Scott's Hill Project: Some Technical Issues Addressed

Photo: Norm Anderson,, KC7YCA

Scott's Hill site as seen from the air near the end of March 1999. The UARC building is the second from the left. Snowmobile tracks can be seen crossing in the foreground. The roof of the lowband pager building is just visible on the far right.

Volume XLIII Issue 5, May 1999

The MICROVOLT

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THE MICROVOLT (USPS 075-430) is published monthly except August for $15.00 per year or $1.50 per issue by the Utah Amateur Radio Club, 632 University St. Salt Lake City, UT 84102. Periodicals Postage Paid at Salt Lake City UT. POSTMASTER: Send address change to " *The Microvolt*" 2684 Kenwood Street, Salt Lake City, UT 84106

Prologue

The Utah Amateur Radio Club was organized under it's present name in 1927, although its beginnings may date back as early as 1909. In 1928, it became affiliated with the American Radio Relay League (club #1602) and is a non-profit organization under the laws of Utah. It holds a club station license with the call W7SP, a memorial call for Leonard (Zim) Zimmerman, an amateur radio pioneer in the Salt Lake City Area.

Meetings: The club meets each month except July and August. The meetings are held on the first Thursday of the month at 7:30 PM in the Doxey-Hatch Medical Building located at 1255 East 3900 South in Holladay, across the street from St. Marks Hospital.

Membership: Club membership is open to anyone interested in amateur radio; a current license is not required.. Dues are $15 per year, including a *Microvolt* subscription. *The Microvolt* and membership cannot be separated. Those living at the same address as a member who has paid $15 may obtain a membership without a *Microvolt* subscription for $9. Send dues to the Club Secretary: Russell Smith, KC7ZDZ, 3267 East 3300 South #115, Salt Lake City, UT 84109 ARRL membership renewals should specify ARRL Club #1602.

Contributions: Monetary contributions are gladly accepted. Send directly to the Club Treasurer: Chuck Johnson, 1612 W. 4915 S., Taylorsville, UT 84123-4244. For in kind contributions, please contact any board member to make appropriate arrangements.

Repeaters: UARC maintains the following repeaters: 146.62 (-), 146.76(-), and 449.10. The repeaters are administered by the UARC Repeater Committee. Comments and questions may be directed to any Committee member. The Lake Mountain repeater 146.76(-) has Autopatch facilities on both the Orem exchange (covering Santequin to Lehi) and the Salt lake City exchange (covering Draper to Layton). The 449.10 repeater has autopatch facilities into Salt Lake City only. Due to the volume of traffic, only mobiles should use this autopatch. Autopatch use is open to all visitors to our area and to all club members. Non members who wish to use the Autopatch are encouraged to help with the cost of maintaining the equipment by joining the club.

Ham Hot-Line: The Utah Amateur Radio Club (UARC) has a Ham Hotline, 583-3002. Information regarding Amateur Radio can be obtained, including club information, testing, meeting information, and membership information. If no one answers leave your name, telephone number and a short message on the answering machine and your call will be returned.

Publication: The Microvolt is the official publication of the club. Deadline for submissions to the Microvolt is the 10th of each month prior to publication. Submissions by email are preferred (bbergen@xmission.com), but other means including diskettes and typewritten submissions can be mailed directly to: Bruce Bergen, 3543 Fieldstone Cir., SLC, UT 84121. All submissions are welcome but what is printed and how it is edited are the responsibility of the Editor and the UARC board. Reprints are allowed with proper credits to The Microvolt, UARC, and authors. Changes in mailing address should be communicated to the Club Secretary: Russell Smith, KC7ZDZ, 3267 East 3300 South #115, Salt Lake City, UT 84109.❑

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❑

Contents

For late breaking news listen to the UARC Information Net Sundays at 21:00 on 146.62 or set your browser to:
www.xmission.com/~uarc/announce.html ❑

We are grateful to the management of Xmission, our ISP, for the donation of this Web-Page service. ❑

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The Microvolt

The Official Publcation of the Utah Amateur Radio Club, Salt lake City, Utah

Volume XLIII, Issue 5, May 1999

Photo: Steve Perry, N7SWP

QST from The Prez

One of the most significant rules in all of part 97 and perhaps the shortest is the rule labeled "Good Amateur Practice." It says "In all respects not specifically covered by FCC rules each amateur station must be operated in accordance with good engineering and good amateur practice." (Part 97.101(a)). You are expected to strive to maintain your equipment, signals and operating practices in a manner consistent with the highest possible standards.

I have received several items of information regarding good operating techniques. Some relate directly to the use of our repeaters and other local issues. I thought I would pass these along. Some of this information is found in the ARRL Handbook, the ARRL Repeater Directory, the FCC Rule Book, and some advice from other Amateurs. These are in no particular order.

1. No music, obscenity, broadcasting, malicious interference, and indecency. If you are listening to music and happen to be on the air, you need to turn the music down or off. Do not forget that anyone could be listening including non-amateurs, so I would suggest you do not use obscenity, indecent speech, or discuss highly personal issues. Leave a good impression. Broadcasting is also not permitted by an individual operator. There are nets or announcements that may broadcast items pertaining to all Amateur Radio operators. This is what is called a QST. Malicious interference is forbidden, even if you do not like the operator.

2. Amateurs need to identify every ten minutes and at the end of the of the QSO. It is proper to call the operator by call sign you want to talk to and then say "this is" and your own call sign. (KI7OM this is KC7AWU). In sending Morse Code "de" is used which stands for "This is."

3. At then end of each transmission, it is a good practice to leave a pause in case someone would like to break in and join the QSO or may have an emergency.

4. If you cannot be understood in giving information, it would be helpful to use phonetics as set forth by the International Telecommunication Union (ITU). These are listed in almost any Amateur Radio book. Memorize them - they were in the test material.

5. If you are new to Amateur Radio or new to a specific repeater, it is best to listen in for a bit to see how others use the repeater.

6. Use simplex whenever possible. If you can conduct your QSO on a direct frequency (simplex) there is no need to tie up a repeater.

7. Do not KER-CHUNK (keying up without IDing) just to see if the repeater is operating. If you want to check to see if your programming on your radio is correct, then key up and state your call sign and say "Test."

8. All repeaters are assembled and maintained a considerable expense by a group, individual or club which is responsible for that repeater. Those who use the repeaters should support the efforts of keeping the repeaters on the air.

Thank you. and 73.

Gary Openshaw, KC7AWU .□

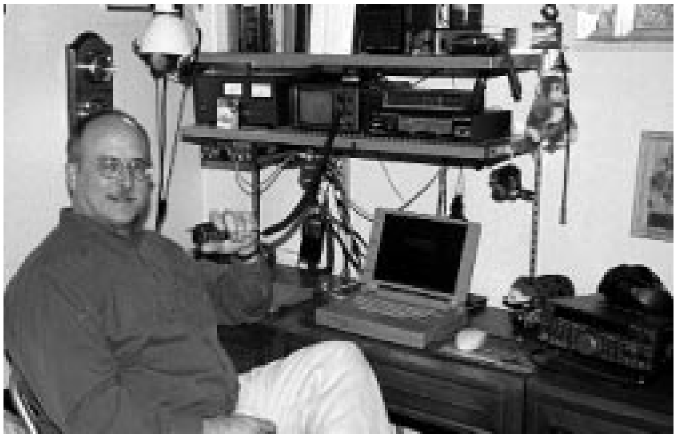


Photo: Ron Speirs, KC7MYS

Mike Youngs, KB7WUY, in his shack.

