Friendship Cruise - May 1998

Photo: Carla Pitsch, KC7HON

Where in the world could you find an operating position with a better view? Mike Collett, K7DOU, operated from Canyonlands Overlook as he made use of two voting cross-band repeaters home-brewed by Clint, KA7OEI. The cruise and the water? It's a thousand feet below in the bottom of the canyon.

Volume XLII Issue 10, November 1998

The
MICROVOLT

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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.

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 1998 Board - Partial Listing

President: Tom Schaefer, NY4I	569-2664
Exec VP: Ray Allen, N7TEI	963-0790
Vice Pres: Gordon Smith, K7HFV	582-2438
Secretary: Russell Smith, KC7ZDZ	463-2568
Treasurer: Chuck Johnson, WA7JOS	268-0153
Microvolt Editor: Bruce Bergen, KI7OM	943-1365
Book "Lady": Fred DeSmet, KI7KM	485-9245

Note: Detailed listing of board members addresses, phone numbers, and email addresses will not appear in every issue. For current information refer to the club's web-page www.xmission.com/~uarc ❑

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 for the donation of this Web-Page service. ❑

The Microvolt

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

Volume XLII, Issue 10 November 1998

Photo: Bruce Bergen, KI7OM

QST from the Prez

Welcome to Fall! On behalf of the entire UARC Board of Directors, I wanted to pass along a thank you to the members of this club that make all the wonderful things we do possible. From the hordes of volunteers on the Scott's Hill project, the help and generosity of members on the club station, our cracker-jack repeater committee, and all the other people that make this club what it is, a heartfelt thank you! Without the help and support of all these people, and all our members, UARC would simply be a repeater on a tall mountain.

On another front, those of you at the October meeting know that we voted 53-0 to remove Dave McDaniel, KD7DNX, from the club. As unfortunate as this was, I think we have sent a strong message that if you choose to abuse your privileges, those privileges can be taken away. Amateur radio is not a right, it is a privilege.

The club station is coming along nicely. I actually made a contact from the station to Taiwan last week. Not bad for a wire antenna 50 feet above the ground. We still have a few things to do to get ready for the big media open house we are planning. We are shooting for November 15, 1998 as the official open house. More details will be available on the UARC information net.

As you may know, this is the time of year we start looking for candidates for office. We will have our nominations at the November meeting. I encourage you to volunteer to hold an office. This is your club and the best way to determine its future is to run for an elected position. I do not feel the democratic process is much served by uncontested elections. I would like to see 3 candidates for each office. We really do have fun doing this job, but it is also good to get some new blood in the club leadership. **Remember, if you want to nominate someone, please make sure they are willing. Also, please ask them to attend the November meeting**. Of course, you can nominate yourself, who knows you better than you?

On the subject of elections, I have had a great year as President of UARC. Everyone has been very helpful to me and has made this a very productive year. However, I will **not** seek the nomination for President again this year. Fortunately, as immediate past president, I do get a spot on the Board to help the transition, but I would like to see someone else take the Presidents position this year. If you are interested, please be sure to be at the November meeting.

That is all for this month…As we approach the holidays, I look forward to sharing a great season with everyone in UARC.

Best Regards and warmest wishes

Tom NY4I ❑

Featured Member Of The Month

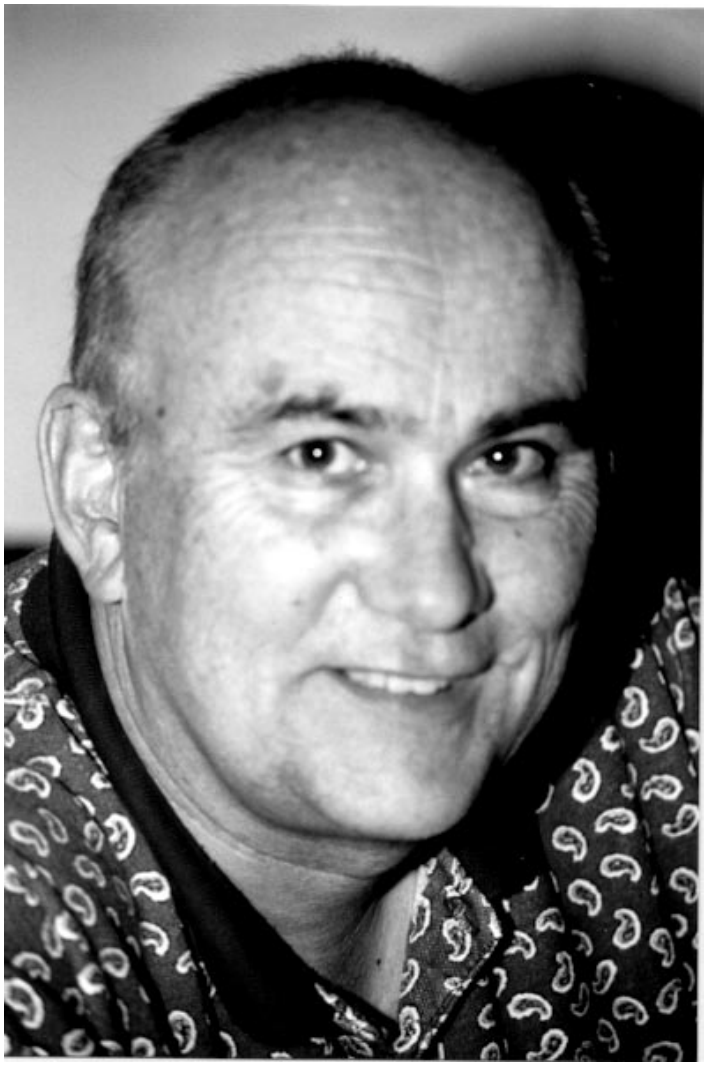


Photo: Bruce Bergen, KI7OM

Fred DeSmet, KI7KM, aka "The Book Lady"

This month we are featuring Fred De Smet KI7KM, who has been in amateur radio since 1989. Fred said he always wanted to be licensed. One day he received a flyer in the mail from Granite School District Adult and Continuing Education about an amateur radio class being offered at Granite High School. Fred decided this was his opportunity to learn what he needed to be licensed, and as a result he attended the class conducted by Jerry Bennion.

He wanted me to tell you that he was one of the last individuals in the class to pass the code. His first call sign was KB7KEP. He now has his advanced class license and his call sign is KI7KM. Fred is working very hard on upgrading to extra and wants to get his extra class license before Gary Openshaw KC7AWU the Assistant Book Lady.

In addition to amateur radio Fred enjoys many other hobbies including vegetable gardening, cooking, photography, classic cars and the great-out-of-doors.

Fred's favorite facet in amateur radio is ATV and is looking forward to the ATV repeater getting up and running. All he needs is an antenna and he is ready to go. He enjoys rag chewing, and has a weekly schedule with a friend in California on 40 meters.

Fred is a member of UARC, Davis County Amateur Radio Club, VHF Society and Rocky Mountain Radio Association. He really enjoys being a member of the Rocky Mountain Radio Association because they have a remote base on 6 meters with a 70 centimeter control link which can be reached and operated with a hand held.

Fred is a VE for the ARRL and W5YI and helps with Eugene McWherter's, W5YI, test session on the last Tuesday of each month.

In addition to supporting UARC and its repeaters, Fred also supports several other repeater systems. This includes two 220, one 440 and a 1.2 gighertz repeater. Fred is affectionately known as the "Book Lady", since this job was previously held by two women before him. The first book lady was Verna Bennion, N7LNL. She was then replaced by Susan Boman AA7HD. It seems that the "Book Lady" title has stuck no matter who does the job. Fred said he likes this job because it isn't political and no one gets mad at you. Fred would really appreciate it if members would buy books to support UARC. The books are always there for you at every club meeting. Fred said you are all invited to buy lots of heavy books for Christmas gifts.

