2019 New Mexico TechFest
Speaker Bios and Presentation Abstracts

Presentations

Beyond Line-of-Sight UHF Digital Communications with the LoRa Spread Spectrum Waveform
by Dan Fay KG5VBY (Albuquerque, NM)

Presentation Abstract:

Semtech's LoRa transceiver products, utilizing Chirp Spread Spectrum (CSS) modulation, provide high receive sensitivity for low-power, Internet-of-Things (IoT)-like devices. While Semtech's LoRa transceivers are designed to provide Line-of-Sight (LoS) ranges of several miles with modest radio hardware (i.e., small duck antennas, and 25-100mW Tx power levels), the high receive sensitivity (up to -138dBm or more) of a LoRa transceiver allows for leveraging common VHF+ DX techniques to achieve ranges beyond radio line-of-sight. By using higher power levels (5W/37dBm or more), high gain antennas (14.8dBi base station Yagi, 12.4dBi mobile Yagi), and horizontal polarization, it is possible to achieve Beyond Line-of-Sight (BLoS) packet radio communications using LoRa on the 70cm band. This presentation will discuss digital communications using the LoRa waveform, how BLoS communication is achieved at VHF+ frequencies, the experimental setup used, and the real-world test results. To the best of the author's knowledge, the 218km LoRa ground-based LoRa communications distance discussed in this paper is the longest ground-based (ground station-to-ground station) LoRa communication on record.

Speaker Bio:

Dan Fay, KG5VBY received his amateur radio license in September 2017. He lives in Albuquerque, NM with his wife and two daughters. He received his Ph.D. in Electrical Engineering from the University of Colorado at Boulder in 2011, an MS in Electrical Engineering from the University of Colorado at Boulder in 2007, and a BS in Computer Engineering from the University of Illinois at Urbana-Champaign. He currently works for Sandia National Laboratories as a computer engineer.

Hands-on with SWR, Reflections, and Impedance
by Chris Hamilton AE5IT (Denver, Colorado)

Presentation Abstract:

What is Standing Wave Ratio? A little box on our desk tells us a number and we fiddle with dials or trim our antennas in order to keep that number low. But what does SWR really mean, what's really happening on the transmission line, and is high SWR really always bad? Using simple equipment, we will directly observe reflections and standing waves, and we will explore ways to make it all work for us instead of against us.

Speaker Bio:

Chris Hamilton AE5IT (ex KD0ZYF) was first licensed in 2014 so he could call for help in the wilderness. Although a lifelong nerdy kid and tinkerer, he somehow never got into electronics; once licensed it wasn't long before that aspect of the hobby consumed his mind and soul. Now a no-code Extra, he probably holds the lowest Morse-weight call in the room *because hubris*!

Getting on 24 GHZ: Part 2
by Bill Schwantes W7QQ (Santa Fe, NM)

Presentation Abstract:

Last year at the New Mexico Tech Fest Bill presented his effort to get on 24 GHz taking two approaches. That development led to a working 24 GHz station. This year he will describe the resulting station and present the performance results of that effort during local operations in New Mexico and his participation in the ARRL 10 + GHz contest while operating across Lake Superior, Michigan. He will describe the unique propagation encountered at the Lake and discuss how that affects 10 and 24 GHz communications with participants in Northern Minnesota and Canada. Bill will review the ARRL 10 GHz + contest format, discuss his goals and comment on the event organization. He'll wrap up the presentation with a brief description of a future project to get on the 47 GHz ham band.

Speaker Bio:

After a long school boy fascination with ham radio, Bill Schwantes, W7QQ was first licensed in 1967 as KL7GHS while on isolated duty on a US Coast Guard LORAN Station in Southeast Alaska. He had a long career with Lockheed Martin as a mechanical engineer. His propulsion and ordnance experience brought him to Albuquerque in 2006 where he worked on a Targets and Countermeasures program until he retired. Bill's amateur radio interest is focused on VHF and higher frequency operations. He has been a VHF contester and Rover since 2012 and, with a small group of active VHF'rs started the New Mexico VHF Society. Bill continues to push the frequency envelope well into the microwave bands and helps others get started in that fascinating corner of the ham radio experience.

