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Communications Systems

By Bob Wexelbaum, W2ILP

“Communications Systems” is a one semester college course that is given to electrical engineering students who are seeking a bachelor’s degree or to students who need it for post graduate work. While this course relies heavily on familiarity with advanced calculus, and random variables, it covers all the modes and operating methods that should be familiar to the average ham. It is my intention to attempt to explain the basic theories that are taught in this course, while using no math other than high school algebra and trigonometry.

On the introductory pages of a Communication Theory text book we learn to define the basic criteria of communication itself. It states that if two people are separated by some appreciable distance and they have a pair of wires long enough to span that distance and one has a microphone and the other an earphone then communication between the two people may be possible. If the distance is great the signal on the receiving end will be greatly attenuated. More importantly there is the problem of *noise* to be reckoned with. Noise occurs because at the atomic level the entire universe is in a state of constant agitation. The atoms in the wires and around the wires contribute noise. We need not address man-made noise now because motor brush noise, ignition noise, etc. are only temporary in nature; we are talking about what is considered the noise floor. Amplifying a weak signal will not rid a communication system of the noise floor because both the signal and the noise will be amplified. In fact the amplifier itself will contribute more noise. Using a radio transmitter and receiver will not solve this problem because the transmitting and receiving antenna systems will only contribute more noise. Thus the concern of a communication system is to use techniques that can limit as far as possible the effect of noise. To the ear this noise may sound like a hissing *hash* but visually noise is recognized by many different names. On an oscilloscope display which shows amplitude on the vertical axis and time on the horizontal axis (Radar operators Type A display) noise is called *grass*. In the days of analog TV receivers picking up weak TV video signals in fringe areas, noise was called *snow*. In present day digital mode acquisition displays noise is called *the waterfall*. At the present time normal people may never have to deal with noise that will upset their telephone communication, their TV reception or their Internet entertainment. That is because telephone companies, cable companies, fiber companies and internet providers must take care to eliminate the effects of the noise for them. It is only avid radio amateurs who still attempt to copy weak and/or DX signals out of the noise, and thus I dedicate this communication system set of articles to the many hams who remain working near the noise floor and not just the few engineers who work for or may some day work for the large commercial communications corporations. We learn in the communication theory course that the best way to decrease noise is not to directly transmit the original signal (the mike audio for example) but instead to use that signal to generate a different waveform, which is then impressed on the wires or sent by radio. The processing of the original signal to generate the different signal is called *encoding* or *modulating*. At the receiving end the original signal is restored by *decoding* or *demodulating*. When a considerable expense is made to establish any commercial communications link, the next consideration is: why can’t there be more than one signal sent over the same wires or the same radio link at the same time? To get the most use and profit out of a communications system be it by wire or by radio *multiplexing* is an area of commercial but not so much ham concern.

That is because hams operate as singular independent parties and are interested in receiving only one good signal at a time. This has been somewhat altered by digital spectrum decoding such as for PSK-31, where one may read up to 26 decoded messages at a time from up to 26 different stations, but will select only one of the 26 to communicate one-on-one with. Hams do not even use full duplex protocols that telephone companies have been able to use for many years. Hams do not normally transmit and receive at the same time.

There are three ways of analyzing communications systems. One is by using purely mathematical theory; another is by using the best test equipment available to study phenomena, and a third is to understand that neither the mathematical theory, nor the test equipment may completely show the full dynamics of what occurs in the real world.

The two most common methods that are used to visualize a signal are by using an oscilloscope, where the vertical represents voltage amplitude, and the horizontal time; and the spectrum analyzer where the vertical also represents voltage amplitude but the horizontal represents frequency.

[To be continued next month]

<p style="text-align: center;">PRESIDENT'S NOTE by ED GELLENDER, WB2EAV February 2010</p>

Lately the big thing with repeaters is networking via the internet and it is becoming common to have a ham operating on a repeater in say, Las Vegas, give someone a call on a Long Island repeater and then have a normal chat. Apparently to do this requires linking between both repeaters and the internet, sometimes involving intermediate sites with the necessary controlling protocols.

The reason that I am sharing this arcane bit of technological information with you is that several Long Island radio groups that are fully involved with this are aware that we have two repeaters and are asking us if we want to join in. Right up front, let me say that the club will not let ourselves be taken advantage of, and the membership will be kept fully involved by way of the club newsletter all the way. Our repeaters have been kind of quiet lately and it looks like this might put some new life in them, providing interesting possibilities for serving both ourselves and the greater amateur community.

At this month's meeting we expect to have someone describing one approach to the proposed new repeater operation. I believe that it will be Bill Scheibel, N2NFI, who takes care of the club's Hauppauge Repeater.

