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Welcome, Newcomers!

**REPEATERS**

Do you recall the Radio Shack walkie-talkies with which you could talk to someone up to a quarter of a mile away? Maybe this thrill led some of you to become involved in CB, where it was possible to talk with someone from your car reliably at a much greater distance—even 15–20 miles! It never fails to intrigue a non-ham friend of mine, however, when, using a hand-held radio no larger than one of the walkie talkies mentioned above, and putting out as little power, I communicate with someone halfway across New England—and with superb signal quality. And it's all due to an invention that moved onto the ham scene twenty or so years ago—the repeater.

A repeater's basic function is to receive a signal and rebroadcast it simultaneously. It is most useful for line-of-sight signals—those that travel in a straight line. These signals are usually FM for repeater use. The range of direct communications using line-of-sight signals, however, is limited due to the Earth's curvature and large obstructions, such as mountains. A repeater, especially when placed in an area that gives it a great range, such as on top of a mountain, can increase a line-of-sight signal's range by two or three times.

Imagine now linking two or more repeaters together. The range is then limited only by the number of repeater linkages. I often use a network of 14 repeaters located throughout New England, the 220 MHz repeater network, that allows repeater users to talk with hams from New York City to Montreal—over 400 miles apart! Networks like these are sprouting up all over the US, and gaining popularity in many other parts of the world.

Repeaters are quickly showing that the sky's the limit now with line-of-sight FM communications!

---

**GLOSSARY**

**Autopatch** - A device that beds a repeater system to the telephone system. This allows ham communications at the repeater to enter the telephone system.

**Breaker** - A ham who interrupts a conversation on the repeater, often to ask the current user's permission to make a brief call.

**Channel Pair** - The input and output frequency pair of a given repeater.

**Closed Repeater** - A repeater not open to general access.

**Control Operator** - The ham designated to police the repeater. He or she can activate or deactivate any of the functions, and even shut down the repeater. They control it either locally, or more commonly, remotely.

**Courtesy Tone** - That tone that sounds after a user ends a transmission and releases the Push-To-Talk button. This helps other users know when a user has finished transmitting.

**Crossband** - Communications on another amateur band though a link interfaced with the repeater.

**Desense** - Corruption of receiver sensitivity due to swamping the repeater receiver with overly strong signals.

**Duplexer** - A device usually made up of one or more pairs of large metal resonant cavities. It is feed with three transmission lines: one each from the receiver and transmitter, and one from the antenna. It serves to separate the incoming and outgoing signals that flow simultaneously through the antenna system, preventing receiver desense.

**Full Quieting** - A received signal that is so strong that it entirely masks the ambient noise on its frequency.

**Half-Duplex** - This describes communication that takes place on two frequencies, with one as only the receive state, and the other as only the transmit state, at alternate times. Repeater operations are half-duplex; Telephone communications are full-duplex; they allow simultaneous transmit (talk) and receive (listen) states.

**Handheld** - Also known as handy-talkie, or HT. A transceiver small enough to be held in, and operated with, one hand.

**Input** - The repeater receiver frequency. This is the frequency a repeater user transmits on.

**Intermod (IMD)** - The result of the mixing of one or more undesired signals with a desired signal in the first RF amplification stages (front end) of a receiver.

**Key-up** - Causing a repeater to transmit by transmitting on its input (receive) frequency.

**Kerchunk** - To key up a repeater without modulating the input signal (such as by speaking into the rig). "Kerchunkers" are those who, usually unnecessarily, key up a repeater many times.

**Offset** - There are two common meanings for this word here. The first refers to the spacing between the input and output frequencies on a repeater or other transceiver. The spacing and the offset is standardized for most bands.

The second refers to the control on a rig that sets the input and/or output frequency to a point between the standard frequency steps of that band. For example, 2 meter synthesized FM rigs step through frequencies in 10 kHz steps, and most repeater channel pairs are located on these increments. Five kHz is a common offset adjustment on these rigs.

**Output** - The frequency on which the repeater transmits. This is the receive frequency for a transceiver of a person using the repeater.

**Picket-fencing** - Rapid flutter on a mobile signal resulting from multipath fading. This often occurs in urban areas where signals collide off buildings.

**Polarization** - An electromagnetic wave has two planes of energy—the electric field plane (E-plane) and the magnetic field plane (H-plane). These planes are perpendicular to each other. Polarization refers to the orientation of the E-field; either parallel to the Earth's surface (horizontally polarized) or perpendicular to the Earth's surface (vertically polarized).

**Repeater antennas are usually vertically polarized, because the antenna systems of most transceivers that use repeaters—such as whips mounted on car roofs or hand-held radio antennas—have the same polarization.**

**Reverse Autopatch** - This is a device that, like an autopatch, beds a repeater system to a telephone system. This allows a telephone user to initiate radio communications through the repeater.

**Simpless** - Communications via only one frequency.

**Split Sites** - Refers to a repeater system that has separate transmitter and receiver sites, and are connected either by radio or by telephone lines. These systems don't require a duplexer since the transmit and receiver posts use different antenna systems, and are sufficiently far apart to prevent repeater receiver desense.

**Squelch Tail** - The noise burst that follows the short unmodulated carrier following each repeater transmission.

**Timer** - A control in the repeater that shuts down its transmitter after a continuous input exceeds a preset time limit. This keeps long-winded users from tying up the machine. The time limit is usually set at 1½–3 minutes.

