

John Buttles, N7NTZ: Featured Member of the Month



Photo: Ron Speis, KC7MYS

John Buttles, N7NTZ, part way up his crank-up tower which hosts (from left to right on the top boom) two flat panel array antennas (2.4 GHz, 900 MHz) plus two 70 cm yagis (one horizontally the other vertically polarized). The boom has rotators for both azimuth and elevation.

Volume XLIII Issue 2, February 1999



The MICROVOLT

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Prologue

The Utah Amateur Radio Club was organized under its 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.

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.

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. ARRL membership renewals should specify ARRL Club #1602.

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.

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.

THE MICROVOLT: *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. In order to maintain ease of conversion it is suggested that you contact Bruce at 943-1365, or via e-mail before making electronic submissions. All submissions are welcome but what is printed and editing are the responsibility of the UARC board. Reprints are allowed with proper credits to *The Microvolt*, UARC, and authors. □

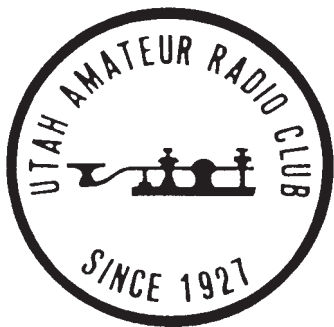
UARC 1999 Board - Partial Listing

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Exec VP: Maurine Streckenfinger, KC7HOZ	254-1536
Vice Pres: Gordon Smith, K7HFV	582-2438
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□	

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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 □



The Microvolt

The Official Publication of the Utah Amateur Radio Club, Salt Lake City, Utah

Volume XLIII, Issue 2 February 1999



Photo: Steve Perry, N7SWP

QST From the Prez

There are a variety of activities in which an amateur radio operator may participate. Some of these may be Phone, Packet, CW, Satellites, Contesting, Emergency Services, RTTY, DX, ATV, or other activities. For whatever reason you are in amateur radio, it is considered a hobby. It can be an expensive or inexpensive hobby. One doesn't need to spend an excessive amount of money to have a reasonably good station, though we all know someone who has sunk a small fortune into the hobby. However, it is the operator's responsibility to have a station with a readable signal.

It is my opinion that amateur radio operators should be willing to support those groups which provide services to them. Granted, there are many clubs along the Wasatch Front which provide services such as repeaters, activities, auto-patches, newsletters, etc. I

personally feel it important enough that I am a member of six such organizations along the Wasatch Front. I use all of the repeaters that these organizations provide. It is important to note that these organizations cannot function without member support.

This is also true with the Utah Amateur Radio Club. Your membership dues and contributions have provided the necessary financial support to equip and put up a club station; to start a synchronous repeater project on Scott's Hill; an ATV repeater; the ham radio hotline; maintain the three repeaters and auto-patches that we already have; publish an outstanding monthly newsletter (*The Microvolt*); activities for the club members such as Steak Fry, Field Day (June 26th & 27th); and the excellent monthly meetings.

To keep all of this going we need more membership in the Utah Amateur Radio Club as well as members giving of their time and skills. If you have a friend who has a license and is not a member, or is interested in obtaining a license, please encourage them to support UARC and to use what UARC has to offer.

Recently I finished leading a class for Novice, Technician, and Technician Plus licensing. Each one who attended was encouraged to join UARC. Most who passed the license exam did join. If you take a moment to invite those you know, or meet in person, or on the air, to join us, you will be surprised how many appreciate being invited.

Your cooperation and enthusiastic support of UARC both financially and with your time is very much appreciated.

Thank you. and 73.

Gary Openshaw, KC7AWU □

Featured Member Of The Month



Photo: Ron Speirs, KC7MWS

John Buttles, N7NTZ, at the keyboard in his shack.

This month we are featuring John Buttles N7NTZ. John has his tech plus license and has been in amateur radio for 30 years. He says that he has been in and out of the hobby several times over those years. When in high school in Illinois he became interested in amateur radio and later obtained his license. He was fortunate: the high school he was attending had a ham station and an active program.

Hoping to upgrade soon, he plans on taking advantage of Gary Openshaw's, KC7AWU, class in February assuming he can fit it in his schedule.

John first came to Utah to attend The University of Utah and received his degree in electrical engineering from the U. He currently works for Nextel as an RF engineer.

He is married and with his wife has 2 boys, 16 and 19 years old.

John is a member of UARC and he stated that is enough to keep him "out of trouble". He has been very involved with helping put the club station together. John is really excited that it is up and running, and that after over 70 years our club station is now a reality.

He is also one of the club web masters. He originated the first design for the club web page when Xmission

first donated the account to UARC and now helps maintain the current web pages (<http://www.xmission.com/~uarc/>). John said he would like to see members post items "Wanted or For Sale" on the web page. The original web page had a linked page for this sort of information but had very few takers. If you have anything you would like to see on the web page just email him and let him know. His email address is uarc@xmission.com. John enjoys working with the club and is looking forward to participating in special events and attending the club meetings.

VHF and UHF are his favorite facets of amateur radio. He has a goal to work satellites in the future. He, like many others, would like to see more individuals involved in UARC activities and projects.

John, thanks for all the help you give UARC and good luck in your future endeavors.

73 N7HVF, Linda Reeder □

Sunday Night Information Net Changes

For quite a number of years now UARC has conducted a Sunday Night Information Net, 9:00pm each week, on the 146.620 Repeater. This net is now being revised and some new ways of conducting the net are being tried. If you have suggestions, please contact Maurine Streckenfinger, K7HOZ, the Executive Vice President of UARC, at 254-1536.

We also are in need of several persons who will act as net control on the fifth Sunday of some months and substitute for other net controls and conduct the "Other Club Information" segment. If you have always secretly wanted a large audience or simply can help please contact Maurine. Thank You.

Gary, KC7AWU □

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. Leave your name, telephone number and a short message on the answering machine if no one answers and your call will be returned. □

What Is the Morse Code? Part I

During 1998 the last official radiotelegraphy messages were sent in the merchant marine, and it was a time for reporters to wax poetic about retiring the code that had served us for over 150 years. Maybe you've had a special feeling while learning the code or working DX at the bottom of 20 meters. Perhaps you felt a connection right back to Samuel F. B. Morse himself. Well, enjoy the feeling, but don't take it too seriously, because the fact is we don't use the same code.