Featured Member of the Month: Mike Youngs, KB7WUY

Featured this month is Mike Youngs KB7WUY, who has been licensed since 1993. Mike's father, Leonard Youngs, WA6VXZ, has been an active amateur radio operator since 1943 with his advanced license. His father never seemed to be able to get his son interested in the hobby. Mike reports that it was because his father was always trying to get him to learn the morse code instead of letting him get the experience of talking on the radio. This frustrated him because he claims he just doesn't have an ear for the code. It wasn't until years later that Bruce Bergen, KI7OM, sparked Mike's interest in the hobby when they were working, in 1993, together on the scouting *On Target* program. He passed his test in May of that year and immediately bought a radio. Back then one often had to wait 18 weeks, or longer, to get the license issued, since the FCC had not yet automated.

In August of that year mike attended the BSA National Jamboree at Fort A.P. Hill, Virginia (a US Army Base). There was an extensive, well equipped, and well maned amateur radio pavilion at the Jamboree, but all he could do was listen because he still had not received his license. (Bruce Bergen’s, son Anthony, KB7WMD, was also there and in the same predicament - no issued license) Mike is very active in the scouting program, serving at the unit, district and council levels. He is also the recipient of the coveted Silver Beaver award, the highest award a scout council can bestow upon an adult volunteer.

Mike works for US West as a systems engineer. He and his wife Pam, have one boy and four girls. He says he can't get his wife near the radio. His only son did pass the novice portion of the tech test but is now serving a mission for the LDS Church in Bolivia. Hopefully when his son returns he will get his license.

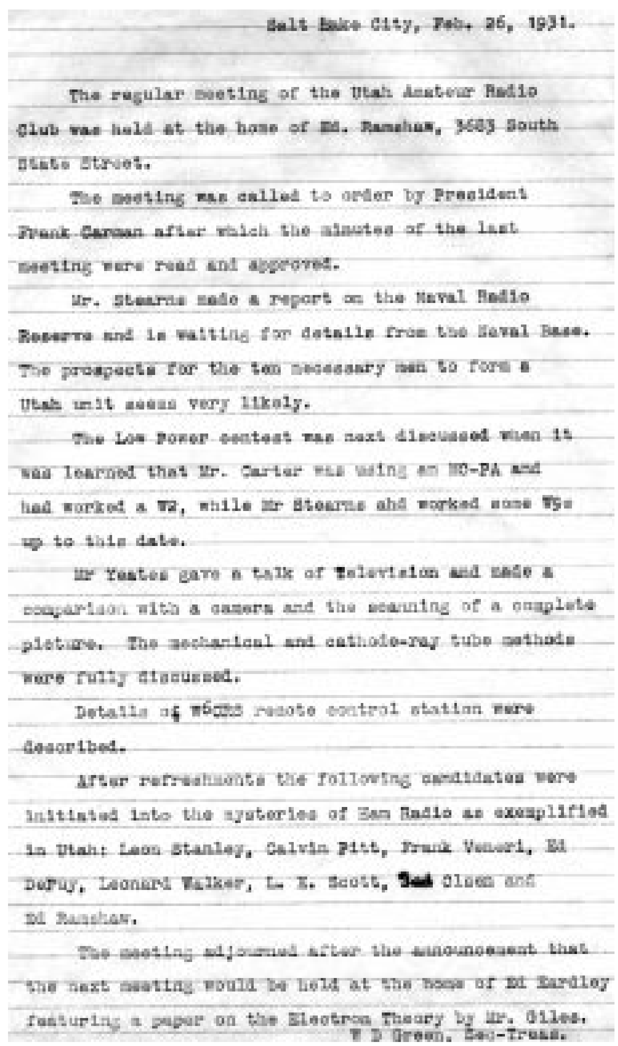
His favorite facets of amateur radio are emergency service, packet radio and APRS. He enjoys listening to the HF bands on his Kenwood TS- 450 SAT (an all-mode HF rig) and hopes to upgrade soon so he can use those frequencies on his 450.

Mike is a member of UARC, ARRL and the Davis County Amateur Radio Club. Mike has been serving as the coordinator for the UARC Information Net since 1993. In this roll he is in charge of scheduling the net control operators each week and assuring that the net takes place as scheduled.

Mike, we wish you the best in all your endeavors especially upgrading so that you can use your 450 rig.

73 N7HVF, Linda Reeder.□

A Blast from the Past



Salt Lake City, Feb. 26, 1931.

The regular meeting of the Utah Amateur Radio Club was held at the home of Ed. Ramshaw, 3683 South State Street.

The meeting was called to order by President Frank Carman after which the minutes of the last meeting were read and approved.

Mr. Stearns made a report on the Naval Radio Reserve and is waiting for details from the Naval Base. The prospects for the ten necessary men to form a Utah unit seems very likely.

The Low Power contest was next discussed when it was learned that Mr. Carter was using an UX-PA and had worked a W2, while Mr Stearns ahd worked some W9s up to this date.

Mr Yeates gave a talk of Television and made a comparison with a camera and the scanning of a complete picture. The mechanical and cathode-ray tube methods were fully discussed.

Details of W6CRS remote control station were described.

After refreshments the following candidates were initiated into the mysteries of Ham Radio as exemplified in Utah: Leon Stanley, Calvin Pitt, Frank Veneri, Ed DePuy, Leonard Walker, L. E. Scott, Ted Olsen and Ed Ramshaw.

The meeting adjourned after the announcement that the next meeting would be held at the home of Ed Eardley featuring a paper on the Electron Theory by Mr. Giles.

W D Green, Sec-Treas.

"So, you want to put up a synchronous repeater system?" or Is a synchronous repeater right for you?

Editors Note: Since posting details of our Scott's Hill Synchronous Repeater plans, we have received inquiries, literally, from around the world. Clint, KA7OEI, wrote the following as a FAC (Frequently Asked Questions). I thought it was of enough merit to share with the general membership who may not have read it on the Club's WebPage.

The Utah Amateur Radio Club (UARC) has embarked on a major repeater project: A synchronous/voting repeater system. More specific information on this repeater system may be found at http://www.ussc.com/~uarc/rptr/synrpt1.html and its links. I strongly suggest you read these pages to get a general idea of what this system is, and what it will do, as well as to get a handle on the approaches we are taking to accomplish our goals.

I have received a number of emails with questions and comments about the system which have prompted this page. At the risk of repeating myself, I'll attempt to answer some of the common questions.

"What is a synchronous repeater system?"

A synchronous repeater is a linked system of several repeaters. Unlike a conventional linked system, all transmitters are on the same frequency.

"What is a voting receiver system?"

A voting receiver system is where there are several receivers with different antennas at the same site (or different sites.) The advantage of a voting receiver system is that is it much more likely that at least one of the receivers will be able to receive the input signal. Having a voting system can go a long ways toward reducing multipath, improving repeater's receive coverage in fringe areas and/or to handie-talkies.

