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President's Corner

Another DCC is upon us. This one is our first live conference in three years, and it is shaping up to be a good one. Come visit the DCC in Charlotte, NC on September 16 through 18. This year we are happy to have the Charlotte Digital Radio Group and the Mecklenburg Amateur Radio Society as our local hosts. They have generously sponsored the Saturday morning coffee and pastries for this year's DCC. I would also like to thank ARDC for their sponsorship of this year's DCC. Their quick response and financial help made the DCC possible. And don't forget ARRL, whose support we could not do without. If you aren't a member, why not?



This year's conference will be streamed live via YouTube for those of you who cannot attend in person. We will have moderators monitoring the chat window to field your questions and pose them to the presenters. You will be able to hear their answer via the live stream. The link is available on the TAPR web site, tapr.org.

Other exciting news is that the TangerineSDR hardware is approaching completion. Come see the prototypes in the Demo room or listen to the talks on the various components. We still have a long way to go before we have a complete working radio, but we are getting closer!

Production is complete on the Magnetometer Raspberry Pi Hat, so look for those to become available in the TAPR store shortly after DCC. Again, prototypes will be available to play with in the Demo room.

73,
Scotty WA2DFI

###



DCC in a Nutshell

Everything you wanted to know about the 2022 ARRL and TAPR Digital Communications Conference (DCC) in a nutshell:

Register for the DCC here (<https://tapr.org/product/2022-dcc-registration/>)

Register for the DCC host hotel (Hilton Charlotte Airport) here (<https://tinyurl.com/24hjmktw>) or dialup 1-800-445-8667

View the DCC schedule below or here (<https://tapr.org/preliminary-2022-dcc-schedule/>)

Be a DCC live presenter or speaker by contacting Steve Bible, N7HPR at steven.bible@gmail.com

###



TAPR Directors Election

Three Director positions on the TAPR Board of Directors are now open for nomination and nominations may be submitted now.

TAPR Board members serve three-year terms and their responsibilities include:

- 1) Attendance at both in-person board meetings each year. [One is held at the Hamvention in May, the other at the Digital Communications Conference (DCC) in September.]
- 2) Regular participation in the continuous board session, which is conducted over the Internet.
- 3) Active engagement in TAPR's management. To place a person in nomination, please remember that he or she must be a member of TAPR. Also, confirm that the individual is willing to have his or her name placed in nomination. By September 10, 2022, send that person's name (or your own if you wish to nominate yourself), call sign, mailing address, e-mail address, phone number(s), and a biographical sketch (250 words maximum) via contact@tapr.org or via snail mail to TAPR, 1 Glen Ave., Wolcott, CT 06716-1442. Nominations close after the call for nominations at the TAPR Membership Meeting at the DCC on September 17, 2022, and an online election will be held from October 21, 2022 to October 14, 2022.

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DCC Schedule

The 2022 ARRL and TAPR Digital Communications Conference (DCC) will be streamed live on YouTube for free on the TAPR YouTube channel (<http://youtube.com/user/TAPRDigitalVideo>). Those who are subscribed to our channel will receive an email announcement when the stream goes live.

We hope to have a parallel Zoom meeting where breakout rooms will be available during break times and for hallway discussions during a session. It will be a separate, free meeting with the link provided during the live stream or by email request.

THURSDAY, 15 SEPTEMBER 2022

9:00 AM to 5 PM: TAPR Board Meeting
(everyone is welcome to attend)

FRIDAY, 16 SEPTEMBER 2022

8:45 AM: Conference Registration
Demonstration Room Open

9:30 AM: Welcome and Introduction

9:45 AM: HamSCI, The Personal Space Weather Station, and the 2023 and 2024 Solar Eclipses by Nathaniel Frissell, W2NAF
Database/Central Control System for PSWS by Bill Engelke, AB4EJ

10:30 AM: Crowdsourced Doppler Measurements of Time Standard Stations Demonstrating Ionospheric Variability by
Kristina Collins, KD8OXT

11:15 AM: Measuring Characteristics of Traveling Ionospheric Disturbances Observed with a Network of Low Cost HamSCI
Personal Space Weather Stations by Veronica Romanek, KD2UHN
Progress on Programming the TangerineSDR FPGA by Cuong Nguyen, KC3UAX

12:00 PM: Lunch

- 1:00 PM: Lightning Talks
- 1:45 PM: Towards Developing an Algorithm for the Separation of Transmitters of High Frequency Chirp Signals of Opportunity for the Purpose of Ionospheric Sounding by Nisha Yadav
PyLap: An Open-Source Python Interface to the PHaRLAP Ionospheric Raytracing Toolkit by Gerard Piccini, KC3ZHK and Devin Diehl
- 2:30 PM: Comparison of Manual and Machine Learning Assisted HF Amateur Radio LSTID Observations by Diego Sanchez, KD2RLM
- 3:15 PM: Claude Shannon's Radiotelegraphy: Progress in Coherent CW by David Kazdan, AD8Y
The Whistler Catcher VLF LEAF Module 2022 TAPR DCC Update by Jonathan Rizzo, KC3EEY
- 4:00 PM: TangerineSDR Prototype Hardware Status by Scotty Cowling, WA2DFI; John Ackermann, N8UR; Tom McDermott, N5EG
MagnetoPi Hat Magnetometer Hardware Production Status by TBD
- 4:45 PM: Play Time
- 5:30 PM: Friday Night Social
- 10:00 PM: Demonstration Room Closed

SATURDAY, 17 SEPTEMBER 2022

- 8:00 AM: Conference Registration
Demonstration Room Open
- 8:45 AM: Welcome and Introductions

- 9:00 AM: ESP32 APRS: Creating a Low-Cost Tracker by Jason Rausch, K4APR
Introductory Session: Intro to System Fusion Digital Voice by Mark Thompson, WB9QZB
- 9:45 AM: Bushwhacking in the Land of Digital Voice by David Vine, WA1EAW
- 10:30 AM: Amateur Communications Below 9 kHz: The Dreamer's Band and The New EbNaut Digital Mode by Jonathan Rizzo, KC3EEY
Introductory Session: Introduction to High-Definition Digital ATV by Mel Whitten, K0PFX
- 11:15 AM: Starlink, AREDN, and Networking by Tom McDermott, N5EG
- 12:00 PM: Lunch
- 1:00 PM: Lightning Talks
- 1:45 PM: GPS Modules as RF Signal Sources, Possibilities and Pitfalls / TAPR SynthDO by John Ackermann, N8UR
Introductory Session: Introduction to D-STAR Digital Voice by Roland Kraatz, W9HPX
- 2:30 PM: Technical Presentation TBD
- 3:15 PM: Technical Presentation TBD
- 3:15 PM: Introductory Session: Basic Microcontroller Interfacing Techniques by Darrell Davis, KT4WX
- 4:00 PM: Technical Presentation TBD
- 4:45 PM: TAPR Membership Meeting
- 6:00 PM: No Host Cash Bar
- 7:00 PM: Dinner Banquet, Awards Presentation, Prize Drawings
After Dinner Speech: On-Ramps to Learning and Other Lessons from the Road by Rosy Schechter, KJ7RYV,
ARDC Executive Director
- 10:00 PM: Demonstration Room Closed

