SEPTEMBER 2018 Volume 7 Issue 9

VE3ERC-LUB

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Newsletter: Bob VE3IXX

ERC REPEATERS

UHF 444.700 TONE: 131.8
UHF 444.700 TONE: 123.0
VHF 147.390 + TONE: 123.0
EMERGENCY SIMPLEX: 147.51
UHF– IRLP node 2404
VHF– IRLP node 2403, ECHOLINK node VE3ERC-R

In an emergency, tune Into our repeaters,
UHF 444.700 or
VHF 147.390 or
HF 3.755 LSB or
Simplex 147.510
For coordination and assignments.

Tony VE3DWI sent this picture of his new tower and vertical antenna. A beam and rotor will be added on in the future.

HAM TECH 2018 - see page 5

HAM TECH 2019
WILL BE SEPTEMBER 21, 2019

IN MEMORIAM

HARRY EIX VE3EIX-SK

Harry was one of the founding members of the Elmira Radio Club. We all donated $100.00 to obtain our membership from Ralph Brubacher VE3EUC-SK and then we registered as a new club– VE3ERC. Previously Harry had belonged to the K-W ARC but then transferred to ours.

In his younger years as a ham, Harry taught morse code weekly and I still have some of his tapes. He was a good teacher: clear, slow, easy to listen to and translate.

Harry attended meetings regularly and spoke in a gentlemanly fashion. One of the outings Harry attended with a group of us in our earlier years was to Hammond place in Guelph. If work had to be done, Harry was right there chipping in to help.

One memory I had was how Harry always offered his farm for experimental antennae work. His high security source was his twelve watchful cows circled around the working hams in the field while they tested the antennae on a pole.

As I always did the Wednesday morning net at 8 to 8:30 am Harry would never fail to come in and say "Hello" with some comments about farming. His farming experience along with my own farming background always gave us a common connection.

The club will always miss Harry but his memories will go on.

Till We Meet Again Harry,

de Reg VE3RVH

THE PREZ SEZ!

This club is Radio-ACTIVE

President's Update for September 2018

September draws to a close and it looks like summer is over for the Elmira Radio Club VE3ERC. With this latest round of rain and cool weather we are reminded to get outside to our towers, antennas, and coax and perhaps get in some timely seasonal inspection to these various components before it gets too cold or icy to allow it.

September saw the Elmira Radio Club's premier Ham Tech seminars come to fruition in a very exciting and successful day at the legion. Five guest speakers provided very informative, leading edge insight into the latest in amateur radio and associated technologies. Kudos goes out to Rich and Al for their tremendous efforts in organizing this grass roots initiative.

Join us on the evening of Wednesday, October 24th for an evening beginning with our Elmira Radio Club's Silent Key Memorial Dinner from 5:30 to 7:00pm at the Crossroads Restaurant in Elmira, followed by our regular meeting back at the firehall.

Thinking ahead, our Christmas Pot Luck Party is planned for the evening of Tuesday, December 11th from 6-9:30pm at the Elmira Legion. Details will be finalized during the October and November meetings.

Keep in mind we are always looking for speakers, presentations, outings and other ideas for our club meetings. They do not necessarily have to be radio related. All ideas and suggestions are welcome. I will be emailing out a survey to the membership to address this issue. Let's try to dress our meetings up a little with some excitement, innovation, and entertainment.

de Brian VA3DXK

Back-of-the-Napkin Eyeball

QSO notes and stuff

by Rich, ve3DCC

SEPTEMBER 2018

This article started off as a "book report" on an excellent work of non-fiction that was published in March 2018. It is called "The Perfectionists: How precision engineers created the modern world" . The author is Simon Winchester. Next month, I will be commenting on Chapter 8: Where am I and What is the time? In the meantime, you may want to check your local bookstore and browse it. It is an amazing read.

This month, though, I would like to comment on an aspect of Ham Radio that just seems to happen spontaneously and ,quite frankly, is exemplary. It is that way, that Hams join in an ad hoc plan (that is, a plan that develops as the situation develops) with energy and ingenuity to make the effort come together. It is not just in evidence during civil emergencies such as ice storms, floods, tornadoes and the like.