**Tone Pad** - Also known as Dual-Tone Multiple-Frequency (DTMF) pad. It generates the standard telephone system tones that control various repeater functions.
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Cover photo by Tom Curlee
Life After Death

It’s only by accepting the FCC figures on ham licenses at face value that we have the appearance that amateur radio is growing at about 1.5% per year. But just how accurate are those figures? Alas, the answer is: not very.

I’ll accept that the FCC’s computer is able to keep pretty good track of the new licensees and upgrades. I’ve no complaints there. But it’s only by trying to maintain the fiction that hams, unlike other people, do not die, that the FCC is able to make it look as if our numbers have been significantly growing.

The hole in the FCC fabric is a big and obvious one. They have no mechanism for finding out when our smoking, drinking, overeating, and lack of exercise of anything but our jaw, volunteers us for that last glorious mention in QST: Silent Keys. The result is that, like Chicago voting lists, deceased hams are carried on the FCC’s books for up to ten years, making the numbers look substantially better than they are.

How much? Well, we can’t tell exactly, but even if we only go by the full page Silent Key lists in QST, we know there’s a bunch. One way to get a handle on the FCC’s ghostly inflated figures is to check with insurance company actuarial tables and see about how many hams are, on the average, dying every year.

Some estimates of the average ham age are as high as 59 (that I believe), and some are as low as 50 (that is much more difficult to believe). Anyway, let’s look at the actuarials for 53 and see what that does to the FCC figures. At 53 we can expect 10.1 deaths per thousand. The FCC says we have 435,000 licensees, which would lead us to expect 4400 ham gear sales by ham widows per year. Since the FCC takes ten years to discover that a ham is either operating on a completely new wavelength or has lost interest in the hobby, we could have as many as 44,000 phantom hams. And that doesn’t count those semi-live hams who have lost interest in the hobby and have no intention of becoming active or even renewing their ticket. I constantly run into ex-hams at electronic shows, so I know there are a lot of them.

We know that less than half of the licensed hams are active, so if half of the remainder drop out when renewal time comes along, we could be losing several thousand more a year.

Anyway, the bottom line is to take those rosy figures showing ham growth with a big dose of salts. Hello QST, are you reading this?

So, okay, the 54% drop in new licensees in the last four years has been made to look like less of a disaster by a bit of fiction. So what’s the harm? Well, one harm is that a depressing number of old hams believe the fiction and believe the pollyanna QST reports of all being well. If things are going well, let’s ignore doom and gloomer Wayne—boo on Wayne and his anti-code belonie. He’s just hot air—trying to sell more subscriptions to his lousy rag. He’s just trying to get rich off us old timers.

Get rich, eh? I’ll tell you what, if there are any wealthy hams out there who are interested in a deal, here’s one to think about. If you’ll guarantee to cover any possible 73 losses each year, I’ll guarantee you can have all the profits. Now doesn’t that sound like a great way to make a mint fast? Get down off that turnip truck and give me a call. News flash for you: there’s only one ham magazine making big profits and that’s QST—they have millions salted away for a rainy day. How hard does it have to rain for them to start actually doing something to get amateur radio growing? And I’m not putting down the ARRL, I’m putting you, the members, down for not saying word one. As long as you aren’t the least bit interested in what they do or in getting
#1 Rated HF!

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Competition class HF transceiver

TS-940S— the standard of performance by which all other transceivers are judged. Pushing the state-of-the-art in HF transceiver design and construction, no one has been able to match the TS-940S in performance, value and reliability. The product reviews glow with superlatives, and the field-proven performance shows that the TS-940S is "The Number One Rated HF Transceiver!"

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Optional accessories:
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- SP-940 external speaker with audio filtering
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- VS-1 voice synthesizer
- SO-1 temperature compensated crystal oscillator
- MC-435 UP/DOWN hand mic
- MC-60A, MC-80, MC-85 deluxe base station mics
- PC-1A phone patch
- TL-922A linear amplifier
- SM-220 station monitor
- BS-8 panel display
- SW-1000 and SW-2000 SWR and power meters
- IF-232C/IF-10B computer interface.

- Complete all band, all mode transceiver with general coverage receiver. Receiver covers 150 kHz-30 MHz. All modes built-in: AM, FM, CW, FSK, LSB, USB.
- Superb, human engineered front panel layout for the DX-minded or contesting ham. Large fluorescent tube main display with dimmer, direct keyboard input of frequency; flywheel type main tuning knob with optical encoder mechanism all combine to make the TS-940S a joy to operate.
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Affordable DX-ing!

**TS-140S**

HF transceiver with general coverage receiver.

Compact, easy-to-use, full of operating enhancements, and feature packed. These words describe the new TS-140S HF transceiver. Setting the pace once again, Kenwood introduces new innovations in the world of "look-alike" transceivers!

- Covers all HF Amateur bands with 100 W output. General coverage receiver tunes from 50 kHz to 35 MHz. (Receiver specifications guaranteed from 500 kHz to 30 MHz.) Modifiable for HF MARS operation. (Permit required.)
- All modes built-in. LSB, USB, CW, FM and AM.
- Superior receiver dynamic range

Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range.

