

acc notes

advanced computer controls, inc.

2356 Walsh Avenue, Santa Clara, California 95051

(408) 727-3330

April/May/June '86

We've Moved! Effective May 26, we've moved our facility in Silicon Valley down the road from Sunnyvale to a new and larger plant in Santa Clara. (The Northridge Square address in Cupertino remains acceptable as an alternate mailing address.) Our new address and phone numbers are:

Advanced Computer Controls, Inc.
2356 Walsh Avenue
Santa Clara, CA 95051

408-727-3330 Information/Orders

408-727-3414 Technical Support (9am-3pm)

DVR In Full Production. We've shipped out the bulk of our Digital Voice Recorder backlog, so that delivery times are shrinking. If you've been considering adding a DVR to your repeater, now is the time to contact us about getting a DVR for your system.

Be a Star. The DVR's voice mailbox prompts users through the process of leaving messages. Dedicated "tracks" instruct the user when to record, and acknowledge various mailbox operations. These tracks can be recorded remotely. That means that your "mailbox prompter" can be anyone you'd like, and can change any time. Get your wives and kids involved in your amateur radio activities. Feature a "mailbox prompter kid of the month". Or if you have access to celebrities, get them to record the prompting messages.

DVR IDs of the Month. "Hi, I'm Art, N60WX. When I'm in town, from LA, I listen to WA6AXX repeater. Easy listening." "Is it live, or is it DVR? This is WA6AXX, repeater."

IDs of the Month. "Pass the time on W5ALG, repeater. (tic, toc, tic, toc). The time is (time)." "Fire up your radio on the right repeater. This is W5ALG repeater. Good morning/afternoon/evening." "(male) Hi, Kay. (female) Good m/a/e. (male) And to you too, on W5ALG, repeater".

Northern California Stays 15 kHz. At its semi-annual meeting in April, the members of the Northern Amateur Relay Council of California voted to keep two meters (146-148 MHz) on its mix of upright and inverted 15 kHz spacing. It rejected a 20 kHz proposal by 79 to 69.

Looking at a map of 15/20 around the country, with very few exceptions, it appears that 20 kHz fits well in low population density areas, while 15 kHz is optimum for congested areas such as the northeast and California. Maybe this controversy is finally over, and amateur organizations can consider more important issues - such as how to keep 220 MHz and 70 cm in the amateur service.

Interfaced a Radio? We occasionally get requests for how to interface an old transceiver to our products as a remote base. Since there have been scores of transceivers available throughout the short history of VHF FM amateur radio, we can't possibly have personal experience with each one. The irony is that the older radios are some of the best values in remote base installations.

If you've interfaced a vintage transceiver to your controller or ShackMaster, such as a Kenwood TR-7400A, or Drake UV-3, send us notes on what you did. We'll add it to our library and make it available to others who want to do the same thing. In the case of the TR-7400A and UV-3, we'll offer a \$100 gift certificate to the one who submits complete, proven details for either rig. In case we get more than one per rig, we'll select the most complete writeup.

ITC-32 Intelligent Touch-Tone Control Board.

Thanks to improved manufacturing efficiencies, we've lowered the price on our field proven Intelligent Touch-Tone Control Board. But we haven't taken out any of the features that make it the most sophisticated Touch-Tone control product we know of anywhere. It offers 28 remotely controllable outputs, and four inputs which may function as alarms to activate your transmitter, or may be interrogated. Commands are acknowledged in Morse code, or synthesized speech if you wire up the Digitalker speech chips. The board also has a repeater COR and IDer, which make it the choice when you're looking for a decoder for your homebrew repeater.

Compare it to one or two function decoders, or even to "dumb" sixteen output decoders, and we think you'll agree that no other decoder comes close. At its new price of only \$275, the ITC-32 offers outstanding "bang for the buck". And of course it's assembled and tested, not a kit.

Why We Use TI Speech. We introduced synthesized speech to amateur repeaters with our RC-850 and RC-85 controllers. We carefully evaluated all the synthesizers, and selected Texas Instrument's top-of-the-line chip set. It remains by far the best quality speech synthesizer available.