It is likely that Mr. Morse never had occasion to learn the code we use on the radio, let alone invent it. So when we talk about "learning Morse," we aren't being entirely accurate. We would be closer to accurate if we called it the "Gerke Code." More about that later.

It turns out that many codes were used over the years of telegraphy by wire and by radio, but only two achieved widespread long-term use. The first was invented in May of 1844 and bears Morse's name although some say he had little or nothing to do with its design. This is what was called "The Morse Code" by virtually everyone from the time of its creation up until about the 1920s. It was used on most U.S. and Canadian wire telegraph circuits right up until the railroads stopped using manual telegraphs in the late 1960s.

The second code was originally known as "The Continental Code" and became the overwhelming favorite for use on the radio. It is the one that is used in amateur radio licensing tests. The number of operators who know Continental Code today is many times as large as the number who know Morse, but few know where the Continental Code came from.

The ratio of Continental to Morse operators became clear at a recent reenactment of the Battle of Gettysburg where telegraph communications were included. The original Civil War operators used Morse, but for the reenactment, only one Morse operator could be found. The rest (no doubt many being radio amateurs) knew only Continental Code. That wasn't a problem because spectators couldn't tell the difference. What *was* a problem was that the Continental operators were accustomed to copying a tone, not the clicking of a sounder. The solution involved some ingenuity. A small oscillator using a

555 timer IC was built for each telegraph station and placed in parallel with the sounder. The operator used a single earphone in the ear away from the spectators. The spectators heard the sounder clicking; the operator heard the tone he could copy.

One additional problem was that, on telegraph circuits, the keys on both ends are closed (through their shorting bars) when no traffic is being passed. This allows either end to interrupt the circuit and start sending. For the tone-enhanced reenactment, this meant the operator, if he kept his earphone in, had to listen to a continuous tone. The solution here was to place a piece of paper in the keying relay contacts. That silenced the tone. When the operator on the far end opened the circuit in preparation for sending, the relay contact released its tension and the paper fell out. Therefore, re-enabling of the tone was automatic. Now, the operator could go to sleep between messages, but not miss a single character.

But I digress. Resuming the tale of two codes, don't you think the technique of starting at the beginning is overused? Let's start the story in the middle: where the two codes diverged.

A man named William Robinson introduced Morse Telegraphy to Germany in 1847, just three years after the creation of Morse Code. He didn't bother with such niceties as permission and licensing. It was hoped that the electric telegraph could replace an optical telegraph system used for the Marine Dispatch Service between Hamburg and Cuxhaven, a system passing shipping messages, unusable on foggy days.

Some major changes to the Morse Code were accomplished by a German engineer named Frederick Clemens Gerke. Morse Code had some features that will seem strange to Continental practitioners. Five of the characters, C, O, R, Y, and Z, had embedded spaces. These spaces were a bit longer than a normal element space, but shorter than the space between characters. "C," for example, was . . . and could easily be mistaken for "IE." L and T were both a single dash, but L was a longer dash than T. A zero was also a single dash, but was longer still. These features made the code very efficient in terms of the number of characters per second for a given keying speed, but required considerable skill on the part of the operator. Gerke believed that by simplifying the code to just dots and dashes with no embedded spaces, what time was lost to inefficiency would be made up in accuracy. There would be less time lost asking for repeats.

Gerke kept 15 of the original Morse characters, but redefined C, F, J, L, O, Q, R, W, X, Y, and Z, as well as almost all the numerals and punctuation marks. The letters were almost the same as the final Continental Code, but Gerke's code had the interesting feature that "I" and "J" were the same. Perhaps this works out well in German.

As telegraphy spread through German and Austrian states, most of the systems adopted Gerke's changes, but added modifications of their own. In 1852 a conference was held to standardize to a single code. Gerke's code was the basis, but O, P, X, Y and Z were changed to their current forms, and the current system for the numerals was adopted.

Telegraphy and codes based on the German system spread through other European countries, but accented characters were added as necessary for each language. These ideas merged into a single standard code in 1865 at the Paris International Telegraph Convention. One other change emerged from the conference: "J" finally got its own unique code character. The code was now truly international, and began being called "The International Code."

The changes went largely unnoticed on the other side of the Atlantic, however. The Morse Code was used in its 1844 form for most wire telegraph circuits in the U.S. and Canada. It was not until wireless telegraphy, no respecter of national boundaries, was invented that North American operators found the need to deal with the Continental Code. In the early days, American operators would use Morse when communicating with each other, but would switch to Continental to exchange messages with Europeans.

Gradually, though, the practice shifted to use of Continental Code for everything. Not only did it make it possible to do all radio communications with a single code, the Continental Code simply worked better on the radio. Morse's embedded spaces and "ditty" character made it harder to copy through static and fading.

That didn't relieve operators of the need to know both codes. In the early days of radio operator licensing (circa 1913), knowledge of both codes was a requirement for the First Class license. It was common for an operator to take traffic on the radio, then turn around and re-send it (in Morse) on wire telegraph circuits.

Meanwhile, the Navy embarked on a project to create

a totally new code, designed to work well on radio circuits. It was abandoned just before the US entry to World War I. Apparently it was discovered that Continental Code already worked just fine. The job of inventing a suitable radio code had been completed fifty years earlier.

About in the 1920's the Continental Code started being referred to as "The International Morse Code." This increased the confusion factor and angered some Morse operators. The term "American Morse" came into use for the wire code to help keep the distinction clear.

The Continental Code was refined with some minor punctuation changes in 1939.

But at least we can be proud of our connection to the original Morse Code for 15 of the characters we use, right? Well, not exactly. The *original* Morse Code was quite different from either of the two codes in use in the early days of radio.

We'll examine the evolution of the code during Morse's work in Part 2. CU next month.

Gordon, K7HFV □

Flash - Get Your Membership Renewal Extended - Free

I'm excited to announce that the UARC Board has approved an offer to all members of a free one month extension on their membership for each **new member**, or **lapsed membership** (must be 12 months or more lapsed), they are successful in getting to become members of the club. What this means is that if you have friends or acquaintances who are not UARC members, you will be able to get a month's extension on your own membership for each one who joins.

It is hoped that this offer will provide some small incentive for each member to go out of the way to invite new members into the club. Simply have the new member mention and note your name as the recruiter when they join and Russ, KC7ZDZ, our Secretary, will see that your membership is extended a month for each.