SUNDAY, 18 SEPTEMBER 2022

- 8:00 AM: Sunday Seminar: Opening Remarks by John Hays, K7VE
8:10 AM University of Scranton ARC – W3USR by Nathaniel Frissell, W2NAF
8:50 AM Bridgerland ARC by Kevin Reeves
10:00 AM National Radio Astronomy Observatory by Lyndele von Schill and Heather Cochrane
10:40 AM M-17 Project by Ed Wilson and Stephen Miller
11:00 AM ARISS by Frank Bauer, KA3HDO
11:40 AM A Quick Review of the ARDC Grant Application Process by John Hays, K7VE
12:00 PM: The End

#

2022 ARRL / TAPR Digital Communications Conference

Make your reservations now for three days of learning and enjoyment at the Hilton Charlotte Airport Hotel. The Digital Communications Conference schedule includes technical and introductory forums, demonstrations, a Saturday evening banquet and an in-depth Sunday seminar. This conference is for everyone with an interest in digital communications— beginner to expert.

September 16-18
Charlotte, North Carolina

Contact Tucson Amateur Radio at:
www.tapr.org

ALL PLANS ARE SUBJECT TO CHANGE DUE TO THE CORONAVIRUS



DCC Banquet Speaker

Rosy Schechter, KJ7RYV, is the 2022 DCC Saturday evening banquet speaker. The topic of her speech is “On-Ramps to Learning and Other Lessons from the Road.”

At multiple points during my career, I’ve had the opportunity to work on projects that have brought people together to technical skills or take part in a technical process. The most notable of these was [Maptime.io](#), a small project that exploded into an international movement of people co-learning how to make open-source maps. I’ve also developed curriculum for learning HTML, CSS, and JavaScript, worked with farmers to “prototype” (with craft materials) imaginary robots to work on organic local farms, and developed diagrams explaining how the patent system works with plant inventions. Throughout this journey, I’ve learned a thing or two about how to bring people into learning technical subject matter, even if they don’t consider themselves technical. In this talk, I’ll share some of these lessons and how they can be applied to increasing engagement in amateur radio, highlighting some of our grantees who are using similar methods in their projects.

Rosy Schechter is the Executive Director of Amateur Radio Communications (ARDC). From curriculum writing to project management to nonprofit leadership at organizations like Skillcrush, Stamen Design, Periscopic, and Burning Man, she has turned her love of learning into a lifelong practice. Rosy holds a MS in Digital Media from Georgia Institute of Technology and a BA in Philosophy and Creative Writing from Georgia State University.

#

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

Proceedings of the DCC

The following technical papers appear in the proceedings of the 41st ARRL and TAPR Digital Communications Conference. Printed copies will be available from Lulu.

Central Control Database for HamSCI Personal Space Weather Station by William D. Engelke, Cole Robbins, Nicholas Muscolino, Anderson Little, Travis Atkinson and Nathaniel A. Frissell

FST4W on the HF Bands: Why – What to expect – Equipment – Results by Gwyn Griffiths, G3ZIL; Glenn Elmore, N6GN; Rob Robinett, AI6VN; Lynn Rhymes, WB7ABP and John Watrous, K6PZB

VARAC by Walter Holmes, K4WH

HTTP Authorization Implementation for APR-IS Servers by Peter S. Lovell

TLS Implementation for APRS-IS Servers by Peter S. Lovell

ESP32 Paacket/APRS: Creating a Low Cost Tracker by Jason Rausch, K4APR and Remi Bilodeau, VE2YAG

exDV: Low Cost Digital Voice on the ESP32 by Mooneer Salem, K6AQ

Detecting Field Lines, as Propagation, at Fault Lines with an Amateur HF-Radio by Alex Schwarz, VE7DXW

A Brief Survey of Technological Innovation in Amateur Radio by Steve Stroh, N8GNJ

Bushwhacking in the Land of Digital Voice by David A. Vine, WA1EAW

Preliminary Analysis of an AI-powered Transcription Bot for FM Transmissions by Zhemin Zhang, KD2TAL and Brian Robert Callahan, AD2BA

#

Student project enables 33-cm ham experimentation

ARDC grant enables Bradley University students to develop an open-source, 915 MHz digital transceiver system.

June 15, 2022—DAEMod-915 is a Bradley University project whose goal is to design a digital transceiver system for experimentation in the under-utilized 33 cm band. The design includes support for multiple FSK/ASK modulation standards, and both hardware and software are open-source. The designers—Peter Handler, W9PLH; Connor Dickey, KD9LSV; and Philip Pierce, AC9YC—chose the 33 cm band for several reasons:

- It is one of the most under-utilized bands,
- It is available for use by non-licensed ISM users and licensed radio amateurs,
- It offers a good balance between cost, range, and available spectrum, and
- There is a lack of available open-source and open-hardware modules for implementing digital radio modes in this band.

Once complete, the DAEMod-915 project will reduce barriers to innovation in the 33 cm band. The project's detailed documentation will allow radio amateurs to experiment with digital protocols without spending a lot of money, and allow developers—be they solo developers, other educational institutions, or amateur radio clubs—to build upon the base

hardware and software for their own unique applications. Documentation for the DAEMod-915 project is at <https://github.com/DAEMod-915>.

About the developers

Peter, Connor, and Philip are recent Bradley University graduates and are active Amateur Extra Class licensees. They serve as volunteer examiners and are active in a variety of amateur radio clubs. Peter has a strong interest in VHF/UHF digital modes as well as consumer electronics from the 1990s and 2000s, including portable media players, computers, and radio-operated devices. Connor enjoys contesting, portable operations, and administering amateur radio exams. Philip loves the outdoors and also enjoys mobile and portable operations. Dr. Prasad Shastry and Dr. Aleksander Malinowski are the project advisors. Dr. Shastry's expertise is in RF design and analysis and Dr. Malinowski's expertise is in embedded devices.

About Bradley University

Bradley University is a top-ranked private university in Peoria, Illinois, that offers nearly 6,000 undergraduate and graduate students opportunities and resources of a larger university and the personal attention and exceptional learning experience of a

smaller university. Bradley offers more than 185 undergraduate and graduate academic programs in business, communications, education, engineering, fine arts, health sciences, liberal arts and sciences, and technology. These high-quality programs incorporate global and experiential learning opportunities, preparing graduates to succeed in a complex world. To learn more about Bradley University, please visit <https://bradley.edu/>.