- New Feature! Programmable band marker. Useful for staying within the limits of your ham license. For contesters, program in the suggested frequencies to prevent QRM to non-participants.
- Famous Kenwood interference reducing circuits. IF shift, dual noise blenders, RIT, RF attenuator, selectable AGC, and FM squelch.

- M. CH/VFO CH sub-dial. 10 kHz step tuning for quick QSY at VFO mode, and UP/DOWN memory channel for easy operation.
- Selectable full (QSK) or semi break-in CW.
- 31 memory channels. Store frequency, mode and CW wide/narrow selection. Split frequencies may be stored in 10 channels for repeater operation.
- RF power output control.
- AMTOR/PACKET compatible!
- Built-in VOX circuit.
- MC-43S UP/DOWN mic. included.

Optional Accessories:

- AT-130 compact antenna tuner
- AT-250 automatic antenna tuner
- HS-5/HS-7 12-headphones
- IF-232C/IF-10C computer interface
- MA-5/VP-1 HF mobile antenna (5 bands)
- MB-430 mobile bracket
- MC-43S extra UP/DOWN hand mic.
- MC-55 (8-pin) gooseneck mobile mic.
- MC-60A/MC-80/MC-85 disk mics.
- PG-25 extra DC cable
- PS-430 power supply
- SP-40/SP-SB mobile speakers
- SP-430 external speaker
- SW-100A/SW-200A/SW-2000 SWR/power meters
- TL-922A 2 kW PEP linear amplifier (not for CW QSK)
- YG-455C-1 500 Hz deluxe CW filter
- YK-455C-1 500 Hz CW filter

**TS-680S**

All-mode multi-bander

- 6m (50-54 MHz) 10 W output plus all HF Amateur bands (100 W output).
- Extended 6m receiver frequency range 45 MHz to 60 MHz. Specs guaranteed from 50 to 54 MHz.
- Same functions of the TS-140S except optional VOX (VOX-4 required for VOX operation).
- Preamplifier for 6 and 10 meter band.
Reallocation

"Amateur stations may continue to use the 220-222 MHz band until Private Land Mobile and government users are allowed access. Amateur operators are cautioned, however, to refrain from making any investment in equipment suitable for operation only in this band. Amateurs should begin an orderly transition of ongoing operations in the 220-222 MHz band to other amateur service frequency bands so that an abrupt termination of such activities will not be necessary."

That was just one of the summary conclusions from the text of the Report and Order on General Radio Docket 87-14, that, among other things, orders the transfer of 220-222 MHz over to use by land mobile interests. The 10-page document issued 6 September, closely paralleled the FCC Press Release of 4 August.

As a part of the same concluding statement, the Report and Order hinted that the FCC is aware of the hardships the reallocation will cause to current 1 ¼ meter amateur operations: "... the amateur community may wish to address any changes to the amateur rules it finds desirable in preparation of the removal of the 220-222 MHz band. For example, the lifting of the prohibition on auxiliary link operation on some of the longer wavelength bands and the placing of a prohibition on repeater operation in a portion of the 222-225 MHz band are two matters the amateur community may wish to consider and petition for amendment."

For a fuller discussion on the reallocation of 220-222 MHz, see this month's "Looking West."

Microsat

The AMSAT-NA Microsat project took a big step forward in late August when accurate models of the generic satellite passed a rigorous series of shake and vibration tests. The tests subjected the Microsat bus to vibration levels much higher than those to which AO-13 was subjected.

According to W3GEY, the prototype Microsat passed the tests with flying colors. Acceleration levels over 14 Gs in the vibration test and over 44 Gs in the shock test caused no problems for the rugged microsat bus. The tests were performed at Utah State University in Logan. For those not aware of this project, AMSAT-North America (AMSAT-NA) President Vern Rippetoria WA2LQQ announced plans on 30 July to launch four microsats from a single European Space Agency (ESA) Ariane launch vehicle. These satellites are truly small, measuring only 9" cubed and weighing only 22 lbs. Two of these microsats are planned as "Pac-Sats":—store and forward packet satellites. AMSAT-NA and AMSAT-LU (Argentina) each will operate one of the Pac-Sats. The other two birds will be special purpose amateur satellites. One is being sponsored by Brazil AMSAT (BRAMSAT), and will carry DOVE (Digital Orbiting Voice Encoder) This satellite will carry a synthesized voice transmitter. The final satellite is sponsored by the Center for Aerospace Technology (CAST) at Weber State College of Ogden Utah, and will carry a low resolution camera.

Writer's Guides

Warm up your pens, typewriters, and word processors! The new 73 Magazine Writer's Guide is ready for distribution. Along with that goes a sheet with pointers on shooting photos you would like considered for the cover of 73.

Compuserve and GENie users will be happy to know they can download the Guide to their systems. Of course, you can obtain a hardcopy of the Guide via conventional mail at the address listed at the end of this column. Send your request to the attention of Martha Gouse.

Space Hotline

A new dial-up voice space news service is on line. The Space Activities Hot Line (SPACHL) carries the very latest news on amateur radio satellite operations, related radio nets, and general world space activities.

The five-minute recorded announcement carries details of times and frequencies. It might be a good idea to record the bulletin since it flows quickly and gives many details and numbers.

