5)

PACTOR 4

(Continued from page 4)

Perhaps the simplest approach to *effectively* squeezing in more bits is to simply compress the payload before it's transmitted and then decompress it on the receiving end. Text contains a lot of redundancy and has high compression ratios. However, many of the payloads we are used to sending are already compressed. For example, JPEG images throw out higher frequency content that the brain can't see, and MP3s throw out frequency content not easily detectable by the human ear. JPEG images and MP3 audio files are effectively already compressed as are most movie formats.

Compression is even used over high bandwidth datalinks. There will simply never be enough bandwidth and there never was, or the cost of the bandwidth is always too high. If you want a good example of this, it wasn't long after Morse Code was in full swing over telegraph lines that businesses started developing code books that encoded common business phrases to reduce message length since they were charged for each letter sent. If you don't believe me, read The Information (https://amzn.to/2zNs0jL) by James Gleick.

Another approach to increasing the bit rate — or reducing the required bandwidth for the same bit rate — is to design a modulation scheme that encodes more than one bit per symbol.

For a simple on/off signal, we can encode 1 bit for every symbol. Remember, a symbol is a change in the waveform. But what if the signal is not just on or off, what if the signal has multiple discreet amplitude, frequency, phase, or pulse width values? For every N total states, we can encode $\log_2(N)$ bits. The figure on the left is an example of QAM64 modulation, which has 64 total states that can encode log2(64) = 6 bits of information per symbol. It does this by using 8 different phases and 8 different amplitudes.

QAM modulation affects both amplitude and phase as do many other waveforms. These different states can be plotted on what's called a constellation diagram with amplitude on one axis and phase on the other in the figure on the left. The figure also illustrates all possible values for 6 bits of information if you don't believe me.

Furthermore, these bits are often "Gray coded", which is a fancy way of saying that only one bit changes between neighboring states, which helps with error correction.

While these higher order modulation schemes can encode more bits per symbol, it isn't a free lunch. The more complex the modulation, the more errors in the signal can make one state look like another causing a decoding error.

Errors in amplitude are often dealt with by simply ensuring that the signal-to-noise ratio is high enough — think more power. The higher the order of modulation, the higher the signal-to-noise ratio needs to be for effective data transmission. Amplitude errors are also why we need to use linear amplifiers when encoding information with amplitude. Modulations such as Gaussian Mean Shift Keying or GMSK don't encode information with amplitude and can therefore utilize smaller, cheaper, and more efficient non-linear amplifiers.

PACTOR can detect increasing bit errors by counting the number of retransmits required and automatically select a lower order modulation thereby reducing decoding errors at the expense of lower data rates — it's better to get something through slower than not at all if all you're doing is high rate retransmits. On the flip side, if band conditions improve and error rates are low, PACTOR and other technologies will select increasingly higher order modulations until the error rate reaches the threshold again.

Errors can also creep into the phase information two different ways—multipath interference and dispersion. Well, there might be more than two, but I'm an aerospace engineer not a radio guy. So ...

Multipath interference is the result of the wave energy taking two or more paths and creating interference patterns. This is the picket fencing you sometimes hear when using a radio while driving.

Dispersion is a little more complicated to explain, but basically waves of different frequencies travel at different speeds in a dispersive medium. So the wavefront tends to separate into component frequencies. Dispersion is the cause of rainbows and chromatic aberration in optics. In radio, air and the ionosphere will act as dispersive media, and because signals occupy a bandwidth not just a center frequency, we expect real radio signals to exhibit dispersion, especially for world-wide, e.g. HF, radio communications.

There are various techniques to combat phase errors. Multiple Input Multiple Output (MIMO) antenna arrays is one method. Channel equalization is another technique.

In channel equalization, we attempt to correct the received

(Continued on page 7)

Get Your Park ON

What is hoped will be the first annual "Get Your Park ON" operating event will take place October 14 – 20, in celebration of Earth Science Week. The event is open to Amateur Radio operators around the world and is sponsored by the national affiliates of World Wide Flora and Fauna (http://bit.ly/2xThpSF), which encourages radio amateurs to operate outdoors in protected nature parks.

During this on-the-air celebration, hams can participate in one of two ways. North American hams can opt to be Activators, setting up and operating in geological and nature centers such as national and state parks and forests, national monuments, and protected nature habitats. They also may decide to be Hunters, operating from home and searching out and making contact with the Activators.

"We are trying to have parks activated in all states of the USA and Mexico and all Provinces of Canada," the sponsor's Facebook page notes. "Let's have some fun." The week-long special event is reminiscent of ARRL's popular National Parks on the Air (NPOTA) event in 2016 but extends to a larger set of national treasures beyond those managed by the National

(Continued on page 8)

EXERCISE EXERCISE EXERCISE

Your county will be severely impacted by severe winter weather on Saturday, October 6. Your neighbors and the agencies that serve them need your help to communicate—will you be there? Put your skills to good use on October 6 and 7 as part of the ARRL Ohio Section Simulated Emergency Test (SET), test your limits, learn from your fellow operators, and have a great time in the process!