Fred thanks for all you do.

73 N7HVF Linda Reeder ❑

General Class Upgrade Course

UARC is planning a class, to begin in February, for those wishing to upgrade to 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. To properly plan the class now, we need to determine the level of interest. 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 ❑

A Blast from the Past

This meeting was held on May 27, 1929. The Salt Lake members of UARC reciprocated the Ogden group's visit to UARC, in Salt Lake City, the previous month. The Ogden meeting was held in the Armory. It would be interesting to know where the Ogden Armory was in 1929.

Tests were planned to be made between Ogden and Salt Lake stations. It seems that the mysterious rite of initiation was carried out on four of the Ogdenites.

Alan, K7OPT ❑

Minutes.

May 27, 1929.

At a regular meeting held at the home of L. K. Irvine 786 Hawthorne Ave., Salt Lake; Adjourned to Ogden.

Attendance from Salt Lake Club; 9, one visitor. Bradford, Stearns, James, Morgan, Vogler, Bowman, Neal, Yeates, Miller. Ogden; Schatz, Giles, Rhead, McCrumm and 8 visitors, total of 12 from Ogden and 10 from Salt Lake; Total from both cities 22.

Meeting called to order at 6:50 PM Harold Bradford Chairman.

Decided to drive separately to Ogden and meet at City Hall then proceed to Armory. Adjourned to Ogden.

Meeting resumed at about 8:00 PM at Ogden Armory. Salt Lake Hams introduced to ogden hams; the glad hand passed around and the various summary of bright cracks cracked. Meeting called to order, Harold Bradford Chairman. Minutes of preceeding meeting not read or approved, to be approved next meeting.

Introductory explanation of club purposes and greeting by Harold Bradford.

Letter from Paul M Segal discussing "Radio Protective Assn." Read by the Secretary. Suggested by Bowman that vote of confidence be given Mr. Segal. Motion by Stearns that the membership have an opportunity to decide whether they wished to vote Mr. Segals confidence before putting to vote. Affirmed by James. Discussion on the subject followed. Decided?

Tests to be made between Ogden & SL Stations to establish ti
Explanation as to "What Amateur Radio is and How to become rou
an Amateur" by Stearns.

General discussion of Club activities and possibilities and general hamfesting.

Explanation of club organization and dues by Bowman.

Schatz, Giles, Rhead, McCrumm Initiated.

Don Giles, 851 30th St. Ogden elected Ogden Division Representative. Unanimous.

Speech of accertance by Giles in which he expressed his intention to "carry on" and his belief in and appreciation of the Amateur Fraternity.

Help Wanted - Experience Required

The Scott's Hill Repeater Committee is looking for experienced RF designers and bread-boarders. Since what we are planning is not generally available commercially, we will be designing and building most of the modules from the component level. In order to get this done before the reconstruction of I-15 is finished (Boo Hiss !), we would like to spread the work around to as many who have these competencies. Specifically experience in the following is sought:

-900 MHz link transmitters/receivers: These need to be retuned, and checked out. Some 900 MHz bandpass cavities and isolators need to be located. We already have a suitable 900 MHz notch-duplexer.

-Some power supplies need to be modified for use: This would involve building a low-dropout regulator and some charging/monitoring circuits.

-Repeater controllers. There need to be two repeater controllers -one at each site. These need to monitor the status of various points in the system, provide voting selection of the receivers and, over a communications link on the 900 MHz link, needs to communicate (and monitor) the other site. Also required is to be able to control the system (directly to each site) via a control frequency.

-The radios themselves. The receivers and transmitters for this repeater will be built "from the ground up." Both are specially designed for this purpose, involving high-dynamic-range receivers, careful attention to spectral purity, and numerous PLLs to lock various portions on-frequency.

If you or someone you know has these abilities we will reward you handsomely for volunteering with all expense paid tours of the Scott's Hill Site for you and your significant other, complete with a cold six-pac of diet cola of your choice. (Applause!) To collect your booty and assignment, should your chose to accept it, call Clint Turner at (H)566-4497, (W)263-0519 or email turner@vsat.ussc.com .

Clint, KA7OEI ❑

UARC Invites You to Become Radioactive
Posters

Some posters were shown at the October UARC meeting. If you would like to get one or more copies for posting at an electronics retail or wholesale outlet or on a company bulletin board please email me at bbergen@xmission.com or call 943-1365. ❑

Friendship Cruise - 1998

Overview

The Friendship Cruise started long before any of us hams can remember. It's a river cruise through the beautiful deserts of Utah which covers just over 180 river miles. It starts on the Green River at Green River, Utah and winds South to the confluence with the Colorado River; then North -- against the current -- up the Colorado River to Moab, Utah.

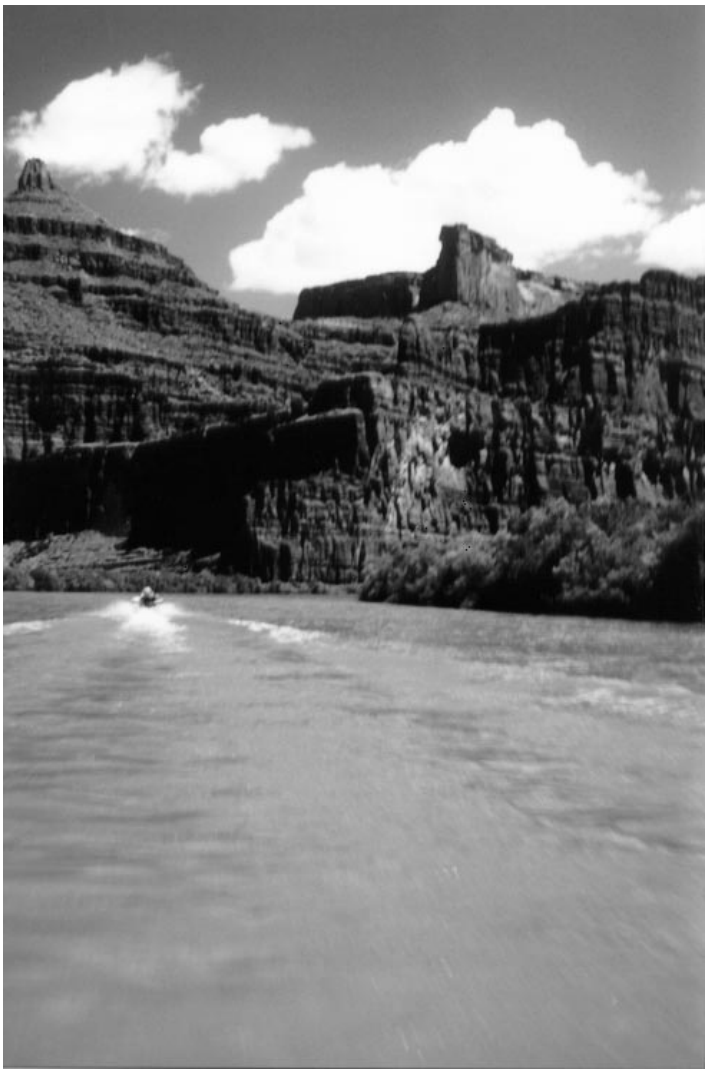


Photo: Jim Rudnicki, NZ7T

A boat participating in the Friendship Cruise heads up-river in the spectacular Canyonlands area.