This is Only a Test…
by Scott Johnson AD5U (Midland, Texas)

Presentation Abstract:

Scott Johnson, AD5U, will present an overview of testing procedures and the gear required to check out a typical FM radio (although this applies to many AM and digital radios as well). He will explain a bit about the various measurable parameters, typical methods to test them and his favorite part, "Why do you care?". Through slides and equipment, he will cover such items as an oscilloscope, spectrum analyzer, frequency counter, power meter, return-loss-bridge, Rubidium frequency standard, frequency generator, SWR/Return Loss meter, Distance-to-fault meter, FM Deviation meter, and SINAD and distortion meters. This fast-paced presentation will end with an actual test measurement of some device that will require the use of the RF frequency generator and spectrum analyzer, such as a filter or duplexer, to show some of the test equipment in action with equipment a Ham might own or operate. While some of the test gear can be used to test APCO-25 (P25) radios this will NOT be covered, rather it will be primarily geared at typical Ham FM radios to allow time to cover all the bases. As an overview-only presentation it is not intended to be a training-type presentation, rather to show the wide variety of functions needed to test radios and some of the equipment with those functions. One can expect to see cool test gear from such leading manufacturers as IFR, Aeroflex, Hewlett-Packard, Bird, and others.

Speaker Bio:

Scott Johnson, AD5U, has worked in the "Oil Patch" of West Texas and Southeast New Mexico since 1978. He has been involved in the design, manufacture, installation, and maintenance of instrumentation, control and communications gear throughout the area. Also a computer specialist and certified programmer, he has been recognized in Federal and Texas state courts as a computer forensics expert. Currently employed by the largest energy infrastructure company in North America, he enjoys working at maintaining the various communications systems needed for a mega-corp. He has fun and exciting days (sometimes nights!) working on telephone circuits and PBX systems, low-band truck radio/repeater systems, Cisco and Juniper network installations, UHF radio/repeater systems for plant operations and microwave links that tie everything together on about 24 radio tower sites. For automation and control telemetry (SCADA) in the field he has great sport with 900MHz master/remote radio systems, CDMA (cell data modems), point-to-point Ethernet radios and satellite systems. He has personally collected test equipment and has access to advanced test gear through his employment allowing him to bring his expertise (and toys) to the 2019 TechFest. On the Ham Radio front, he really enjoys operating HF, using local repeater systems, operating digital modes and satellite ops, making antennas and kits, and anything to do with a Raspberry Pi computer and a radio. Scott has previously been involved with Jamboree-on-the-Air for over 15 years and has put youth from "6 to 60" on the air. He claims that the grin on their face from their first contact is the same for a 60-year old as a 6-year old…

Synchronization in FT8: What the heck is a Costas Array?
by Mike Hasselbeck WB2FKO (Albuquerque, NM)

Presentation Abstract:

FT8 is a sub-mode of WSJT-X that has become extremely popular for working DX because it enables fast, efficient communication in ultra-weak signal conditions. Forward Error Correction makes this possible, but requires that stations be synchronized to better than 20 ms in time and less than 1 Hz in frequency. Such precision is generally not attainable with amateur radio equipment using external reference clocks, so the protocol must supply its own synchronization signal. How this works, to the best of my knowledge, has never been documented by the WSJT-X development team. By careful deconstruction of the FORTRAN open-source code, the synchronization algorithm of FT8 has been unraveled. At its heart is a Costas Array, a specially constructed square matrix that was invented in the 1960's to improve the reliability of underwater sonar. An intuitive explanation of the Costas Array will be given, followed by a detailed description of its implementation in the FT8 decoder. Although state-of-the-art, complex signal processing is involved, this will be a graphical, no-equations presentation.

Speaker Bio:

Mike Hasselbeck, WB2FKO, was first licensed as WN2FKO in 1975 in Tonawanda, NY, a suburb of Buffalo. He obtained a BS and MS in Electrical Engineering from the University of Buffalo in 1981 and 1983, respectively, and spent a decade in the aerospace industry. He received a PhD from the University of Central Florida in 1995 as a Hughes Aircraft Company Doctoral Fellow, then joined the Air Force Research Labs at Kirtland AFB. In 1997-98 he was a Humboldt Fellow at the Max Born Institute in Berlin, Germany and spent 2010-11 as a guest professor at the University of Konstanz. He has been in the Department of Physics and Astronomy at UNM since 2001, where he is currently on the teaching faculty. His amateur radio interest is VHF/UHF weak signal communication and contesting. He is a founding member of the New Mexico VHF Society.