"Why go through the trouble/expense of putting up a synchronous/voting repeater?"

Linked repeater systems are quite common these days. These systems offer the users wider coverage than a single-site repeater. However, when you go from the coverage area of one repeater into another, you have to switch to another repeater. This can be tedious and, as is often in the case in fringe areas, there are zones where you have to constantly switch among the various repeaters in the system in order to find the repeater that is good at that particular instant. Having a synchronous/voting system will allow this "site handoff" to become transparent, eliminating the need to constantly switch between sites.

An additional benefit is the ability to re-use frequencies. Instead of every repeater in a linked system occupying its very own pair, it is possible for every repeater in the link to be on the same frequency. The ability to do this would, of course, depend on the availability of frequencies in the areas to be covered and might require "realignment" of some other repeaters in the area.

"I have several repeaters in a (large/small) area that are linked. How far apart do they need to be from each other?"

The decision of if/how to implement a system of synchronous transmitters takes a bit of study. The most ideal situation for synchronous repeaters is where the transmitter sites have only fairly small areas of overlap, such as that which would occur in a mountainous region (such as the case of the Farnsworth/Scott's Hill system in Utah.) Having very large overlaps would not only be a waste of resources, but it would allow for the inevitable degradation to an otherwise perfectly good signal in that overlap area: No matter what scheme of transmitter synchronization you use, the result in the overlap areas is always somewhat of a compromise.

One of the primary considerations is to make sure the effect of the signals in the overlap areas causes less degradation than having having no overlapping coverage in the first place. If you were to allow a very large overlap area, you might end up with worse signals in that overlap area than if there was just one transmitter.

It is important that one doesn't go overboard with trying to put together such a system and cause more problems than are solved: You might find that with a synchronous system intact that one or more sites are no longer needed and it would be prudent to not include those sites in the system.

"What can be done to limit/reduce the amount of overlap between sites?"

One of the most obvious ways to minimize unnecessary overlap is by careful site selection. Having too much overlap can/may result in actual degradation in those areas. Another way is to carefully select transmit power.

The coverage areas may be "sculpted" somewhat by the use of directional antennas. The possibilities include:

Yagi
Side-mounted verticals (1/4 wave spacing from, say, a tower, to create a cardiod null)
Corner/Trough reflectors
Phased verticals

Since the system is likely to employ a voting receiver scheme as well, one should consider separate transmit/receive antennas: The directionality of the antenna will affect transmit as well as receive, and multi-element antennas such as yagis may be subject to creating their own intermod products in one or more of their many electrical/mechanical joints.

"Where can I buy a synchronous repeater system?"

I know of no off-the-shelf solutions that are directed at the amateur market. If you have deep enough pockets, you can buy commercial equipment that can be configured for amateur service.

"Can existing equipment be modified to operate in synchronous service?"

One of the most important parameters to control is transmit center frequency. If you are using crystal-controlled transmitters, it will be necessary to frequency lock them together. If synthesized transmitters are used, then the reference oscillators should all be clocked from the same source.

Almost as important is that the audio characteristics of the transmitters match. The most important of these is that the modulation sense is the same for all transmitters. That is, all transmitter swing up and down in frequency in unison. The frequency/phase response should also be as uniform as possible everywhere in the system.

This implies that all radios should be identical throughout the system. This not only includes the repeater transmitters themselves, but the link transmitters and receivers that tie all sites together. This may even mean that at each site, you have a receiver listening to the link transmitter in order to obtain transmit audio so that audio that is local to the repeater is affected in precisely the same way as the audio received from other sites.

"I have heard that you need to put an audio delay in the system. Is this true?"

If there are large areas of overlap that are, for the most part, of consistent time-of-flight difference between the two sites, then it might be a good idea to consider adding an audio delay to make sure the modulations from each site occur simultaneously in that area. Remember: it takes 1 millisecond for the signals to go 186 miles and 1 millisecond is the period of 1 KHz, and only a few 10's of miles difference could put the delays well into the audio range and cause significant distortion. Don't forget that the audio/signal processing in the system will add a measurable amount of delay.

Since our overlap areas occur in areas with different timing differentials, we plan to evaluate performance in those areas before deciding if a delay is necessary.

"How is UARC putting their system together?"

The UARC system is being put together from the ground-up. Well, mostly... The 33cm link radios are retired STL (Studio Transmitter Link) units from the broadcast industry that have been modified to operate in the ham band and various other components like Duplexers, power amplifiers, etc. from the existing equipment will be used.

But the actual 2 meter transmit and receive systems will be built from the component level.

We are taking a somewhat extreme approach in implementing this system. In order to assure that all receivers and transmitters match each other as much as possible, the actual receive and transmit audio for the entire system appears only in one place: At the Farnsworth Peak transmitter site.

Although you can read about it in detail on our webpage, I'll review the operation of the system in brief.

The receive signal is converted down to 10.7 MHz, where it is filtered and limited. It is then converted down to 40 KHz, yielding a replica of the received signal at that frequency. The 40 KHz received signal is modulated onto the baseband of the 33cm microwave link (in the case of Scott's Hill) or it is sent via twisted pair from the receive site to the transmit site (in the case of Farnsworth Peak, as it is a split site.)

At Farnsworth Peak, the 40 KHz signals from each site are upconverted to 10.7 MHz, filtered, and the audio from each site is recovered by identical demodulators. Each demodulator output is monitored to provide squelch information and data about the signal quality so that the receiver with the best signal will be selected for retransmission. The received/processed audio is modulated onto a 40 KHz carrier. In the case of Scott's Hill this signal is sent via 33cm microwave and in the case of Farnsworth, it is local, but in both cases, this signal is upconverted first to 10.7 MHz for filtering, and then to the transmit frequency.

The 33cm microwave link also contains a reference subcarrier to allow all oscillators to be locked to the same source.

The advantage of this scheme is that there is only one modulator in the system for all transmitters. This helps assure that the qualities of the signal from each transmitter as as close to being identical as possible. The use of this scheme for receive signals also helps convey squelch information and preserves the audio consistency among the sites for seamless voting receiver operation. It does involve a lot of construction of equipment, though.

If you are interested in the more technical aspects of this system, go to the Technical Description of the Proposed UARC 146.620 Synchronous Repeater page. You may also be interested in the Predicted Coverage Area of the system.

Clint Turner, KA7OE.□

Tigger's Quiz

Last month we covered basic Ohm's Law, and applied it to a simple circuit. This month I want to expand on that, and introduce you to two common types of circuits.

The first type of circuit I want you to become familiar with is called a "series circuit." (If you have any of the miniature Christmas light sets you are familiar with on application of series circuits and their shortcomings.) In a series circuit, the *same current* must flow through all the individual components of the circuit at the same time, but the *voltage dropped* across each part can be different (current must remain the same), and the *sum* of the voltages dropped must equal the supply voltage.