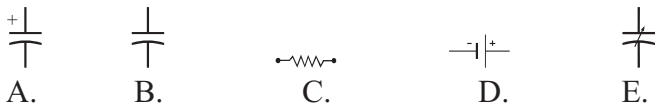
Bruce, KI7OM □

Tigger's Quiz

Allow me to introduce myself, John Bradshaw, KA7TGR. I've been asked to provide a pertinent column for *The Microvolt* through 1999. I've decided to create a regular short feature called "Tiger's Quiz", which will appear monthly with electronic/electrical theory question(s), (with an answer, and explanation printed elsewhere in the same issue), to test your knowledge of basic electronic principles.

My goal is to provide an entertaining way of getting those of you who have "forgotten" the theory you learned to pass your license exams, to try to solve the puzzler and diagrams I'll provide, **on your own, before** looking up the answers. (I taught classes long enough to know that is tempting to look at the answers first, and then "reverse engineer" the question, but please don't do that here. I want to get you **thinking!** Not just passively reading.)

So here goes - this month's questions are to identify the following:



- 1) Resistor?
- 2) Fixed Capacitor?
- 3) Electrolytic Capacitor
- 4) Variable Capacitor?
- 5) Battery Cell?

To see how you did go to page 16. □

General Class Upgrade Course

UARC is offering upgrade classes, beginning Wednesday February 3rd at 7 PM, for those wishing to obtain the General Class License. We expect all participants to hold a Technician Plus License and be able to send and receive code at a rate of at least 5 wpm. The classes will be held at the Doxey Hatch Building at 1255 East 3900 South 4th Floor, where we hold our monthly UARC meetings, and will run for 6 weeks. **Important - this is a change of location!** If you are interested please contact Gary Openshaw at 484-3407. If you get the answering machine leave your name and telephone number.

Gary, KC7AWU □

VHF Society Schedules Swap Meet

February 27 will be the date for the Utah VHF Society's annual swap meet, typically the biggest such event in the state each year. This event, including the Society's annual business meeting and elections, will be held at the Utah National Guard Armory Number 2, 1527 East Sunnyside Avenue, in Salt Lake City. It will commence at 8 a.m. (The number 2 Armory is the westernmost building in the complex.)

Admission will be free to those who are members of UVHFS. There will be a charge to others to help cover building rental charges.

A business item of particular importance this year will be a proposal to increase the Society's annual dues. A huge increase in the site rental charges for the Snowbird (147.18 MHz) repeater is a prime reason the dues increase appears necessary. Those who renew their memberships during 1998 will get their 1999 membership at the old rate of \$10 per year. The proposed new rate has not yet been announced.

The Utah VHF Society is a statewide organization devoted to operation and support of VHF and UHF repeaters. It performs frequency coordination for the state and conducts a net each Tuesday evening at 2000 hours on the 146.94 MHz repeater. It gives financial support to a variety of repeaters throughout Utah.

Currently, dues are \$10 per year. Membership runs for the calendar year, so all 1998 members (except those who have paid for multiple years) will expire on December 31.

Those wishing to join or renew can do so by sending \$10 to:

Utah VHF Society
P. O. Box 482
Bountiful, Utah 84011-0482

New members should include their names, addresses, call signs, and indications of whether they would like to be placed on the roster for the Tuesday night net.

Gordon, K7HFV □

Mobile Radio Noise Elimination

Engine noise in the mobile radio environment is as old as radios in cars, and it still plagues users today. With cars becoming more sophisticated and onboard computers become standard fashion for modern autos, the noise production potential of a car's electrical system is steadily increasing. But don't lose hope - you can still enjoy a trouble-free mobile radio installation. Here's how.

First, install the radio equipment in the most ergonomic location convenient to the intended radio operator, mounting it securely with fasteners that will not allow the equipment to tear away during rough traveling. Second, always lay a direct wire line with a fuse protector and connect the radio equipment directly to the car's battery. This element of system design is important because the battery acts as a noise-filter through which other auto-produced noises cannot easily pass to reach the DC input connections of the radio chassis. It also provides better voltage regulation, overvoltage protection, DC purity and prevents overload of the car's accessory line. Don't forget or bypass the fuse in the +12V (red) line, and place the fuse close to the battery. If the line should fault to ground otherwise between the battery and the fuse a fire could, and probably will, erupt.

Try to place antennas on the vehicle away from the engine, where most of the noise is produced during travel. And always try to use antennas with mounts that make direct physical and electrical connection of coaxial cable shields to the car body. This keeps the integrity of the shields high.

Next, try the radio equipment with the engine running and see if noise is noticeable. If it persists, perform this simple test. Disconnect the antenna and see if the noise continues. If it does, then all or part of the noise is still coming through the DC line and a mobile regulator/filter may be needed for further isolation. If the noise disappears with the antenna disconnected then the DC line is substantially clean and the noise is being received as an therefore generated signal from the vehicle's engine or electric system. If the noise changes in speed or pitch with engine speed changes it's likely the result of the most common noise - electrical charge and cylinder detonation. This type of problem can only be resolved in the engine itself, but don't let that stop you from pursuing a final solution.

First, install resistor-type spark plugs and possibly

resistor-type anti-noise spark plug wires in the engine. This is good practice for all engines and not expensive. See if the noise is resolved before going further. If not, see if you can round up an oscilloscope. The scope is a commonly available and excellent tool for running down noises. Place the scope lead on the 12V side of the distributor or other 12V wiring around the engine block, or on the output of the alternator or generator and observe the pattern. A typical cylinder detonation appears to be a large thin line straight up (the initial spark detonation) and then a trailing line outward to the zero line (burning of remaining fuel until push - out during the exhaust stroke). Anywhere a +12V line can be found in the ignition system that shows noise spikes, attach a bypass capacitor on the order of 200-500 Mfd. at about 50 volts from that point to chassis ground and then observe the reading again. Using clip leads for the test allows rapid testing. Make sure that the car's engine hood is electrically bonded to the car chassis and that all connections are tight.

Since all cars are somewhat different it's difficult to provide a straight path for all troubleshooting in vehicles, but a scope and a handful of capacitors can do wonderful things with some careful experimentation.