(Demonstration / Posterboard Presentation abstracts and bios next page)

Demonstrations / Posterboard Presentations

VHF/UHF HandiTalkie (HT) Test Table
by Scott Johnson AD5U (Midland, TX)

Presentation Abstract:

Scott Johnson, AD5U, states that one year at Ham Comm in Dallas, the ARRL had a table that could check the SWR and the actual transmit power of your favorite HandiTalkie and antenna. Much to his surprise, the 3rd-party, high-dollar, dual-band antenna that he thought so highly of was seriously worse than the factory "dummy load"! The claimed 5-watt output was measured at a meager 2.95 Watts. Scott plans to provide a similar (but more advanced) test setup to help his fellow hams quickly have a better idea of how their own favorite HT measures up. He will have a spectrum analyzer that will allow viewing of the bandwidth, clean or dirty rf spectrum and more. He advises that we bring our own most-beloved HT, set for FM-simplex on 146.52 and/or 446.00, without tone, to see how it compares to others. Don't bring the inexpensive stuff, he will already have tested a Baofeng or other cheapie HT for comparison.

Speaker Bio:

Scott Johnson, AD5U, has worked in the "Oil Patch" of West Texas and Southeast New Mexico since 1978. He has been involved in the design, manufacture, installation, and maintenance of instrumentation, control and communications gear throughout the area. Also a computer specialist and certified programmer, he has been recognized in Federal and Texas state courts as a computer forensics expert. Currently employed by the largest energy infrastructure company in North America, he enjoys working at maintaining the various communications systems needed for a mega-corp. He has fun and exciting days (sometimes nights!) working on telephone circuits and PBX systems, low-band truck radio/repeater systems, Cisco and Juniper network installations, UHF radio/repeater systems for plant operations and microwave links that tie everything together on about 24 radio tower sites. For automation and control telemetry (SCADA) in the field he has great sport with 900MHz master/remote radio systems, CDMA (cell data modems), point-to-point Ethernet radios and satellite systems. He has personally collected test equipment and has access to advanced test gear through his employment allowing him to bring his expertise (and toys) to the 2019 TechFest. On the Ham Radio front, he really enjoys operating HF, using local repeater systems, operating digital modes and satellite ops, making antennas and kits, and anything to do with a Raspberry Pi computer and a radio. Scott has previously been involved with Jamboree-on-the-Air for over 15 years and has put youth from "6 to 60" on the air. He claims that the grin on their face from their first contact is the same for a 60-year old as a 6-year old…

The RPi DV-Mega Hotspot with OLED Display – A Demo
by Ed James KA8JMW (Edgewood, NM)

Presentation Abstract:

This demonstration will highlight the DV-Mega Hotspot, a function-rich module that turns a Raspberry Pi into a 10-mW UHF hotspot capable of operating on DMR, D-STAR, and P-25 with or without repeaters nearby.

Speaker Bio:

Ed James KA8JMW first earned his novice license in 1978. Since then he's savored from the broad palette that amateur radio offers. Ed's activities have included the design and fabrication of various projects from DC to daylight, QRP, net operations, traffic handling, rag chewing, contesting, DXing, transmitter hunting, search and rescue, public service communications, ARES, youth promotion, satellite operations, EME, and elmering/mentoring many new hams.

Amateur radio runs deep in Ed's family. His father Art, now a Silent Key, was WD8MMG. His wife Carol (N5ZYP) and all five of his daughters – Rebecca (KD5PMX), Kim (KF5HOA), Amada (KF5CHH), Kathy (KE5WKW), and Sarah (KF5OAZ) – all hold amateur radio licenses. Ed has served as New Mexico Section Manager, New Mexico Assistant Section Manager, and Assistant Director of ARRL Rocky Mountain Division with a focus on emerging technologies.

SpaceVNX: A VITA Standard for High-Performance High-Reliability Small Spacecraft Applications
by Bill Ripley KY5Q, Jorge Piovesan, and Alonzo Vera KG5RGV (Albuquerque, NM)

Presentation Abstract:

The small satellite/nanosatellite industry has been successful in using Commercial-Off-The-Shelf (COTS) parts to enable low-cost high-performance space missions. The drawback of this approach is that it sacrifices the reliability of the spacecraft, which limits the applicability of these methods in more critical missions. The SpaceVNX standard, currently in development, is an ideal approach to address this limitation without substantially increasing the costs of deploying small spacecraft and in particular Cubesats. SpaceVNX (VITA 74.4) is an implementation of the VNX standard (VITA 74) that targets space and other high-reliability applications by providing means to use redundancy schemes in critical components of the system. This poster will provide an overview of the VNX standard, the SpaceVNX development, and an application scenario where Low-cost Radiation Hardened components are combined with high-performance COTS components in a SpaceVNX approach to obtain a high-performance, high-reliability system that fits in a Cubesat form-factor.