About ARDC

Amateur Radio Digital Communications (ARDC) is a California-based foundation with roots in amateur radio and the technology of internet communication. The organization got its start by managing the APRN address space, which is reserved for licensed amateur radio operators worldwide. Additionally, ARDC makes grants to projects and organizations that follow amateur radio's practice and tradition of technical experimentation in both amateur radio and digital communication science. Such experimentation has led to advances that benefit the general public, including the mobile phone and wireless internet technology. ARDC envisions a world where all such technology is available through open source hardware and software, and where anyone has the ability to innovate upon it. To learn more about ARDC, please visit <https://www.aprn.org>.

###



WBT in Charlotte, NC, circa 1927

Hamvention 2022 is a Wrap

By Steve Stroh N8GNJ (Source: [Zero Retries](#))

As I begin writing this issue on Sunday 2022-05-22 in my air conditioned room, my feet are still swollen from much walking and standing, my neck is sore from sunburn where I forgot to apply sunscreen, and my mind is awash from all the impressions of two days of immersion in Amateur Radio. Even without much that was explicitly “Zero Retries Interesting” there was more than enough to keep me busy and enough to report out that I’ll probably overflow.

You’d think that with 8 hours on Friday, 8 hours on Saturday, and 2 hours (effectively) on Sunday, you’d have enough time to see all the commercial vendor exhibits, but that’s not the case. I got sidetracked into unexpected interesting conversations, spent time cooling off my swollen feet, and of course, the Forums.

But, more than any previous Hamvention, you no longer need to be physically present to get a reasonable feel for what was there - just check out YouTube and you’ll have many hours of video to watch, as will I, in the weeks after I return home. It was amazing to me the number of folks that were recording Hamvention 2022 for posterity... and their audiences. My attendance at Hamvention came in the latter phase of a personal cross-country car trip, and thus this issue of Zero Retries will suffer a bit from being written in a few late nights in hotel rooms when I’m not-quite exhausted.

One thing that has remained a constant of Hamvention from Dayton’s Hara Arena to Xenia’s Green County Fairgrounds is that Ohio weather dominates Hamvention. Rain on Thursday and Friday morning dampened enthusiasm for the Flea Market which was almost entirely on grass which quickly transitioned to mud in places. By Saturday morning, the Flea Market was reasonably accessible (minimal mud), but heavy weather was threatened by mid-afternoon, and when the weather reports warned of heavy rain approaching, many Flea Market vendors took that as a sign to close up and depart (while their vehicles could still get traction on grass, rather than mud). One dismaying aspect reminiscent of one of the worst aspects of Hara Arena was the appallingly bad condition of some of the “paved” portions of the Flea Market area, with large chunks of failed pavement laying around randomly. If you weren’t carefully watching where to step and avoid those chunks for us on two feet, you could easily step on a chunk and have your leg disappear out from under you. Those pavement chunks were a nightmare for the Hamvention attendees those in power chairs, scooters, and wheelchairs. Surely Green County Fairgrounds and Hamvention can afford to do a better job with those portions of pavement considering the very, very high foot (and wheeled) traffic in the Flea Market area on Hamvention weekend.

My new iPhone 13 Pro Max largely proved up to the

challenge of recording a lot of video / audio and photos from Hamvention weekend... especially that 1 TB of storage. After nearly a month of travel, including recording a lot of video at Hamvention, "Available" is at 948.06 GB. However, I also learned at Hamvention that I'm not yet up to the challenge of optimally operating it. I recorded a lot of video / audio, but that precluded taking photos while I was recording video. Eventually I can excerpt photos from the videos. I should have taken more photos. Another conclusion is that while that big battery works well, it's not infinite, thus if I'm going to be recording a lot of video, I'm going to need some supplemental power. Another conclusion was that I need a better platform than a short "selfie stick" to hold the iPhone 13 during video recording, such as a lightweight tripod. I saw some of the "pro video" folks using impressive iPhone-based video rigs that included an external power pack, a tripod (even one on wheels), and external directional microphones via dongles (to allow simultaneous audio input and charging). Thus, while the iPhone 13 Pro Max certainly worked for recording some casual videos and photos... it may be more practical to just resort back to a camcorder that is better optimized for the purpose. But more experimentation is warranted before making that decision.

One big question you might be curious about is if I got a chance to make my pitch to Gerald or Matt Youngblood

of FlexRadio (see Zero Retries 0043)? Yes, I did get a few minutes face to face with Matt Youngblood to plead my case for a FlexRadio VHF / UHF Radio. I promised to follow up with a detailed email, which will have to wait until I return to Bellingham - I'll only have that one shot and will have to make it count.

This issue is a glancing blow of just a few highlights of Hamvention 2022 - more in subsequent issues. Turns out (surprise!) I'm just not nearly as productive "on the road" as I am at my office where my workflow is much more optimized.

Digital at Hamvention 2022? Not much.

In the vendor exhibit areas, Digital (data) was almost entirely absent, other than the numerous Digital Mobile Radio (DMR) digital voice mobile and portable radios for sale, and the exhortations from Icom and Yaesu that their > \$1k HF radios were based on "Software Defined Radio" technology. And of course, the Icom SHF-P1 - see below. There was the TAPR Forum on Friday, and the Digital Modes Forum on Saturday afternoon.

Even in the flea market (of which I saw perhaps 50%), there were very few data devices. I saw exactly one "interesting" TNC - a Kantronics KPC-9612, for \$25... which I bought.

That... is a **problem!** More on that later.

The Big Five Four Radio Manufacturers at Hamvention

Elecraft, FlexRadio, Icom, and Yaesu were present at Hamvention 2022. Kenwood was not. Kudos to Elecraft, FlexRadio, Icom, and Yaesu for showing up. Raspberries to Kenwood for not showing up.

Not knowing what to expect of Hamvention after a two-year hiatus, I didn't make a real plan to survey all the vendors, and thus there are some gaps in my observations. I did not check out Elecraft and Yaesu for Zero Retries Interesting new products, but I did not hear any new "buzz" about anything with them.

I did spend some time with my daughter Merideth KK7BKI in front of a FlexRadio Maestro and 6400M explaining to her what was different about this concept of radio. Yes, there are other manufacturers doing "Software Defined Radio", but in my opinion, FlexRadio is very serious, all-in on Software Defined Radio, and that when I'm ready for a significant investment in HF gear within the year, I will be investing in FlexRadio units.