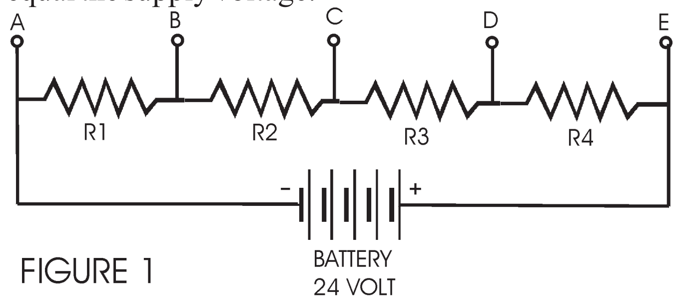


FIGURE 1

If all the resistors were the same value, lets say 10 Ohms (Ω), and the battery supplies 24 Volts, what would be the voltage dropped across each resistor? (Measure the $Volts_{R1}$ from A to B , etc.) you can calculate this one mathematically, or since all the resistors are the same ohmic value you can simply divide the number of same value resistors by the supply voltage to arrive at ta value of 6 volts being dropped across each resistor. (Notice that since the same 600 milliamps (.6 amp) of current must flow through all the resistors at the same time, **and** all the resistors are all the **same value** the voltage drops will all be the same)

Now what happens to figure 1 if:

R1 = 12 Ω	Measure from A to B	7.2 Volts V_{R1}
R2 = 8 Ω	Measure from B to C	4.8 Volts V_{R2}
R3 = 5 Ω	Measure from C to D	3.0 Volts V_{R3}
R4 = 15 Ω	Measure from D to E	9.0 Volts V_{R4}

Notice that we still have 40 Ω total resistance, so we'll still have the same 600 mA (milliamps) of current flowing through all the pasts of the circuit; but the voltages dropped through each part will be different and add up to the supplied 24 Volts. Let's figure for r1 together and then you get to try the rest yourself (and check how you did with the current answers shown above). Just for fun add up VR1 through VR4 - What number did you get?

To figure for VR1:

We already know the resistors value of 12 ohms (Ω), and the fact that 600 mA or .6Amp (remember 1000 mA = 1 Amp) is flowing through it you can calculate: Volts R1 = Amps R1 X Ohms R1 (or) V=A x R (Does that look familiar from last month?) So: .6 Amp x 12 ohms = 7.2 Volts dropped across R1. Try this for the rest of them - see you're smarter than you thought! Notice how the voltages dropped across each one varies with the resistors ohmic value, but they all add up to the 24 Volt supply.

One last not on series circuits, (this is why I hate miniature Christmas lights wires in series); if any part of the circuit burns our, (opens), it stops the current flow through the entire circuit. That's why when on lamp burns out in a set of miniature Christmas lights , the entire set won't light.

The second kind of circuit you'll run into is call a *parallel circuit*. It is a circuit made up of separate *branch circuits*. All drawing different currents from the same voltage source or put another way: *in a parallel circuit, the* ***voltages*** *across all the components or branches are the* ***same****, but* ***the currents can be different****.* Did you notice the difference between "voltage the same = parallel, and current the same = series, in the descriptions of the circuits? Also of note: in a parallel circuit the **currents** through all the individual branches are additive.

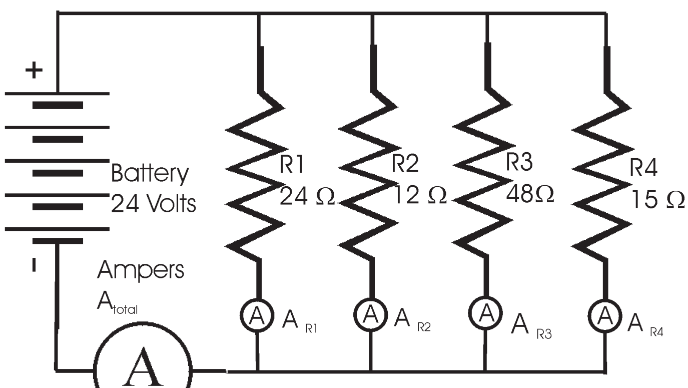


Figure 2

If: R1 = 24 Ω, what is current thru ammeter A_{R1}?
R2 = 12 Ω, what is current thru ammeter A_{R2}?
R3 = 48 Ω, what is current thru ammeter A_{R3}?
R4 = 15 Ω, what is current thru ammeter A_{R4}?
What is current thru ammeter $A_{to\ al}$?

Let's figure it out for R1, then I'll let you figure out the rest and check yourself against the current answers shown. Remember Amps = Volts/Resistance, or for R1, V_{R1}/Ω_{R1} or 24 Volts/24 Ohms, which equals 1 Amp. Try the rest of these and see how you do. Notice that even though the currents through each resistor are different, their supply voltage always equals 24 volts. The nice thing about parallel circuits is that when one part of it opens, or burns out, it doesn't affect the rest of the circuit branches (again, Christmas lights, when wire in parallel (sometimes called multiple) when one burns out the rest remain lighted.

This months column ended up becoming a lot longer that I originally planned. I hope the theory didn't get to deep (up to the knees). Next month I'm going to cover "fun stuff". Just in time for field day, well have a column discussing the do's and don't's of installing equipment in your trailer or RV. (Don't find out the hard way that the **black** wire in you trailer's 12 Volt wiring is +12V.

C Ya KA7TGR - John

P.S. We apologize for last moths type, the symbol for the lamp was incorrect it should have been (Opps!)

Editors Note: It's really wasn't a typo - the galley proof from the printer was OK - but when the plates were made up for printing it seems that an earlier layer in the graphics data had a resistor in that location and the top layer seems to have been removed in the version that went to press - sorry. □

Those Mysterious Transforms – Finally A Real Circuit!

The Big Picture.

The last article in this series used the Fourier transform to *specify the basic requirements* of a band pass filter, for improving the signal to noise ratio of a Morse code signal. But, that transform didn't help us to *design the actual filter circuit*. The Laplace transform will help out with developing the circuit. If you can hang on long enough you'll see how this all works, and we'll end up with a pretty neat Morse code filter with an design employing garden variety transistors. The filter will improve the signal to noise ratio by upwards of ~15 dB by using an audio filter with about 75 Hz bandwidth (to accommodate up to 30 words per minute of code). This is the calculated improvement over using a typical SSB filter for code work. Although this present article will focus on the Laplace transform and an analog solution to our filter problem, it would also be possible to migrate to the digital world via the z transform, and realize the signal processing function in a computer. That will have to wait.

An Opinion.

Some will disagree with this, but I think the objective of a Morse code filter should be to improve the desired signal to background hiss (noise) ratio, without eliminating the ability to hear other code signals in the frequency vicinity. Experts will tell us that the human brain processes sounds much like a spectrum analyzer – we pay great attention to sound pitch differences and overtones. (The human brain does not handle visual information in an analogous fashion. Thus, what is important in electronically processing audio may be different than what is important in processing video, but I guess I'm getting off the subject). Anyway, my point is that it is helpful to remain aware of other (different pitched) signals near the signal of interest, and our brains can still focus on the desired signal. The filter that I will propose will *increase* the strength of the desired signal *without increasing* background hiss and neighbor signals. I think this is better than a "brick wall" audio filter that virtually eliminates neighbor signals. A second order bandpass filter with some special qualities will fill our needs, as described later on. There are also group delay considerations that a second order filter handles quite well, but we won't get into that here.

Important Laplace Tramsform Features.