Other repeater controllers which have come and gone since we introduced our controllers have used National Digitalker synthesized speech. This is primarily because the Digitalker chips are easy to design with, and the parts are available from hobby type surplus electronics suppliers. But their speech quality is vastly inferior to TI. (Since they're easy to find and hook up, we support Digitalker chips only with our ITC-32 Touch-Tone control board.) If you've heard Digitalker on the air, you know it doesn't compare to TI speech. In addition, National Semiconductor exited the speech business about a year ago.

Texas Instruments remains committed to the speech business, and continues to offer the best quality speech synthesis chips available. That's why we use TI speech, rather than Digitalker or any of the other synthesizers, in our repeater controllers.

Talking Clock For Your RC-85 Controller.

Some time ago, we published information on adding a "talking clock" to your RC-85 controller. The addition makes time available on command as a bulletin board message, or periodically as a tail message. The writeup is reproduced in this issue. While it's based on a Radio Shack model, the principals apply to any similar unit.

Dayton Speakers. We were privileged to have three interesting speakers at our Dayton forum on Sunday at the Hamvention.

Graham Newton, VE3ME0 described how he and his partners developed the VE3TRO repeater organization in Toronto. Starting from scratch, their goal was to finance construction of a top notch, open autopatch repeater system. Graham was one of the very first RC-850 controller owners. To cover capital equipment costs, contributing memberships were offered to area hams. Each contributing member received a certificate acknowledging his participation, plus a callsign slot, an autodial slot, and most other repeater codes. Operating expenses are financed by annual subscription memberships, which entitle the amateur to an autodial slot. Graham proved that, even if existing repeaters or clubs in your area don't meet your amateur community's repeater needs, it's possible to raise the funds to build a repeater from scratch - without scrimping.

Jack Burton, WB2CJS described and demonstrated "Identiguard", a new digital sub-audible tone system developed by Eastern Microwave. Encoders can be put in base station, mobile and handheld radios, and the decoder unit at the repeater site identifies which user is transmitting. Identiguard protects against jammers, and allows the use of short, easy command codes on your repeater, even on 2 meters in New York! (PL no longer offers security, now that programmable PL encoders are built into new radios.) The Identiguard system can be programmed to allow privileges for specific users, and can handle up to 256 different users. For more information, contact Eastern Microwave, 180 Bedell Ave., Hempstead, NY 11550. (516) 292-9554.

Dave Schultheis, WB6KHP spoke on day-to-day emergency communications: calling your local police, sheriff, fire department, or ambulance through your autopatch. He stressed that transmissions should be short, without "commericals" for amateur radio. Autopatch users should state the nature of the call briefly and concisely at the beginning: "reporting an injury accident", "reporting a stalled car blocking traffic", etc. If not sure what information to give, let the emergency dispatcher ask the questions. If you can't answer a question, just say "I don't know" - don't guess. Tell what it "looks like". If it looks serious, say so. If it looks minor, say so.

Many thanks to this year's forum speakers.

Lightning Season. It's once again the time of year for the Lightning Demons to come down from the sky. Our controllers include transient protection, but no electronic equipment is a match for a serious hit. We recommend protection on your ac power line, telephone line, and coax to protect against large transients which can damage your repeater. Design a good ground system, separate the protector from the protected, and insure your repeater system. For bottom line protection we recommend Lightning Elimination Associates TET-200-100 device on the phone line, SE-115-10-BF on the ac power line, and a PolyPhaser coaxial impulse suppressor on the coax. Amateur equipment insurance is available to members from the ARRL at a cost of just about \$50 per year for a typical repeater (see "Equipment Insurance" elsewhere in this issue).

For a copy of our four page application note, "Lightning Protection For Your Repeater System", send us a self addressed envelope.

Lightning Elimination Associates, 12516 Lakeland Road, Santa Fe Springs, CA 90670

PolyPhaser Corporation, 1420 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410

American Radio Relay League, 225 Main St. Newington, CT 06111

Monitor Your Site - Carefully. Last time, we described how to use the Spare Audio input to your RC-850 or RC-85 controller to listen and converse with people at your site. John Holmes, W5ALG, indicates that it's important to be sure anyone at the site knows they're being listened to and consents. He indicates that "interception of communications" is a federal felony with a five year sentence, and is also a state crime in most areas.