That ham spirit is also evident in non life-threatening situations. The recent Elmira Ham Tech Seminar showcased that "ad hoc" participation in a risky and new venture. That innovative idea was born in a discussion initiated by Al va3TET as our club staffed the ham radio station at the Elmira Maple Syrup Festival in April 2017. The notion then developed into an initial call for proposals and ideas, in this column. Finally a firm direction started to take shape at Maple Syrup Festival 2018. Al Macdonald, va3TET, had wondered aloud if Hams would welcome a day of seminars and workshops that would address leading edge radio and tech research. Could such an event facilitate innovation? Ontario Hams had many of these sessions during the heyday of RSO in the 1970s and 1980s. The Elmira Club said "yes" and try to keep the price reasonable and the program accessible. The problem was one of developing a program, enlisting good speakers and finding both a site and a time that would work.

As the Spring of 2018 stretched into Summer, members reached out to their contacts to find innovative speakers and topics. As the project started to take shape, more and more folks added layers to the event. Several locations were scouted and a hall was booked with deposits paid. Al va3TET toured all of the local club meetings to introduce and promote the day; Robert Ross ve3VEG donated cash to cover the cost of all-day coffee and snacks; the Elmira Legion catered a light but satisfying "funeral" lunch; Bob Koechl ve3IXX called to offer his skill in creating a poster; Rob Hammond ve3EIL of Hammond Manufacturing volunteered to offer door prizes(industrial power bars); Ted Rypma ve3TRQ offered to provide a projector, Frank Monteith ve3FJM showed up with a large portable screen, a backup projector and an entire PA system while others in a random show of support researched the availability of hot spots and internet. There was a wonderful level of cooperation and focus that bodes well for the hobby and those who are a part of it.

Elmira Ham Tech 2018 was a remarkable event, made all the more impressive by the selfless efforts of members of the local clubs and Research Institutes. It is appropriate on behalf of the organizers to thank all those who helped this project succeed.

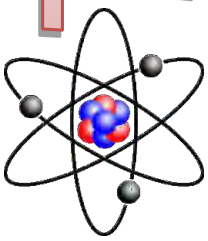
Now, Should this be a recurring event? Let us know!

De ve3DCC, Rich.

The HAM TECH Experience

By

Bob Koechl VE3IXX



Ted Rypma VE3TRQ started the seminar off "picture-perfectly". At the back of the Legion hall, Ted had a camera mounted with one Mesh antenna aimed across the hall. At the front he had a second Mesh connection attached to a wi-fi router. From his computer (projected onto a large screen) we saw a video of ourselves participating in the Ham Tech Seminar on Sept. 22. It was a practical demonstration of just one of the things of which a Mesh network is capable.

Mesh is a multi-point to multi-point ad hoc wi-fi network. The communication allows for any number of modes whether video, voice or data. The only requirement is that communication has to be line of sight. With its roots in a software program developed in California, it is a network that allows ad hoc communications from one point to another or to multiple points. These points are: self-routing

self-building

and self-healing.

In the high mountainous regions of California, distances as much as one hundred miles have been achieved. But, while great heights are not always available, distances can be covered with connections through intermediate nodes within the line of sight. If one node should fail, the software immediately re-routes through other nodes. For emergency communications, Mesh networks can be a life-saver.

Ted's hour and twenty minute presentation flew by and he was inundated with questions.

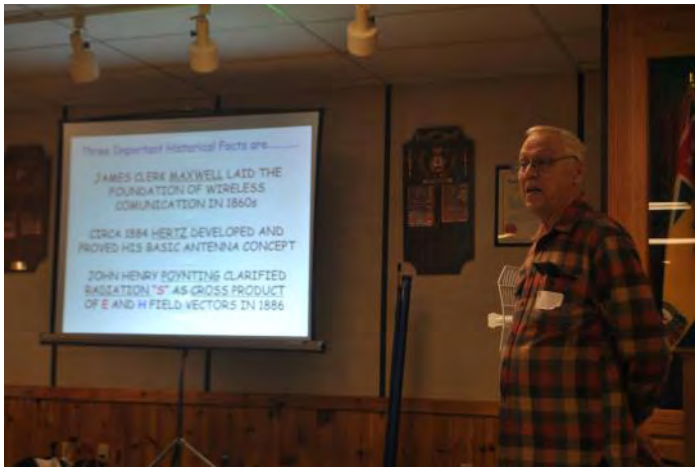
FIND OUT MORE DETAILS OF HAM TECH AT

www.ve3erc.ca

Dr. Gordon Hayward gave a presentation of his research primarily intended for the early detection of ovarian cancer using radio waves.