This section moves kind of fast and is not very rigorous, but it may peak your interest in doing some further personal studying. Some time domain functions cannot be directly transferred to the Fourier frequency domain. The unit step function, g(t), is such an example, sited in a prior article in this series:

$g(t) = \mathbf{0}$ for $t < 0$ $\quad g(t) = \mathbf{1}$ for $t \geq 0$

The Laplace transform, however, can deal with the above unit step function. Using the definition given earlier over non-zero limits of integration:

1) $G(s) = \int_{0,+\infty} \mathbf{1}e^{-(\sigma+j2\pi f)t}dt = [-1/(\sigma+j2\pi f)][e^{-\sigma t}e^{-j2\pi ft}]\Big|_{0,+\infty} = 1/(\sigma+j2\pi f) = 1/s$

where $s = \sigma+j2\pi f$, and G(s) designates the Laplace transform of the step function, g(t)

The above step function can be thought of as plotting against time the results for taking the integral (= area) of a short burst or "lump" of electrical current that occurs right at t = 0. Consider also what would happen if this short lump of current flow were applied to a capacitor: the capacitor would retain a charge, and therefore a stored voltage inversely proportional to the capacitor value. This capacitor voltage, plotted against time, would also look like the above step function. Thus, the Laplace transform of a capacitive reactance for a capacitor of value "C" is 1/(sC). The Laplace transform of a resistor is just itself (nothing special).

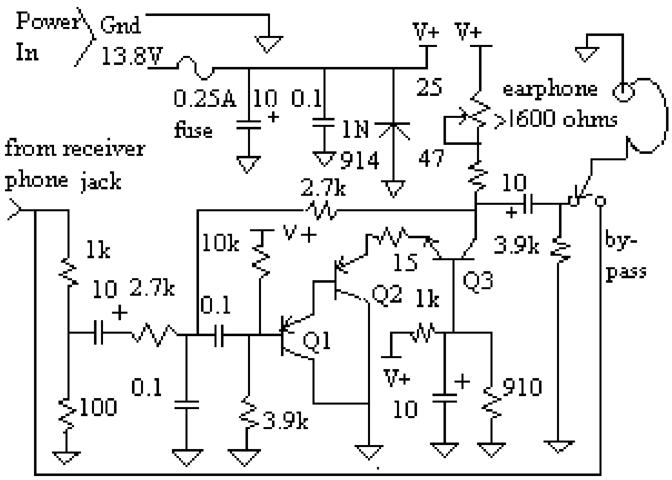
Note from equation 1) that when σ approaches 0 (in the limit) then g(t) transforms to $1/(j2\pi f)$. This amounts to replacing s with $j2\pi f$ (a "cheating" way to take the Fourier transform), and this gives us the long term "steady state" physical frequency response. This is because the Fourier transform, by its very definition, supplies us with physical frequency information. In general, replacing all of the "s" terms with "$j2\pi f$" in *any* Laplace function gives us the ability to determine steady state properties. For example, finding the function magnitude requires one to calculate the "square root of the sum of the squares" of the real and imaginary parts of such a function. If you were to play with it long enough (using this approach, or other approaches beyond the scope of this writing) you would discover that equation 2) below is a band pass function, defined here as $G_{BP}(s)$. That is, it has the steady state magnitude response of a band pass filter with a gain of k at a center frequency of f_c hertz, and it has 3dB bandwidth of B_W hertz.

2) $G_{BP}(s) = [s2\pi kB_w]/[s^2 + s2\pi B_w + (2\pi f_c)^2]$

Consider that some "messy" circuit may have a bunch of resistors, capacitors and active devices (like transistors) all connected together such that one can apply Ohm's Law multiple times to the Laplace transforms of these parts' impedances. By doing this properly one can get a relationship between the output signal and input signal. This ratio of output voltage, Vo, to input voltage, Vi, will then be a mathematical expression with R, C, and s terms. If the *form* of this expression happened to be the same as equation 2) we would know that we had a band pass filter.

Now For An Actual Circuit!

OK, enough fooling around with laying a foundation. (I still think it is important to see where it all comes from. Does anyone want to do some further reading? Are you HAVING FUN yet?) Consider the circuit shown in figure 1.



NOTES: Let R1 = all 2.7k resistors, and also the parallel combination of 10k and 3.9k connected to base of Q1. Let R2 = 15 ohms, R3 = series combination of 47 ohm and 25 ohm potentiometer. Let C1 = 0.1uF capacitors associated with base of Q1. Q1 & Q2 are 2N2907, and Q3 is 2N3904.

FIGURE 1

The circuit components referenced in the notes of figure 1 are the ones that define the AC filter characteristics. Other components are necessary for signal coupling and DC biasing. By applying Ohm's Law in the manner stated above (too messy to show in this limited space) we obtain the following AC transfer function for the circuit:

3) $Vo/Vi = [(sR_3)/(R_2R_1C_1)]/[s^2 + s(4 - R_3/R_2)/(R_1C_1) + 2/(R_1^2C_1^2)]$

Notice that this is of the form given in equation 2), and is therefore a band pass filter. (Said differently, both equations 2) and 3) have a first power s term in the numerator and a quadratic s expression in the denominator.) This circuit has a special property such that when the variable resistor (part of R_3, per notes in figure 1) is increased, the bandwidth is narrowed, the center frequency remains constant, and the gain at the center frequency increases. This is evident by inspecting equations 2) and 3), and noting what happens when R_3 is made larger (for example, increasing R_3 in equation 3) will make the bandwidth term in equation 2) get smaller). This is precisely the desired performance that was hoped for, as expressed near the beginning of this article: A) a code signal tuned to the filter center frequency can be increase in strength by narrowing up the bandwidth, B) neither the broader band audio noise nor the other audible code signals are increased much in amplitude since they are not set right at 800 Hz.

I suppose I should mention that I have actually built up this circuit, and it works great! I use it when listening to CW on the bands. I can (and usually do) set the 25 ohm potentiometer to its maximum value, giving a bandwidth of about 63 Hz. Since I am not interested in listening to a full 30 words per minute code signal, I can narrow the bandwidth further than the 75 Hz that was calculated for 30 wpm. I use the receiver's audio gain knob for a comfortable volume, and I tune the receiver to get the wanted signal to have an 800 Hz pitch. I was careful with construction, placing the circuit in close proximity to a ground plane and keeping wires short. Even though it is "just" audio, a circuit like this with a narrow bandwidth (high Q) can tend to act a bit strangely if not built carefully.

We've used the Fourier and Laplace transforms to first specify and then design this analog filter. In my judgement, this present analog design is probably the optimal solution. Maybe another time we can talk about using the z transform to migrate the design into a computer. This would serve to illustrate the technique because some design problems (if not this one) are better solved using a computer.

Steve Curtis , AB7LF .□

Conquering the PL-259

By Walt Stinson-WOCP. This appeared in the February 1999 edition of "B.A.R.C's Bark", the newsletter of the Boulder Amateur Radio Club, Mary Ciaccia Editor.

New year's resolutions for hams. Among the ones I've heard recently is "I will always solder the braid to the PL-259." That got me to thinking about what a hassle it is working with coax and PL259's (not to mention hardline and N connectors!).

Well. many years ago, after consulting with Mr. Murphy. I made that same resolution. I faithfully followed the instructions for assembly of connectors in the Handbook. I remember using the tip of a nail to unravel the braid and trimming it with scissors.