An added special feature of SPACHL is the SPACHL Technical Service. OSCAR users can get free technical advice on getting their stations running and keeping them in top shape. Simply dial the SPACHL number and, at the tone, leave a short message indicating your name, callsign, telephone number, the time of day you would prefer to be called and the nature of the problem. An expert in that field will call you (collect) within a week to give free guidance on getting your OSCAR station operating or on other related problems.

This service is so far available only in the US and Canada. The number to call is (914) 986-3875. SPACHL will be available 24 hours/day. Bulletins will be updated daily. SPACHL is a private, volunteer service provided by WA2LQQ.

17 METERS

On 1 September, the FCC released PR Docket 88-467 that proposes the opening of the 17 meter band for amateurs in the United States. The rule-making procedure will lay out the band plan. The docket proposes giving amateurs access to the entire band, 18.068 to 18.168 MHz, with a 42 kHz CW/Digital emissions subband from 18.068-18.110 MHz. The balance of the band would be for phone, FAX, and television emissions of the types authorized for use below 30 MHz. According to the Commission proposal, only General class and above licensees would have access to 17 meters. Power limitations would be the same as for other high frequency amateur allocations.

The final acts of the 1979 World Administrative Radio Conference allocated 18.068 to 18.168 MHz to the amateur and amateur satellite services. Normally a two-step process follows on a domestic level after such an allocation is made internationally. The FCC took the first step by amending the domestic Table of Allocations to add 17 meters to the amateur services. The second step—the issuance of this NPRM—awaited the removal of the government-fixed services from the band. These operations must cease no later than 1 July 1989.

Ham Call Directory On Packet

This is an ideal system for packeters who don't have the Callbook. Jim Dearras WA4QNG of Richmond VA has a database of US ham addresses up to December 1987 resident on CD-ROM which he has interfaced with his PBBS. They may be addressed by a simple packet radiogram. The callinfo is from Buckmaster Publishing and is stored on CD-ROM.

There are two ways to access address information. If you're local to the BBS (145.01 MHz), simply type in "OS QTH (desired call-sign)." The address will usually appear on your home PBBS. You can ask for multiple addresses by separating callsigns with a space or comma.

Non-local users should log on to their local BBS and send "SP REQQTH @ WA4QNG." When the PBBS prompts you for the title, type in the calls of the desired addresses, again separated by spaces or commas. At the end, put an @ and then your home PBBS call to allow the WA4QNG PBBS to forward these messages.

The HF gateways for this system are WB2TAX Hampton VA, and W3IWI in Maryland, both on 20 meters. Packeteers as far away as Australia have obtained addresses through this system!

Thanks . . .

to Westlink, Gateway, Chattering Relay, The Birmingham, and WA6WZO for furnishing this month's news items. Keep your ham-related news items and photos rolling in to 73 Magazine, 70 Rte. 202 N, Peterborough, NH 03458-1194. Attn: QRX.
The Maggiore Hi Pro Basic Repeater
High quality repeater at a reasonable price.

My club, the Mt. Tom Amateur Repeater Association, made a commitment to put a 220 MHz repeater on the air. It seemed improbable, however, with only $1500 in hand to cover the costs of the repeater, duplexer, and antenna. The club was already supporting three two meter machines, and with our 220 MHz amateur allocation in jeopardy, few members were willing to risk a large personal or club investment.

Then we noticed an ad from Maggiore Electronics Laboratory (MELCO) in an issue of 73 Magazine. A phone call brought quick results. Within a few days, we received Maggiore’s latest catalog in the mail. Another phone call to Frank Maggiore was equally productive—yes, we could buy the Maggiore Hi Pro Basic repeater (their lowest-priced repeater) without the internal power supply. And yes, we could have the optional 25 watt PA and HPC201 microprocessor controller/autopatch installed.

The price seemed too good to be true. Half-heartedly, I mailed the check and rationalized to myself, “Even if it only runs a year and croaks, the club will then be in a better position to replace it with a ‘known’ brand.” That was over three years ago with faultless service.

Simple and Direct

The Hi Pro Basic isn’t much to look at. Its front panel is void of light shows, controls, or even a power switch! The Maggiore Basic repeater packs into a tiny 11-pound package. The COR1 identifier and timer board come with the Basic package, but I suggest you consider substituting them with the optional HPC201 microprocessor controller/autopatch. (See the HPC201 review in a future issue.)

The Basic repeater is normally supplied with a 15 watt transmitter. The repeaters shipped with one set of crystals, tuned and ready to run.

Transmitter Performance

Two of our two meter repeaters, a GE Master Pro and a Spectrum 77, are also using 30 watt transmitter assemblies from Maggiore. This represents several years of aggregate service on busy wide-area coverage repeaters with no transmitter failures to date. One nice thing we quickly noticed about these transmitters is their ability to make rated power output at the specified DC supply voltage.

Power sag—a common repeater woe—is the annoying tendency for power output to slowly fall off after a transmitter has been on for a while. It can be caused by inadequate heatsinking, poor design, or both. The repeaters are monitored daily with commercial service monitors and the long-term frequency stability has held within a few hundred cycles on all of the transmitters.

The 220 MHz repeater is running a Wacom WP-652 duplexer (Maggiore Electronics) and a Falcon MOSFET repeater power amplifier at 70 watts output. A Hamtronics GaAsFET preamp is also being used on the receiver. No measurable desense was found with the higher power levels.