The communications exercise BLACK SWAN 18 is coming with winter storms that interrupt phone and internet service, power, and transportation. Starting Thursday, October 4, exercise controllers will be bringing exercise situation reports to the Ohio Section, providing weather forecast, reports from other affected areas, and the background you need to understand what you'll be facing on Saturday, October 6: the first day of the ARRL Ohio Section Simulated Emergency Test (SET).

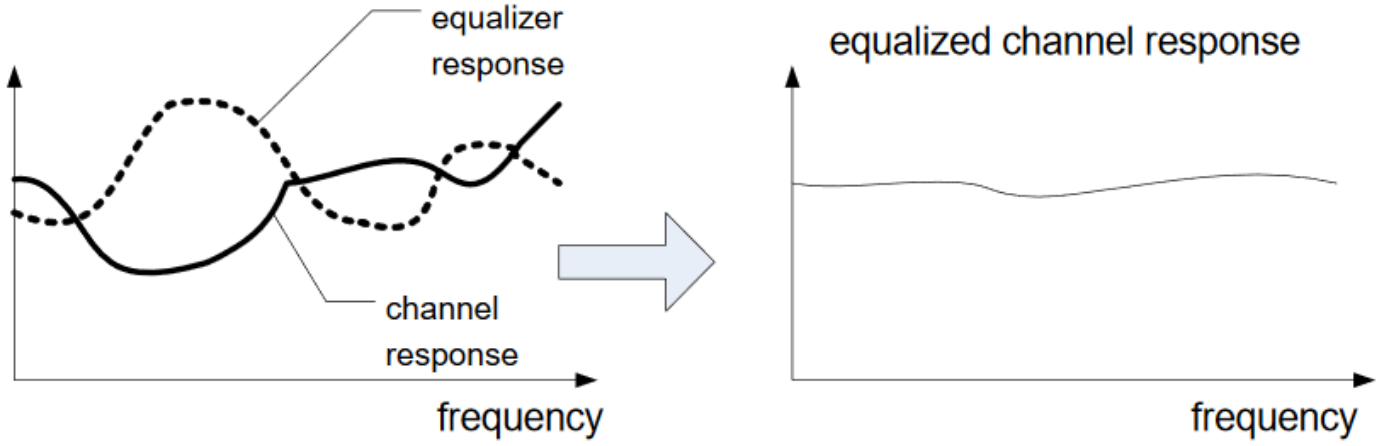
Throughout the Ohio Section and beyond, there will be activity, for ARES and NTS nets, as well as others — and they're all working together.

1. W8SGT will be active on 3902 kHz, taking checkins, gathering signal reports, and making calls to individual ARES stations.
2. OHDEN will be active 3584.5 (OLIVIA 8-500) receiving bulletins from W8SGT and retransmitting them on a regular schedule to provide the latest situation report, as well as instructions for local stations.
3. OSSBN will be active on 3972.5 kHz, taking situation reports from EOCs staffed by ARES operators.
4. Local ARES nets should be active and participating. Check with your county ARES organization. If your county ARES is not active or will not be operating for SET, check for your District activity and get active there! Use the ARES Report Card (http://bit.ly/2zKG3X0) to find out whether your county has been reporting lately, who your EC is—and if you need to get to your District EC, whom to contact!
5. Local NTS nets should be active and participating. Find your local traffic net (http://bit.ly/2xQG9uS). If you don't have one, check in to OSSBN at 3972.5 kHz. Even if no net is actively passing traffic, someone is listening and ready to relay your traffic.

Information about the BLACK SWAN 18 exercise is available in its Concept of Operations (http://bit.ly/2y5Jdmc). Pay special attention to Annex A to see how the entire Ohio Section is working together.

C Matthew Curtin

Columbus Ohio USA



PACTOR 4

(Continued from page 5)