Icom SHF Project / SHF-P1



Icom SHF-P1 Concept Unit at Hamvention 2022 - Scott Honaker N7SS Photo by Steve Stroh N8GNJ)

What Icom displayed at Hamvention for the "SHF Project" might as well have been a mockup made of carved styrofoam. It was a mockup, not functional, and was not necessarily meant to

be representational of what this unit will eventually become... if it ever comes to market. Talking to the Icom exhibit staff, it quickly became apparent that:

- The Icom exhibit staff knew nothing (were not given any additional information) about this unit beyond what was on the double-sided handout available at Hamvention.
- The primary purpose of this unit to be at Hamvention was simply to be a conversation starter with Hamvention attendees about what features they would like to see included in such a radio, especially what bands beyond 1240 - 1300 MHz (available on the Icom IC-9700).

The accompanying one-pager released at Hamvention states that the “SHF-P1” will include 2.4 GHz and 5.6 GHz bands (and a GPS receiver). Although there was no explicit mention in the one-pager, Icom’s exhibit staff stated that there may be other versions of this radio for other “SHF” (Super High Frequency) Amateur Radio bands. One Icom rep was keeping a tally of bands they heard requested on a scrap piece of paper.

A lot of Hamvention attendees were confused that Icom used a (modified) Icom IC-705 as the control head / power supply for this system, and thought that the unit was an IC-705 and the tower unit was a transverter, rather than a 2.4 GHz / 5.x GHz radio.

The one key piece of information answered in the one pager that had not been mentioned in previous SHF Project Updates is what modes Icom plans to offer on the SHF-P1:

“All modes including the DV/DD Modes”

Icom’s DV (Digital Voice) mode is 4800 bps with 2400 bps devoted to digitized voice, 1200 bps of Forward Error Correction, 950 bps for data such as from a GPS receiver, and the rest is overhead - callsign, repeater being used, etc. in a 6.25 kHz channel.

In the Icom ID-51A portable D-Star radio, Icom introduced DV Fast Data Mode:

“By using data in place of voice frames, the ID-51A transfers data 3.5 times faster (3480 bps) than in the conventional DV mode (with voice). Pictures taken by an Android™ device can be quickly transmitted in the DV Fast Data mode.”

DV Fast Data Mode has not been universally implemented in Icom D-Star radios, nor was it implemented in the Kenwood TH-D74A portable D-Star radio, nor (to my knowledge) any of the open source implementations of D-Star. Thus it’s an open question if Icom will implement DV Fast Data Mode in the SHF-P1.

With the inclusion of “DD Mode” - 128 kbps data-only mode that Icom first offered in the [discontinued] ID-1 (1240-1300

MHz) and DD Mode for 1240-1300 MHz in the Icom IC-9700, the SHF-P1 is now “officially” Zero Retries Interesting for offering a unique new data mode for 2.4 GHz and 5.6 GHz Amateur Radio bands.

But, that's simultaneously disappointing, because DD Mode is now more than two decades old, and as mentioned, could have been implemented better then, and (as far as I've been able to determine) has not advanced since then.

I also asked Icom booth staff (several different ones through the course of Hamvention) if the SHF-P1 would be adapted for, or a version of it made for use with the QO-100 geostationary Amateur Radio payload positioned above Europe and Africa (2.4 GHz uplink, 10 GHz downlink). The answers were shrugs, “I don't know”s, and “what's QO-100”?

It will be interesting to watch the evolution of the SHF-P1.

Phil Karn KA9Q-Radio Presentation

The second-ranked Digital Retries Interesting thing seen at Hamvention 2022 was Phil Karn KA9Q's presentation of his ka9q-radio project during the Digital Modes Forum on Saturday Afternoon. It could be argued that since ka9q-radio is “shipping” (available on GitHub), it's more interesting than the SHF-P1 which at the moment is vaporware. Sometimes sexy-looking

hardware trumps software.

From ka9q-radio's GitHub page:

ka9q-radio is a software defined radio for Linux I've been working on for a few years. It is very different from most other amateur SDRs in several respects:

1. Efficient multichannel reception. A single Raspberry Pi 4 can simultaneously demodulate, in real time, every NBFM channel on a VHF/UHF band (i.e., several hundred) with plenty of real time left over.
2. All I/O (both signal and control/status) uses IP multicasting. This makes it easy for more than one module, on the same computer or on a LAN, to operate on the outputs of other modules, or for individual modules to be restarted without restarting everything else.

The hardware components of KA9Q's system are a reasonable performance Software Defined Receiver such as an Airspy unit (specifically mentioned by KA9Q) and a Raspberry Pi 4, and a general purpose host computer. The SD Receiver is connected to the Raspberry Pi 4 and the ka9q-radio software on the raspberry Pi 4 virtualizes the SD Receiver into as many virtual receivers and modems as you wish, within the bandwidth of the SD Receiver. With three SD Receivers (and, I think, 3 Raspberry Pi 4s) KA9Q is able to monitor all the Narrow Band FM (NBFM)

frequencies in use (repeater outputs, mostly) in his area (San Diego, CA) on 144-148 MHz, 222-225 MHz, and 440-450 MHz. Currently, as research, he records all of those channels to disk.

To me, what was interesting was that each channel could be simultaneously decoded for any number of “modes”, such as FM voice, 1200 bps Audio Frequency Shift Keying (AFSK) Automatic Packet Reporting System (APRS).

The “magic” of KA9Q’s approach is that the output of the SD Receiver is shared to many processes on the Raspberry Pi via the underutilized, poorly understood, and often poorly implemented technique of IP Multicasting. KA9Q goes to some trouble to explain in his GitHub documentation how to choose equipment such as Ethernet switches that implement IP Multicast correctly so ka9q-radio will work.

Besides the “fun” of being able to monitor all of 50-54 MHz, 144-148 MHz, 222-225 MHz, 440-450 MHz, and at least some of 1240-1300 MHz, I can think of a number of practical uses for ka9q-radio such as setting up relatively inexpensive, but highly capable remote receivers in quiet places. I can imagine a future “shack” of mine to have one ka9q-radio receiving system for VHF / UHF and only transmitters, allowing full duplex operations.

It's early days for ka9q-radio, and one thing that was

encouraging about KA9Q’s projects is that he meticulously documents them. I look forward to trying to get ka9q-radio running for myself later in 2022.