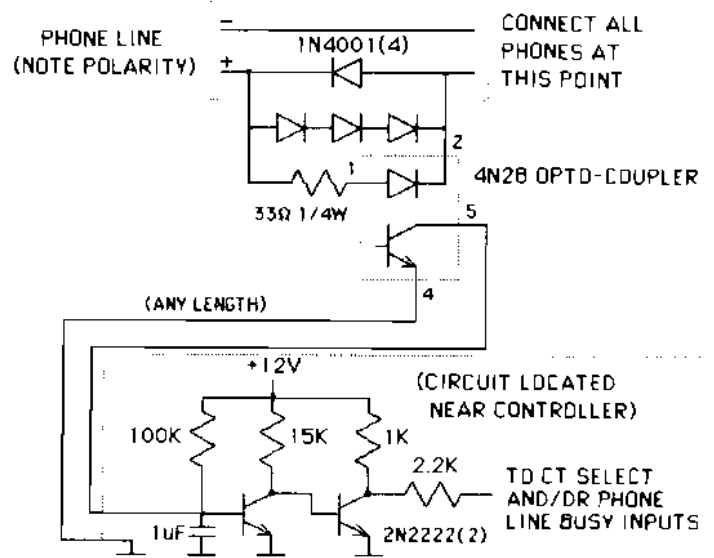
John should know - he's the District Attorney of Houston, Texas. Thanks, Mr. D.A., for keeping us all out of the slammer.

Back Up Your DVR. The Digital Voice Recorder stores audio in its dynamic RAM. If you lose power at your site, the audio is erased. It's easy to prevent that from happening, by connecting a gel cell to the battery input at the DVR's power connector. Dick Smith Electronics (800-332-5373) offers 12 volt gel cells, 3AH at \$13.95, and 1.2 AH at \$7.95. The big one should last about three hours, and the smaller one about one hour, which is enough to protect against brief outages (the batteries are rechargeable).

If you're fortunate enough to have celebrities record announcements for your repeater, store them on audio tape so that you can "upload" them to your DVR in case you lose power.

Shortening the Delay. The RC-850 controller includes an audio delay line which delays repeater receiver audio by 75 ms. The delay allows the controller to mute squelch tails, and fully mute Touch-Tone. In some applications, such as full duplex operation, a shorter delay may be desirable. It's easy to shorten the delay to 37 ms. If the delay line in your controller is an SAD4096 chip, simply move the jumper wire next to U11 to the other position. If you have a delay line subassembly at U35, remove one of the R5108 chips, and short pin 4 to pin 6.

Phone Line Busy Circuit. Monte Smith, WDØDIR sends us this circuit which he is using with his RC-85 controller. The '85 and '850 support shared phone line usage, providing hardware handshaking and a "Busy" indication to the user attempting to initiate a patch when the phone line is already in use. If you're sharing the line with other than an '85 or '850, Monte's circuit will provide the logic signal to your controller. Monte uses the signal to change the courtesy tone so users will automatically know when the line is already in use. The controller will then block the repeater use of the line if the user ignores the modified courtesy tone, and respond by saying "Busy" instead of initiating the patch. Thanks, Monte.



Least Cost Routing Through Your

PBX. Chris Boon, WB5ITT, points out a nice feature of Version 3 with your RC-850 controller if you're connected to a PBX. Certain calls can be automatically routed to different tie lines, using the multiple "logical phone lines" of the controller, and its telephone exchange tables to make the routing decision.

Set up the controller's primary phone line as the local line, with a "dial 9" prefix to get local outside lines. Using the exchange tables, identify those area codes and exchanges outside the local calling area as "long distance". Disable long distance on the primary patch, and enable it on the secondary patch, with an "access tie line" prefix for the secondary patch (perhaps "7", or "79" access a tie line). Both the primary and secondary autopatch command prefixes should be the same. When making a call, the controller tries first to place the call through the primary patch (local PBX line), or if it can't because the number is "long distance", then it uses the secondary patch (the PBX's tie line).

Least cost routing wasn't intentionally built into the '850 controller, but under some conditions, it's really there!

Musical Tone Frequencies.

Designing your own courtesy tones with the RC-850 controller is fun, but you may be more successful if you know the actual frequency of various musical notes. Below is a table of frequencies of one octave of the tempered scale. Double each frequency for each octave higher; halve them for each octave lower.