Our three two meter repeaters now using the 30 watt Maggiore transmitters drive bipolar power amps with power outputs in excess of 100 watts. The receiver repeaters are also using preamps. As with the 220 MHz system, no problems with receiver desense was noted, thanks to the absence of transmitter noise.

None of the transmitters showed signs of instability when operating into the reactive loads which duplexers can present, or when driving external power amplifiers. Tuning is smooth, with no unusual power jumps or other anomalies. A Cushman CE-15 spectrum analyzer verified that the transmitters were clean and free of spurious output.

The EV-1 exciter is rated at 4.5 watts output continuous duty; optional power amplifiers are available from 15 to 40 watts. The power amplifier mounts in the die-cast aluminum housing with the exciter. Power output may be set via an internal drive control. The EV-1 transmitter is used in the two meter and 220 MHz repeaters.

The R4V Receiver

The Maggiore R4V VHF receiver is dual-conversion design, using 10.7 MHz and 455 kHz first and second IFs. A six-pole monolithic crystal filter follows the first mixer. A Murata E ceramic filter (5.5 kHz bandwidth) at the lower IF frequency really sharpens things up. There’s a Murata F filter with a 4.5 kHz bandwidth available for those repeaters plagued by extremely strong signals on adjacent 15 kHz channels. Another two-pole 10.7 MHz filter can be added. Both of our Basic repeaters have the six-pole filters and the 5.5 kHz Murata filters. The Maggiore receivers are FCC certified for commercial use.

Dual-gate MOSFETs are used in the RF and first mixer stages. Five top-coupled LC stages provide good RF selectivity at the operating frequency. A third-overtone crystal in a bipolar oscillator, followed by a bipolar tripler stage, generates the desired LO frequency for mixer injection. The remaining receiver circuitry uses ICs. The R4V receiver is used in the 144 MHz and 220 MHz repeaters.

R4V receivers do not have the problem of the squelch breaking in the presence of electrical noise, such as from lightning discharges or power lines. Sensitivity was best with the receiver squelch set at its threshold. Once set, the squelch is stable.

I mentioned earlier that we use Hamtronics GaAsFET preamps on our receivers. The R4V receiver has a hot front end, and unless the repeater is located in an extremely quiet RF environment, I doubt you will note the difference. If you must use a preamp, the Hamtronics repeater preamp is your best bet for several reasons: they have fairly low gain (about 10 dB) and use sharp helical resonators. You might be surprised by how many repeater receiver problems can be caused by preamps!

The documentation for the Maggiore Hi Pro Basic repeater is adequate. Separate booklets cover each repeater component. Parts lists, schematics, alignment, and general technical information are provided. The repeaters are well made, the PC boards are mil-spec G-10 glass-epoxy, and the board lay-outs are clean and uncluttered. The receiver and transmitter are housed in rugged die-cast aluminum enclosures, and all signal and power feeds are via feedthrough capacitors.

The parts are generic and most are readily available. And, last but not least the customer support is excellent! The Hi-Pro is a fine bargain.
Raise the Hazer!

No longer go out on a limb to work on your beam.

What's the big deal about this odd triangle-shaped frame? Well, the Hazer can lower your antenna farm for ground work, which is enormously convenient and a great relief to a cowardly tower climber like myself! What follows is a review of a model of this intriguing piece of equipment, the Hazer Model H4HG.

The Arrival

The UPS man delivered a couple of boxes from Glen Martin Engineering, both packed in conventional heavy duty cardboard. The smaller one measured 15" x 16" x 10" and the other was a 6" sided triangle shaped box 46" long. Inside the small box was assorted hardware, a smaller box, and a single sheet of instructions.

The Instructions

The front page outlines the three assembly steps: the construction of the Hazer around the tower, the fastening of the winch on the tower at an appropriate level, and the installation of a wire rope pulley. Eight notes followed the steps offering some obvious, and a few not-so-obvious, precautions. The next paragraph described assembly and testing instructions.

The back page has a detailed home-brew drawing of an assembled Hazer complete with item numbers matching a nearby part list, and several detailed sketches of various assembly procedures. The assembly team—Jim Blankenship N5KYO, Stew Wells K5PWD, Glen "Blackie" Blankenship KD5LM, and myself—found these instructions to be quite adequate.

Assembly

We assembled the three Hazer side parts separately. Two side parts were connected with #2 lugs. The rotor and thrust bearing plates were loosely attached to one of the side parts—bolts were installed with their threaded end facing downward. The two-part assembly was placed around the tower, just above the house bracket, with the rotor and thrust bearing plates on the side opposite the house. The third side part easily fit the two-part assembly and was fastened with #2 lugs. We periodically checked clearance and alignment while tightening all bolted joints.

Pulley bracket assembly was first thing we installed on the Hazer side, near the tower section tube skirt. This location caused the wire rope to rub on the top (horizontal) Z-brace, a less than desirable condition. Installing the pulley bracket on the Z-brace eliminates rope/tower friction and prevents binding caused by top Z-brace interference when raising Hazer to its maximum height.