The heart of this detection process is a tiny surface acoustic wave (SAW) circuit board. A tiny transmitter on one side transmits an rf wave resonant at 58.75 Mhz, through a small space (where a sample such as a drop of blood can be placed) to a receiving circuit on the other side. It is then amplified. The particular characteristics of this signal is analyzed as its RF fingerprint. Depending on the contents of the sample, the radio wave will display slightly different characteristics. Just as light going through water undergoes changes in refraction, the RF going through any material will also change.

Using this method, Dr. Hayward hopes to be able to tell when cancerous cells are present in a tiny sample. Dr. Hayward's work fascinated his audience and also elicited quite a lot of interest.



Al MacDonald VA3TET and Paul Burke VE3PVB were next in line to talk about the Poynting Vector Antenna.

The Poynting Vector antenna dates way back to 1886 and a theorem was developed by an English physicist, John Henry Poynting. Radiation is the cross product of the E and H field vectors.

S=E x H

S is the photon flow measured in watts per metre squared.

E is the electric field in volts per metre and

H is the magnetic field in amps per metre.

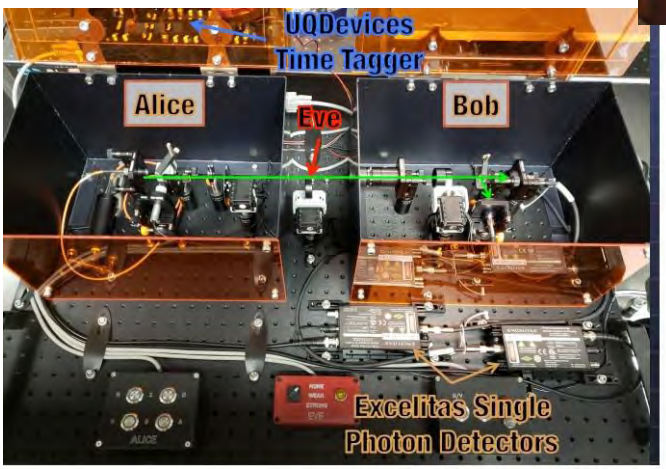
For some unknown reason, Poynting's work was much ignored and antenna designs based their focus entirely on the electric field. It was in 1998 that Ted Hart and a few others in Sweden and Russia, as well as our own Al and Paul, began intensive research into using the magnetic field as the basis of antenna design.

Some big advantages of the poynting vector antenna is that it is much smaller in size, requires no radials, and is not affected by ground so it can be placed very close to the ground. Al showed off a version of the Poynting vector antenna that he had designed for the 40 M band. It has a gain similar to a dipole antenna. It drew a lot of attention.

The afternoon conference began with Dr. Katanya Kuntz. Her topic was quantum communications for encrypted messages. Katanya is doing research for NASA for satellite communications aiming to achieve 100 percent secure encryption. She works primarily with lasers.

All encrypted messages revolve around the "key". In the past, the sender had a key and the receiver had the same key. To break the code any intruder had to find the key.

In her work Katanya uses lasers. Unlike the old methods the key is not pre-arranged but is actually sent by laser before any message is sent. Any intruder would have to intercept the key by intercepting the laser beam. Katanya named the sender Alice and the receiver, Bob. Eve is the evil intruder who is trying to steal the key. To do this Eve must physically intercept the beam. However, in intercepting the beam Eve cannot help but to disturb the photons in that beam of light by causing some phase or polarity shift. These changes can be easily detected and the system immediately shuts down to be attempted again at a later date.



With her exuberant style, Katanya kept her audience enthralled and many questions followed.

The final speaker for the day was Bob Moyer who spoke about Digital Mobile Radio (DMR). Bob was very knowledgeable about DMR and took a lot of the mystery out of the topic especially for those of us who were neophytes in this area. The beauty of digital voice radio is that you don't get the background noise.

The heart of the system is the Vocorder (Voice Coder) that converts an analog signal (such as a voice) into digital form and then compresses it. This requires a fraction of the frequency space needed by a similar analog signal. It is an all or nothing signal which really shines when the signal is in the fringe area. Bob showed a short video demonstrating a normal analog signal from a handheld first when it was nearby, and then in the far field along with all the hash noise. Then this same process was repeated using digital voice. When quite far away, the voice was no different than when the radio was close and had absolutely no noise.