Freq (Hz)	Note
440	A (above middle C)
466	A [#] , B ^b
494	B
523	C (high C)
554	C [#] , D ^b
587	D
622	D [#] , E ^b
659	E
698	F
740	F [#] , G ^b
784	G
831	G [#] , A ^b
880	A (above high C)

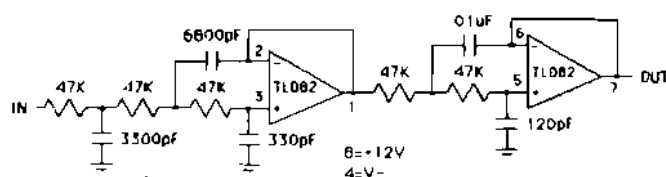
Speech Splatter. Operating repeaters on inverted 15 kHz splits (on two meters) is perfectly feasible, but can require additional attention to detail. Electronic speech synthesizers contain significant high frequency components - more than in human voice. These components are largely filtered out in our controllers, with the transmitter's low pass filter following its clipper providing additional attenuation.

Scott Seidel, WA2WUX, experienced a situation where his repeater's synthesized speech messages would sometimes bring up an adjacent 15 kHz repeater input. Scott placed the filter circuit shown below, designed by Al Helfrick, K2BLA between the controller and the transmitter, to further attenuate high frequency synthesized speech components which create energy outside the 15 kHz channel.

If you have a similar problem, first be absolutely sure that the speech synthesizer is not overdeviating, that it is not hitting the clipper too hard (independent of deviation), and that the synthesized speech pitch sounds normal (too high a pitch increases high frequency components). Also, make sure that your transmitter is on-frequency, and the adjacent channel repeater's receiver isn't excessively wide or off-frequency.

If your repeater splatters over to adjacent channels on user's audio, not just synthesized speech, check your transmitter and their receiver, not your controller. The RC-850 and RC-85 controllers don't introduce distortion or frequency shaping when adjusted properly - what comes in is what goes out.

Thanks, Scott and Al, for the information.



Adding A Talking Clock To Your RC-85 Repeater Controller

A talking electronic clock may be added to your RC-85 controller to make time of day announcements available to users.

The RC-85 controller supports an external tape playback unit. The talking clock may be substituted for the tape unit. The clock can then be referenced from any of the programmable messages. The practical applications include time as a tail message, a bulletin board announcement, and phone hangup message. (When a programmable message is defined as an external device, the message must be entirely contained in the external device, so the time cannot be joined with other words to construct an ID.)

We'll use as an example the Micronta Vox Clock 3 from Radio Shack (Cat. No. 63-906, \$49.95). Other talking clocks are available from Radio Shack and elsewhere, and the principles discussed here may be applied with other units.

Addressing the Clock From the Message Editor

A programmable message is specified as the external talking clock by unlocking the controller, selecting the message with *13mm, and loading the speech letter "X". See the hint near the top of page 7-8 in the manual.

For example, to access the clock from Tail Message #2, unlock the controller, select TM2 (*1308), enter speech "X" (92), write the message (*0), and you're done. The clock can be accessed from Bulletin Board #2 (*1324) or the Phone Hangup message (*1321) as additional examples.

Hardware Interface

When the external talking clock is addressed, a one second low true pulse is generated by the controller at Control Output 2 in the non-expanded mode, or at UF2 in the expanded mode. If using the expanded mode, such as with the FC-1 frequency control board or home-brew shift register circuitry, the glitch-free mode must be used (SW4/5/6 all ON), and the Serial Transfer signal must drive the transfer pins of the 4094 shift/store registers. 4094 shift/store registers must be used rather than 74C164 shift registers.

After the controller supplies the pulse to start the external device, it looks for a high true busy signal at the External Device Busy logic input. When the busy signal returns low, the controller assumes that the message is over, and generates the courtesy tone or allows the carrier to drop.

Audio may be supplied from the talking clock to the audio connector pin 2 - direct transmitter mixer audio input. This input to the controller is fixed level so that the level must be adjusted externally. The Vox Clock 3 includes a volume control which serves the purpose.

- Interface Circuitry

The controller could interface directly to the Vox Clock, since the one second pulse is adequate for starting the time announcement. However, the Vox Clock scans its

keyboard, so a simple contact closure to ground isn't sufficient. We need an actual electrical connection between the "row" and "column" scanning pins of the clock's key matrix. The simplest way to accomplish this is with a small relay.