Winch installation presented only one minor problem—because of double thick construction across one pair of its mounting holes, the U-bolts provided were about ¼" short of filling the nut threads. A right angle grinder, with metal cutting disk, reworked the tower leg saddle clamp to provide an additional ¼" of thread exposure. Otherwise, winch mounting went smoothly. The stiff 3/16" wire rope presented a problem. Wrap the cut end with plastic tape, and form a kink near the end. This prevents fraying and makes installation of its hold-down clamp easier. Do not attempt to cut the wire rope with ordinary diagonal pliers—use a bolt cutter or other similar tool.

Operation

Using the Hazer is a piece of cake. A spring loaded safety latch engages each Z-brace (horizontal portion), when raising the assembly. Loosening the winch slightly, after the latch engages the last Z-brace, transfers the entire Hazer/Antenna assembly load to the Z-brace. Since the mast center line is only 3-½ inches from the tower face, side loading is much less than one "skinny" tower climber! When lowering Hazer and the antenna assembly, a nylon pull cable releases the latch, one Z-brace at a time. The assembly, accidentally dropped, falls less than one foot!
RC-10 Remote Controller

For TM-221A/321A/421A/521A.

Optional telephone-style handset/remote controller RC-10 is specifically designed for mobile convenience and safety. All front panel controls (except DC power and RF output selection) are controllable from the RC-10. One RC-10 can be attached to a combination of two transceivers with the optional PG-4G cable. When two transceivers are connected to the RC-10, cross band, full duplex repeater operation is possible. (A control operator is needed for repeater operation.)
Kenwood TM-221A
2 Meter FM Transceiver
As user-friendly as the TR-7400A—
with more power out in a smaller box!

I had so much fun using the TM-221A in the car that it was hard to take time to write it up! This is one of the more user-friendly two meter transceivers on the market today—the beauty of its design is the overall simplicity. This is very welcome in this day of bells, whistles, foghorns, CRTs, readouts and 5,000 plus knobs and whatever else one finds on "full-featured" rigs.

Worthy Replacement

For many years, my tried and tested two meter radio was also a Kenwood of 1978 vintage. Many readers will recall the legendary TR-7400A that set the two meter crowd abuzz with full 800 channel synthesis, a super-selective receiver, and more than 25 watts output. In that time of rock-bound rigs, the design was truly state-of-the-art and user-friendly—controls were kept to a minimum, reflecting the demands of mobile operation. Since then, numerous two meter mobile transceivers appeared on the market, flourished briefly, and disappeared. All sorts of crazy options such as remote control heads, continuously adjustable output power and unpoint-million scanning speeds had their day. Meanwhile, the 7400A performed yeoman service in four different cars without one day of downtime.

And yet... I found myself thinking how nice it would be to have something smaller under the dash that didn't use power-hungry TTL technology... that didn't have its display wash out in bright sunlight... and that would allow storage of a few memories, say just 10. About that time, the ads for the TM-221 caught my eye. Ten years to the month that I bought my 7400A, I departed a hamfest with a brand new TM-221 under my arm.

The photo of the TM-221A shows the simple control layout. Here is a package installable virtually anywhere in your car or shack! It measures 5½" x 1½" x 7½", and weighs a mere 2.6 pounds. But, at over 40 watts, there's plenty of punch in that box... more than enough for 90% of all mobile FM needs.

Front panel switches and knobs adjust volume, squelch, power on, HI/LO power, and dial tuning. Additional pushbuttons select either memories or the VFO, input memory data, and allow high-speed tuning with the main knob in MHz steps.

Five more pushbuttons are located under the frequency display, tucked out of the way until needed. They are (in order): SHIFT (for repeater offsets), REV (to listen on repeater inputs), SCAN, CTcss (selects receiver subtone frequency), and TONE (selects transmitted subtone frequency). That's it! No other buttons to push, dials to turn, switches to set... a piece of cake.

One handy feature of the TM-221A is automatic repeater offset selection, based on the current ARRL two meter band plan. As you tune up from 144 MHz, the "correct" repeater offset automatically kicks in, depending on your position in the band. For example, simplex operation is selected from 144 to 145.10 MHz. From 145.10 to 145.5, the transmitted signal will offset —600 kHz from the receiver frequency. Above 145.50, simplex operation is again selected to 146.00, where an offset of +600 kHz kicks in. The procedure is repeated for all segments through 147.99 MHz.

In everyday use, you'll probably select favorite repeater or simplex frequencies that are stored in memory positions 0-9. Additional memories or the VFO, input memory data, and allow high-speed tuning with the main knob in MHz steps.

Kenwood kept the scanning functions simple as well. There are only two modes, (all that are usually necessary): Programmable Band Scan, where the upper and lower limits of the scan are entered into memories A and B, and Memory Channel Scan. One scan feature gaining popularity is channel lock out in a memory channel scan. Kenwood includes it here.

The supplied microphone is the MC-48 TouchTone microphone, that looks like a black version of the MC-46. One nice variation from the older MC-46 is that the PTT line must be keyed in order to transmit tones. On older microphones, the keypad was always active, and merely squeezing the microphone tightly often resulted in very interesting transmissions.