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Contesting and DXing Taught Here

As the solar cycle improves and Winter is upon us many Hams will be looking forward to one of their favorite activities: Contesting and DXing. Would you like to learn what their excitement is all about? Darryl, AF7O and Alan, K7OPT have volunteered to conduct some real life training on several of the upcoming contests. Contact them for arrangements. Darryl at 942-3817 and Alan at 572-8112.

Bruce, KI7OM □

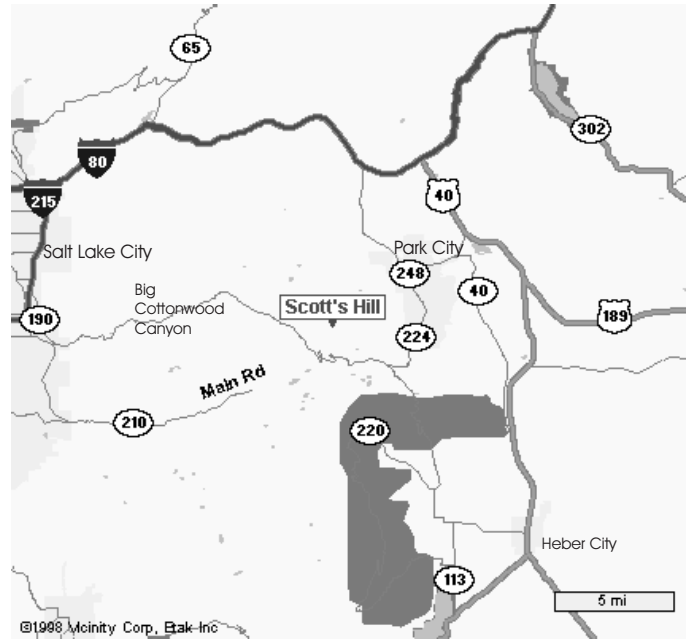
A Scott's Hill Photo Album

A September 5 work-party finished excavating tower holes and applied both bonding and UV protective coats of paint over existing 2-part epoxy base. □



Photo: Bruce Bergen, KI7OM

Dennis Millard, KC7KCW, Steve Perry, N7SWP, work at "swamping" out a hole as Tom Schaefer, NY4I, works the jack hammer.



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Photo: Gary Crum, KK7DV

Steve Perry, N7SWP, and Dennis Millard, KC7KCW, "swamping" out the tower holes, while Bruce Bergen, KI7OM, wearing his traditional bib overalls puts on yet another coat of paint.



Photo: Gary Crum, KK7DV

September at 10,000 feet in the Wasatch - a great way to spend a Saturday.



Photo: Gary Crum, KK7DV

Looking down on the UARC building one can see the section where John ran short of roll roofing - since corrected but leaking still.



Photo: Bruce Bergen, KI7OM

Gary Crum, KK7DV, also lent a hand at "swamping"

Intermountain Area Amateur Radio Organizations

Amateur Radio Venture Post 1973, Utah National Parks Council (Utah County), is a coed Venture Scout post open to all young men and women ages 14-20. The post is supported by a committee of hams over the age of 21. The post meets on the third Wednesday of each month at 7:00 at the UVSC Provo campus, and holds a net on the 147.34+ machines on the first Wednesday of each month at 8:30 PM. Post members provide communications for various parades, and Boy Scout functions and participate in other ham groups. Contact person is Post President Sariah Whitehead KC7KEI 465-3983, Committee Chairman Derick Wolsleger KC7KRS 465-1134 KC7KRS@ucares.org or Advisor Terry Gardner, N7QGA, 785-7517 jerrygardner@juno.com .

BARC or The Bridgerland Amateur Radio Club Monthly club meetings are held each second Thursday of the month at 7:30pm at the Hyde Park City offices building, 113 E. Center St., Hyde Park (except June, July and August). They hold a net at 9:00 PM on the 146.72 repeater on Mt. Logan (hard linked to 147.26 on Promontory) every Tuesday. Their contact person is Tyler Griffiths, N7UWX at (435)752-7269. Postal mail address for the club is: BARC, P.O. Box 111, Providence, UT 84332. WebPage URL is <http://barc.everton.com/>

BYUARC (Brigham Young University Amateur Radio Club) is open to all alumni, faculty, staff and student of BYU. The club maintains the 145.33(-) repeater that has a closed autopatch (members only). The dues of \$15.00 cover Autopatch usage for a whole year. The club also has a shack with a variety of equipment. Members have the opportunity to provide emergency communications for the campus. Meetings are held the second Thursday of each month, and the location varies. The information line for the club is (801)378-COAX, or you can contact the president Andrew Barney by email at WH6KU@byu.edu . Club webpage URL is: <http://byuarc.clubs.byu.edu/>

The **Davis County ARES** conducts a Net each Thursday night at 7:00 P.M. on 147.42 simplex. DCARC The Davis County Amateur Radio Club meets the 2nd Saturday of each month at 10:00 A.M. The Davis Club operates the 147.04 and the 449.925 (normally cross-banded to 147.42 simplex) repeaters. For further information please contact Clark

Dowding, N7TDT at 296-1797 or call the DCARC Ham Hotline at 299-9570. The Club Webpage URL is <http://www.thriftyweb.com/dcarc/>

Dixie Amateur Radio Club (DARC) meets every third Wednesday in the basement of the Washington County Administration Building, in St. George, UT. Sunday Night Net 7 PM local time on 146.910 with an alternate frequency of: 145.450. Contact Person; President Bob Palambo K9ZWH P.O. Box 422 Santa Clara, UT 84765. E-mail, palambo@infowest.com Club Wepage: <http://www.infowest.com/DixieSun/suar/index.html>

Eagle Rock Amateur Radio Club Idaho Falls, Idaho operates the 146.640 and 146.740 repeaters. Club meetings are held the 1st Wednesday of each month in Room 22 of the John Sessions Building on the Eastern Idaho Technical College. at 7:30 P.M.. A net is held every Tuesday night 9PM MST on the 146.640 MHz Repeater Contact person is club president, Chuck Olsen, N7PME, phone (208) 523-7948, email hamradio@ida.net . Club Webpage is <http://www.ida.net/org/hamradio/>

The **Elko Amateur Radio Club** (Nevada) holds its monthly meeting the third Monday at 19:00 Pacific with the location announced in the monthly newsletter. They conduct a weekly net on Wednesday at 19:30 Pacific on the 147.21 repeater with a PL of 100. Contact person for the club is Mike Giles, N7EV (701)753-6959 Email for club business is russell@sierra.net Club Webpage URL is <http://www.expage.com/page/earc> .