Bob went into detail on how to set up a digital radio which is more complex than the equivalent analog radio. He also brought along his digital repeater which can run two separate channels of voice transmissions at the same time.

I found Bob's talk very informative as I knew almost next to nothing about digital voice radios. Again there were many questions afterwards.

In summary, the day was a great success. There was food and coffee aplenty.

There was ample time, if not between the presentations, at the end of the day to talk and ask questions of all the speakers. Many people said they would come back next year and judging by the excitement generated, next year will have a much larger crowd. To get 26 participants for a first time around, is not a shabby number.

The motley Crew

[WAX Group] quarter wave shorted stub filter for HF

by Al Duncan VE3RRD

A quarter wavelength stub makes an excellent filter to protect your receiver from interference from a nearby transceiver on anther band (example is Field Day, or other event where more than one transmitter will be on the air at the same time). It would also be great for various Sota / Pota and Gota events.

RF theory states that a shorted 1/4-wavelength stub will appear as an open at the other end (1/4 wavelength away). A T-connector can be used to install the 1/4-wave stub at the transceiver antenna input.

Although the experts say that you should use 50 ohm RG-8 coax for the stubs, experimentation has shown that the stub does not even have to be made from 50 ohm coax. Several of us in the WAX Group have made a number of 1/4-wave stubs from 75 ohm RG-6 coax (used for TV). These have worked well at both QRP power and at 100W.

You will need to make a separate stub for each HF band you plan on using. Initially calculate using the formula 468/MHz to calculate a 1/2-wavelength. Divide the result by 2 to calculate the 1/4-wavelength. Since most RG-6 has a velocity factor between 78% and 90% (varies with manufacturer), multiply your calculated 1/4-wavelength by 0.9 and cut the coax to that length and install an F connector on one end.

Now you will need to connect a BNC T-connector to an antenna analyzer with a 50 ohm dummy load on one side of the T and your 1/4 wave stub (using an F to BNC adapter) on the other side of the T. You can use a paper clip to short out the end of the cable for testing. The stub will be too long to start with, so cut off an inch or two at a time and keep checking until you see an SWR of 1.0:1 or close to it in the part of the HF band you are making the stub for. Note that the RG-6 braid is made of aluminum and can't be soldered, so a crimp connector could be used to provide a permanent short at the far end of each stub.

Here are the starting lengths of RG-6 for the bands from 10m through 40m. Trim until a 1.0:1 SWR is obtained:
10m = 7.5 feet
12m = 8.5 feet
15m = 10 feet
17m = 12 feet
20m = 15 feet
30m = 21 feet
40m = 29.5 feet

You could also use a UHF style of T-connector with the male end connected to the transceiver, the antenna connected to one of the female ends, and a UHF to BNC adapter connected to the other female end for the stub.

An example of use would be where one transceiver is on 40m (7 MHz) and

the other is on 20m (14 MHz). The 40m station would use the 40m shorted stub which would not affect 40m but would attenuate signals outside of this band. At 14 MHz, the stub is 1/2 wavelength long (two 1/4-wavelengths) and thus would appear as a short, attenuating any 2nd harmonics from the 40m transmitter.
The 20m station would use the 20m stub which would not affect 14 MHz signals but would greatly attenuate the 7 Mhz transmitter signals (and other signals outside the 20m band).

We used these stubs at our Lighthouse activation event with 2 or 3 transmitters (on different bands), one was 100W while the others were 5W to 10W transceivers. Almost no interference was noticed, even though the antennas were quite close together.

Here are a couple of pictures of the test setup for making a shorted 1/4-wavelength stub.

An accurate 50 ohm load is connected to the antenna port of the T-connector.

As shown above, the 20m stub was flat (1.0:1) from 14.0 to 15.5 MHz. The 40m stub was flat from 6.9 to 7.6 MHz.

Since the "notch" produced is not very sharp, all transceivers must have appropriate shorted stubs installed for best results.

73
AL VE3RRD

CONTRIBUTIONS TO VE3ERC-CLUB NEWSLETTER

Do you have an article you'd like to submit? Or photos? Do you have any comments you'd like to make?

Perhaps you'd like to share a photo of your shack, a special project you are working on or a special interest!