Two moods would fall over me after a session of soldering 259's: Self righteousness, for I was truly entering the ranks of the deserving; and klutziness, because about half the time I would have to cut off the end I was working on and start all over again.

Finally, after years of trial and error. I devised a fast and foolproof method of assembling the little buggers. If you follow my prescription. I assure you that you too will enter the ranks of the deserving (of course you will also need an antenna.)

Gather up the following tools: (There are no guarantees unless these tools are used!)

- Weller D550 240/325 watt soldering *gun*
- 1" adjustable pipe cutter (Rigid No.104)
- Tape measure with sixteenth inch scale razor blade style cutting tool
- Triple core 60/40 solder, .047" diameter black felt tip pen
- Household style pliers
- Vise

Here are the steps: (POST THIS BY YOUR WORKBENCH)

1. Using the razor. cut off 1-1/8" of insulation.
2. Put the Weller on high and tin the braid.
3. Measure 13/16" from the end of the coax and mark it.
4. Using the pipe cutter, cut through braid and insulation.
5. Slip off the insulation & tin the exposed center conductor.
6. Slip on the coax fitting sleeve!!!
7. Screw the coax fitting onto the coax using the pliers.
8. Heat a hole in the coax fitting, touching tip to braid.
9. Apply solder through all holes. Keep fitting hot.
10. Solder the tip of the fitting and check continuity

Since I have been using this method I have not had one intermittent problem. Moreover, my coax recently got caught as I was raising my motorized crank up and the cable just about tore the tri-bander off of the tower! Fortunately the coax was connected to a balun and a remote switch. The females were ripped out of both of these but my cable was unscathed, which proves that solving one problem simply reveals another. □

Soldering Safety

Editors Note: Even though it seems that the author, who is unknown, chose to write in cryptic style and not always in complete sentences - this reads like a warning label on a bottle of over-the-counter medication - I felt that it had some good information for those who may be trying their first soldering job.

SOLDERING IRONS pose burning and electrocution hazard. Degree of burns depends on reflexes.

ALWAYS wear goggles or AT VERY LEAST glasses. ALWAYS wear long sleeve clothing and NEVER shorts. WARNING! Solder contains lead which may be harmful. Federal and State laws prohibit use of lead solder in making joints in any private or public potable (drinking) water supply system. Avoid breathing flux fumes emitted during soldering. Flux fumes may cause pulmonary irritation or damage. After handling solder wash hands with soap and water. NEVER breathe soldering fumes, they are irritating at best. ALWAYS wash hands with soap and water after handling flux. Always have good ventilation when soldering.

Iron in 15-35 Watt range is ideal. That power will melt solder just fine but will also give enough time for any extended heating without severe board damage. Gun type heats up in matter of seconds and are usually between 50 and 150 watts. When getting a pencil iron buy one that has replaceable tips. Tips are usually copper or iron and some fluxes are VERY corrosive at high temps.. For most electronic work pointed or flat tip works best.

Solder is an alloy of several metals. Proportions of each metal determine solder characteristics. Things like melting temperature, strength, conductivity, and other properties are very dependent on the alloy. Most solder used in electronics is 60/40 and describes an alloy of 60% Tin and 40% Lead. Silver solder is 62/36/2 and is composed of 62% Tin, 36% Lead, and 2% Silver. Silver solder is used in SM (Surface Mount) applications to improve conductivity. Added silver in alloy gives lower melting point.

Rosin Core is most common in electronics and is 60/40 solder with rosin flux. NEVER USE acid core solder IN ELECTRONICS. Solder wire comes in many gauges (diameters). For electronics use no bigger than 19 (.040). Flux removes the oxidation & oils from the wires and allows the solder to stick. Even the rosin core solder sometimes needs that extra "oomph" to work. Don't get flux from plumbing stores. More is better is not the case with flux. Just a little bit gets the job done.

Don't try to solder aluminum wire (can't be done without special equipment and materials) or use 15 Watt iron on 300 Watt job. With soldering gun forget about point-soldering (ie. soldering by just touching the tip of iron to connection). Tip gun iron looks like letter "U" from side. Molten solder tends to stay in inner part of U and very little of it stays on outside surface. Carbon and other deposits that are always present when soldering cause whole outer surface of tip to be covered with junk and only tinned surface is inside the tip.

STRONGLY do not recommend using gun style irons for soldering chips or any other PCB-oriented activities. Gun iron is very useful when soldering wires or other applications where high power and fast heat-up time are essential. Gun soldering irons are really low-ratio transformers. Tip completes circuit for low-voltage-high-amp loop while handle hides line-voltage-low-amp coil. If gun iron takes bit longer than usual to heat up most likely looking at bad connection where tip attaches to 2 rods coming out of the iron. Loosen screws, take tip out, polish contact area (tin them) and reassemble. Don't try fixing by just tightening the screws -going to strip threads in no time since 2 rods are made out of a material that conducts well and is not physically strong.

Pencil iron is length of heater wire wound around chunk of iron with tip on one end and heat-insulated handle on other. Pen irons are very useful in almost all low-power applications. Using thin enough solder (with rosin core) can practically assemble any computer motherboard. Pen irons of 15 to 30 watts recommended for soldering surface mount and delicate chips while 35 to 50 watts works well when soldering other components (like resistors, capacitors, switches, etc). These wattages melt solder don't burn fiber glass (PC board). .□

The Care of Power Supplies

This appeared in the February 1999 (electronic) edition of the TSRC Newsletter, the newsletter of the Twin States Radio Club, Mike Maynard WBIGRR Editor.

With all the high-tech toys out there, what can be so interesting about the lowly power supply? Well, when the power supply dies, many of the toys also stop working. Knowing how to maintain and service your power supply will keep you on the air, while others are scratching their heads.

Recently, I was on a trip and had the radios and power supply with me. One night, as I was about to connect the power cable from the supply to the radio, the cable slipped from my hand and the exposed negative lead brushed up against a power transistor on the supply. When the lead touched the transistor, it produced a loud spark and the supply ceased to fimction. This meant no power for the HF, VHF and UHF radios, the laptop computer and the GPS! The supply had to be fixed!

Power supplies come in two general varieties: Linear and Switching. There are other types, but they tend to be rare. A linear supply uses a transformer to drop 120 volts to around 16 volts AC, which is rectified with diodes, filtered with capacitors and regulated with transistors and/or IC's. A switching power supply, or switcher, rectifies the 120 volts directly and voltage is dropped and regulated by chopping or oscillating the voltage, and then, finally filtering back to pure DC. You can easily tell the difference between a linear and a switching supply. If you have a 20-amp supply and can pick it up without getting a hernia, it's probably a switcher. A linear supply requires a transformer large enough (heavy) to handle the current. Switching supplies are almost always used in computers. The linear supply is quite simple-if something goes wrong, it is often a transistor or IC in the regulator. The switcher is very complex, and any part can fail. Don't ever open up a switching power supply when it is on.There are peak voltages over 200 volts all over the place. Leave that to someone who knows what they are doing. You should also be careful when working around a large linear supply. Those large capacitors inside pack quite a wallop. There's not enough voltage to kill you, but the current they can provide, even when unplugged, can weld your watch or ring, Use a 100 ohm resistor across large capacitors to discharge them before playing around.