The **Evans & Sutherland Radio Club** is currently inactive. The club callsign is KC7LCX. Trustee and President is Alan Brubaker, KO7X. For more information contact Alan Brubaker at 600 Komas Drive, Salt Lake City, telephone (801)588-7212 or email alan@es.com .

Grand Mesa Repeater Users Group, Grand Junction CO, operates repeaters located on the western slope of Colorado with coverage of west central Colorado and eastern Utah. Repeater Frequencies are 145.145, 145.22, 146.82, 147.39 and 147.57 (simplex remote) that are linked together on a full time basis. 147.12 and 147.36 are linked part time from their end. Contact Person: Robert Kirner - NØMBJ Mail:3087 Bookcliff, Grand Junction, Co. 81504. Webpage URL is: <http://www.bewellnet.com/Fgriffee/>

The **High Valley Net** from Heber City every Monday at 9:00PM on the 147.18 repeater. Their contact person is Doug Neilson, N7PPW at 756-5927.

Idaho Society of Radio Amateurs has two chapters serving South Central Idaho: The Magic Valley Chapter and Mount Harrison Chapter. Magic Valley is a general purpose organization and Mt Harrison exists to support several repeaters including: 146.06 in Jerome, 146.16 in Twin Falls, and 146.16, 449.20, on Mt Harrison near Burley. They also support the ATV Repeater on Mt Harrison with a 434 Mhz Uplink and 1253.125 MHz Downlink. Contact person for the Magic Valley Chapter is WI5E, Joe Herring Twin Falls (208)736-7027. The club's monthly meeting is 7:00 PM the 2nd Wednesday in Shields Building, Room 102, College of Southern Idaho in Twin Falls. ISRA has a Webpage with links to both chapters at <http://netnow.micron.net/~wb7cyo/isramvc.htm#CA>.

JARS -Juab Amateur Radio Society of Nephi has a club call sign of KD7AGX. The Club newsletter the JARS Roundtable can be viewed on the Club's website: <http://members.xoom.com/kf6lor/jarssite.htm> Dues range from \$3 to \$6 depending on the status of the prospective member. They hold a weekly net on 2 meter simplex, 144.330, at 20:00 Mountain Time on Thursdays. Club contact person is A. J. Grantham, KF6LOR, who can be reached at (435)623-1179, and emailed at kf6lor@broadcast.net.

KC Amateur Radio Club, Kanab, UT. Contact Person: Joyce Ross N7KDU Pres. Mail: 57 N Dry Gulch #6-14 Kanab, UT 84741

Las Vegas Radio Amateur Club, Las Vegas, Nevada. Contact person is Tom Allen, N7GBJ (702)362-8107. Regular monthly meetings are held on the 2nd Tuesday of each month, 19:00 local, at the Nevada Power Company offices. The Club conducts a net each Tuesday at 19:00 Pacific Time on the 146.94 repeater with a PL of 100. It also maintains a repeater on 449.70 MHz. Mailing address for the club is PO Box 27342, Las Vegas NV 89126-1342. E-Mail to the Club Editor, Craig Brunson n7tsz@anv.net

Las Vegas Repeater Association (LVRA) owns and operates VHF and UHF amateur radio repeaters throughout Southern Nevada. The following are its open repeaters: 146.88 (PL 100, linked to the Snowbird system), 145.11, 147.99, 449.150 (PL 127.3 & linked to Arizona). The coverage and linkages of these repeaters are detailed on their web

page: <http://www.hxo.com/> . Contact association President Craig Brunson n7tsz@anv.net

MARA or Mercury Amateur Radio Association is a world wide group of radio amateurs dedicated to training and traffic handling for emergency operations. They conduct VHF nets each Wednesday at 9:00PM. They also conduct health and welfare traffic net on 3.873 Mhz (80 meters). The Salt Lake area is on the 146.74 repeater and their contact persons is Willy Peake N7VVL at 446-1144. The Ogden area is on the 145.49 repeater. The Provo area is on the 145.37 repeater with Walt Nicholes, President-Elect, WA7YPL, 224-0668, wnichole@nuskin.net or nicholes@Q13.com , as their contact person. The Provo/Utah Country group maintains a webpage at <http://physc1.byu.edu/~peterson/marautco.html>.

OARC or Ogden Amateur Radio Club meets the 3rd Wednesday of each month in Ogden at 7:00PM. The meetings are held at the Red Cross building at 2955 Harrison Blvd. Members and nonmembers are invited. Dues are \$15.00 per year and can be sent to P.O. Box 3353, Ogden, UT 84409. OARC supports the 444.60, 146.82, 146.90 and the linked 146.92 repeaters, all with a PL of 123.0. The OARC Web Page URL is <http://www.lgcy.com/oarc.html> . The contact person is Greg Moore, KD7BPQ who can be reached at 782-3064.

Payson High School Amateur Radio Club (KC7PJY) is composed of students who are interested in radio communications at Payson and Springville High Schools in the Nebo School District. The Club holds the call sign of KC7PJY. Club advisor is Bob Strange, K7VVU, 754-3535 and can be reached via email: srobert@admn.phs.nebo.edu. Coadvisor is Reed Thomson, N7YVJ.

Rainbow Canyons Amateur Radio Club of Cedar City meets at 7:30 PM the 3rd Tuesday of each month in the FAA Building (north door) at the Cedar City airport. They sponsor the 146.94 Frisco Peak WR7AAA repeater (part of the linked Snowbird system), and the 146.76 Iron Mountain repeater. Club president is Gene Urie, N6LHA (435)865-1724. The URL for their webpage is: <http://www.netutah.com/rcarc/>.

RMRA: Rocky Mountain Radio Association is open to all Utah hams and they support the 447.900, 448.800, 448.400, 448.700 + 6 mtr gateway repeaters. Contact Marc Peterson KB7YJJ at 977-9845 for

information. They also house other affiliated repeaters: 447.450 linked to 146.660 Manti system . The URL for their webpage is: <http://www.inconnect.com/~rmra/>.