The Grumman Amateur Radio Club was founded as a Grumman Aircraft employee recreational facility in 1944, and we have been affiliated with the company ever since. In 1994 our parent organization changed to Northrop Grumman (good thing the merger took place after Leroy Grumman and Jack Northrop had both passed away, as they hated each other). Over the past few years, Northrop Grumman's dedication to it's employee clubs has been on the decline so I am incredibly pleased to report that the company just gave each of the remaining clubs (including us) an annual grant of a couple of hundred dollars as a show of corporate support.

73, Ed, WB2EAV

**GRUMMAN AMATEUR RADIO CLUB
MINUTES OF GENERAL MEETING 1/20/2010**

By Karen, W2ABK, secretary.

The meeting was called to order by Gordon at 5:30 PM.

TREASURERS REPORT – Ed, WB2EAV

Finances continue to be in good shape.

REPEATER REPORT - Gordon, KB2UB

The repeaters are working fine.

VE REPORT – Bob, W2ILP

One applicant passed both Technician and General exam. VEs were W2ABK, WB2IKT and W2ILP.

NET REPORT- Zack, WB2PUE

Thursday night net had a good turnout. Sunday morning 40 Meter net is back up and running, as reported by Bill, N2SFT.

OLD BUSINESS

Liability forms are being filled out.

NEW BUSINESS

GARC dues will be the same as last year. Please remit yours if you have not already done so. Bob Vonrekowsky, W2II is scheduled to be our February guest speaker. He will talk about the expedition to Palmyra Island and Kingman Reef. [changed to a repeater linking discussion – Editor]

PROGRAM

There was a discussion about amateur radio operation in Haiti.

The meeting was adjoined at 6:30 PM

GARC NETS:

40 Meters: 7.289 MHz at 7:30 AM EST Sundays. *Note: Frequency has changed again.*

Net Controller: Eugene, W4JMX

2 Meters (via repeaters): 146.745 MHz (-.600 kHz) at 8:15 PM EST Thursdays.

145.330 MHz (-600 kHz) at 8:30 PM EST Thursdays

Net Controller: Zack, WB2PUE

[Tone for both repeaters is 136.5 Hz]

(ARES/RACES) Mondays

MEETINGS

General Meetings of the GARC are held on the third Wednesday of each month, starting at 5:30 PM. The meetings are usually held at the Ellsworth Allen Park in Farmingdale. Driving directions and maps can be obtained from <http://www.mapquest.com> It is suggested that the GARC Web Site be checked to be certain of meeting location, which may change after this newsletter is distributed. Board meetings are held eight days before the General Meeting.

GARC WEB SITE

The web site of the GARC can be found at <http://www.qsl.net/wa2lqo/> Webmaster is Pat Masterson, KE2LJ. Pictures of GARC activities, archives of newsletters, roster of members, and other information about the GARC may be found there.

INTERNET LINK OF THE MONTH FOR INTERNERDS

This month's internet link is an awe inspiring video that a ham on QRZ called my attention to. It is "The Known Universe":-

<http://antwrp.gsfc.nasa.gov/apod/ap100120.html>

This video was produced by the American Museum of Natural History and the Rubin Museum of Art. It offers viewers a trip across the known universe. Be sure to have the audio turned on. I dunno how much is science and how much is art, but it brings to my mind what is called by some "The Fabric Theory." This is the concept that we are all in this together; that sub-atomic particles, atoms, molecules, plants, animals, humans, planets, stars, constellations and galaxies are all connected by gravitational forces (or strings, if you will see it that way). It makes one feel insignificant in the vastness of time and space and yet awe inspired to realize that everything is connected and nothing - including each one of us, each grain of sand or dust, can be left out. Now I won't go on to how Buddhists further interpret this concept, but you can appreciate the video for its astronomical or aesthetic value alone without evaluating it philosophically. Teaching science is an art. Teaching art is a science. Art is not always philosophy but there may be philosophy in art. Some may see it. Some may not. Art is in the eye of the beholder. Philosophy may be in the mind of the beholder who thinks that he knows it when he sees it. Computers may be programmed to gather images. They may convolute and converge images...but they can't feel the way that this editor, who can't even insert many still images into MS Word, can feel about the images.

PUZZLE

Here is another Cryptogram:

VTQL TE VXHV JXLYLTM VXLYL TE GBBGYVWMTVK, HMA GBBGYVWMTVK TE

VKHV JXLYLTM VXLYL TE MG UYLHV VTQL. -XTBBGPYHVLE--

Solution to the January 2010 Cryptogram: I must apologize for the many errors in this cryptogram. I thought that I had checked it and I dunno how so many errors could have gotten into it. It was supposed to say: BIGOTRY IS THE DISEASE OF IGNORANCE, OF MORBID MINDS; ENTHUSIASM OF THE FREE AND BOUYANT. AND FREE DISCUSSION ARE THE ANTIDOTE OF BOTH -THOMAS JEFFERSON-- *If you want to figure out what Jefferson meant by that you can Google up his biography. I can't freely discuss it here.*

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CONTRIBUTING WRITERS

All the members of GARC (we hope!)

