



2021 New Mexico TechFest

Speaker Bios and Presentation Abstracts

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Presentations

Modern DSP Tools for Amateur Radio **by Richard Naething AE5JI (San Antonio, Texas)**

Presentation Abstract:

Moore's law and other similar trends including improvements in oscillator stability, performance of analog-to-digital converters, and increasing complexity of systems on a chip have progressively driven the signal processing in communication systems from the analog and towards the digital domain. The ham radio operator has benefited indirectly through lowered cost and increased performance of commodity radios. However, there is also significant potential for the ham experimenter to benefit directly from the wide variety of available digital signal processing methods. This talk will provide a brief overview of digital signal processing, introduce some of the more promising tools and techniques currently available for the amateur community, and conclude with ideas on potential future research.

Speaker Bio:

Richard Naething is an electrical engineer at Sandia National Laboratories. His team develops radar systems and algorithms that today are used for diverse applications such as finding military targets, maritime search and rescue, facilities and border protection, and crevasse detection to determine safe landing strips for emergency air vehicles. He is stationed in San Antonio on special assignment as a visiting researcher at the National Security Collaboration Center at UT San Antonio.

He has five patents in the fields of radar and digital communication systems and has authored several publications on radar and signal processing.

He is active in the ham radio community and is a member of the Amateur Radio Relay League (ARRL), the Sandia National Laboratories Amateur Radio Club (W5MPZ), and Rocky Mountain Ham Radio. He is particularly interested in weak signal propagation, QRSS, and digital modes.

Richard Naething graduated from Rensselaer Polytechnic Institute with a bachelor's degree in computer and systems engineering in 2004. He pursued graduate studies at The University of Texas at Austin, receiving a master's degree in 2006 and a doctoral degree in 2010, both in electrical engineering. Richard joined Sandia National Laboratories in 2010.

Through Earth Communications Systems for Cave Studies by John Lyles K5PRO (Los Alamos, New Mexico)

Presentation Abstract:

Besides operating amateur radio, John spends a lot of time exploring and mapping caves. Some of these are long and are entered for multiple days using underground camps. One New Mexico project is Fort Stanton Cave, now being explored over 10 miles from the single entrance. This distance requires hiking and crawling for up to 8 hours to reach camp. Being able to stay in contact with a surface team is an appealing concept, especially in case of injuries, illness or flooding. Pulling John's two passions together -- amateur radio and caving -- is challenging as propagation through the earth is far different than through the air. Early cave communication systems used 185 or 87 kHz AM and SSB voice via magnetic loop antennas. These worked using the magnetic near field. There is an optimal 30-40 kHz range where one could build a simple DSB radio system for voice. An even lower frequency magnetic field radio is a 3496 Hz underground beacon and a linear receiver without AGC on the surface for radiolocation. W1IR has designed a complete system that we use for a number of experiments at FSC where we can determine where a point underground is located as projected by the field lines to the surface. What about HF radio? Experiments in the southwest and in UK have demonstrated that 80 and 40 meter propagation can be effective, especially through moderate rock thickness in semi-arid regions. Two years ago at Techfest John discussed a QRP HF PSK31 communicator on the 30 meter band that was being considered. A two-way digital communication link was developed using compact commercial PSK transceivers and old PDAs as terminals. Plans are to test it in a cave near Albuquerque this winter.

Another project is for monitoring sensors for scientific studies. We have a project with the Bureau of Land Management to have a distributed mesh network for low data rates that can run over a year on batteries. The quasi-real time sensor network can relay measured air conditions such as temperature, air movement, air direction, and CO2 content, and similar water conditions in the intermittent stream channel in FSC. The telemetry is sent to the surface and to a nearby facility. Most Internet of Things radios are intended to operate on mains power or with free sources such as photovoltaic, neither of which is available in a cave. The unlicensed 915 MHz band will be used, based on antenna size and propagation characteristics of tunnels. A hardware variation of the Zigbee standard called Xbee will be used, using DigiMesh protocol. It is optimized for battery life as nodes will remain asleep with little power consumption, waking up predetermined times to pass traffic. Challenges besides the environment include getting low power signals through metal gates and the propagation anomalies that may hamper transmission through lossy-walled passages.