Salt Lake County ARES (Amateur Radio Emergency Service) conducts a net each Wednesday Night at 8:00 PM on the 146.88 repeater (PL tone of 88.5). All amateurs are welcome to participate. Their in-person meeting is held the third Wednesday of each month. For more information please contact Don Scarlet N7DIZ at 278-3204. Call the ARES Infoline, 333-7400, for the upcoming inperson location and other info. Their webpage URL is: <http://www.inovion.com/~ares/>.

Sinbad Desert Amateur Radio Club (SDARC) meets the first Thursday of each month and rotates between at least two counties, Emery and Carbon, (South Central and Eastern Utah) during winter months either in local restaurants or individual homes, during spring, summer, fall, we try and get in several campouts. The Club conducts a net on Tuesdays at 2000 local using their entire system. SDARC sponsored repeaters are linked together on a full time basis and cover most of Eastern Utah with the following repeaters: 147.06 Horn Mountain, 145.31 Ford Ridge, 147.14 Cedar Mountain, 147.32 Bruin Peak, 146.61 Abajo peak, 146.76 Bald Mesa (linked), 146.90 Downtwn Moab (linked). Other repeaters not fulltime linked to the system include: 447.700 Horn Mountain, 223.920 Skyline Drive, 224.480 Navajo Mountain , 448.550 Cedar Mtn., 145.43 Downtwn Price, 442.025 Star Point, Club Dues: \$25.00 First Year. \$20.00 Each Year thereafter. Contact Person: Communications -Jim Anderson, KG7BC, Email jima@ecso.co.emery.ut.us . The Club has a webpage at: <http://168.179.236.137/sdarc.html> .

SPARC or Saltlake Peaks Amateur Radio Club (sponsored by L3 Communications In Salt Lake City) normally meets the 2nd Wednesday of each month at Noon in the L3 Communications Building "F" Cafeteria (640 N. 2200 West, Salt Lake City, UT 84116). Dues are now set at \$12 per year. SPARC supports the 448.050 repeater and conducts an emergency committee net there each workday at 7:05 a.m. The current president is Ray Riding, KC7FGT, who can be reached during working hours at (801) 594-7132. SPARC also publishes "The Signal" monthly. The editor is Rick Donkin, KA7MMM, who can be reached on workdays at (801) 594-2167 (email to: donkin@csw.L-3com.com). Webpage for the club is at: <http://sparc.csw.L-3com.com/> .

UARC or Utah Amateur Radio Club meets the first Thursday of each month except the months of July and August. The meetings are held in the Doxey-Hatch Medical Building located at 1255 East 3900 South in Holladay (a Salt Lake City suburb), across the street from St. Marks Hospital at 7:30 PM. There is a newcomer's meeting held prior to the main meeting 7:00 PM. UARC conducts an information net every Sunday nite originating on the 146.62 Farnsworth repeater. UARC maintains the following repeaters: 146.62 (-), 146.76(-), and 449.10. The UARC Webpage can be found at <http://www.xmission.com/~uarc/> . E-mail can be sent to uarc@xmission.com . The Club (UARC) has a Ham Hotline, 583-3002. Information regarding Amateur Radio can be obtained, including club information, testing, meetng information, and membership information.

UBET (Utah Box Elder Thiokol) holds a net every Wednesday at 8:00 PM on the 145.43, 448.300, 145.29 repeaters. Net control changes monthly. Contact Wayne Jensen AB7TS for details about net. Club meetings are held the first Tuesday of every month at 7:00 PM at Mills Montessori School 575 N. Main Brigham City. Club President is Bob Anderson AA7TR, Email anderra@thiokol.com . Their "unofficial" webpage URL is: <http://www.vii.com/~rndjohn/ubet.html> .

The **University of Utah Radio Club** is open to University staff, alumni and students. There is a fully equipped station available 24 hours a day. Their contact person is Marvin Match, KA7TPH, MEB 2575, at 581-8761 or Clint Turner KA7OEI at 566-4497, Email: ka7oei@uugate.wa7slg.ampr.org.

UPRA (Utah Packet Radio Association) is open to all radio amateurs interested in packet radio and its applications, including TCP/IP, highbandwidth, and digital repeaters. The purpose of the club is to coordinate packet activity within the state and interface to adjoining states. Meetings are scheduled as necessary, and there are no dues (at this time). For more information contact Jack Christensen KD7NX at (801) 581-0897 or email jack.christensen@icn.siemens.com .

Utah Army MARS (Military Affiliate Radio System) VHF nets are held Monday, Wednesday and Thursday at 2100 local. Frequency is 143.99 rcv 148.01 xmit. Membership information can be requested from Dave Raab, State MARS director for the Army, phone 225-4128 or Dave Christensen State

Training Director 292-9242. The Utah Army MARS webpage is: <http://osm7.cs.byu.edu/people/Dubois/MARS/index.html>.

The **Utah Contest Club** is still in the start up phase. The President is Jim Lawrence, W7CT. The club callsign is NC7J and the trustee is Matt George, NG7M matt@qrq.com. The only Scheduled meeting for 1999 is Field Day weekend at the FD site, at a location to be determined. For more information contact Jim Lawrence at (801)546-4399 W7CT@qrq.com.

Utah County ARES holds their general meeting the first Tuesday of every month at 7:00 PM. They also conduct a net each Tuesday at 9:00 PM on the 147.34 repeater. The contact person is Derick Wolsleger KC7KRS phone 465-1134 email: kc7krs@ucares.org Their Webpage URL is: <http://www.ucares.org/>

The **Utah TCPIP Users Group** or **UTUG** is an informal group that discusses TCP/IP protocols and other packet information. They are geared to all levels of users, new and seasoned. They hold a weekly net Sundays at 8:00 PM on the 146.62 repeater. Their contact person is Clint Turner KA7OEI at 566-4497. Email: ka7oei@uugate.wa7slg.ampr.org.

The **Utah VHF Society** is a group dedicated to maintaining and operating a system of repeaters in the state of Utah. Dues are \$10.00 per year and can be sent to PO Box 482 Bountiful, UT 84011-0482. The Utah VHF Society holds a swap meet annually, usually on a Saturday in February. The Society holds a traffic and swap net for its members each Tuesday night at 8:00 PM on the 146.940 repeater (PL 88.5). Contact is Eldon Kearn KB7OGM at 571-9955.