In the past the boaters have paid a registration fee for a Utah river-running organization, the Canyon Country River Marathon Association (CCRMA), to help them with logistics through some very remote and otherwise foreboding (but strikingly beautiful) country. The CCRMA has essentially disbanded and the cruise has been run by the Emery County Jeep Patrol or the Emery County Sheriff's office.

The cruise is not practical -- even dangerous -- for a boat and crew to undertake unsupported. The river is chock full of floating logs and debris -- some visible, some submerged -- and hidden sand bars, and there is always the real possibility of mechanical breakdown or running out of gas. We've had three fatalities in the last ten years and have had to call an ambulance to Mineral Bottom on another occasion. And there aren't too many places to escape from a river bottom 800-1,000' below the plateau. So, the sponsoring organization arranges for maps, orientation, fuel drops, emergency rescue service, and the shuttle of cars and boat trailers from the launching ramp at Green River to the exit ramp at Moab. And, incidently, the service of delivering car and trailer to two emergency boat ramps along the course can make or break the trip for the crew of a disabled boat. The Emery County Sheriff's Jeep Posse handled that task this year.

Photo: Mike Collett, K7DOU

A view from up on top of part of the course. From here one begins to appreciate the difficulty in providing support and relief services to over a hundred boats on 180 miles of the the two rivers.

The CCRMA discovered the utility of amateur radio to coordinate all these services. Amateur radio stations (just like Field Day) operate on emergency power (there isn't any alternative, although rumors of rare desert "current bushes" persist) in VERY remote locations and on rescue boats on the river to keep the 100-or-so boats and crews safe and found. (The number used to reach 600-700 boats. Low water years has taken its toll over the last two decades.)

Radio communications for the Friendship Cruise generally consists of H-F voice on 3987.5KHz, the statewide RACES channel. This is occasionally supplemented by VHF-FM voice in the high-traffic areas of Moab and MGM Bottom. I asked Pat Buller, W7RQT of Issaquah, Washington how it all began. Pat helped found the Ogden Amateur Radio Club and the Utah VHF Society, and was a charter operator of amateur radio communications for the Friendship Cruise.

Pat recalls: “It all began with a conversation between the late John Blevins, W7BRB, and Jerry Warner, then W7VSS (now W7RH) on the 75 meter band. It seems that John had some association with the Carbon County Jeep Posse who, at that time, had the contract to shuttle cars from Green River to Moab, with stops at Mineral Canyon or the Potash plant for pull outs if necessary. John reported that the Jeep Posse had tried CB and Civil Air Patrol with poor results. The CB didn't work, and the CAP didn't take the whole thing seriously.

The first time amateurs came on the scene was with John at Green River, Ron, WA7BME at Moab, and Jerry, W7VSS, Pat, W7RQT, and John Merrill, (his call escapes me), at Mineral Bottom. That was it for the first year. The same scene was repeated the next year with Gordon Smith located at MGM or Potash plant. The equipment at Mineral consisted of a Swan 240 and Heath HP23 power supply owned by W7CQP, Jerry's dad, an Onan 350 Watt generator of OARC, 240' antenna center fed with ladder line, tuner & masts by W7RQT. Additionally we brought down a Motorola 5V FM rig and 5 element Yagi in hopes of talking to Moab or Green River. No such luck.

The FM rig did however, help us out. During the Saturday operation, someone asked if there was a way we could charge a battery. Yes, we could. He took the battery from the boat, and we connected it to the ONAN which had a 12V charge capability. To speed up the charge, we raised the RPM on the generator. All was fine for several hours. Unknown to us, the battery owner decided it was time to take his battery. Perhaps 5-10 minutes lapsed before we had capacitors blow in the HP23 power supply. When the battery was removed, the engine RPM raised along with the AC voltage to about 135 volts. Repairs were made by robbing the capacitors from the 2 meter power supply. Were back on the air in about 20 minutes. Another strange thing happened Sunday morning. The Onan wouldn't start. The valve clearance somehow went to zero. We re-gapped to about 0.13" and the first pull it started. Were operating again.

Food was arranged by the wives of the two members of the Carbon County Jeep Posse who attended Mineral Canyon. The arrangements were that they would provide the food, and the River cruise would provide the Gas for travel and generator. The success of the "HAM" operators was so far above expectations of the Jeep Posse, they demanded our presence the next year. They knew they had a system that made their operation far above any one else that wanted to bid on the operation. We kept accurate records of what trailers were requested, by whom, and time. It was the most complete document of the entire operation. It became obvious that a radio on the rescue boat would certainly be to everyone's advantage.

The following year included improvements. A 3.0 KW generator of W7RQT, 1000watt flood lights, more spare parts, and the addition of Gordon Smith at MGM. I could go on, but how much detail is desired?” (Pat Buller 3/30/98)

Fast forward nearly thirty years... There have been some efforts over the last couple of years to experiment with an expanded VHF-FM voice capability to try to reach more locations on the river. 1995 saw some success with cross-band repeaters on Island-In-The-Sky and at the East Rim of the Colorado river, South of Moab. 1996 Saw the use of in-band repeaters. 1997 saw the addition of the Panorama Point repeater site. This year we used two linked in-band VHF repeaters at Canyonlands Overlook and Panorama Point, plus a cross-band repeater at the North end of the Green River.

The 1998 communications plan (we use that term when we’re really just winging it) called for four land-based communications stations, three land-based temporary repeater stations, and three rescue boats. The land-based stations were set up at the Green River Fire Station, the Mineral Bottom (dirt) boat ramp on the Green River, the concrete MGM Bottom boat ramp on the Colorado River, and the Moab boat trailer parking lot off Highway 191 just outside Moab.

Repeater stations were set up after a long four-wheel-drive commute to Panorama Point, high up on the West Bank of the Green River by Clint Turner, KA7OEI, Gordon Smith, K7HFV and Michael Hines, A7XY. Mike Collett, K7DOU and Dick Abbott, K7MZ four-wheeled out in the dead of night and set up at Canyonlands Overlook on the East rim of the Colorado River south of Moab. Ron Jones, K7RJ set up a portable cross-band link outside Green River late Friday afternoon.

The Rescue Boat stations consisted of Bret Mills, WX7Y on the Sheriff’s boat with VHF, UHF and H-F with a loop antenna., plus Mike, WA7ARK on Rescue Boat 2. Mike flew down to Canyonlands airport and

Photo: Jim Rudnicki, NZ7T

Clint, KA7OEI, makes some adjustments to the 80 Meter loop used on the Sheriff's boat

was ferried to the boat dock by an accommodating Ham. (Is this tough duty, or what?) Brent Thomas, AC7H operated "Rescue-3" with a VHF setup. Next time you see Brent ask him why he keeps his pager on a tether attached to his belt. (Boat. Pager. Water. New pager.) Now, these three guys really had the fun. Additionally, Doug Miller from KSL Channel-5 boarded the Sheriff's boat to 'do' the cruise and Bret got his mug on KSL Outdoors a few weeks later. Not to be outdone, Clint Turner filmed the boat and amateur activities and presented the nifty video you saw at the May UARC meeting.

Green River Fire Station

There are two handy telephone poles on the SW side of the building which are 104 feet apart. A "loading-coil" dipole about 90' long strung between them usually fills the bill. The dipole is only 20-25' off the ground, so you don't have the customary 50-70 ohms at the feedpoint. Ladder line and a tuner are always in order. The "cruise people" let us set up our rig on a table inside the fire station. Elaine Jones, N7BDZ had a nifty station set up Friday night in solid contact with the crew at the Panorama Point remote site on two meters. One can sleep on the floor of the fire station Friday night if one wishes, or lately the Sheriff's office has been putting the hams up in the holding cells in the Green River office. It's either that, or rising early at the fire station. The building starts filling with people at 7am!