Performance

I spent almost three hours installing the radio in a 1987 Toyota Corolla LE in an attempt to create a low-profile and safe installation. The final resting place is inside a continued on p. 20

Kenwood USA Corp.
PO Box 22745
Long Beach, CA 90801-5745
(213) 639-4200
Price: $440

Kenwood TM-221A Manufacturer's Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Manufacturer's Claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>(Transmit) 144.000-148.000 MHz</td>
</tr>
<tr>
<td></td>
<td>(Receive) 138.000-173.995 MHz</td>
</tr>
<tr>
<td>Power Output</td>
<td>High 45 Watts</td>
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<tr>
<td></td>
<td>Low 5-30 W adj.</td>
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<tr>
<td>Current Drain</td>
<td>TX High 9.5 A</td>
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<tr>
<td></td>
<td>RX Squelched 0.4 A</td>
</tr>
<tr>
<td>Receiver Sensitivity</td>
<td>(0.16 μV for 12 dB SINAD)</td>
</tr>
<tr>
<td>Receiver Selectivity</td>
<td>-6 dB/12 kHz</td>
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<tr>
<td></td>
<td>-80 dB/26 kHz</td>
</tr>
<tr>
<td>Audio Output</td>
<td>5% distortion</td>
</tr>
<tr>
<td></td>
<td>&gt; 2 watts @ 8Ω</td>
</tr>
<tr>
<td>Weight</td>
<td>1.2 kg (2.6 lb)</td>
</tr>
</tbody>
</table>
The CES 510SA-II Enhanced Telephone Interconnect

A solid 4-in-1 controller.

The CES 510SA-II is an automatic microprocessor-controlled telephone interconnect (autopatch) that provides telephone access to mobile and portable radios operating in simplex, half-duplex, and full-duplex modes (see sidebar for explanations of these modes). But it’s more than an autopatch. With built-in ID capability, it can operate as a repeater controller, and has provisions for limited remote control of external devices as well.

Out Of The Box

The first thing I learned about the Smartpatch II was that you have to be careful not to drop it when you open the shipping box, or you could be limping around for a while. It’s enclosed in an expensive looking 16 gauge steel cabinet that weighs almost four pounds!

Also packed with the interconnect, I found a DTMF (Touchtone) encoder for programming the unit, three cables, and a 27-page manual marked “Preliminary” that had a picture of an earlier version patch on the front cover.

After unpacking, I immediately grabbed a screwdriver and took the cover off the patch. You need to do this to make the connections since there are no rear panel connectors. You have to run the connecting cables through a cutout in the rear panel to a screw terminal block inside the unit.

Inside is a well laid out, double-sided circuit board with a lot of trimmer potentiometers and jumpers. More about those later. There was no silk screen on the board, but various components were identified by lettering etched in the copper itself. I found it interesting that none of the ICs were labeled. (U1, U2, etc.) The manual, however, has a parts layout diagram that serves this purpose.

I always like to look at the bottom of boards for “OPS” components and jumpers. These usually are extra parts added to correct problems found after the PC board has been made. There was one jumper and seven components on the bottom of this board.

The front panel of the interconnect sports four indicator LEDs—POWER, NOISE, PTT, and CONNECT—and two push button switches, POWER and CONNECT. The PROGRAM jack in the center of the front panel accepts a DTMF programming pad connection. See Photo A.

The Circuit

The brain of the CES 510SA-II is a MOSTEK 38P70 microprocessor. This is a piggyback type of micro in which the program ROM plugs directly onto the top of the microprocessor itself. It’s an expensive way to go. This minimizes board space and complexity, however, and eliminates several memory interface components. Also, it makes it easy to upgrade software later. A watchdog timer automatically resets the processor should some type of glitch send the processor wandering off into never-never land. There is also a Power-On Reset (POR) circuit to get the micro started properly when power is applied.

Customer programmed parameters are stored in an 8 pin, XICOR 2404-type 512 byte EEPROM. This EEPROM can hold data even with power removed, and can be easily erased and reprogrammed electrically without using ultraviolet erasers and expensive EEPROM programmers.

The Smartpatch II uses the powerful CMOS chip, the MITEL MT8880 DTMF transceiver, for decoding and generating touchtones (DTMF). It has an onboard call progress tone filter which detects various phone line signals, such as dial tone, busy signals, etc. It also has a microprocessor bus interface.

Quite impressive for a 20 pin chip! The 510SA-II uses all of these features.

The phone line interface consists of a hybrid transformer coupler circuit for full duplex operation. The traditional holding coil is replaced by a three-transistor current sink circuit. Optically isolated ring detection and “off hook” detection circuits are included. Diode bridges eliminate polarity sensitivity when connecting....continued on p. 35
GET YOUR BEARINGS STRAIGHT

At last! A map dedicated to the radio amateur. Announcing the Azimuth-Equidistant wall map from the Great Circle Map Co.

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... to make operation easy. We haven’t neglected the receiver either. With typical sensitivity of only 25 µV for 10 dB S/N in CW and SSB modes, the HR 2510 has the extreme sensitivity needed for operation with less than ideal mobile antenna systems. There’s also a highly effective switchable Noise Blanker for the ultimate in mobile ignition noise suppression. You also get receive scanning, (scan fifty 10 KHz channels), and RIT (Receiver Incremental Tuning) to precisely zero beat on your receive.

... with lots of standard features. Of course, an easy to read multifunction LCD display with selectable dim or bright backlighting, multifunction metering on the LCD with S/RF, Modulation, SWR Cal, and SWR functions, RF Gain control, Frequency Lock, and Channel Up/Down switches on the PTT microphone are all standard features.