CQ de WA2LQO is published monthly by the Grumman Amateur Radio Club for its members and friends. Send articles and amateur equipment advertisements to: W2ILP. Articles may be sent by e-mail or postal mail. They can be in MS Word format or simply in plain text. Articles will only be edited when permission is granted by the author.

ELECTRONIC SUBMISSIONS

For insertion to the WA2LQO website, information may be sent to Pat Masterson.

Pat Masterson's e-mail address:

Pat-Masterson@tampabay.rr.com

Ed Gellender's e-mail address:

Edward.Gellender@ngc.com or

wb2eav@yahoo.com

EDITORIAL

I've been suffering from a virus (not a computer virus), which started last Saturday, giving me a temperature of 101.3, and extreme tiredness, and has now been converted into a hacking cough. It is not life threatening in any way and it is being medicated by doctor's orders. In spite of it I have managed to put this newsletter together. I expect to be well enough to run the February 9th VE Session. I won't cancel because, as of this time, we have four registered applicants.

I have read the presidents message which explains that we may be connecting our repeaters to the Internet. I have mixed emotions about this potential proposal. It makes me bring some questions to mind. What is the purpose of the repeaters? Can ham radio be connected to a commercial communication system and still be ham radio? What is ham radio? I've tried to answer the last of these questions many times. Ham radio means different things to different people. For some it is a technology...for others it is a tradition. Others just go by what the ARRL says or what the FCC rules and regulations permit.

73,
w2ilp (Interconnections Legally Permitted?)

GARC VE EXAMS

We are continuing to proctor exams for all classes of ham licenses on the second Tuesday of each month, starting at 5:00 PM.

The present exams are:-

The Element 1 CW exam is no longer required.

Element 2: Technician

Element 3: General

Element 4: Amateur Extra Class

The fee for 2010 is \$14.00 for all exams taken in one sitting. The ARRL-VEC now charges \$15 but W5YI-VEC has decided not to change the required fee.

Applicants for upgrades should bring their present license and a photocopy of it and know their FRN number.

New, first time applicants should be aware that their Social Security number will be required on their application form, unless they register with the FCC for an FRN.

All applicants should bring picture ID such as driver's licenses.

Until further notice exams will be given at:-

Briarcliffe College

1055 Stewart Avenue

Room: Long Beach #5

Bethpage, NY

Briarcliffe, Bethpage is located in a building that was formerly part of the Grumman complex.

All applicants should contact W2ILP to register, so as to confirm location. If no applicants apply, the exam session will be cancelled.

For any information e-mail

w2ilp@optonline.net or phone-

(631) 499-2214

Study material is available at the web sites of the ARRL

<http://www.arrl.org>

or W5YI

<http://www.w5yi.org>

All VECs use the same Q & A pools.

Since the beginning of the VE program the GARC has provided opportunities to take the ham exams monthly, during all 12 months of every year.

Bob Wexelbaum, W2ILP and the GARC VE team.

GRUMMAN AMATEUR RADIO CLUB OFFICERS FOR 2010

President	Ed Gellender	WA2EAV	X02-14	516-575-0013
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FIRST CLASS

DO NOT DELAY

HRU 2010

HRU 2010 was held at Briarcliffe College in Bethpage on January 10th. If you missed it you will have to wait for HRU 2011. It was quite well attended, with the front desk reporting over 400 people signing in. I didn't see as many local hams there as I had seen at previous HRUs; However, there were more hams than ever from areas outside the New York City - Long Island section. I did not attend the VE session there, but I noticed that there were fewer applicants for ham exams than at previous HRUs. My own forum titled Communications Systems was not very well attended, in large part because its time conflicted with other interesting forums, including a forum that was pre-registered for by hams who wanted to build their own antenna for a

\$10 fee. Also these forums were the last on the program schedule, and many of the attendees had gone home after hearing the keynote speaker. The people who were at my forum did seem to enjoy it. Nobody fell asleep and good questions were asked at the end. One ham said that he enjoyed reading this GARC newsletter, but I didn't get his call. I will start writing about the general subject of Communications Systems in this issue, and if I continue for a while I will be able to put more into it than I did at the time-limited HRU forum. I will also be better able to stay focused on the topic without adding too many off-topic anecdotes.

MOON BOUNCE

I met Dick Knadle, K2RIW at the HRU. Everyone on Long

Island knows that Dick is an antenna expert and a real extra class ham. Dick reminded me that he still runs a technical chat net on Sundays at 8 PM on the LIMARC repeater, 146.85 MHz. Googling up K2RIW, I found that Dick is also involved with Moon bouncing. Out of curiosity I signed up and joined the [Moon-net] chat group and soon my INBOX became full of reports from hams who had been Moon bouncing or trying to make EME skeds. I don't have the antennas needed for such sport so I'll delete my membership. Recently the Moon has been closer to Earth than it had been for quite some time. Another lost opportunity! It won't wait for W2ILP to build an antenna array and bark at the Moon.