Mineral Bottom

Dink, KC7AW and Jim Marshall, NY7E operated at 'Mineral" this year. There are no natural antenna supports at Mineral Bottom. Neither is there adequate shelter. We have some nifty pictures of tarps and tables (& hams) in disarray after the hailstorm in '97,

Photo: Mike Collett, K7DOU

A desert hailstorm can put a bit of a damper on the fun, but fortunately passes by quickly.

Right Dink? A 30' mast supports an inverted-V for 80-meters, but everyone is tied together now on the linked two-meter repeater system, so H-F is mostly a novelty now. This is one of the most scenic spots on the river, with red sandstone cliffs towering 800 feet above the campsite. We've tried some crazy communications schemes out of this spot over the years (bouncing 2-meter signals off the opposite canyon wall–it worked, using a Special Forces H-F antenna lying on the ground (HA!), using an unattended cross-band link on top of the plateau (that worked too), trying a passive yagi repeater on top of the cliff (HA, HA, HA, HA, HA!) and using Mark Mallory's crazy five foot loop antenna. The loop worked best.

MGM Bottom

John Mabey, W7CWK held down the fort and kept the mosquitos at bay at MGM Bottom this year. John has a nice portable setup in his trailer, and at MGM the lady ranger isn't trying to chase him out of the campground (*ugly* antennas? What?????) John swore

he'd never go back to Willow Flat at Island in the Sky. Too many tourists to appreciate the finer things (skyhooks, generators) in life!

Moab

Steve Carver, N7VVW set up in the Davis County War Wagon at the parking lot outside Moab. He was assisted by Dave Raab, N7VDV (the men from MARS.) These guys pass a lot of traffic between the Jeep Posse boat trailer shuttle, and the rescue boats. This is the hardest duty of all, and this station is really the 'anchor' spot. Steve showed off his new GPS receiver and software on his laptop as he used it to navigate out to the "Overlook" Sunday Night to visit Dick and Mike. Pretty nifty.

Canyonlands Overlook

This is the site of the first portable 2-meter repeater system used on the Friendship cruise. It's located on

Photo: Mike Collett, K7DOU

Part of the portable 2 meter repeater used at Canyonlands Overlook.

BLM land in the Canyon Rims Recreation Area on the east rim of the Colorado south of Moab. We had the only injury at this site this year. Dick Abbott was attacked by a pole holding up the awning, and drove himself to Moab to get stitched up, then came back to operate some more. (He really just wanted to see the 'road' he came in on in the daylight.) The potholes of water in the slickrock don't look as menacing in the middle of the day. Mike spent the weekend chasing the 450 link transmitter up and down the band. This site provides the greatest view on Earth. The operating table was set up on the edge of the 1,000-foot plateau. Mike was greeted one morning by a big-horned sheep clip-clopping up the red rock. One look at the antenna farm (or was it Mike) and off he went. Carla, KC7HON, stopped by Sunday on her mountain bike to see the view. She provided some great backup at the Moab station during the weekend.

Panorama Point

Clint's homebrew repeater is something to behold. It consists of a remote receive site half a mile's hike from the transmitter. Separate VHF yagis (also home-brewed by Clint) point north and south and have homebrew GASFET preamps and a voting arrangement to select the receiver with the strongest signal. The receive signal is relayed to the transmit site on 450 (and to Canyonlands Overlook as well.) Clint transmits back to the river (and to visiting mobiles a hundred miles away) with 200 watts from a pair of surplus Motorola Mocom-70's hooked together with a phasing harness. All together this affair has an ERP of some 3,000 watts directed up and down the river. The 450 linking connects the two split-site repeaters on the two rivers and provides VHF communications over some 80% of the Friendship Cruise course.

Photo: Mike Collett, K7DOU

Mike, K7DOU, from his position at Canyonlands Overlook is able to communicate with stations covering hundreds of square miles of some of the most rugged and remote landscape in the lower 48.

Red dirt, friends, nifty apparatus, red dirt, sounds of the river in the middle of the night, a full eclipse of the moon in Mineral Canyon, red dirt, more nifty apparatus....Marconi would have loved this stuff.!
Come join us on the Friendship Cruise. It's habit-forming.

73, Mike K7DOU ❑

Contesting and DXing Taught Here

As the solar cycle improves and Winter approaches 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. Daryl at 942-3817 and Alan at 572-8112 ❑.

Gel-Cell Batteries

The gel-cell battery is really a sealed lead-acid battery. I believe the term Gel comes from the fact that the electrolyte is really in a jelly form, as the correct term for the electrolytic is Dilute Sulfuric Acid. Because of this form of electrolyte and the fact that the batteries are sealed allows the battery to be used in any position. The batteries have a internal safety valve to protect the battery from rises of internal pressure in the case of overcharge. For this reason the manufacturers recommend that the sealed lead-acid batteries are not placed in service in a gas tight enclosure, as the batteries can outgas.

Another difference between the sealed lead-acid and the conventional lead-acid is that the internal plate grids of the lead-acid battery are made with Lead-Antimony alloy. This is a disadvantage in that the antimony precipitates on the negative plate and forms a local reaction, resulting in an increased self-discharge current with time. In the sealed lead-acid battery Lead-Calcium alloy is used for the grids, which reduces the self-discharge current.

In the previous article I mentioned that the state of charge for a battery can be determined by the open circuit voltage of the battery. In figure 1, cell voltage of 2.0 volts or 12.0 volts for a 6 cell battery is approximately 30% charged. It is important to note that the open circuit voltage should be taken 24 hours after removal of the charger or 10 minutes after the discharge load is removed. The temperature is 25 °C(77°F)during these tests. Figure1, has a fairly wide line that depicts the charge voltage versus the remaining capacity of lead-acid batteries. I interpret this to line to mean variations in this type of battery.

I have a portable power pack that contains 2 each 6 volt 10 AH sealed lead-acid batteries connected in series. Twenty-four hours after a recent charge the battery measured 12.76 volts. Dividing this by 6, because there are 6 cells gives 2.12 volts as the cell voltage. Looking at figure 1, top of the wide line the battery appears to have 75 percent of remaining capacity. It seems like my portable power pack no longer has a capacity of 10 AH but is now 7.5 AH. This reduction in capacity can be the result of the number of cycles the batteries have gone through, or from the fact that is was once discharged below the cutoff voltage without recharging for a spell.

Figure 1. Open Circuit Voltage and Remaining Capacity.