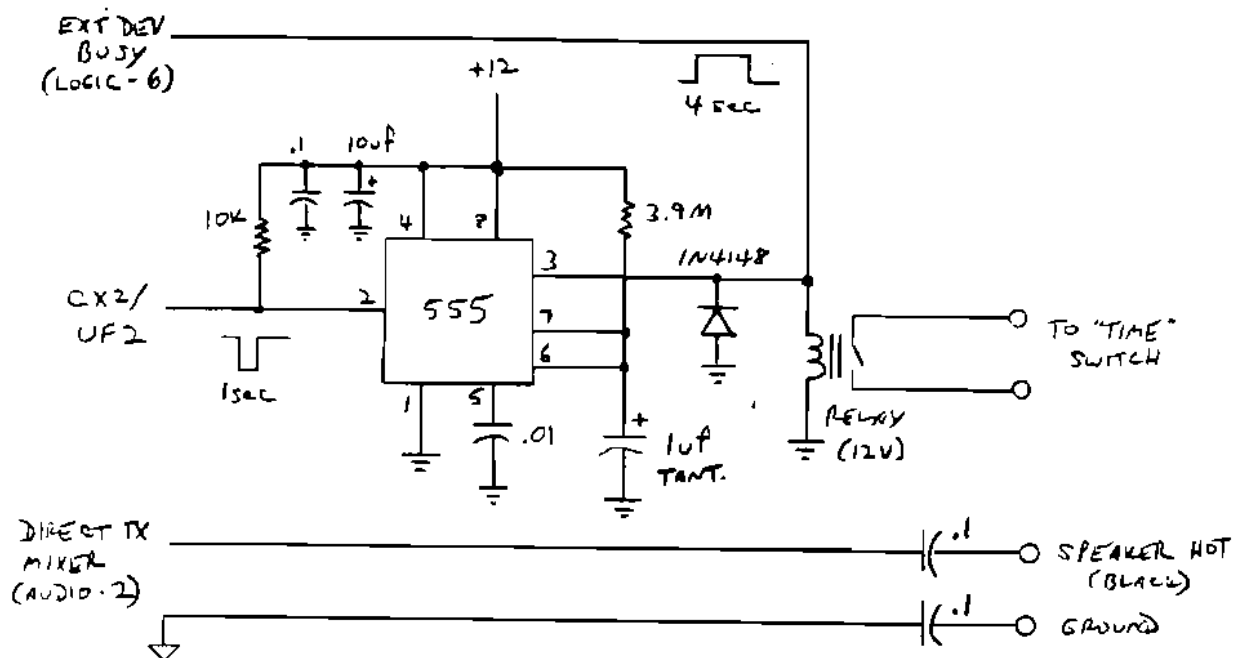
We also need to supply a busy signal to the controller for the duration of the voice announcement. This is easily done with a 555 timer and a few components. We can set its period to about four seconds, which covers the duration of the announcement.

The complete interface circuit is shown below. The CX2/UF2 signal from the controller drives the 555 timer, which both drives the relay starting the time announcement, and supplies a busy signal back to the controller.

Chime

The Vox Clock can generate a Westminster chime every quarter hour, every half hour, or on the hour only (or it can be turned off). We'd suggest that you leave it off, since it could be considered music, which would violate §97.115.

Note: If using the FC-1 Frequency Control Board and the expanded UF mode, firmware version 2.05 or later should be used, which allows the proper transfer signal logic sense for the glitch-free mode.



Novice Enhancement. The FCC has acted in proposing enhanced privileges for amateur novice operators. You've probably already read about it, so we'll limit our comments to thoughts we haven't read elsewhere. Needless to say, as we've written before, we strongly support it, and think that you should too, in the best interest of the amateur service.

The proposed allocation of 220 MHz to novices is tentative at best, since the future of the 220 MHz band is being handled by another bureau of the FCC. At least three petitions seeking reallocation of 220 must be "resolved" before expanding the band to novice use, and this could be years.

That makes even more important the selection of the portion of the 1200 MHz band available to novices. One of the intents of the proposal is to allow novices VHF/UHF phone privileges. 1246-1260 MHz proposed by the League would seem a poor choice, since no commercial equipment is available below 1260, and repeaters operate above 1270 MHz. We believe that novices should have VHF or UHF phone privileges, and that any allocation at 1200 should include the FM/repeater portion, since early availability of 220 is unlikely.