Voice of Idaho Amateur Radio Club is a Boise, ID based organization. They maintain the following repeaters: 147.24 Cinnabar Mtn; 443.600 Cinnabar Mtn; 146.840 Shafer Butte (PL 100) with an emergency autopatch; 146.620 Snowbank Mountain; and 443.850 on Lone Mountain, near Baker, Oregon will be relocated to somewhere in the Treasure Valley for local coverage on an interim basis. The VOI net meets every week on Thursday evening at 8:00 PM on 147.24, 443.600, and 146.62, which are linked during the net. 147.240 and 443.600 cover all of southwest and southern Idaho (as far as Twin Falls normally) and south sometimes to Winnemucca, Nevada. 146.620 covers all of west central Idaho as far east as Stanley and west into Oregon. Club Contact person is

N7HQT Jeff Shinn, email jshinn@compuserve.com. The VOI website URL is: <http://www.interplus.net/~voi/>. Mail address is Post Office Box 812, Boise, Idaho 83701.

The **West Desert Amateur Radio Club** in Tooele county holds a net on the 146.98(-) repeater on Tuesdays at 7:00 PM. The club meets at 7:00 PM in the Tooele County EOC (in the Courthouse building) the first Tuesday of every month except election months. Their contact person is Gene May, KC7MBF and he can be reached at (435)882-1222. E-mail contact is Dave Haag, KC7PVD, KCPVD@erda.net

Wood River Amateur Radio Club is located in the Sun Valley, Idaho area. WRAC supports the 147.18 repeater on Della Mountain in Hailey. They conduct a net on that repeater on Tuesday nights at 8:00 pm. Contact person is Fred Naumann at (208) 788-4540. The club webpage URL is <http://www.geocities.com/SunsetStrip/9202/>

If you have corrections or updates to this list please email, or if that is not possible then snail-mail, the information to my address listed on page two.

Bruce, KI7OM □

February Meeting: Lightening Protection and The Eyring Portable Antenna

Enough money, time, and effort goes into putting an amateur station on the air that once it's on, one should consider protecting it. Lighting, electromagnetic pulse (EMP), and weather are some of the enemies of antennas and equipment that one might want to protect against.

Our speaker at the next UARC meeting, February 4, is particularly qualified to speak about protection, having had the responsibility of protecting ICBM sites against nuclear attack. Glenn Foster, KD7BHG, had a long and interesting career including active duty with the Air Force, civilian service to the Air Force, and work with military contractors in Utah and Idaho.

He had to deal with protecting the radio equipment for the Minuteman and Titan II missiles. He tells us this protection was successful enough that the radios were better hardened than the missiles. This was tested

once with an explosion roughly equal to a two kiloton bomb. He will be bringing a piece of tower that went through that explosion, an explosion that cause destruction more than three miles from the center.

Communication and control to such missile sites use almost every available medium including cable, LF, HF, and satellite communications. All have to be protected.

Protection against EMP has much in common with protection from lightning, something that can be an enemy to any amateur installation. Glenn will tell us some of the techniques and pitfalls involved in lightning protection.

One of the possible protection strategies involves use of antennas that don't have to be up in the air. Glenn worked for Eyring Research, a Utah company, when they were producing antennas made for operation on the surface of the ground and even underground. These antennas, while lacking in gain, feature wide bandwidth and ease of protection. When these antennas were in production, they cost well over \$1000 apiece. The design for the portable version of the Eyring antenna has been licensed to an organization that can make kits for amateurs for approximately \$100. Glenn will have full details for anyone interested in procuring one.

Of course, the meeting will have all the customary features. Fred, the book lady, will be there with all the latest ARRL publications. There will be a chance (often disillusioning) to have "eyeball QSO's," with some of the folks you have worked on the air. And, the famous "Dime Lime" or "Meeting After the Meeting" allows a chance to check out the most popular kinds of pizza. Don't miss the fun!

Gordon, K7HFV □

For Sale or Trade

-Cush-Craft R7000 HF vertical, 80 -10m. \$150.00 or best offer. Glen, KB7VHR, Elko NV, 775-738-5544 or e-mail: qrse@isat.com.

-48-foot Rohn tower, model HBX-48, with Tailtwister rotor and Mosley Pro-57 5-band beam (20 -10m). \$1000 for all. Gary, KD0TA, Elko NV, 775-753-4948, e-mail: ghaskett@hotmail.com.

-Auto-tuner for Icom IC-706 HF transceiver: \$150.

Gary, KD0TA (contact info above).

-3-head reel-to-reel tape deck, Pioneer model RT-701, with 7-inch tapes. Works great. Also Pioneer PL-15-DII semi-auto turntable. Sell or trade, make offer. Ron, KG7OR, Elko NV, 775-738-7474, e-mail: russell@sierra.net.

-TV receiving tubes, many compactrons and odd filament types, for 1950-1970s TV sets. Complete list available by e-mail to russell@sierra.net or U.S. mail (enclose SASE) to 1927 Laxalt Way, Elko NV 89801. Ron, KG7OR, 775-738-7474.

The Elko ARC has the following surplus equipment available:

--1 Motorola BBB-LA tube type UHF base station with desk mike.

--1 Motorola UGGT UHF mobile.

--6 Motorola Motrac low band (33 mhz) mobiles

--1 Data Signal SAI-800 system interconnect unit

This equipment is available for a small donation to Elko ARC. For more information, contact Joe, N7JEH, phone 775-738-7110 or e-mail: giraud@sierra.net

-A ham shack full of equipment including HF transceivers, tuners, keyers, test equipment, power supplies, and VHF transceivers. Contact William Jones, WA7JRC, 306 East 17th South, Salt Lake City, UT 84115-1730. Phone 467-7480.

-Public Radio station KRCL has available 5 equipment racks for sale for \$10 each. . They are standard 19" racks, over 6 feet tall and about 18 inches deep. These are ideal for a repeater site. Contact Lewis Downey at either KRCL Radio 363-1818 or KUER radio 581-5010. The racks can be seen behind the KRCL studios at 208 W. 800 S. Or E-mail to ldowney@media.utah.edu

Editors Note: If you have Amateur Radio related items for Sale or Wanted you can advertize these free in The Microvolt. Please e-mail, or if this is not possible snail-mail will do, to one of my addresses on page two.

Thanks,

Bruce, KI7OM □

Do you have a TNC? Yes, you remember, packet don't you? If you are in the same boat as many packet radio users, you may have gotten into it, thought it was a bit slow or lacking a good application, and put the TNC on the shelf.