Speaker Bio:

John Lyles was first licensed in 1971 (WB4PRO). He has been a designer of high power RF amplifiers for radio broadcast, industrial and scientific applications. In 1992 John joined Los Alamos National Laboratory as a R&D Engineer, developing several high power amplifier systems for a proton accelerator. He upgraded to K5PRO with Extra Class license in 1997. His

other hobby is cave exploration, where he has helped find and map miles of new cave passages. He owns property with a cave east of Albuquerque, and uses this as a test bed for underground communication concepts.

Grounding and Bonding for Home HF Stations by Ward Silver N0AX (St. Charles, Missouri)

Presentation Abstract:

Definitions of grounding and bonding, along with other basic concepts, for ac safety, lightning protection, and management of RF current and voltage in the station. Recommended and safe practices are covered, along with some examples, and a set of references that are available as books and online.

Speaker Bio:

Licensed since 1972, Ward is the Lead Editor of the ARRL Handbook and the ARRL Antenna Book, and is the author of all three ARRL License Manuals and study guides. He released the well-received "Grounding and Bonding for the Radio Amateur" in 2017 and recently authored the third edition of Ham Radio for Dummies. An electrical engineer, he designed microprocessor-based products and medical devices for twenty years before beginning a second career as a teacher and writer. He is a co-founder of the World Radiosport Team Championships, was inducted into the CQ Contest Hall of Fame in 2015, and is President of the Yasme Foundation.

Batteries: Their Chemistries, Care and Feeding by James Cizek KI0KN (Loveland, Colorado)

Presentation Abstract:

The amateur radio hobby finds us using batteries all the time. James will focus on the two main chemistry families usually found in our hobby, Lead-acid and Lithium. You will learn about what's inside these batteries, why they work, and most importantly, how to care for them to get the most life from your investment. The presentation will touch on the best practices for charging, storing, and some basic testing of each battery type. It will also provide you with the needed information to try to rescue a battery that may not have been treated quite right. You'll learn how to keep the newer lithium chemistries stored and used safely as well.

Speaker Bio:

Although an active SWL'er from childhood, and brought into the hobby by encouragement from his father, WORAE, James was first licensed in 1994 as KB0RDP, eventually keeping the Advanced class callsign KI0KN on the way to Extra. Today James sits on the board of the

Northern Colorado Amateur Radio Club as the Technical Chair, and serves on the board of Rocky Mountain Ham Radio - Colorado as a director. Although almost exclusively doing work on repeaters for the clubs, his true passion in amateur radio is DXing. Currently holding various DX Certificates on his way to honor roll, his current country count is 218. James' favorite mode to work is CW, highly inspired by a late friend friend, W0CGR to become a top notch QRQ CW Op. When not attending to his "radio job", he is an IT manager for Colorado State University, Fort Collins, starting out in Atmospheric Science, and for the last 25 years, working in the Central IT division.

What Kind Of Solar Cycle Awaits?

by Dr. Scott McIntosh, Deputy Director of National Center for Atmospheric Research (Boulder, Colorado)

Presentation Abstract:

There has been a lot of interest in forecasts of the strength of Sunspot Cycle 25 given that the new cycle has officially started. In this presentation I'll discuss the relationship between the Sunspot Cycle and the underlying (magnetic) Hale Cycle and how that relationship can help us understand what the Sun might be doing. Further, as a result of this relationship we have a better sense of how the Hale Cycle shapes the amplitude of sunspot cycles. Finally, I'll discuss how we arrived at our "out of the box" forecast - that SC25 could be large - and why that forecast is contrary to the opinion of dynamo experts. Finally, I'll present an update on the early growth of SC25 and look at how our forecast is tracking against reality.