Amateur Radio Digital Communications - ARDC



ARDC Exhibit at Hamvention 2022. In the foreground is Bob McGwier N4HY and Ria Jairam N2RJ. Those in white lab coats are members of HamSCI. Photo by Steve Stroh N8GNJ

The ARDC exhibit in Building 1 was a gathering point for ARDC grant recipients and ARDC staff. Those representing

ARDC included all five ARDC staff members:

- Executive Director Rosy Schechter KJ7RYV
 - Grants Manager Chelsea Párraga KF0FVJ
 - Communications Manager Dan Romanchik KB6NU
 - Outreach Manager John Hays K7VE
 - Operations Manager Merideth Stroh KK7BKI
- and two ARDC Board Members
- President / CEO Phil Karn KA9Q
 - Director Robert McGwier N4HY

In my periodic visits, ARDC's exhibit was usually busy. It was amusing to watch the interaction of some those who had never heard about ARDC, but saw "Digital" and asked what digital devices ARDC made? At times, ARDC's mission got abbreviated to "We give out money" and that very quickly refocused the conversation.

ARDC Grant Recipients attending Hamvention 2022 all found their way to the ARDC exhibit at some point during Friday and Saturday, and the photo above was typical of the spontaneous discussions that sprung up near ARDC as smart, interesting people met each other. Because of their extensive histories and accomplishments in Amateur Radio, KA9Q and N4HY were particularly busy talking to their fans and colleagues.

Discussions with ARDC staff were that they explained ARDC's mission to many, many Hamvention attendees and handed out many hundreds of ARDC stickers and brochures, with promises that the attendee would be discussing the possibilities of ARDC grants with their clubs upon their return from Hamvention.

Hamvention Attendance

Hamvention's official tally of attendance was 31367. That felt... overstated... to me. I have no experience at judging crowd size, but I did attend all three days of the first Hamvention at the Greene County Fairgrounds in 2017 and I remember what that crowd was like. A quick websearch found this page which states that the official Hamvention attendance in 2017 was 29296, and that was, of course, pre-COVID-19. At Hamvention 2022, it just didn't feel, to me, like there were 31367 of us during all three days of Hamvention 2022. Hamvention could have easily sold 31367 tickets... (advance tickets were \$26 and onsite tickets were \$31) and there may have ended up being a significant number of last minute no-shows that just decided not to chance it, or gas prices were too high, or there weren't (enough) sexy new radios to see and touch. It was also notable that there was a distinct lack of staffing at gates, etc., of both volunteers, and paid security personnel. Thus in my opinion there was no way that

actual attendees could have been actually counted.

Thus, given the gaps in the Forum seating, the very light crowding in the exhibit areas (except for the peak hours around Noon on Saturday), and the sparse crowds in the Flea Market, it's my personal, highly unprofessional, likely very incorrect feeling, again based mostly on what I experienced in 2017 versus what I experienced in 2022, that the actual number of unique physical bodies on the grounds of Greene County Fairgrounds over the course of the 3-day weekend... was closer to 20000 than 31367.

Not Much Digital / Data - That's a Problem

First, the idea I floated in Zero Retries 0047 of a Zero Retries exhibit at Hamvention 2023 elicited no response from Zero Retries readers. Nada. Zilch. Zip. Lead balloon. That doesn't mean the idea is dead, just that it won't be a "community supported" project like I discussed.

As I mentioned in Zero Retries 0048, at Hamvention 2022, I didn't see much evidence of Digital / Data in Amateur Radio other than a few notable exhibits such as TAPR, M17 Project (hosted by Bruce Perens K6BP), K6BP's new organization HamOpen, K6BP's \$14 Remote Rig Controller project, and of course Icom (as discussed in Zero Retries 0048). FlexRadio is a notable exception with their product line being entirely based

on Software Defined Radio technology and thus everything FlexRadio makes is Zero Retries Interesting.

I think that lack of digital / data exhibits is a significant problem because without such "in person" exhibiting, one could reasonable infer, especially new Amateur Radio Operators excited to attend their first Hamvention, that "nothing much" is happening with Amateur Radio data. For example, there was no presence of AREDN, despite that AREDN networks are growing quickly. (A "back channel" communication after Zero Retries 0047 hinted that AREDN may appear at a future Hamvention.)

Another significant "data" organization that I think should exhibit at Hamvention is Amateur Radio Safety Foundation, the parent organization of the Winlink Amateur Radio email system. Winlink is the major data activity on VHF / UHF and should be represented. APRS used to be well-represented as part of the TAPR booth, but I couldn't even find any APRS trackers being sold, let alone advocacy of APRS.

I hope Digital / Data will be better represented at future Hamventions. Let me know if I can help.

ARISS-USA Forum

I've mentioned here in Zero Retries, and as often as I can in conversations, that, at least to me, one of the proudest boasts

I can make as an Amateur Radio Operator is that there is an Amateur Radio station on the International Space Station (more than one actually - see ZR > BEACON below), and it's used by Astronauts that are Amateur Radio Operators, and their primary activity with the station is to contact kids in schools to inspire them to study STEM (Science, Technology, Engineering, and Math) subjects... and of course, a small dose of Amateur Radio.

I was encouraged when ARISS-USA spun itself out of being supported by AMSAT-NA and ARRL into an independent organization that continues to work with both AMSAT-NA and ARRL on matters of mutual interest, but (as I understand it) ARISS-USA is no longer dependent on those organizations for core functions, especially financial. As a standalone organization with a US 501(c)(3) certification, individuals and organizations can donate specifically to support ARISS activities rather than "pass through" donations via AMSAT-NA or ARRL.

I attended ARISS-USA's presentation at Hamvention 2022 - ARISS 2.0: A Next Generation Vision for Amateur Radio on the ISS. I was very, very impressed with their activities. They are energized with their major 2021 grant from ARDC and appear poised to make good use of it. Seriously, the presentation was just so upbeat that I left it energized. Presenters Frank Bauer KA3HDO, Randy Berger WAØD, Rosalie White K1STO, and Diane Warner KE8HLD did a great job.

What amazed me was the sheer magnitude of the schedule of contacts for ARISS. From what I read, my impression was that there were a few dozen contacts per year. Actually, there are many, many more than that.

I saw recording equipment in various Forums, but wasn't aware that Hamvention was the organization actually doing the recording and putting the presentations on YouTube, thus you can watch the entire presentation for yourself:

<https://www.youtube.com/watch?v=WB1mTVEzJjc>

I visited the ARISS-USA exhibit and spoke with KA3HDO and K1STO and offered my gratitude for what they're doing. ARISS-USA is just amazing. I got to see the Engineering Test Article of the specially modified Kenwood TM-D710GA radio and power supply, identical to the unit (now units - see ZR > BEACON below) onboard the ISS.

Just to clear up any confusion, the 2021 ARDC grant to ARISS-USA was to fund a specific program, not general ARISS operations. Thus, ARISS-USA continues to need financial contributions to fund their ongoing activities, and especially volunteers to help manage all those contacts. I recommend ARISS as one of the best investments you can make for insuring Amateur Radio has a future.

Disclaimer - I was on the 2021 ARDC Grants Advisory

Committee when ARISS-USA's grant was considered. The views expressed here my own; I do not speak for ARDC, and they don't speak for me.