SEND THEM TO:

Bob bobve3ixx@gmail.com

(519-787-2279)

WEDNESDAY NITE NET CONTROLLERS

SEPTEMBER 5 - BRIAN VA3DXK

SEPTEMBER 12 - BOB VE3IXX

SEPTEMBER 19 - TED VE3TRQ

SEPTEMBER 26 - M E E T I N G

OCTOBER 3 - AL VA3TET

OCTOBER 10 - REG VE3RVH

OCTOBER 17 - TOM VE3DXQ

OCTOBER 24 - DINNER AND MEETING

OCTOBER 31 - PAUL VE3PVB

NOVEMBER 7 - BRIAN VA3DXK

NOVEMBER 14 - BOB VE3IXX

NOVEMBER 21 - TED VE3TRQ

Thanks to Brian VA3DXK for sending the following articles:

Spinning the hits: quantum radio comes one step closer

https://cosmosmagazine.com/physics/spinning-the-hits-quantum-radio-comes-one-step-closer

New Quantum Radio Challenges the Laws of Physics

https://incompliancemag.com/new-quantum-radio-challenges-the-laws-of-physics/

Quantum Radio Takes a Giant Leap

https://www.afcea.org/content/quantum-radio-takes-giant-l

Spinning the hits: quantum radio comes one step closer

https://cosmosmagazine.com/physics/spinning-the-hits-quantum-radio-comes-one-step-closer

How do you communicate in environments that radio waves can't penetrate? By harnessing the power of magnetism. Andrew P Street reports.

We take easy communication for granted in our globally-connected world, but there are plenty of places where the environment hinders the straightforward use of radio signals: under water, for example, or underground, or in areas of high electromagnetic interference. This also poses challenges for mapping the oceans or inside mines, where GPS cannot penetrate.

The issue is that the higher the radio frequency, the less good the signal is at penetrating matter. This is why your phone cuts out while you're driving in tunnels, while the lower frequency FM radio reception gets patchy but the even lower frequency AM radio continues to be reasonably audible.

A solution, however, may be at hand. Researchers at the National Institutes of Standards and Technology (NIST) in Boulder, Colorado, US, have managed a proof-of-concept for "quantum radio", manipulating the magnetic field of rubidium atoms to send digital signals. The work is described in the journal Review of Scientific Instruments.

"The big issues with very low-frequency communications, including magnetic radio, is poor receiver sensitivity and extremely limited bandwidth of existing transmitters and receivers. This means the data rate is zilch," NIST project leader Dave Howe explains.

"The best magnetic field sensitivity is obtained using quantum sensors. The increased sensitivity leads in principle to longer communications range. The quantum approach also offers the possibility to get high bandwidth communications like a cell-phone has."

Modulating the spin of the atoms vertically and horizontally via a magnetic field sensor allowed the researchers to create "zero" and "one" positions which could be transmitted to, and read by, a direct-current magnetometer.

The atoms themselves are in a tiny glass container, and the changes in their spin creates alternating current electric signals. The voltages are then read by a light detector. Since these are (mostly) well-understood technologies, such detectors should be able to be made at a low cost, at small size, and work in a normal temperature range, making them a practical system for field use.

The researchers also developed a signal processing technique to reduce environmental noise – for example, from the electrical grid – and thereby increase the range of communications. The

plan from here is to develop ways in which the signal can be boosted and ways to improve bandwidth further.

There are also some challenges in pinpointing the location of a receiver, which they are hopeful will be addressed by better digital algorithms and noise suppression.

“Atoms offer very fast response plus very high sensitivity [while] classical communications involves a trade-off between bandwidth and sensitivity,” says Howe. “We can now get both with quantum sensors.”

New Quantum Radio Challenges the Laws of Physics

Posted by Lauren Saccone on January 5, 2018 in Engineering News

https://incompliancemag.com/new-quantum-radio-challenges-the-laws-of-physics/

Scientists at the National Institute of Standards and Technology (NIST) are working on a new form of quantum radio. Researchers believe that quantum physics could potentially allow them to communicate in places where traditional cellphones and radios are unable to function. These device could also be used to enable GPS in underwater, underground, and in urban canyons — places that normally struggle to achieve a working signal.

This type of technology could have numerous applications. GPS signals are generally unable to penetrate water, building walls, or soil. This limits their uses, particularly for soldiers, mariners, and surveyors. However, this new device could solve all those problems, allowing people to work safely even in inhospitable conditions.

Scientists are studying low-frequency magnetic radio. Very low frequency (VLF) digitally modulated magnetic signals are capable of traveling through water, soil, and various building materials. Traditional electromagnetic communications signals, which operate at higher frequencies, are simply unable to achieve these levels.