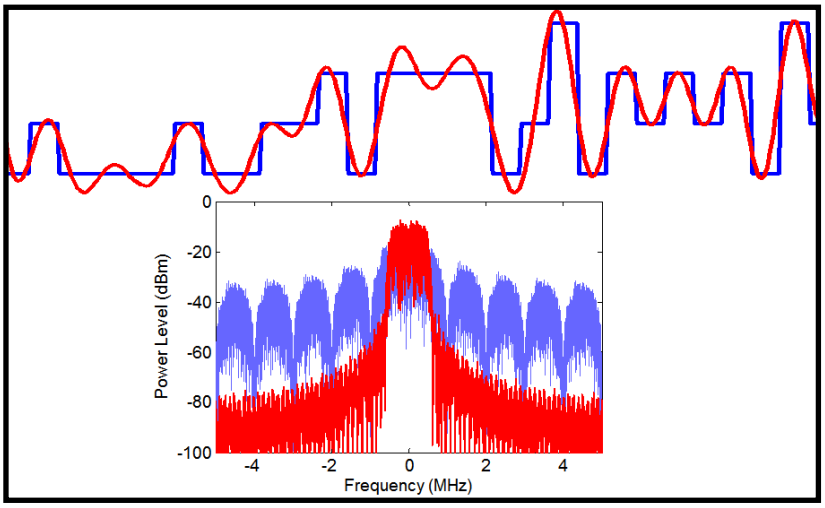
signal so that the transfer function between transmitted and received signal is 1 (see the figure above). PACTOR 4 takes this another step by using adaptive channel equalization. Every so often, a test signal with known *a priori* content is transmitted. The receiver also knows this content, and the receiver will mathematically deduce a set of filter coefficients that produce a transfer function of 1.

Another technique used to detect and correct errors is forward error correction. Basically we add extra bits to the transmission that allow us to first detect and then correct certain kinds of and amounts of errors. The more FEC used, the more kinds and amounts of errors we can correct at the expense of reducing the amount of actual information we are trying to send.

I've saved probably the most arcane aspect for the last. There is yet another reason we've been able to fit more symbols into the same bandwidth. And it has to do with waveform shaping.

If we just transmit the raw digital information, which is essentially a bunch of square waves, the bandwidth required will be huge. A guy named Joseph Fourier helped us understand that back in the 19th century.

It turns out that making a square wave requires an infinite number of sine waves from low to high frequency. The good news is that the higher frequency content also decreases in amplitude, so it does roll off into the noise. But not before it's turned into a bandwidth hog.



In the figure on the left, the blue lines are the raw digital signal. You can see the enormous occupied bandwidth. But if we apply a shaping filter to the raw blue signals, the result is the red curves. That higher frequency content caused by the sharp square waves is effectively eliminated — amplitude dies off much more rapidly with the filter — while still maintaining enough information — the amplitudes and phases — to decode properly.

Well, that about does it for now. Remember, symbol rate isn't bandwidth, and it's bandwidth we should be worried about if interference is the purposes for the regulations. Here's hoping the FCC will show some movement on the NPRM soon to align the US with the rest of the world.

Get Your Park ON

(Continued from page 6)

Parks Service.

The American Geosciences Institute in October 1998 organized Earth Science Week, a national and international event to help the public gain a better understanding and appreciation for the Earth sciences and to encourage stewardship of the Earth, a common goal shared by WWFF. Both programs encourage participants to get outside and enjoy nature.

"Get Your Park ON" gets under way at 0000 UTC on October 14 and continues through 2359 UTC on October 20. Visit the "Get Your Park ON" Facebook page (http://bit.ly/2xTbkFZ) for more.

Earth Science Week 2018 (http://bit.ly/2OrQhny) engages young people and others with learning resources and activities exploring the relationship between the arts and the Earth systems. This year's theme of "Earth as Inspiration" promotes public understanding and stewardship of the planet. Of special interest to the Amateur Radio community and their families is an "Inspired by Earth" photo contest and an essay contest for students in grades 6 through 9.