TAPR Forum

I also attended the TAPR Forum at Hamvention 2022. There's renewed energy at TAPR with new projects (some funded by ARDC grants).

The presenters were Scott Cowling WA2DFI, John Ackermann N8UR, John Hays K7VE, and Nathaniel Frissell W2NAF (the YouTube description, apparently supplied by Hamvention, is not accurate).

One new detail was that the 2022 ARRL and TAPR Digital Communications Conference (DCC) may be held in person... or may (like the 2020 and 2021 events) held virtually - TAPR has not yet decided. If it is held in person, it will be in Charlotte, North Carolina, USA.

One of the things WA2DFI mentioned in passing is that TAPR now has "WSPR Kits" for all Amateur Radio HF bands - 160 meters (1.8 - 2.0 MHz) through 10 meters (28.0 - 29.7 MHz). These are small boards that mate with a Raspberry Pi (Hardware Attached on Top - HATs) and provide minimal filtering and very minor amplification for the chosen band. The "magic" of

generating a WSPR signal is done entirely in software on the Raspberry Pi. Thus a "Software Defined Transmitter" (kind of novel...) combined with the familiar and capable Raspberry Pi computers makes for an unusually interesting project for a new Amateur Radio Operator.

The 10 meter version is specifically interesting because 10 meters can be used with manageable sized antennas, and it's a band with occasional HF (like) propagation that US Amateur Radio Technician class operators can use. Thus if you want to expose an Amateur Radio operator with a Technician class license to the wonders of HF operation, WSPR on 10 meters should be an easy and fun way to do so without the (sometimes not-so-subtle) pressure to upgrade their Amateur Radio license to General. I was able to purchase two 10 meter WSPR boards at the TAPR booth - one of the few purchases I made at Hamvention. I think this will be a project for my daughter Merideth KK7BKI and I; we'll set one up at each of our homes (she lives in an apartment, but does have a balcony) and see which of our locations works better with the same system - same Raspberry Pi, same antenna, etc.

WA2DFI talked about the status of various TAPR projects, mostly the Tangerine SDR, and the workarounds they've had to do because of the ongoing chip shortage that has especially impacted "hobby" type projects such as TAPR's projects.

N8UR talked about the SynthDO GPS Disciplined Oscillator Project. More and more Amateur Radio systems benefit from an accurate timebase, so this was of more interest than usual to me. N8UR mentioned that a follow-on to the current version of this project will be a “Time Nuts” version with even more inputs and outputs.

K7VE gave an overview of ARDC’s activity and encouraged folks (especially this audience, interested in what TAPR is doing) to apply for ARDC grants and what ARDC looks for in a grant proposal.

W2NAF talked about “Traveling Ionospheric Disturbances”, one of the activities of HamSCI. One of my regrets at Hamvention 2022 is that I didn’t make time to visit the HamSCI booth; that’s my loss because they are one of the most energetic groups at Hamvention, and spending even a few minutes with them just energizes you. As with the ARISS-USA Forum, watch for yourself:

<https://www.youtube.com/watch?v=tt1EZRcBxSg&t=20s>

Disclaimer - I was on the 2021 and 2022 ARDC Grants Advisory Committee when TAPR’s grants were considered. The views expressed here are my own; I do not speak for ARDC, and they don’t speak for me.

SDRplay’s Stealth Exhibit at Ham Radio Outlet Exhibit

SDRplay’s Software Defined Receivers are one of my favorites for high performance at reasonable cost, and they’re my primary recommendation when I’m asked about SD Receivers. I managed to miss SDRplay at Hamvention 2022 as they were not on the official Hamvention exhibitor list so I didn’t know to look for them. Argh!

Oh well, like you other non-attendees, I can catch up on the latest developments from SDRplay, presented at Hamvention 2022, via YouTube:

https://www.youtube.com/watch?v=qTXEH_yPKII&t=4s

Since I have no firsthand knowledge, here’s the description from an article of what SDRPlay demonstrated at Hamvention 2022:

“At Hamvention in Dayton, Ohio, SDRplay demonstrated the core underlying technology behind “SDRconnect”. “SDRconnect” will be the new name for the multiplatform version of SDRuno (up till now we called it SDRuno V2).

“At Dayton, SDRplay demonstrated the completely rewritten Core DSP engine for Spectrum and Waterfall displays – with the prototype software running on a Mac M1 computer. We are also showing the networking capability by remotely accessing an RSP based in the UK. This is still an early stage demo, and

the software team have a lot to do to complete the graphical user interface. Work is underway on the new graphical user interface which: Retains the style and popular features of SDRuno Offers a more consistent and intuitive layout Addresses fixes and improvements suggested by users ever since SDRuno was first adopted. SDRplay plans to release the first version of SDRconnect before the end of 2022. SDRplay is planning that SDRconnect will fully support the older obsolete RSP2 and RSP2pro products, although the original RSP1 (phased out in 2017) cannot be supported by SDRconnect. (SDRuno V1.42 will continue to be available for RSP1 users). The new graphical user interface will bring a lot of advantages based on what users have been asking for – like more consistency in the way panels and menus are organised making it more intuitive and easy to use, and the ability to lock panels together.”

One of the few complaints I've heard about SDRplay's products is that their supplied software is... (hopefully soon that gets modified to was) Windows-centric - glad to hear that's being fixed.

M17 Project Developments

At Hamvention 2022, M17 Project was represented at the Bruce Perens K6BP / HamOpen.org exhibit by Ed Wilson

N2XDD (a Zero Retries subscriber!). One mystery that got cleared up about M17 being simultaneously “sponsored” by HamOpen.org and Open Research Institute (ORI) was that ORI chose not to attend Hamvention 2022, and K6BP thought that M17 Project should be present at Hamvention 2022, so K6BP extended an invitation to M17 Project to exhibit at his exhibit table and N2XDD accepted on behalf of M17 Project. They showed off some cool stuff.

Module 17 is a built-for-purpose hardware module:

“This project provides a standalone smart microphone that transforms any 9600 baud capable transceiver into an M17 compatible radio. It is based on a STM32F4 microcontroller and is designed to run the OpenRTX firmware. Audio and PTT connectivity is given through a “Kenwood 2 Pin” compatible connector (2.5 and 3.5mm audio jacks).”

According to N2XDD, Module 17 is pretty close to “good enough” to use to start doing experimental M17 digital voice if you have access to any data radio that has a flat audio connection. N2XDD said that M17 Project's hope is to condense Module 17 into the form factor of a handheld Push-to-Talk microphone. I offered feedback that, in my opinion, Module 17 was good enough and I would buy a pair if they were made available. In fairness, being an open source project, I'll guess

that all the relevant information is available to build your own Module 17... I'm just saturated with projects at the moment, and putting together my own Module 17 from disparate parts is, at the moment, one project too many.