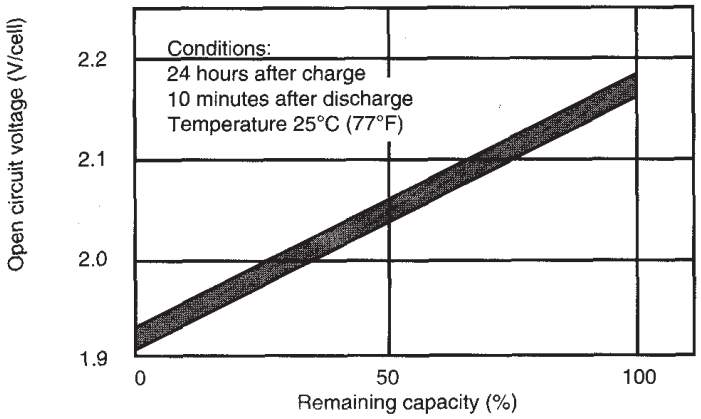
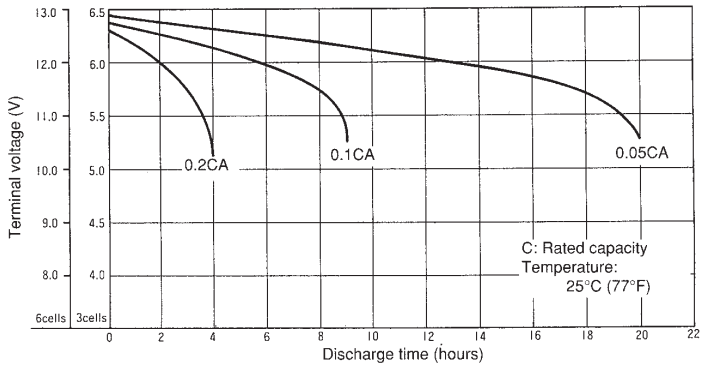


Figure 2. Discharge Time Vs. Discharge Current



The capacity of the sealed lead-acid battery is based on the 20 hour discharge rate. For example if you have a 6.5 AH battery. 6.5 divided by 20 gives 0.325 amps. Looking at figure 2 one can also see if the discharge current is increased to 1.3 amps or 0.2CA the battery will discharge in approximately 4 hours. When we multiply 1.3 amps times 4 hours to get 5.2 amp/hrs. One can clearly see the capacity of the battery is no longer 6.5 AH. If the discharge current is increased until it equals 6.5 amps, the discharge time is now 30 minutes. The capacity is only 3.25 AH. However the sealed lead-acid battery has the capacity to provide 10 times or more of its capacity for a short time. For this reason I always connect a fast blow fuse between the battery and anything else that connects to the battery. I learned the hard way to connect the fuse to the battery.

I was building a battery pack for a 12 volt fish finder. The battery pack needed to be charged from the cigarette lighter jack of an automobile or from house current. To accomplish this I used two 6 volt batteries in series to get 12 volts to run the fish finder, but the batteries were connected in parallel mode for charging. This was okey as it is easy to charge a 6 volt battery from the cigarette lighter jack with

appropriate circuitry to limit the current and the voltage for proper charging. The switching between fish finder operation and charging was accomplished with some plugs and jacks. When the fish finder was connected the batteries were in series, when the charger was connected the batteries were in paralled with isolation diodes. Well I thought I had everything wired correctly, and was testing the system. In the process of connecting the batteries one way or another with the plugs and jacks, I had red hot wires and a workshop full of smoke from the short circuit. Not only did I have to rewire the plugs, but I had to replace the plugs. Had I used a fuse in series with the batteries I would have saved myself lots of work.

Ambient temperature affects the capacity of the battery. As the temperature increases the capacity increases, and when the temperature goes down the capacity also goes down. Looking at figure 3, the capacity can increase as much as 5%, but can decrease by 35%, or more. This figure also has the curves for various discharge rates.

Figure 3. Effect of Temperature on Capacity

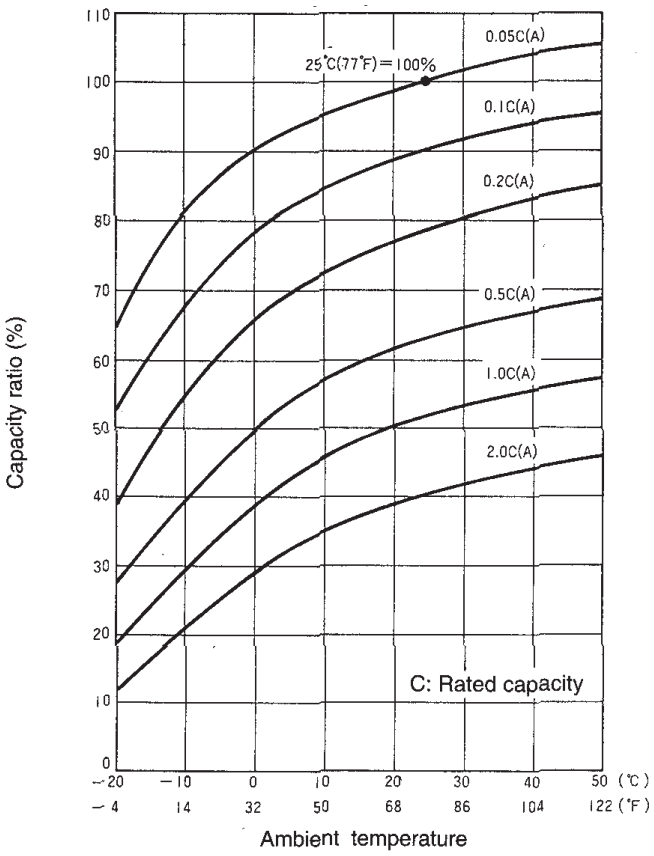
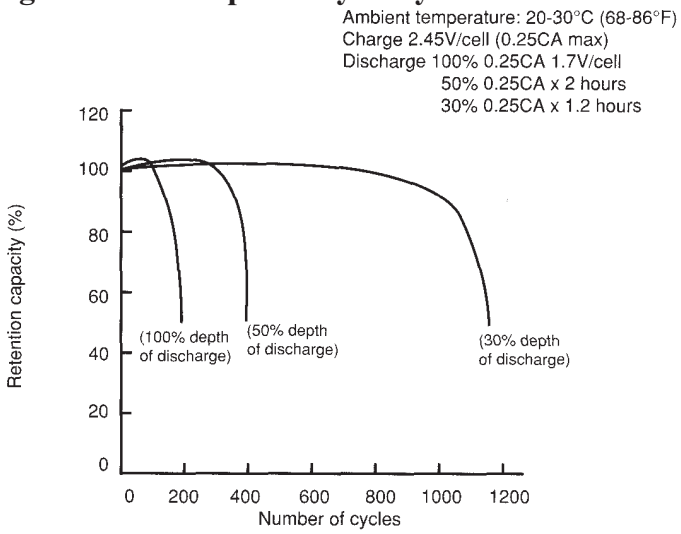


Figure 4, gives an idea of how long the battery will last. The depth of the discharge determines the number of cycles and thus the life of the battery. The depth of discharge can be at the 20 hour rate (.05C) or at a higher rate. A word of caution here is necessary. It is still important not to discharge the below the

Figure 4. Life Expectancy of Cyclic Use



Cutoff voltage, or permanent damage to the battery can occur. My research has shown that it is better to discharge to the cutoff voltage at a high current discharge rate than at the 20 hour rate. Some manufacturers claim the construction of the sealed lead-acid battery prevents damage by deep discharge. Deep discharge means to discharge the battery below the cell cutoff voltage. There are many brands of sealed lead-acid batteries and their construction is bound to vary between manufacturers, so in my opinion discharging too low may in fact damage a particular brand of battery.

I learned not to discharge the sealed lead-acid cell too low or you might as well get a new battery. Yes I learned it the hard way also. I was testing a single 2 volt 2.5 AH cell. I decided to use a 2 volt lamp bulb to discharge the cell. I had no monitoring equipment connected to the cell, I wasn't paying attention for quite some time. When I returned to check to see if the lamp was out, it was. The battery essentially measured 0 volts. Since I had previously built a 2 volt charger, I immediately connected the charger and was I surprised when there was no current flow from the charger to the cell. To get the cell to even take a charge I had to use a variable power supply and start with over 10 volts to get any current to flow. As the current increased I reduced the charge voltage, and eventually I was able to get the cell to charge from the 2 volt charger. Then I noticed that the cell did not have near the capacity as when it was new.