Well, dust off that old TNC and set your radio to 144.390 MHz and join the fun!. The latest rage to hit packet radio is APRS. APRS, or the Automated Position Reporting System, uses coordinate information to plot hams on a map. This can be for fixed stations or even better, a mobile station with a GPS receiver in the car to report their position in real-time. With software at home, you can track other hams, use it for public service such as tracking Red Cross vehicles, or the lead car in a race/parade (Days' of '47, anyone?).

We are starting a group here in Utah to setup an APRS network that will reach from Las Vegas to Salt Lake to Boise to Seattle and all points in between. If you have in interest in packet radio/GPS receivers/public service/just plain fun, please contact Tom Schaefer, NY4I at 801-501-0899 or send email to utahaprs@qsl.net. You can also check out the Utah APRS website at <http://www.qsl.net/utahaprs>. We are also holding a weekly voice net on 146.62-in Salt Lake on Sunday nights at 8:00 PM just before the UARC Information net.

So, dust off that old TNC, set your radio to 144.39, and join us!

Tom, NY4I □

UARC Calendar Items

Get out your planners and mark these items in addition to our regular monthly meetings:

May 1 - Scout-O-Rama - State Fair Park

June 26-27 - Field Day

July 17 - AM - Operation On Target; PM - Steak Fry - Spruces Campground in Big Cottonwood Canyon

October 15-17 - Jamboree On The Air (JOTA)

Bruce, KI7OM □

In this UARC meeting of November 6, 1930, several technical papers were presented. There is also reference to the "initiates" - perhaps an anthropologist or archeologist will someday discover what this mysterious cult was doing.

Alan, K7OPT □

November 6, 1930

Minutes of the meeting of the Utah Amateur Radio Club.

The regular meeting of the Utah Amateur Radio Club was held at the home of Mr. Stearns with eighteen members and prospective members present, *President Combs*

Receipt of the telegram sent to the Pacific Division Convention acknowledged by Mr. Green.

The election of a secretary-treasurer to fill the vacancy caused by Mr. Yates moving to Chicago was the next order of business. Mr. Stearns was nominated but declined due to other duties.

Mr. Green was elected by unanimous vote to fill the vacancy and assumed immediate charge of the minutes.

Mr. Carzen gave a talk on the elementary theory of the operation of the electron tube when used as a detector and as an amplifier. The screen-grid tube was also explained. This was preliminary to an explanation of the function of the detectors, oscillator or mixer tube, and intermediate amplifier tubes of the Super Heterodyne circuit. The talk was interspersed with lively discussion during which Mr. Irvine gave information concerning the Radiola Superheterodyne as at present manufactured.

The following papers were assigned by Mr. Carzen for presentation at the next meeting:

The Dynatron Oscillator	- Mr. Irvine
Resonance	- Mr. Giles
Amplifiers	- Mr. Lambert

Mr. Green gave a report on the A R R L Pacific Division Convention held in Sacramento, Calif. on October 17 and 18th.

Initiates were instructed to choose a topic for discussion at the next meeting as a part of the initiation.

Receipts, dues and initiation fee \$6.25.

The meeting closed with the most important event of the evening, a delicious lunch prepared by Mrs. Stearns and served by the OM.

Next meeting will be held at 726 Hawthorne Ave. the home of Mr. Irvine, on Thursday evening Nov. 20, 1930.

W D Green
W D Green-W5DWJ
Secy-Treas.

**U.A.R.C. ANNUAL FINANCIAL
STATEMENT -1998**

INCOME/EXPENSE

INCOME

Membership dues	\$7,102.56
Book sales revenue	\$6,074.42
Interest earned	\$423.74
Steak fry revenue	\$333.00
Donations	\$211.00
Microvolt advertising	\$35.00
Miscellaneous Income	\$21.00
Transfer from Savings (Capital projects)	\$2,500.00

TOTAL INCOME \$16,700.72

EXPENSES

Administrative overhead	\$72.79
Returned check charges	\$5.00
Books, inventory purchase	\$4,664.26
Scott's Hill construction	\$2,312.46
Red Cross Station	\$1,491.83
Capital items purchased -Other	\$301.61
Xfers from prior year expenditure-\$1,734.42 (Towers purchased in 1997 for Farnsworth but used for Scott's Hill project)	
Total Capital items purchased	\$2,371.48
Club Liability Insurance	\$325.00
Expenses for monthly MTG	\$148.84
Expenses of Field Day	\$603.06
Ham Hot Line	\$49.98
Microvolt mailing cost	\$610.00
Microvolt printing costs	\$4,851.80
Microvolt expenses -Other	\$282.30
Total Microvolt expenses	\$5,744.10
Postage (other than Microvolt)	\$134.00
Repeater phone costs	\$625.18
Repeater associated costs -Other	\$12.76
Total Repeater associated costs	\$637.94
Sales tax pd on bks sold (97 & 98)	\$620.23
Reservation	\$134.09
Steak fry expenses -Other	\$901.38
Total Steak fry expenses	\$1,035.47
Storage	\$170.00

TOTAL EXPENSES \$16,582.15

OVERALL TOTAL \$118.57

Chuck Johnson, WA7JOS , Treasurer □

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Examination Schedule for February

02/06/99 (Sat.) Salt Lake City
Contact: Gordon Smith, K7HFV
Phone: H 582-2438 B 534-8116

02/17/99 (Wed.) Provo
Contact: Steve Whitehead, NV7V
Phone: H 465-3983 B 225-5200

02/23/99* (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> □

Tigger's Quiz Answers

Don't peak at these answers until you have taken the quiz on page six.

- 1) C. Resistor
- 2) B. Fixed Capacitor
- 3) A. Electrolytic Capacitor
- 4) E. Variable Capacitor
- 5) D. Battery Cell

How'd you Do? Remember to look closely at the various capacitors for small differences between drawings. (The FCC exams used to use their similarity to "trip up" the examinee) notice the similarity to a battery cell? Notice the curved plate and polarity of electrolytic capacitor? The arrow thru the variable capacitor is a dead giveaway that it is adjustable. (I put the resistor in just to make you think these were all easy).

Now a question for the "old timers": What was an earlier term to describe what we now call a capacitor? Good Luck P.S. If you tuned up an older car you replaced one of these routinely.

Bye for now, see you next month.

John, KA7TGR □