If your power supply has power transistors mounted externally on the case, you might want to make some modifications to avoid shorting them out. With a voltmeter, carefully measure the voltage from the transistor case to both the positive and negative leads of the supply. The case is often "floating" and is neither positive nor negative. If you see voltage, it would be prudent to construct a guard to keep metal objects from shorting out the supply. A piece of hard plastic or bakelite should do the trick. The two things you must consider is that the transistor and heat sink often gets really hot and anything you put over the transistor should not interference with air getting around it to keep it cool .around in there or you will really be in trouble.

Always, always, always have a multirneter available. Check your voltage regularly and keep it around 13.5 volts, measured at the supply. Make sure the leads are fat enough for the current draw. If the voltage drops more than a few tenths of a volt in transmit (while staying steady at the supply), use fatter leads. One nasty thing about linear supplies is that the pass transistor sometimes shorts out. The result is 25 volts on the output. If you have anything connected, you end up with dead supply and dead radio. When hooked to a transceiver, that usually means that the power amplifier chip or transistor on the transmitter is destroyed. These devices usually cost around $100. I had a circuit called an overvoltage protector, which would short out the supply if the voltage got above 16 volts. Unfortunately, any RF in the shack set off the protector. It now resides in the junk box. Yes, I live dangerously! Mitch Sten-wlsj @ vbimail.champlain.edu .□

UARC News

Join/Renew Your ARRL Membership and UARC Gets Money!

Through a special program offered by the American Radio Relay League (ARRL), whenever someone joins the ARRL **through UARC**, the club gets to keep $5 of the ARRL membership fee. For renewals, UARC keep $2 each year. As UARC has a large number of ARRL members, this can add up to a sizable amount to go towards various club activities like the Steak Fry and Field Day. In order to do this, you **must** renew through the club. If you renew directly with the ARRL or through their web site, UARC does not get any of the money, so please plan on renewing at the club meeting. There will be an area manned by Gregg Smith, KD7APW, where you can fill out applications. Please remember that by joining the ARRL you get a great magazine, QST, and you are supporting the only national amateur radio membership organization in the country.

Go Take a Hike

It all started over ten years ago when a Don Richardson, WA7QKF, and his wife decided that hiking was an enjoyable way to get exercise, but just doing it once a week wasn't enough. The solution seemed easy enough --in addition to a regular Saturday hike, have one in the middle of the week as well, say, on Wednesday. So they tried it and invited some friends to come along, and the tradition of Wednesday night hikes was launched.

With a certain amount of on-the-air exposure, including using the '62 repeater to coordinate arrival at the starting location, and talking about the hikes afterwards, several more hams joined in. We're not just sure if it sounded like the "in" thing to do or if they were convinced they were having fun.

Then there were the folks who hiked with us exactly once and were never seen again. We don't know just why they didn't return, but our phone calls are answered with some comment about further communication being through their attorney.

Well, the tradition is continuing for yet another summer. Every Wednesday evening, starting sometime in late May or early June, we meet at 6 p.m. in the parking lot at the mouth of Big Cottonwood Canyon. Our numbers range from about two to twelve. We then pile into a small number of cars and head for one of the nearby National Forest trails. There are enough of them in Big Cottonwood, Little Cottonwood, and Millcreek canyons to keep us busy all summer without repeating. Sometimes the trip is as short as a jaunt around the boardwalk at Brighton, and other times it is as ambitious as Mt. Baldy and Hidden Peak starting from Albion Basin.

Where will we be going next week? Well, we don't know, yet. Wanting to prepare for possible future management positions, we always put off the decision-making as long as possible. When everyone has assembled we make the decision together, taking into account the weather, how ambitious we all feel, how much daylight we have, any special requests, and how several tossed coins land.

If you would like to join us, please do. We are fortunate to live where we have so many great mountain trails virtually on our doorstep, and a chance to get up in the mountains for a couple of hours makes a great break in the middle of the workweek. Just show up at the Big Cottonwood parking lot at 6 p.m. on a Wednesday evening (starting late May or June). Talk-in is usually on the 146.62 repeater.

Gordon, K7HFV

May Meeting: CW Can Be Fun!

Max Matthew George, NG7M, found that operating CW can be a lot of fun.

Since the late Eighties, when the FCC changed the entry license requirements, by offering a new class of license, the "No-Code Technician", the majority of new Hams have entered the hobby with little or no exposure to the Morse Code. HF privileges, which allow operation in the Ham bands below 50 MHz, are for the most part the only way to communicate beyond the horizon, are still reserved for those who have demonstrated at least a five word a minute code skill. Some have made several unsuccessful attempts to get their arms around this skill only to find themselves frustrated. There is still hope for those poor frustrated souls in the form of Matt George. You may find his name confusing. His full name is Max Matthew George, and his friends typically know him as Matt, but in most Amateur Radio circles and on HF, he go by Max. Max sounds much better in CW!

NG7M, Max George was first licensed in July of 1994. After waiting 14 weeks for his Code Less Technician ticket to arrive (KC7DWP), he decided to investigate what would be required to upgrade to the next Amateur license. This obviously led him to the Morse Code requirements. Rather than worry about the required effort to learn Morse Code and or the viability of Morse Code as used on the Amateur frequencies, Max decided then and there that he was going to learn the Code and upgrade regardless of the effort required.

He quickly found that there were several software programs that were available to help someone learn and master the code. Two weeks of one hour sessions with a software program called 'Morse Academy' followed along with a trip to a UARC testing session and an attempt at the 5 wpm Morse Code exam. Max left that session with a grin on his face and a burning desire to get on the air and make a Morse Code contact on the HF bands. A borrowed HW-8 Heathkit CW rig and a hunk of wire in the back yard help accomplish that first CW contact with WJ7H in Clinton Utah.

More time listening and learning code help prepared Max for the 13 wpm exam several weeks later. At this test session in Farmington, he attempted the 20 wpm exam just for fun. By some miracle that can't be explained he walked away with a passing grade on the 1C 20 wpm element that night. Now a 'coded' Technician with a CSCE sign sealed and delivered confirming that the 1C 20 wpm element was out of the way.

The rest of the upgrade process was academic at this point. General, Advanced and Extra theory was a pleasure not having to worry about the 1C 20 wpm element. Max waited for an exam session to be held at Weber State University the first part of December 1994. At this exam, the Extra theory exam was put to rest and Max became AB7GM. A couple of years later when the Extra Class vanity callsign program was put into effect, Max put a request in for a vanity callsign and was issued the call NG7M.

He is quick to mention that far more time and effort has been put into learning and study Morse Code since passing the 1C 20 wpm element. Max has had a rewarding 5 years as an Amateur operator. His current Amateur interests include HF contesting (the mode of choice is CW of course!), running and maintaining the Utah DX Packet Cluster.

Max is the Director of Software Development for Axiom Technologies in Clearfield Utah and earns a living pushing buttons writing custom software for several different companies in C++.

If you would like to hear about the excitement and enjoyment Max has extracted from Amateur Radio along with his experience in learning to operate CW, you should plan on attending the May meeting of UARC. Matt will show how, first of all you can master the code with a systematic and fun approach, and his enthusiasm of operating CW may give you some insight to why it, even in the digital age, CW remains the favorite mode of many operators.