VLF technology has already proved useful for underwater submarine communications. Unfortunately, it lacks the data-carrying capacity for audio or video. One-way texts are the only real option. Additionally, submarines are forced to carry antenna cables along with them if they hope to communicate this way. Furthermore, they have to rise to periscope depth — about 60 feet beneath the surface — for this mode of communication to work effectively.

“The big issues with very low-frequency communications, including magnetic radio, is poor receiver sensitivity and extremely limited bandwidth of existing transmitters and receivers. This means the data rate is zilch. The best magnetic field sensitivity is obtained using quantum sensors. The increased sensitivity leads in principle to longer communications range. The quantum approach also offers the possibility to get high bandwidth communications like a cellphone has. We need bandwidth to communicate with audio underwater and in other forbidding environments.”

NIST project leader Dave Howe

To achieve this goal, researchers have demonstrated detection of digitally modulated magnetic signals. This system alters magnetic fields so as to control the frequency of the signals. The sensors were able to detect significantly weaker signals, as well as suppress any ambient noise

that could interfere with the transmission. Location tracking is proving a greater challenge to the team, as it requires additional bandwidth and improved digital algorithms.

To deal with these issues, researchers are actually inventing an entirely new field of study. It will combine quantum physics with low-frequency magnetic radio. Further research will determine the strengths and weaknesses of these devices, and when they will be able to undergo real world testing.

Quantum Radio Takes a Giant Leap

May 1, 2018

By Henry S. Kenyon

https://www.afcea.org/content/quantum-radio-takes-giant-leap

Detecting atoms' spin allows mobile communications in unlikely places.

A quantum physics-based technology developed by National Institute of Standards and Technology researchers may enable first responders, warfighters and mariners to communicate and navigate in areas where radio and satellite-based communications are limited or nonexistent. The capability would allow military and emergency personnel to stay connected in urban canyons, under rubble, inside buildings, underground or even underwater.

The system uses an atomic magnetometer as a radio receiver to detect very low frequency (VLF) digitally modulated magnetic signals. At its heart is a miniscule glass vial containing rubidium atoms illuminated by a laser that perceives changes in the atoms' spin as they're affected by a signal. This quantum property allows the device to detect VLF magnetic signals, which can travel farther through rock, dirt, concrete and water than conventional communications signals at higher frequencies.

For the project, National Institute of Standards and Technology (NIST) researchers developed a direct-current (DC) magnetometer using polarized laser light as a detector to measure the spin of the rubidium atoms induced by magnetic fields. Changes in the atom's spin rate correspond to an oscillation in the DC magnetic fields. This oscillation creates an alternating current electronic signal, or voltage at the laser light detector, which is more useful for communications.

Acting as a receiver, the magnetometer and its rubidium atoms allow researchers to detect digitally modulated magnetic signals sending digital bits of information in 1s and 0s. Researchers varied the magnetic fields to control the frequency—the horizontal and vertical positions of the signal's waveform—created by the atoms.

"Atoms offer very fast response plus very high sensitivity," explains David Howe, a senior professional research adviser at NIST and project manager for the institute's quantum radio effort in Boulder, Colorado. "Classical communications involves a trade-off between bandwidth and sensitivity. We can now get both with quantum sensors."

To develop the quantum radio, NIST scientists invented a new field, combining quantum physics with low frequency magnetic radio research. Howe explains that the new field's methodol-

ogy involves innovative ways of thinking about how to measure electromagnetic signals in greater detail and ways of adapting existing technologies to those tasks.

The U.S. Defense Department has shown interest in the technology, and NIST has received additional funding from the Office of Naval Research and the Army Research Laboratory to help develop quantum radio technology. With the prototype quantum radio complete, the organization is reaching out to the private sector and government agencies like the Defense Department to develop a production model.

One of the problems with traditional VLF radio communications is that they require very large antennas. In the case of a first responder-usable device, this might require a hypothetical loop antenna as large as a person. One advantage of atomic magnetometers is their very small size, making them ideal for handheld devices. In addition, unlike cumbersome antennas, quantum magnetometers provide superior magnetic field sensitivity, Howe explains.

Another issue with VLF communications, including magnetic radios, is poor receiver sensitivity and extremely limited bandwidth of existing transmitters and receivers. “This means the data rate is zilch,” he relates.