Speaker Bio:

Scott McIntosh is the Deputy Director of the National Center for Atmospheric Research (NCAR) and the former Director of the High Altitude Observatory (HAO). Scott received his First Class Honors Degree in Mathematics and Physics and his Ph.D. in Astrophysics from the University of Glasgow, Scotland. Scott's research in the field of solar physics has focused on three main areas: the detection and impact of magnetohydrodynamic waves; the detection and understanding of ultraviolet and extreme ultraviolet radiation; and understanding the decadal evolution of the solar plasma. Scott has authored, or co-authored, over one hundred and thirty journal articles since receiving his Ph.D. in 1998. Those articles include more than fifty as first author, eleven in high-profile (six articles in Nature and five in Science). His current "H-index" is thirty-eight and he has over 6,300 citations. Recently Scott has examined the evolution of ubiquitous emission and magnetic features in the Sun's outer atmosphere that demonstrate a clear link to the processes which drive the (quasi-)periodic appearance of sunspots. Monitoring the evolution of these features can help us understand how the Sun's radiative, particulate and eruptive output modulate on annual, decadal with a real insight into evolution across weekly, seasonal, decadal to the centennial scales that are pertinent to climate through the detection of magnetized Rossby waves in the sun's interior.

QRSS – Then and Now

by David Hassall WA5DJJ (Las Cruces, New Mexico) and Scott Harden AJ4VD (Gainesville, Florida)

Presentation Abstract:

QRSS is an experimental low-power ultra-narrowband radio mode that uses frequency-shift keyed Morse code to send messages that are decoded visually by inspecting radio frequency spectrograms. The term “QRSS” is a play on the “QRS” Q-code used by CW operators to indicate the transmitter should slow down, and with a typical data transmission rate near one letter per minute QRSS is slow indeed! This niche field of amateur radio experimentation is unique because the transmitter can be extremely simple and use very little power (typically less than 1 watt) yet can send messages all over the world.

In this presentation Scott Harden (AJ4VD) will review the fundamental concepts underlying QRSS and discuss common transmitter designs, software packages, and web tools that support QRSS transmission and reception in the modern age. David R Hassall (WA5DJJ) will then share his adventures in QRSS experimentation that started in 2008 and followed through the present day. He will discuss the equipment built from scratch or created using modified amateur radio equipment. David will share his experience transmitting extremely low powered signals over long distances using simple equipment and antennas. Modern experiments that equip free flight balloons with WSPR and QRSS transmitters will also be discussed. This presentation will explain how you too can get started experimenting with this fascinating part of the hobby using your own MANNED EXPERIMENTAL PROPAGATION TRANSMITTER and/or QRSS Grabber.

Speaker Bio:

David R. Hassall WA5DJJ grew up in Dulce New Mexico, Joined the U S Navy after graduating from Dulce Public High School, Served in Vietnam in 1964-1965 and again in 1970-1971. I served in the following ships: USS Mount Baker AE-4, USS Ranger CVA-61, USS Yosemite AD-19 and the USS IWO JIMA LPH-2. I retired from the Navy in 1981 as a CWO-4 Electronics Officer and Joined the TRW company as an Integration and Test Engineer for the Tracking and Data Relay Satellite System. I worked in various other programs during the 14-year career at TRW and retired in 1995 as a Senior Member of the Technical Staff. My Amateur Radio Career started as a Novice in February 1959, upgraded to Technician class about 6 months later and then to advance class in 1967. I finally made it to Extra class in 1996. I really enjoy all the facets of Amateur Radio Operation and home brewing. I do my best to help up and coming Amateurs to get on the air and keep the Old timers active in the hobby. Rocky Mountain Division Amateur of the year in 2003, Rocky Mountain Division Technical Achievement award in 2012 and New Mexico Section Ham of the Year in 2017 are the awards I have received since I retired and I greatly cherish. I started chasing the QRSS QRppp signals in 2008 and just can't stop. The furthest I have contacted has been 1,640,000,000 miles/watt and I have worked the world with less than a watt. Chasing the little signals can be just as much fun as chasing the Big ones and it can be done on a small budget.

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Dr. Scott W Harden AJ4VD is a biological research scientist with a passion for technology and a love for amateur radio experimentation. Scott first discovered QRSS in 2008, and his interest in the subject led him to get his amateur radio license in 2009. For the last several years Scott (with support from the QRSS Knights community) has maintained QRSS Plus, a web application that allows anyone with an internet connection to see live QRSS spectrograms from all over the world. Scott is the author of FSKview, a free and open-source QRSS and WSPR spectrogram viewer.