2020 New Mexico TechFest

Speaker Bios and Presentation Abstracts

(Rev. 11 Jan 2020)

Presentations

QMesh: A long-range, low-cost wireless mesh network for digital voice communications
by Dan Fay KG5VBY (Albuquerque, New Mexico)

Presentation Abstract:

Wireless mesh networking protocols, such as APRS and Gotenna Mesh, allow for reliable communication between devices by relaying data between nodes until the data reaches its destination. While these mesh networks successfully communicate telemetry and small data bursts, they cannot provide the continuous streaming bandwidth needed to carry real-time voice communications. Presented here is QMesh, which leverages the FM capture effect in the LoRa waveform to allow for reliable synchronized, flooded mesh networking that can support low data rate digital voice communications. An overview of the theory, protocol design, experimental hardware, initial test results, and future plans for QMesh will be discussed.

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.

Exploring the Millimeter Wave Bands: Design and Construction of 78 and 122 GHz Transverters
by Mark Lewis N0IO (Grand Junction, Colorado)

Presentation Abstract:

This presentation will discuss some of the challenges and solutions of transverter design and operation on the 78 and 122 GHz bands. First, we will look at path losses compared to what we are accustomed to in the VHF/UHF spectrum and extra limitations on 78 GHz imposed by the FCC. Next, the problems with frequency stability and aiming accuracy that must be solved just to make a QSO. We will then take a close look at the hardware options and fabrication techniques for antennae, oscillators, mixers and filters. I will explain in detail the design

tradeoffs in my implementations. Lastly, we will look at some commercial options available to build a system and what to look for in the surplus markets.

Speaker Bio:

Mark, N0IO, was first licensed in 1994 as a Tech Plus and earned his Extra class license later that same year. He enjoys designing and building his own equipment, particularly for the microwave bands. Mark prefers weak signal work and is currently active on all bands from 2M thru 134 GHz. He has recently retired from a 35-year career operating an aerospace manufacturing company and is working on getting his station in western Colorado back into shape.

A Review of the NanoVNA – its history, its configuration and its usage in Amateur Radio
by Larry Goga (Albuquerque, New Mexico)

Presentation Abstract:

The NanoVNA is a credit card sized electronic device that brings to the amateur radio operator the features of a Vector Network Analyzer (VNA) with a frequency range beyond 900 MHz. and at the incredibly low price point of less than $60 USD. This VNA unit is the result of the "open source" collaboration of programmers and designers from around the world. However, the open source nature of this device has led to the creation of clones and knock-offs and less than desirable copies cluttering the marketplace. This presentation will discuss the history of the NanoVNA with its pros and cons. The presentation will review the current hardware, firmware and software versions that are available and how and where to obtain them. And finally, the presentation will conclude with some demonstrations of the NanoVNA and its applications around the modern ham shack.

Speaker Bio:

Larry Goga, AE5CZ, has worked in the field of Electronics for most of his adult life. He has retired from a career in Audio Engineering for the Motion Picture Industry after living and working in Los Angeles for almost 30 years. Larry was licensed as an Amateur Radio operator in 2007 and quickly obtained his Extra classification. Now Larry likes to use his experience in Electronics to teach other aspiring radio amateurs about the subject of Electronics and to advance his own knowledge of the subject with an emphasis on learning about RF Technology. Larry greatly enjoys the field of Electronic Test and Measurement and how to use modern test equipment to learn and understand circuit operation. Over the years Larry has given presentations on various topics at the Duke City HamFest, the New Mexico TechFest and various club meetings around the area. Larry is part of the team of Amateur Radio Operators that maintain the operation of the Gary Diamond Memorial Repeater (442.600 MHz + PL100) on Sandia Crest.

3D Printing for Amateur Radio Applications
by Jerry Boyd WB8WFK (Albuquerque, New Mexico)

Presentation Abstract:

This presentation will focus on how 3D printing can be used for building projects within amateur radio. Examples will be provided that range from project enclosures, QRP antennas, DF antenna parts to microphone adapters. Topics will also include what free software you can use to generate the 3D models and how to prepare the models for printing (slicer). In addition, an overview of a kit of one of the most popular 3D printers kits on the market will be covered. Also, if you don't currently one a 3D printer some options will be presented that will allow you to still make 3D printed parts.

Speaker Bio:

Jerry Boyd WB8WFK became involved in 3D printing to support his ham radio project builds. He recently built a Prusa i3MK3S 3D printer kit for use in making 3D printed parts for QRP and ARDF related ham projects. In addition, Jerry also use 3D printing to make toys for the grand kids. His main ham interests are QRP and ARDF.