Charging the sealed lead-acid seems quite simple, as there are two recommendations. First if the battery is in a standby service, then the charge voltage should be between 2.25 volts and 2.3 volts per cell. This relates to, from 6.75 volts to 6.9 volts for a 6 volt battery, and 13.5 volts to 13.8 for a 12 volt battery. At these

levels the battery will never overcharge. This method is called float charging. In this condition as the battery charges the current drawn from the charger decreases. When the current decreases to 0.1% of the rated capacity the battery is assumed to be fully charged. The current varies some what due to the condition of the battery and the ambient temperature. Some manufactures say that in this method of charging the initial charge current should be limited to 0.25C, while other manufacturers say there is no need to limit the initial current.

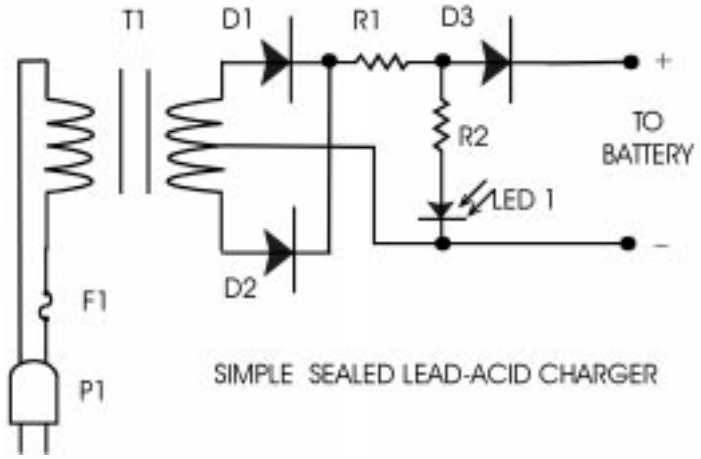
The second method to charge the battery is the cyclic mode. This assumes the battery is being charged then discharged in cycles. The recommended voltage per cell is between 2.4 volts and 2.45 volts. This relates to, from 7.2 volts to 7.35 volts for a 6 volt (3 cell) battery, and 14.4 volts to 14.7 volts for a 12 volt (6 cell) battery. As in the previous method of charging, the current decreases as the battery charges. When the current drops to .01C the charger should be removed or the voltage reduced to the float levels. If the charging conditions are not changed at this point the battery can be overcharged. In this method of charging, all manufacturers that I have read recommend that the initial current be limited to .25C.

With both charging methods the voltages mentioned in the previous text are for 25 ºC(77ºF). As the ambient temperature changes the these voltages have to be adjusted somewhat in a inverse proportion. If the temperature rises the voltage needs to be decreased, and as the temperature goes down the voltage needs to increase. The cyclic charging method has the greatest extremes of voltage change. If the float charging method is utilized, no real adjustment of the voltage is necessary between the temperatures of 0ºC(32ºF) and 40ºC(104º).

Chargers can be purchased locally, or they can be built from available component parts. It is the intent of this article to provide schematic diagrams with parts lists so the reader can construct their own chargers. The simple is the least expensive, but it also has some limitations, and for overall use it is not recommended. The smart sealed lead-acid charger, although more expensive, is very reliable and will charge multiple different capacity batteries without adjustment, or overcharging of the batteries.

At this point it is noteworthy to mention a charging method that is not recommended. I mention it mainly so the reader is aware that I know of the method and will mention the pitfalls in the way of warning. The method is charging directly from the cigarette lighter jack in the vehicle. First the voltage varies depending on whether the engine is running. When the engine is running there is ample voltage to charge the battery, but to prevent damage to the sealed lead-acid battery the current has to be limited. If the sealed lead-acid battery is left connected to the cigarette lighter jack with the engine off, and the vehicle is started, the sealed lead-acid battery may try to start the vehicle engine. The result may be burned insulation on the vehicle wiring, or something worse. There is a solution to this problem. By using a switching regulator converter between the cigarette lighter jack and the smart charger described later in this article one can safely charge the 12 volt sealed lead-acid from the vehicle electrical system.

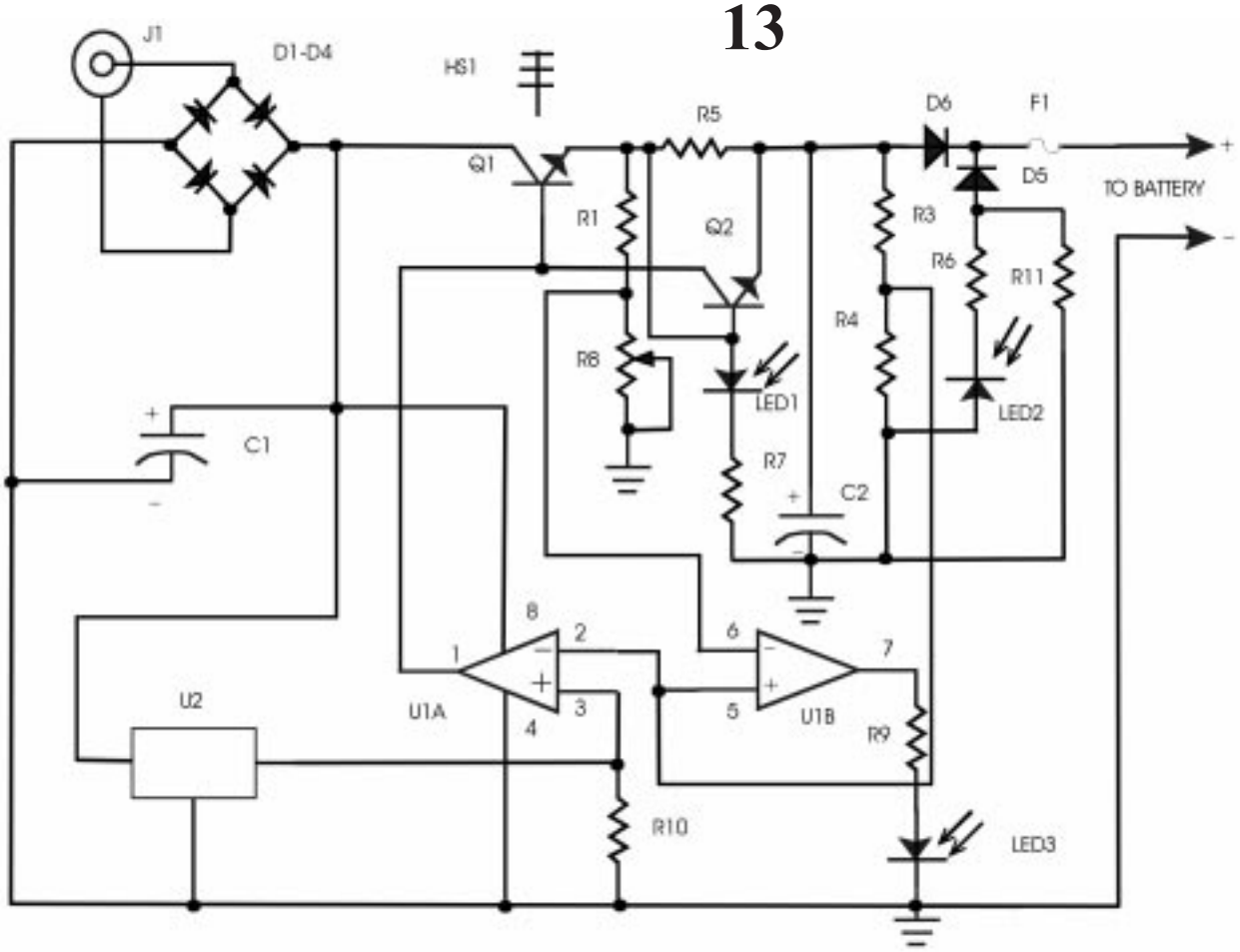
Schematic diagrams and associated parts lists of chargers follow. The values in parentheses in the parts lists are for the 6 volt version.