Novice Enhancement is a positive proposal which we think all amateurs should support. But we think that it helps point out the real problem in attracting newcomers to amateur radio.

With today's "multiple choice" written tests, where all the actual questions have been published and the test consists of a portion of them, the written test would seem to be no real barrier to the technician class license. The new novice exam will actually be made slightly longer, to cover information relating to the new privileges. The real difference in difficulty between the novice and technician exams would seem no barrier to a technically minded, or even non-technically minded but motivated person. And by earning the technician license, the amateur gains access to the choice 2 meter and 440 MHz bands, used for most voice and packet operations.

So the question is, will adding some privileges to the novice license really make a difference, when the tech license isn't much harder to earn?

It should be obvious that the real barrier to entry is the Morse code. Morse code is a fundamental part of the rich history of amateur radio. But as an entry requirement to the service, it's an unnecessary barrier. It makes no sense to have archaic operating skills as an entry requirement for prospective amateurs. To do so only guarantees that amateur radio will eventually follow Morse code into oblivion.

Repeater Docket. The FCC also acted on a proposed set of added rules to aid in resolving repeater interference disputes. By simply stating that repeater stations involved in an interference dispute are responsible for solving their problem, the FCC hopes to be able to keep out most of the time.

Stations would be equally responsible for solving the problem, unless one is coordinated and the other is not, in which case the uncoordinated station has the primary responsibility for solving the problem. The FCC also lifted repeater power and height above average terrain restrictions.

In late 1984, coincidentally with the FCC's initial work on formulating these proposals, a petition was filed by Peter O'Dell, formerly of the League. In his petition, Pete proposed that a national "supercoordinator" be set up to handle coordination of amateur repeaters, and that a special license be obtained prior to putting a repeater on the air. The FCC instead decided to add a minimum of new and restrictive regulations, hoping that this simple action will solve the problem of increasing repeater interference complaints brought to them.

A new repeater doesn't have to be coordinated before going on the air. But if there's a possibility of causing interference to other operations, it better be. In any case, get your repeater coordinated as soon as possible after, if not before, putting it on the air.

Even in interference disputes between a coordinated and uncoordinated repeater, both share some responsibility to solve the problem. I suspect we'll see some heavy handed action from some frequency coordinators. Already, repeater owners in one area have mutinied because of unilateral action by a coordinator. Coordinators that act irresponsibly will destroy their credibility.

Remember that every time an amateur or coordinator brings a repeater complaint to the FCC, a harsher set of formal rules are brought a little closer. If that happens, no one will win.

Aux Operation. The FCC dismissed its proposal to expand the frequencies available for auxiliary operation. Currently, aux operation is permitted only above 220.5 MHz. Westlink Radio reported the action with the headline, "Well, you won't be able to control your two meter repeater from 20 meter cw". A more relevant statement might have been "Well, the growing nationwide two meter packet digipeater linking networks and gateways (which are examples of aux operation on two meters) will remain illegal".

There is a great deal of misunderstanding in the amateur community, and the League, about the range of activities which come under the classification of aux operation, and the benefits they offer.

Very few amateurs who would benefit from an expansion of frequencies available for auxiliary operation filed comments. The League's specious opposing arguments were rebutted only by the QCWA, the Texas VHF FM society, and us. If you're interested in the issue for the future, we have an information package available on request.

Equipment Insurance. The ARRL offers an outstanding "All-Risk" Ham Radio Equipment Insurance program, which provides replacement cost coverage for your amateur equipment, including your repeater system. At a cost of only \$1 per \$100 of coverage, the program covers theft, accident, fire, and lightning damage. You need to be a League member - their insurance program is a great reason to join if you're not already a member.

ARRL, 225 Main Street, Newington, CT 06111

Kenwood TS-440/TS-940: ShackMaster Compatible. Yes! ShackMaster supports the new Kenwood radios, giving you full frequency, mode, and memory recall capability from your handheld. All with a connection of a couple of wires between ShackMaster and the rig (plus PTT and audio). It's as if the new rigs were made for ShackMaster. Hats off to Kenwood for the design of an outstanding pair of radios with provisions for external control.



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**Archive of K6COP
WR6COP Repeater**