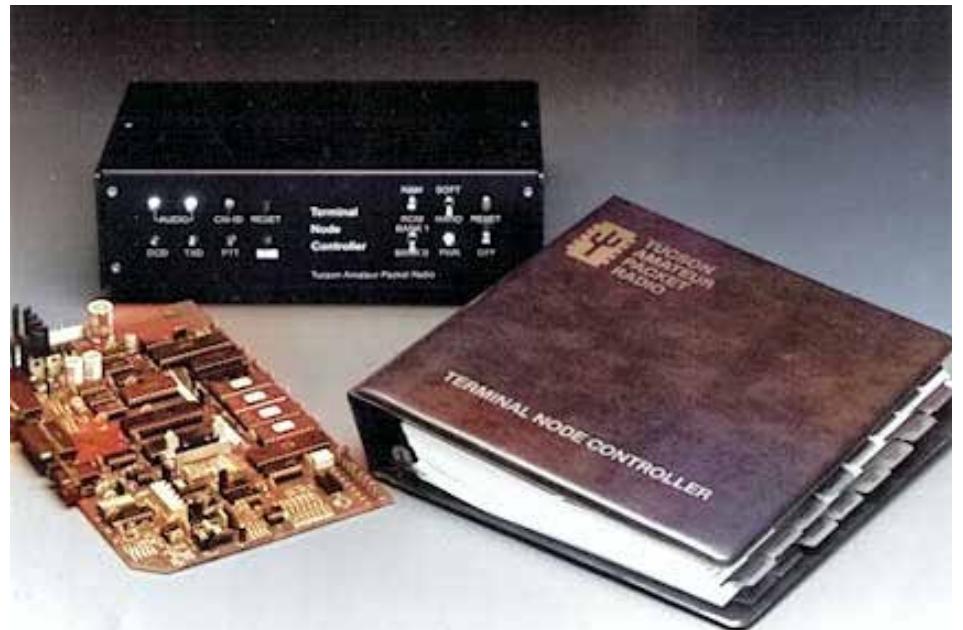
A second item being exhibited by M17 Project was a portable radio that had been modified with OpenRTX firmware, and some very minor hardware mods (but involving surface mount components, so not quite "easy"). If I understood things correctly, you could talk between Module 17 + "flat audio connection" radio and a portable radio running OpenRTX firmware - all via the M17 open source protocol plus open source digital voice CODEC (CODEC2).

A third demonstration was an implementation of a MMDVN hat that incorporates M17.

These developments finally feel, to me, like tangible progress for the M17 Project and it looks like M17 on-the-air activity, for experimenters, could begin soon. Here's the now obligatory YouTube video from Hamvention 2022:

<https://www.youtube.com/watch?v=FTVCyJwRzLQ>

###



Forty years ago, TAPR introduced the Terminal Node Controller

'Hot' Welcome to a Foreign Ham in Greece

By Miroslav "Misko" Skoric, YT7MPB

In late Summer 2021, I was invited to participate in the 26th IEEE Symposium on Computers and Communications (ISCC 2021), held in Athens, Greece (EU). And before that event I managed to attract Manos Darkadakis, SV1IW, the newly elected president of RAAG (Radio Amateur Association of Greece) to join me in writing a good lecture proposal where some practical demo and ham gear display shall be included. After we received the acceptance from the conference organizers, it was the time to apply for special call signs. I preferred a special prefix & number for Greece while to keep my original suffix for a VHF/HF packet-radio node and BBS/Winlink RMS portable facility, as well as another special identifier for both myself and Manos, to celebrate the Institute as then special event organizer. In that direction, SV1IW prepared the application form well in advance, so I was granted J41MPB for my temporary packet/pactor operation, and SX021IEEE for making our project visible globally by operating FT8, CW, SSB, and other modes preferred by OM Manos.

For the HF demo, I asked my local radio club "Novi Sad" (YU7BPQ) to let me travel with the club's old portable HF radio, while Manos brought his power supply and an HF antenna. The club printed for me, signed & stamped all documents telling the ownership of the radio, including copies of the radio's license (issued by Serbian governmental regulator), my own license, HAREC proof, and so on. I added to the travel bag my own

MFJ-904H portable antenna tuner, SCS Dragon DR-7400 modem for pactor email exchange and 'robust packet' APRS, RIGblaster Plug'n'play for VHF APRS, RIGblaster Advantage for HF 300bd APRS, and SCS Tracker TNC as a stand-alone 'vehicle/vessel tracker' simulator. I also prepared few GPS-mouse receivers of Yuechung International (YIC) and a hand-held GPS receiver of Bad Elf. The set of VHF/UHF portable radios included Retevis RT82, Radioddity GD-77 and GD-73, as well as ADI AF-16.

Apart from cables that were packed within my checked-in luggage, all the radios, modems, and other electronics traveled within my cabin luggage. I had also prepared in advance the list of electronics I traveled with, handed it to Serbian Customs officials and showed the content of the bag so they then returned the list stamped & signed. (That's the way I go every time when I cross national borders to avoid any import procedures upon return.) So far – so good.

After landing to "E.Venizelos" airport in Athens, I initiated contact with Greek Customs office in Arrival area, to inform them about having some electronic devices as part of my personal luggage, and asked them if the Greek Customs office may wanted having a copy of the equipment list notified by the Serbian Customs. (I always initiate contacts with foreign customs authorities when crossing borders to avoid any problem with

carrying electronics when depart from a country I visited.)

What I did not expect was that officials of the Greek Customs office would behave very rude and unfriendly. At first it looked that they did not understand what I wanted them to do. So I showed them documents that proved that the electronics I had with me were duly registered with Serbian authorities so that all instruments will be returned back to Serbia after the conference is over and I leave Greece. I added that neither of my devices were new purchases, and instead they were used for a long time (some of which for more than 10-15 years).

Surprisingly, the Greek Customs officials asked me to pay 500 EUR for some Greek tax (VAT?) even though the instruments were parts of my personal luggage that I frequently had with me whenever I participated in similar activities abroad. I repeatedly tried to explain that those devices were my own belongings, and some were the property of the radio club in Serbia (where VAT and import taxes were also paid long ago), and that the devices were only temporarily brought to Greece for performing amateur radio tests as my personal free-time hobby and in favor of a non-profit technical session within a respectable international event in Athens, so they all will be returned back to Serbia after two weeks. However, Greek Customs officials insisted that I had either to abandon my instruments, or to pay 500 EUR for VAT (and then go freely), where that amount would *not* be refunded back to

me prior to my departure. You bet, I found that as not acceptable. Nevertheless, they told me that as an option I may wanted to hire some “broker company” that handles import/export procedures for businesses, to process documentation for my electronics, and in that case a part of those 500 EUR would be given back to me at departure. I tried to explain to the customs officials that it was also not possible because I did not come to Greece as a “commercial businessman” or a “company” by any means. Instead, I was a tourist guest of Greece who was self-sponsored (not sent by any state, governmental, or commercial entity in Serbia or elsewhere), and that the instruments I had were just temporarily brought for a short-term use as my personal things.