Researchers have been considering the communications potential of quantum sensors for some time, Howe says. The initial goal was helping first responders communicate with each other and surface teams in underground or indoor environments. Commercially available underground communications systems provide miners with a means of communications during a cave-in, but Howe notes that these systems are large and most are stationary, which makes them unsuitable for search and rescue teams.

Another domain where a quantum radio offers many advantages is underwater. Submarines currently use VLF radio to communicate, but this involves deploying long cables and rising to periscope depth, about 60 feet below the surface. Bandwidth also is extremely limited, making most communications a series of one-way text messages.

NIST’s quantum radio method is more sensitive than current magnetic sensor technology methods, Howe explains. A key step was developing a signal processing technique to reduce naturally occurring and man-made environmental noise that can otherwise limit communications range.

For example, electromagnetic signal noise from power lines is a major hurdle for VLF communications. However, VLF radios can operate in the low spots on the power line noise spectrum as can the magnetometers used in NIST’s radios. Howe notes that this signal processing technique allows fainter signals to be detected, which increases the signal’s range.

“The best magnetic field sensitivity is obtained using quantum sensors. The increased sensitivity leads in principle to longer communications range,” Howe says. “The quantum approach also offers the possibility to get high bandwidth communications like a cellphone. We need bandwidth to communicate with audio underwater and in other forbidding environments.”

Besides high sensitivity, the “optically pumped” magnetometers have several key advantages, such as room-temperature operation, small size, low power requirements, reduced cost and improved signal reception. Howe adds that this kind of sensor does not drift or require calibration.

During testing, the quantum sensor detected signals significantly weaker than the average background magnetic field noise. It could sense digitally modulated magnetic field signals as

weak as 1 picotesla, or one millionth of the Earth's magnetic field strength, and at very low frequencies, below 1 kilohertz (kHz).

Howe notes that this is below VLF radio frequencies, which span from 3 kHz to 30 kHz and are used for some government and military applications. The NIST-developed modulation technique suppressed the ambient noise and its harmonics, which increased the quantum radio's channel capacity.

NIST researchers also conducted tests to estimate the limits of effective communications and location-ranging capabilities. The indoor quantum radio range with a good signal-to-noise ratio was tens of meters. However, this could be extended by hundreds of meters if the noise was reduced to the sensor's sensitivity levels, which is better than what is currently possible indoors with available technologies, Howe says.

But some aspects of the radio system need refining. One remaining challenge pertains to accurate location fixes. NIST's prototype device has an uncertainty of up to 52 feet in its location reporting, which is much more than the goal of 10 feet. Howe explains that this capability could be improved with future noise suppression techniques, increased sensor bandwidth and improved algorithms to produce exact distance measurements accurately.

NIST researchers now are building and testing an improved quantum magnetometer. This device derives much of its inner workings from the institute's research into small atomic clocks, Howe shares. Like an atomic clock, the device detects signals by their effect on the atoms' internal energy levels. Researchers hope the new magnetometer and its boosted sensitivity will increase the ranges at which the quantum radio can detect VLF magnetic field signals and, by more effectively suppressing noise, expand the breadth and efficiency of the sensor's bandwidth.

One challenge facing VLF technology is noise reduction. Because of man-made and naturally occurring noise at very low frequencies, a variety of noise filtering methods are being considered. One drawback to added sensor sensitivity is that it enhances background noise. "But the idea of having more bandwidth means you're having more ability to use a whole toolkit of noise reduction techniques that are very, very good at this point," Howe says.

As an example, researchers can run incoming signals through a digital filter. The advantage of the digital method is that it allows the signal to be briefly saved and recirculated through the filter's noise-filtering algorithms, further enhancing the signal. The trade-off is a brief delay as the incoming signal is stored and run multiple times through the filter; however, the advantage for VLF radios is enormous because it enables highly sensitive filters to produce audio from the faintest signals picked up by the quantum receiver, Howe says.

Elmira Radio Club Silent Key Memorial Dinner

Wednesday October 24th 5:30-7:00pm
Fireside Alcove at the Crossroads Restaurant, Elmira ON
Soup & salad bar $13.99, Buffet $25.99
Regular club meeting to follow at the Firehall

VE3ERC Elmira Radio Club Inc.