On July 1, 2019 Jerry was appointed as the ARRL Amateur Radio Direction Finding (ARDF) coordinator and since has reorganized the ARRL ARDF committee. Jerry has been involved in ARDF for many years and has been a frequent medal winner at USA's championships. He was a leader of the organizers of the USA and IARU Region 2 ARDF championships in 2001, 2005 and 2011 in his home town. He was on ARDF Team USA for the ARDF World Championships of 2004, 2006 and 2010.

Jerry has been employed in the electronics industry for over 40 years. He has designed custom RDF receivers ranging from HF to VHF, for both ARDF and search-and-rescue. His designs also include ARDF transmitters from FPGA-based software-defined radios to simple CW transmitters.

Basic PC Interfaces for Homebrew Projects
by John Klem AA5PR (Albuquerque, New Mexico)

Presentation Abstract:

The adoption of USB as the primary PC peripheral interface complicates the task of PC control of homebrew projects. I will present options for incorporating basic digital and analog input/output interfaces in projects by using USB-driven pre-programmed microcontrollers and UARTs as configurable PC-controlled input/output servers. More complex functionality is possible through the incorporation of slaved SPI- or I2C-bus devices. This approach allows high-level-language PC programming for homebrew project data acquisition and control without the need to write any microcontroller code. Short, documented, and easily-modified Python scripts will be provided as supplementary material to encourage experimentation.

Speaker Bio:

John Klem, AA5PR, was originally licensed as WN0IOY in 1972, and has enjoyed homebrewing ever since. He has been employed since 1987 as a research and development electrical engineer specializing in the realization of novel microelectronic and optoelectronic devices using compound semiconductor materials.

Skytracker: Send a Party Balloon around the World and Track it by Bill Brown WB8ELK (via Skype from Madison, Alabama)

Presentation Abstract:

This presentation will cover a custom micro-miniature solar-powered tracker that is now light enough to fly underneath a Mylar party balloon, track its position via GPS, and transmit its position down to ground stations as it flies around the world.

NOTE: During New Mexico TechFests's lunch hour, a pico balloon carrying a Skytracker payload will be launched. Attendees and hams around the community will be able to track the long distance balloon's journey via https://tracker.habhub.org

Speaker Bio:

Bill Broown WB8ELK is a NASA Engineer at the Marshall Spaceflight Center working on the big Space Launch System (SLS) rocket that will take us back to the Moon and on to Mars. He pioneered the use of high altitude weather balloons carrying amateur radio telemetry and TV camera systems to teach students about STEM activities. He has launched over 500 high altitude balloon (HAB) missions over the past 32 years. His current focus is on designing lightweight GPS-enabled tracking transmitters that weigh less then 12 grams and sending them around the World on Mylar foil party balloons and larger plastic superpressure balloons.

(Demonstration / Posterboard Presentation abstracts and bios next page)

Demonstrations / Posterboard Presentations

Basic PC Interfaces for Homebrew Projects
by John Klem AA5PR (Albuquerque, New Mexico)

Presentation Abstract:

Breadboards and examples of PC-controlled devices will be provided to illustrate the capabilities and flexibility of the microcontroller/UART approach for input/output interfacing. This is a companion demonstration to the "Basic PC Interfaces for Homebrew Projects" presentation.

Speaker Bio:

John Klem, AA5PR, was originally licensed as WN0IOY in 1972, and has enjoyed homebrewing ever since. He has been employed since 1987 as a research and development electrical engineer specializing in the realization of novel microelectronic and optoelectronic devices using compound semiconductor materials.

Implementing CaveNet, a Wireless Data Network for Cave Communications
by John T. M. Lyles K5PRO (Los Alamos, NM)

Presentation Abstract:

One of my passions is exploring and mapping caves. Integrating this with RF communications is an area of considerable interest for monitoring sensors for scientific studies and for safety and rescue communications. We have a funded project for up to three years with the Bureau of Land Management for installation in Fort Stanton Cave, in Lincoln County near Ruidoso. The goal is to have a low rate data network of nodes that can run over a year on batteries. The radios will need to function in a harsh environment of high humidity with drips and mud. This system will first be demonstrated to transport water level data from a sensor about a mile inside this large cave. An additional feature is proposed to provide a text mode for short

messages. Later objectives include extending the network into other portions of the cave, and increasing the number of sensors and text transmission stations along the network. There are examples of such systems in the mining industry, for large factory complexes (Internet of Things), and for caves. Our goal is to design the system so that the time interval between battery changes at the nodes is optimized by data rate and by placement and spacing of the nodes. Commercial unlicensed UHF modules (915 MHz) appear favorable for our application, using mesh or point to point topologies and developed transport protocols such as Z-wave, LoRaWan and SigFox. Challenges besides the environment include getting low power signals through metal gates and the propagation anomalies that may hamper transmission through lossy-walled passages with pseudo-waveguide-like dimensions.

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.