Again, the meeting is at 7:30 on May 6. Of course, it will have all the customary features including “eyeball QSOs,” a chance to peruse ARRL books, and the famous “Dime Lime” or “Meeting After the Meeting,” which allows a chance to check out the most popular kinds of pizza. Don't miss the fun! ❑

Other Club News

Utah Hamfest

Due to an increased interest in having a Utah Hamfest, the organizational committee is once again reconvening. We are looking for all amateurs interested in working on Utah Hamfest 2000. Any ideas, support, help, or just good suggestions will be welcome.

At press time a meeting was scheduled to be held on Saturday, April 24th in the Utah State Office of Comprehensive Emergency Management to do the initial planning.

We are looking to really bring Utah Hamfest back with a bang!

73 and hope to see you there.

Kathy Rudnicki, N7JSH (Just Say Hamfest)

Golden Spike / Box Elder QSO Party

Don't forget the Golden Spike/Box Elder QSO Party Starting May 8, 1999 8AM local time, ending May 10 Midnight local time. Sponsored by UBET (Utah Box Elder Thiokol) this is an annual event commemorating the driving of the Golden Spike at Promontory, Utah, at the completion of the transcontinental railroad, May 10, 1869. Details are in the March 1999 issue of the UBET’s newsletter the *Radio Flyer*. To view this set your browser to: http://members.xoom.com/ubet/ . The announcement has also gone out to 73 Amateur Radio Today, CQ and QST but they are uncertain whether they met their publication deadlines.

FCC Official Acknowledges OOs Really Are "Official"

The FCC's top amateur enforcer, Riley Hollingsworth, K4ZDH, says that hams who receive notices from ARRL Official Observers should take them seriously or take the consequences. "Failure to take the notices seriously and to take corrective action where possible will not be tolerated by the Commission," Hollingsworth said in an enforcement-related letter to a South Carolina amateur. "The volunteer work of these Official Observers is a critical element of the Commission's enforcement program," he said, adding that failure to act on an OO notice could lead to fines and other sanctions.

Hollingsworth's comments were contained in an April 7 station-inspection follow-up letter to Richard Whiten, WB2OTK, of Easely, South Carolina. Hollingsworth and an FCC engineering team visited Whiten's station on January 22 after what Hollingsworth called "longstanding complaints" about the operation of Whiten's station. Whiten reportedly cooperated in the station inspection. According to the FCC letter, the Commission has received "numerous complaints" about Whiten "regarding profanity, obscenity, broadcasting extreme racial slurs, deliberate interference and failure to properly identify." Hollingsworth also said he'd heard complaints that Whiten had played recordings over the air "for the purpose of harassment or deliberate interference."

Hollingsworth noted that Whiten had "apparently ignored notices from Official Observers," and pointed out that the volunteer OOs work "in accordance with an agreement between the Commission and the ARRL and in accordance with our statutory authority."

"One thing I have really picked up as I travel around to groups is the frustration of the OOs," Hollingsworth told the League this week. "We're going to correct that, pure and simple."

In his letter, he told Whiten that, although the FCC considers hams to be self-policing, "the success of that regulatory approach depends upon the adherence to notices of possible improper operation from other licensed amateurs who are recognized Official Observers." The FCC asked Whiten to list all notices from OOs he has received since the start of his license term on September 27, 1994, and any corrective actions taken in response.

The FCC also set aside a February 10, 1999, grant of the vanity call sign W2OTK to Whiten and said his license expiration date remains October 15, 2001.

Hollingsworth also took advantage of the opportunity provided by his letter to Whiten to spell out the FCC's position on obscene and indecent Amateur Radio transmissions. "Obscene speech is not protected by the First Amendment and cannot be broadcast at any time," he advised. Indecent speech also is not protected between 6 AM and 10 PM, in accordance with the so-called "safe harbor" policy the FCC uses with commercial broadcasters.

Hollingsworth said that while FCC personnel did not notice any technical violations during their January inspection, they did have "serious concerns" about a linear amplifier under construction that was capable of greater than legal output. Hollingsworth asked Whiten to provide details of the amplifier and how it's been used.

Hollingsworth also told Whiten he would be forwarding, under separate cover, tape recordings made of Whiten's transmissions last November on 20 meters. "You will be requested to provide a full explanation for those radio transmissions," he wrote.

"No decisions have been made yet in this case," Hollingsworth told the League. "We're still seeking information."

The ARRL Letter, Vol. 18, No. 15, April 9, 1999 ❑

Tigger's Quiz Answers

1. 1 Amp
2. 2 Amps
3. .5 Amp
4. 1.6 Amp

Total 5.1 Amps. ❑

Examination Schedule for May

05/12/99 (Wed.) Mantua
Contact: Niko Takahashi, AA7OL
Phone: (435) 753-9544

05/19/99 (Wed.) Provo
Contact: Steve Whitehead, NV7V
Phone: (H) 465-3983 (W) 225-5200

05/25/99* (Tues.) Salt Lake City
Contact: Eugene McWherter, N7OVT
Phone: 484-6355

*Only Novice and Technician elements (1A, 2, and 3A) given at this session.

For more detail either call the contact or checkout the information on our webpage http://www.xmission.com/~uarc ❑

Net Schedule

Day	Time	Freq.	Name/Purpose
Sun.	2000	146.62 MHz	TCP/IP Users' Group (packet radio)
Sun.	2100	146.62 MHz	Utah Amateur Radio Club Information Net
Mon.	2100	147.18 MHz	High Valley Net (Ragchew)
Mon.	2100	144.25 MHz	Weekly 2-meter SSB net
Tues.	1900	146.98 MHz & 145.37 MHz	West Desert Amateur Radio Club
Tues.	1930	146.90 MHz	Ogden Amateur Radio Club
Tues.	2000	146.94 MHz	Utah VHF Society (business and swap)
Tues.	2100	147.34 MHz	Utah Valley Amateur Radio Emergency Service
Tues.	2100	146.72 MHz	Bridgerland Amateur Radio Club Net
Wed.	2000	146.88 MHz	SL County Amateur Radio Emergency Service
Wed.	2000	145.43 MHz & 145.20 MHz & 448.43 MHz	Utah Box Elder -Thiokol Net
Wed.	2100	146.74 MHz	Mercury Amateur Radio Association, SL area
Wed.	2100	145.49 MHz	Mercury Amateur Radio Association, Ogden area
Wed.	2100	145.37 MHz	Mercury Amateur Radio Association, Provo area
Wed.	2100	50.125 MHz	Weekly six-meter net
Thu.	1900	147.04 MHz	Davis County Amateur Radio Club
Thu.	1900	147.12 MHz	Youth Amateur Radio Club

HF NETS

Day	Time	Freq.	Name/Purpose
Daily	1230	7272 KHz	Beehive Utah Net (formal traffic handling)
Daily	0200Z	3937 KHz	Farm Net (Same UTC summer and winter)
Daily	1930	3708 KHz	Utah Code Net (formal traffic handling)
Sat.	1100	7272 KHz	Quarter Century Wireless Association (QCWA) ❑