Minutes for September 26

ROLL CALL: Brian VA3DXK, Rich VE3DCC, Al VA3TET, Paul VE3PVB, Ted VE3TRQ, Johan VA3JBO, Jim VE3JMU, Tony VE3DWI, Al VA3DZZ, Scott VE3MTQ, Gord VE3GWM, Paul VA3PDC, Harold VE3CD, Doug VE3CXU, Al VE3AUS, Bill VA3QB, Bruce VE3QB, Reg VE3RVH, Bob VE3IXX

Brian VA3DKX opened the meeting at 7:30 pm.

The Members had a moment of silence for the passing of Harry VE3EIX-SK. Then Al VA3TET spoke about how the club had used Harry's farm for some antenna testing in the middle of Harry's herd of cows who did sentry duty.

A roll call was made around the room. The two visitors Al VA3DZZ and Scott VE3MTQ got up and introduced themselves.

Brian introduced the agenda for the meeting. Adjustments were made and then the agenda was accepted.

Rich VE3DCC gave a report on the Ham Tech Seminar on September 22. Hammonds, the Teacher's Federation and Robert Ross VE3VEG donated door prizes, gifts and money for the coffee respectively for the seminar. For further information, see the report of the seminar in the newsletter.

Tom VE3DXQ, the secretary was away, so the next part of the agenda was the Treasurer's Report by Paul VA3PDC. Following the report, Paul made a motion to adopt the report and a motion to reimburse Rich VE3DCC for the costs incurred by the Ham Tech Seminar. This was seconded by Bill VA3QB.

Brian then began a discussion of member's past summer activities by telling about his visit to family in B.C. and about fishing in the Pacific Ocean. Bill VA3QB spoke about the "ups and downs" of installing a tower for Wes VE3ML. Paul VA3PDC spoke about the poor propagation for summer contacts on HF. Paul VE3PVB talked about finally installing his new Bazooka antenna and the satisfactory results. Tony VE3DWI concluded with his installation of a new tower (see front page) and great success using a gin-pole.

The report on the Point Clark Lighthouse weekend proved a very successful event. It was well represented even though propagation was poor during the day. As in previous years Al's (VA3TET) barbequed hamburgers and special mushroom sauce were a great hit and all the food disappeared. The evening meal at Boston Pizza garnered a big crowd.

Al VA3TET gave some recommendations for next year's Ham Tech. A date of September 21, 2019 has been chosen. Al made a motion that Ham Tech become a yearly event. This was seconded by Paul VE3PVB. A discussion of ideas followed. Reg VE3RVH suggested that in the future all the speakers be given a wireless microphone to be better heard. Al recommended that a committee of six or seven people be formed to help organize the event. He also suggested a prepared press release be issued beforehand. Also, presentations should be made to all area clubs to promote interest. There is a great potential for this to become a source of revenue for the club.

Rich requested Bob VE3IXX to send a report of this year's event to RAC. Bill VA3QB suggested Phil McBride VA3QR from the Guelph club to be a good recipient. He is a representative of RAC.

A round of applause was given to congratulate this year's organizers.

In new business, Paul VE3PVB repeated the story told at the DMR Ham Tech seminar about the vocorder which was used by the computer to digitalize spoken English and how it had great difficulty when French was spoken.

Then Paul VE3PVB and Harold VE3CD told the story of how they participated in the syncronicity of radio telescopes across the entire country using atomic clocks during the 1970's. The

Story of the development of the Hermes satellite followed.

Paul VE3PDC gave a membership report. Currently there are 31 members.

Rich brought up the October Bill Graham Memorial Dinner. Reg VE3RVH suggested calling it a memorial for all the Elmira Club's silent keys. Johan VA3JBO made a motion to call it "The Elmira Silent Key Memorial Dinner". This was seconded by Bruce VE3QB. Brian VA3DXK said he will book it for October 24 at 5:30pm at the Crossroad's Restaurant.

Brian also discussed doing the Christmas party earlier this year. He will check what dates are available at the Legion starting with December 12.

Rich VE3DCC said that RAC is again sponsoring emergency exercises this year but wasn't sure of the date. Bill VA3QB suggested that this year we do a simplex test on 147.510 (the ERC emergency simplex frequency) to test out the range of communications the club can achieve.

Immediately following the 50-50 draw, the motion to close the meeting was passed.

Elmira Radio Club Christmas Party

Tuesday December 11th 6:00-9:30pm
Elmira Royal Canadian Legion Branch 469
11 First St. E. Elmira ON