Thanks to Norm Meyers, N9MM

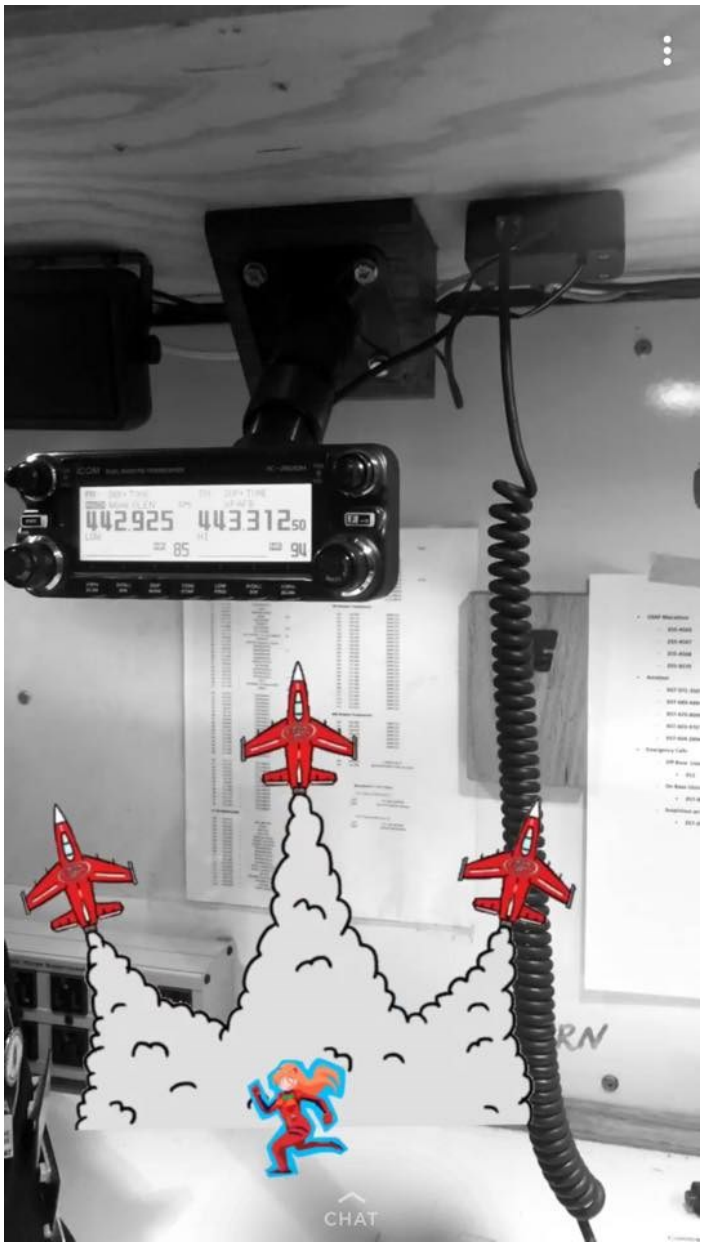
Unites States Air Force Marathon

The 2018 Unites States Air Force Marathon was on Sep 15 this year. As usual, local area amateur radio operators were involved in supporting the race — providing logistics support for water and aid stations, providing emergency communications for medical emergencies, and acting as a liaisons between the race director and their staff and the amateur radio operators.

This year's marathon was the hottest on record, and the full marathon had to be cut short due to black flag conditions and numerous race participants falling ill and sometimes literally falling over. As a participant in the marathon, I couldn't believe I was already sweating at 5AM on my way out the door. It was 70F but very humid and foggy. By about 10AM, the sun had burned off the fog, lowered the humidity to a more comfortable 55% or so, but had nothing in its way allowing race participants to literally bake in Area A around the flight line. The air temperature was measured at 85F, but the course temperature had to be at least 15F hotter. It was very brutal. Between the hospitals running out of room and the potential for more runners to go down, race officials cut bait.

Two weeks afterwards, Phil Verrett, who organized the amateur radio operation, held a debriefing. I'd like to think my Abi Khan debriefing inspired him, but I'm sure Phil was way ahead of me. I'd like to briefly go over the major points and recommendations that were discussed.

1. The marathon communications plan, if one exists, should clearly outlines roles, responsibilities, and the kinds of information expected to be passed. The amateur radio coordinator will evaluate the plan and work with the race organizers to prioritize communications tasks for the given number of amateur radio resources. This grew out of the *ad hoc* effort to attempt to track and report runners without bibs, which is a security concern for the marathon. But this also apparently swamped the logistics net and was not a good use of amateur radio resources.
2. The entire amateur radio net structure needs to be revisited. What worked in the past wasn't working so well.
3. Stations need to exercise discipline and keep transmissions short and only pass the minimum required information. At least one station (me in between water stations while I was running) had trouble breaking into the med net with an actual emergen-



cy due to a relatively low priority conversation taking place. Stations also need to make better use of tactical call signs and remember to end their transmissions with their FCC call signs.

4. Apparently the new race director likes to move around … a lot. The amateur radio shadow assigned to him had trouble keeping up all day. In the future, an amateur radio operator who can keep up with race director should be assigned. My own two cents is that some consideration should be given to setting up nets using radio services that don't require licenses such as MURS and FRS. This way we don't necessarily need to provide shadows just radios. However, given the shear amount of communications going on for this marathon, it probably isn't realistic for the race director to do his job and talk over the radio. But this approach may work for smaller events.

Club Call: W8XRN

XWARN
P.O. Box 562
Xenia, Ohio 45385

Email: info@xwarn.net
Website: XWARN.NET

«FNAME» «LNAME» - «CALL»
«ADDRESS»
«CITY», «STATE» «ZIP»

Wavelengths

Wavelengths is published monthly by the Xenia Weather Amateur Radio Net. Our meetings are currently held on the 2nd Monday of each month at **7:30 pm** at the Greene Memorial Hospital Auditorium. You can find additional information about our organization at www.xwarn.net . We welcome new and experienced Amateur operators and those interest in becoming an Amateur operator to attend our meetings.