Nothing helped. The customs officials treated me in a very unpleasant and inhospitable way - even though I repeatedly showed them all permissions to operate in Greece and the simple fact that it was my initiative to establish contact with them; I self-reported my instruments without any intention to cross the border carrying any ‘hidden goods’. I repeat again, the equipment was the part of my personal luggage that I was using at home and elsewhere in Serbia where all taxes (VAT, import fees, registration taxes, etc) were already paid at the time of purchase or import, and neither item was brand new. All radios were already properly registered according to the European regulations, and I had my valid internationally-recognized operator’s license, as well as the

special license for using the equipment in Greece. I also suggested them to contact Mr. Manos Darkadakis for details.

Despite all my efforts to explain my position, Greek customs officials took away all my radios, modems and other equipment (including the cabin bag where I carried my things), and told me to go out of their office. I was only given a handwritten piece of paper (written by one female customs official) with an unrecognized street address, so I had to pay a costly taxi ride to search for the broker location (unknown to the taxi driver) - even though I was a foreigner in Greece and had no idea how to handle that situation. When I finally managed to find a broker company building and their offices, I asked the employees there to investigate my case and insist at the Customs to return me back my personal belongings. However, the broker employee Akis Xanthopoulos told me that I had to pay him 500 EUR to start the procedures. As I did not have any cell phone with me I could not ask anyone for help or other assistance, so I did not have any choice but to hand over 500 EUR in cash to the broker. I did *not* get any receipt in return for the amount of money I gave him. He only told me that he was going to start the procedures, and that I would need to come back to the Customs office a day later (at the airport) where he would wait for me.

The same day (August 31) I made a telephone contact with Mr. Darkadakis, so the next day (September 1) he and his wife,

Mrs. Darkadakis (the secretary of RAAG amateur radio society) escorted me to the broker's office and the customs office at the airport, in trying to resolve that unpleasant situation. However, the customs officials insisted that I needed to pay VAT in Greece, but mentioned that the amount I handed over to the broker (minus the broker service fee: 500 EUR - 150 EUR = 350 EUR) would be returned back to me prior to my departure from Greece. (However, as I said, I was forced to give the broker 500 EUR at my arrival to Greece, and in the same time I lost two precious days for preparing technical experiments needed for a quality conference lecture.)

On September 15, Mr. & Mrs. Darkadakis escorted me to the airport (incl. visiting the broker company office and the customs office). The broker gave me back only 250 EUR, without any bill or receipt. He told us that some unspecified 'customs fees' further reduced the amount given back to me. That was not the end of the story: He added that I would not get any official receipt because I was "not a [business] company" and that he and other brokers worked "only with companies". There were 3-4 other broker employees in their office. They all smoked cigarettes in front of me and Mrs. Darkadakis, and none of them used COVID-19 masks despite formal measures against the pandemic. It was amazing to see those brokers trying to collect 250 EUR from their own pockets to give me back. To make things worse,

all those customs & broker procedures prior to my exit from Greece took several hours, even though neither the customs officials nor the brokers showed any interest for inspecting my luggage for content. Obviously they were only interested in getting my money!

After returning back home, I felt very embarrassed because of the rude and treatment by Greek Customs at the airport, even though I came from a country that have always had good relationships with Greece. So I emailed Greek Embassy in Belgrade, asking for reimbursement and thoroughly investigation of that unpleasant situation including behavior of Greek Customs officials who, by the way, also did not wear masks, talked to me and each-other in Greek language that I did not understand, while their English was poor. The Greek embassy responded by suggesting me to fill in a complaint to the same office that had asked me to pay for VAT (without specifying instructions on how to do that and whether I would need to travel to Athens again -just to fill in the complaint?) They also suggested to contact the Embassy of the Republic of Serbia in Athens.

For many times I was a speaker in similar events across Europe and other continents, but I was *never* treated the same way as this time in Greece. Not to mention that I am a retired person who sponsored my expenses in Greece on my own. I have been a

licensed radio amateur for more than three decades and, among the others, I served as the secretary in Serbian amateur radio clubs & unions. Having said that, I visited Greece for several times for scientific meetings and covered my costs from my own pocket.

Unfortunately, after having experienced such a bad treatment during my last visit, I referred to Serbian Ministry of Foreign Affairs. They instructed me to contact the Embassy of the Republic of Serbia in Athens, so I did. The embassy responded by telling me that AADE, an independent institution for public incomes and general direction of customs and special taxes, email ddtheka@aade.gr, tel. 0030210 6987500 or 498 or 499, was in charge for cases like mine. The embassy told me that their officials have contacted AADE and were told that I shall forward to AADE any receipt or bill I was given at the airport, including describing circumstances and my equipment, so that AADE could get 'a proper picture' of the case.

I did so (and repeated more than once) since October 2021, including the documents I was given at the Athens airport, but never got any response.

###

Write Here!

Your *PSR* editor is working on the next issue of *PSR* and hopes to find a few good writers, particularly ham radio operators working on the digital side of our hobby, who would like to write about their activities and have them published here in *PSR*.



You don't have to be Hiram Percy Maxim to contribute to *PSR* and you don't have to use *Microsoft Word* to compose your thoughts.

Your *PSR* editor can handle just about any text and graphic format, so don't be afraid to submit whatever you have to wallou@tapr.org --- she can handle it!

The deadline for the next issue of *PSR* is October 15, so write early and write often.

###

On the Net

By Mark Thompson, WB9QZB

Facebook

As you may know, TAPR has a Facebook page, www.facebook.com/TAPRDigitalHam.



However, I also created a TAPR Facebook Group, www.facebook.com/groups/TAPRDigital/.

If you have a Facebook account, "Like" the TAPR Facebook page and join the TAPR Facebook Group.

If you join the group click on the Events link and indicate you're Going to the events.

On Twitter, Too



Access the TAPR Twitter account at www.twitter.com/taprdigital.

Also on YouTube



TAPR now has its own channel on YouTube: the TAPR Digital Videos Channel: www.youtube.com/user/TAPRDigitalVideo.

At this time, there are a slew of videos on our channel including many from the TAPR-ARRL Digital Communications Conference (DCC) that you may view at no cost, so have at it!

###

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