Speaker Bio:

Bill Ripley (KY5Q) is a seasoned Electrical Engineer with over 35 years of experience in the avionic / military embedded computer market; working half his career for a major helicopter / tilt rotor manufacturer's system integration and flight test organizations, and the other half for a COTS board and M-COTS system provider. He has been a mentor and guru for the data bus, computing, and integrated system market sectors supporting the advancement of technologies which have driven this market sector, as well providing guidance and vision as to how and where the Small Form Factor (SFF) rugged embedded marketplace should develop and grow. Bill has been active participant in the VITA Standards Organization (VSO), Vehicle Integration for C4ISR/EW Interoperability (VICTORY) standards committee, the Future Airborne Capability Environment (FACE™) community, as well as the European analog of VICTORY, the MILVA & NGVA groups. Bill is the Chairman of the VITA 74 standard.

Jorge Piovesan has expertise in embedded systems, including hardware design, integration, validation, and production. Jorge has taken embedded systems from conception to market in mission critical applications (first responders, and medical). His R&D experience includes projects from NSF, NIH, and NIOSH in cognitive radios, Medical IoT, and Robotics for First responders' applications. Prior to that, Jorge Piovesan's PhD work was in the field of Cyber-physical systems.

Alonzo Vera (KG5RGV) has Specialized in embedded system design for aerospace applications and dynamic partial reconfiguration applications using FPGAs. He has extensive experience using the OpenRISC core and toolchain. Numerous publications in conferences and journals and invited lecturer on FPGA design and DSP in numerous countries. Current areas of interest are reconfigurable computing, digital signal processing and cognitive radio.

Why FT8 Surpassed BPSK31 as the Most Popular HF Digital Communications Mode
by Jim Frazier KC5RUO (Albuquerque, NM)

Presentation Abstract:

Have you ever wondered why FT8 QSOs are so much easier to make than BPSK31 QSOs? Ok, other than the fact that there are a lot more FT8 operators on the air these days, FT8 can achieve perfect message reception at a significantly lower threshold signal-to-noise ratio (SNR) than BPSK31. This presentation describes the tests this amateur radio operator conducted in his ham station to derive the BPSK31 and FT8 threshold SNRs that result in 100% Message Percent Copy (MPC). Attendees will see how the difference in the receive threshold SNRs correlates to the transmit power levels needed to achieve the 100% MPC. Takeaways from this presentation are the FT8 WSJT-X, BPSK31 FLDIGI, and BPSK31 HRD DM780 Reported SNRs that correspond to the presenter's derived error-free message reception threshold SNRs.

Speaker Bio:

Jim Frazier, KC5RUO, received a BSEE from Penn State University in 1977 and a MSEE in Digital Communications from Air Force Institute of Technology in 1982. Jim is a retired USAF Officer Communications Engineer and a retired Honeywell Aerospace Project Engineer. He was first licensed in Nov 1995 and holds an Amateur Extra certificate. His primary interests are in the HF digital communication modes and emergency communications. He is a member of the Bernalillo County ARES Team and recently presented the ARRL New Mexico Section National Parks on the Air Top Individual Activator Award.

Simple HF Digi-Radios for Through-Earth Communications
by John T. M. Lyles K5PRO (Los Alamos, NM)

Presentation Abstract:

The 2200-meter frequency allocation has created renewed interest in low frequency experiments. We think of over the air transmission using inefficient long antennas. Through-the-earth communications is also practical for short distances (< 1000 feet) and is used commercially in some mines. Cave explorers work in very long caves that are explored for days at a time, using underground camps. One New Mexico cave is now being explored over 10 miles from the single entrance. This distance requires hiking and crawling for up to 8 hours to reach camp. A serious injury would be difficult to deal with. Flooding is another concern, as happened this summer in a Thailand cave with a youth soccer team. Early cave communication systems used 185 KHz AM and SSB voice via magnetic loops. Experiments in the southwest and in UK have demonstrated that HF propagation can be effective, especially through moderate rock thickness in semi-arid regions. A two-way digital communication link has been developed using compact commercial PSK transceivers. Tests are about to be conducted with various antennas at a cave near Albuquerque, using 10.148 MHz and recycled Dell Axim PDAs generating BPSK modulation.

Speaker Bio:

John Lyles was first licensed in 1971 as a Novice, then WB4PRO in 1972. He has been a leading designer of high power RF amplifiers for broadcast, industrial and scientific applications. In 1992 John joined Los Alamos National Laboratory where he is an R&D Engineer developing numerous high power amplifier systems for a proton accelerator. He became 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.