Simple Charger Parts List:

D1-D3 1N5401 Silicon Rectifier
F1 1 amp (0.5 amp) AGC type
T1 Triad F7-28 (F-251X) 28 VCT, 2A (14VCT,2A)
R1 4 ohms 50 watt (2 ohms 25 watt)
R2 1k 1/2 watt (510 ohms 1/4watt)
LED 1 IDI 5100H7 panel mount yellow LED

This simple charger works in the cyclic mode, and to prevent overcharging must be removed when the voltage at the battery terminals with the charger on reaches 14.7 volts for the 12 volt battery and 7.35 for the 6 volt battery. This charger should not be used for capacities less than 4 AH because of the peak current supplied by the charger.



SMART SEALED LEAD-ACID CHARGER

Smart Charger Parts List:

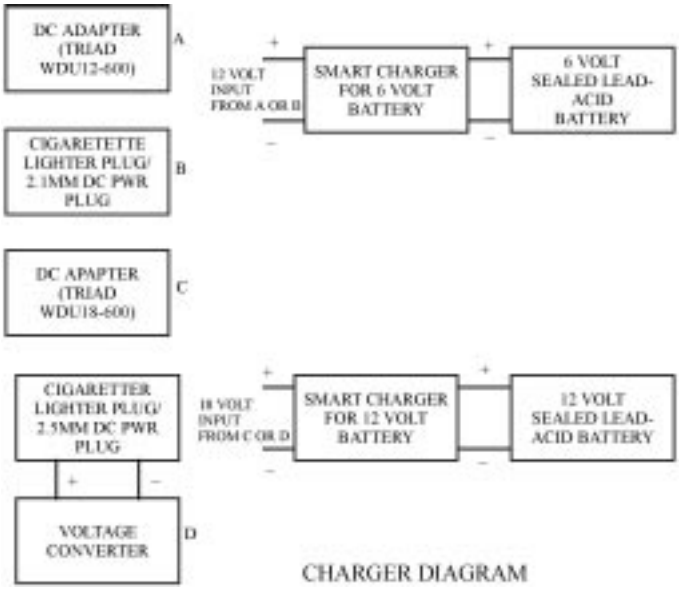
C1 100uf 25V radial electrolytic
C2 10uf 50V radial electrolytic
D1-D5 1N4001 Silicon Rectifier
D6 1N5817 Schottky Rectifier
HS1 heatsink, Thermalloy 6237PB
J1 Switchcraft RAPC722 2.1 mm power jack
LED1 Green T-1 led
LED2 Red T-1 led
LED3 Yellow T-1 led
F1 3/4A Raychem RXE050
Q1 TIP120 NPN Transistor
Q2 2N2222A NPN Transistor
R1 5.23k 1% 1/4 watt
R3 13.3k (5.1k) both 1% !/4 watt
R4 1.3k(1.0k) both 1% 1/4 watt
R5 1.8 ohms 5% 1 watt metal oxide
R6,R7,R9 1.5k 5% 1/2 watt (560 ohm 5% 1/4 watt)
R8 1k trim pot Spectrol 64W1K
R10 120 ohms 5% 1/4 watt
R15 not shown on Schematic 240 (120) ohms 5% 2 watts (1 watt) used to adjust R8
U1A&B LM358N Linear I.C.
U2 LM317LZ Linear Regulator.

The charger requires a minimum of 18V (12V) filtered DC at 500mA, at the input to jack J1 for proper operation. The input voltage can be of either polarity. .The bridge rectifier connected immediately to J1 allows the input to be either polarity. That is either positive or negative ground. This smart charger uses the standby mode for charging. This means that the charge voltage is set to the float level, and the current is limited to about 400 mA. This charger will charge most lead-acid batteries. It should not be used for batteries less than 2.0 AH, with the value of R5 shown. The least expensive way is to use off the shelf DC adapters, commonly called wall warts to power the charger. For the 12V charger the Triad WDU18-600, and for 6V charger the Triad WDU12-600. Both these DC adapters work very well.

Adjustment of R8: Once the charger is assembled and the DC adapter is suppling power, connect R15, 240 ohms (120 ohms) to the output leads, adjust R8 counterclockwise until the yellow LED illuminated. Now turn R8 clockwise until the LED is extinguished. Then carefully turn R8 back counterclockwise to the point that the LED just turns on. The circuit is now adjusted so that the yellow LED illuminates when the

charge current drops to approximately 50 mA.

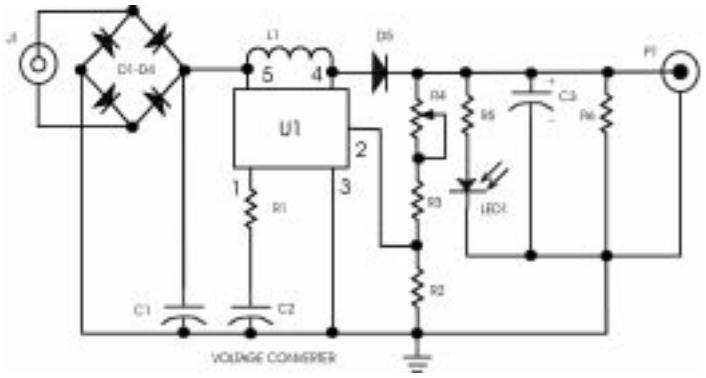
Smart Charger theory of operation: The bridge rectifier, Q1, U1A, R3,R4 and U2 comprise a standard linear voltage regulator. U2 is the reference for the circuit, and R3 and R4 control the output voltage. R10 provides a minimum load for the regulator IC, U2. Q2 and R5 provides current limiting to approximately 400mA. U1B, R1, R8, R3, and R4 function as a bridge circuit and comparator to turn on LED2 when the charge current drops to approximately 50mA. C1 provides a low impedance input for U2. C2 provides noise filtering for the output. D6 prevents the charger from discharging the battery if a power failure occurs while the charger is connected to the battery. D5 and R11 cause excess current to flow and trip the resettable fuse F1 in the event battery is connected to charger in the wrong polarity. LED3 and R6 provide indication of a reverse battery connection condition.



CHARGER DIAGRAM

In the charger diagram, the 6 volt battery charger can be suppled with power either from the DC adapter or a power cord plugged into the 12 volt cigarette ligher jack of the vehicle.

As the charger diagram indicates, the 12 volt battery charger can be suppled with power either from the DC adapter or the VOLTAGE CONVERTER/power cord combination that is plugged into the 12 volt cigarette lighter jack. The VOLTAGE CONVERTER converts an input of 11 to 15 volts to 18 volts to supply the correct voltage and current to the 12 volt version of the smart charger. This is a safe method of charging the 12 volt sealed lead-acid battery from the 12 volt vehicle electrical system. The input power jack for the VOLTAGE CONVERTER is a 2.5mm jack to avoid connecting the DC adapter to it.



Voltage Converter parts list:

C1 0.1uF 100volt Mylar
C2 0.94UF 100volt Mylar (2 ea .47uF in parallel)
C3 1000uF 25volt Electrolytic
D1-D4 1N5817 Schottky Rectifier
D5 1N5820 Schottky Rectifier
J1 2.5mm Jack Switchcraft RAPC712
L1 250uH Coil Miller 5254
LED1 T13/4 Green LED
P1 2.1mm Plug Switchcraft S760
R1 1.2k 1/4watt 5%
R2 2.0k 1/4watt 5%
R4 5k 1/4w single turn trimpot
R5,R6 1.5k 1/2 watt 5%
U1 LM2577-ADJ switching regulator, mounted on Thermaloy 6098 heatsink

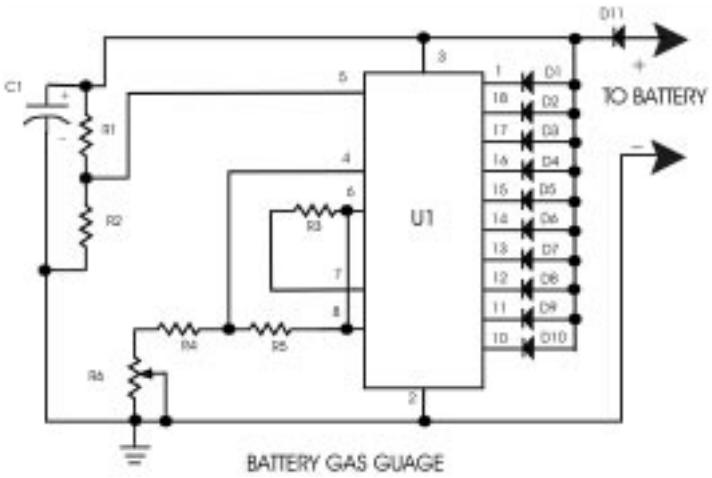
Voltage Converter theory of operation: D1-D4, bridge rectifier allows either polarity for input power. Schottky rectifiers are used here as they have about 1/2 the forward voltage drop as normal silicon rectifiers. C1 provides a low input impedance for U1 at the switching frequency of approximately 50KHz. U1 and associated components comprise a voltage boost switching regulator. R4 adjusts the output voltage to 18 volts. C3 provides output filtering. R5 and LED1 are used to indicate when power is applied, and in parallel with R6 provide a minimum load current of approximately 20 mA for the switching regulator.

If continual charge condition of the sealed lead-acid battery is desired, the following circuit can be used. Even thought it monitors the charge condition of the battery I call it a gas guage.

Parts list for BATTERY GAS GAUGE:

C1 2.2uF 16V Tantalum
D1-D10 individual LED's or 1 10 Segment LED bargraph, such as Radio Shack 276-081
D11 1N4001 silicon rectifier
R1 10k(4k) 1/4w 5%

R2-R4 2k 1/4w 5%
R5 750 ohm 1/4w 5%
R6 1k trimpot Spectrol 64W1K
U1 LM3914N Dot/Bar Display Driver, National Semiconductor



BATTERY GAS GUAGE

Battery Gas Gauge theory of operation: C1 provides power supply filtering for U1. D11 prevents damage to the circuit in the event that power is applied in the reverse polarity. R1 and R2 are a voltage divider for sampling the battery voltage. In the 12V version the voltage seen by pin 5 of U1 is 1/6 the applied voltage and on the 6V version the voltage is 1/3 of the applied voltage. U1 internally has 10 voltage comparators, a voltage reference, LED drivers, and a common LED current limiter. With the components shown the circuit consumes approximately 15mA of current. Resistors R3,R4,R5 and R6 in total control the current drawn by the LED's. R4-R6 control the reference voltage. R6 is adjusted for either one of two points. R6 is adjusted so that D1 is illuminated at the lower voltage of 11.1V (5.6V) or when D10 is illuminated at the higher voltage of 13.8V(6.9V). In the 12V version each step is approximately 0.3V. In the 6V version each step is approximately 0.15V. I say approximately because built into the IC is overlap between each of the 10 segments or steps, and the internal voltage divider resistor chain has a tolerance of about 40%. The segments generally fade off or on when the voltage is changing.

If opto-couplers(the LED part) are connected in series with one or more of the LED's control of other circuits can be achieved. Like cut-off of loads to batteries, or turning on a charger to the battery.

When this Battery Gas Gauge is left connected to a battery it can discharge the battery in a length of time. For example if one were to assume 15mA current consumption. In 10 hours that would be 150mA/hrs. In one 24 hour day 2.4 times 150mA/hrs= 360mA/hrs. In a 30 day month the discharge by the gas gauge would be 360mA/hrs times 30 or 10.8AH.

Earlier I mentioned a 12V power pack that I have. This power pack has a gas guage and one of the smart chargers contained in the pack. With the gas gauge continually on, the battery gets charged about every 20 days, as I have the pack placed in a location where I see it at least once a day. When D1 is illuminated, I start charging the battery. As you recall, I mentioned that my portable power pack no longer had a capacity of 10AH but was down to 7.5AH, hence the recharging every 20 days.

Parts information on the previous supplied schematics: The following parts are available directly from me. I can be reached by landline 801-262-1419. Please no calls after 9:30pm.

Printed circuit boards for the SMART CHARGER, with some parts mounted.

The F7-28 transformers for the SIMPLE CHARGER.

The LM3914N, and the LM2577T-ADJ integrated circuits are available from JDR Micro Devices. The Miller 5254 coil is available from either Mouser Electronics or TECH America. The heatsinks were available from Standard Supply at the time the circuits were designed and built, but are no longer stocked there. Substitutes for those specified can be made as long as the thermal resistance(°C/W)is equal or better. For the SMART CHARGER the 6237B has a thermal resistance of 8, and for the VOLTAGE CONVERTER the thermal resistance is 11 for the 6098 heatsink. Since both heatsinks are for TO220 case size, you may want to get 2 of the larger size if you plan to build both the Smart Charger and the Voltage Converter. The LM3914N and LM2577T-Adj integrated circuits are available from JDR Micro Devices. The Miller 5254 coil is available from either Mouser Electronics or TECH America. All the other components should be available from Standard Supply in Salt Lake City. The power resistors for both versions of the Simple Charger are not real critical in value. A value at the specified resistance or slightly higher should be fine.

73 Ned K7ELP

Ned Stevens K7ELP© ❑

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November Meeting: Homebrew Night

It's that time of year you've been waiting for: the time when everyone brings homebrew to the UARC meeting. Wait! Actually, we don't mean the bathtub concoctions; we mean homebrew equipment. November 5 will be the day to see how creative everyone has been. They will be displaying their construction projects that have something to do with amateur radio.

If you have a prized electronic child, be sure to bring it along and enter it in the display. Everyone who enters will get an award. Past entries have included things like linear amplifiers, keyers, station control boxes, repeaters, and even complete HF transceivers.

Antennas are legitimate entries as well. If you can't fit your 160-meter beer can yagi in the car, just bring enough pictures and diagrams to show what you have done.

Be prepared to tell us what your device is and what it does. Also of interest would be what led you to the design, what its good features are, and what your experiences have been using it. But don't get too prepared. There will be a time limit, typically about three minutes. The exact length will depend on how many others have projects to describe.

Of course, the meeting will feature a chance to check out the latest book offerings from ARRL and match up faces with the voices you've been hearing on the bands. Don't miss it!

Gordon, K7HFV ❑

Examination Schedule for November

11/04/98 (Wed.) Farmington
Contact: Marc Uhrey, AB7PL
Phone: H 7710105 B 5364782

11/18/98 (Wed.) Provo
Contact: Steve Whitehead, NV7V
Phone: H 4653983 B 2255200

11/24/98* (Tues.) Salt Lake City
Contact: Eugene McWherter, N7OVT
Phone: H 4846355

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

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