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Attn: Literature Department (Amateur Radio)

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D o you think you’ve done it all in ham radio? If you’ve never been on a hidden transmitter hunt, you may have missed some of the greatest excitement a ham can have.

This column will help you get in on the fun.

Radio direction finding (RDF) has been around about as long as radio itself. At the turn of the century, Hertz and Marconi developed directional antennas to funnel signals longer distances. Then they discovered that they could use these antennas to determine the direction of incoming signals. RDF pioneers, such as Bellini, Tosì, and Adcock, soon developed specialized receiving antenna systems that gave even more accurate directional indications.

In its infancy, RDF was used as a navigational aid. A ship’s operator took bearings of known shore stations to determine their own location. During World War I, RDF techniques were used for the first time to locate clandestine transmitters, in this case, of enemy ships.

This second kind of RDF is what most hams are interested in. For forty years or so, hams have held hidden transmitter hunts. One or two hams take a station to an unlikely spot and make continuous or intermittent transmissions. Usually, they remain stationary. The hunters, as individuals or in teams, do their best to home in on the transmitter with their direction-finding equipment.

The goal is either to be first, or to drive the least miles, depending on the rules of the hunt. While there are occasional all-on-foot events, most hunts in the US involve—RDF-equipped cars, trucks, vans, and even motorcycles. Occasionally, at the end of the hunt, you have to go on foot to sniff out the concealed transmitter.

Nomenclature

As a sport, RDF is usually called “fox-hunting” by amateur radio magazines in this country, since that’s what it’s called on the east coast and in Europe. It’s written as one word. In a few places, you may hear of “bunny hunting” instead.

Searches for unlicensed stations, or stations which are causing malicious interference, have been dubbed jammer hunts, turkey hunts, or maverick hunts in the ham press. In southern California, we call all RDF work “T-hunting.” The hider is the “hidden T.”

Sport RDF is an adventure for the hunters, but it’s even more of a challenge for the hider. His goal is to select a combination of location and antenna that will make it difficult for hunters to get reliable bearings. Like a good ventriloquist, he tries to “throw his voice” and make the signal appear to be coming from some other location. Perhaps he will camouflage the setup so well that the hunters won’t know that they’ve found the transmitter unless they literally trip over it.

When you compete in a QSO party or DX contest, you don’t know who your competitors were or how well you did until months later. But when you go T-hunting, you know whom you’re up against, and usually how well you placed before you go home. After every hunt, you’ll find a lively post-mortem session with plenty of success and failure stories, either at the hunt location or a nearby restaurant.

Olympic-Style Foxhunting

Just like amateur radio itself, transmitter hunting is a worldwide pastime. In Europe, you have to be an athlete to successfully compete because all the hunting is done on foot. Using hand-held gear, the hunters race off to locate several well-concealed transmitters, each synchronized to go on and off in sequence. The hunters can use maps and compasses in addition to their DF gear, but they can get no other help.

Local, regional, and national DF events in Scandinavia and eastern Europe lead to the IARU Region 1 championship competition, which has all the trappings of the Olympics. There are receptions, banquets, speeches from government officials, and radio and TV coverage. Hunts for prize medals and trophies are held on both 80 and 2 meters in separate categories for men, women, boys, and teams.

Up to five foxes are scattered on a course several miles long. Hilly, wooded terrain is often selected. Starting times are staggered to force the hunters to work independently, and judges patrol the hunting grounds. Winning times are in the order of 45 minutes.

On the other side of the world, direction finding has become an important athletic competition in the Peoples Republic of China. A national competition brings out the best Chinese hunters and guest competitors from neighboring countries, such as Japan. Rules are similar to European championships, with one interesting variation: Before the hunt, each contestant takes a written exam on basic electronics, transistor circuits, and direction finding. Each point scored in the exam gives the hunter a one-minute credit against his elapsed time in the hunt.

RDFing in America

T-hunters in the US love to have fun, but they’re unique because they can and do use their skills for more serious purposes. RDF plays an important part in self-policing amateur radio. Local Interference Committees, part of the ARRL Amateur Auxiliary program, are empowered to solve many ham-to-ham interference problems by peer pressure and jawboning. In an increasing number of areas, there are standing agreements between the Auxiliary and local FCC offices which permit volunteer ham DFers to gather evidence leading to prosecution in serious cases of malicious interference.

Photo A. Every hunter has his own favorite system. At this All Day Hunt start, two teams are using very-long yagis. (Photo by Tom Curlee WB6UZZ.)
T-hunters can also serve the public by participating in search and rescue activities. DFers working with agencies such as the Civil Air Patrol and the US Coast Guard Auxiliary have helped save the lives of victims of air crashes and boating accidents.

Southern California brazenly lays claim to the title of "T-hunting Capital of the USA." There are close to a dozen competitive hunts scheduled each month in Los Angeles and Orange counties, with plenty of hunters every time. There are also hunts in the Santa Barbara and San Diego areas, and hunts are getting organized in western Riverside county.

Most hunts are on two meters, but there are monthly hunts on 28, 50, and 223 MHz. All hunts are on Saturday or Sunday, daytime or evening. For a list of the regular Los Angeles and Orange County hunts, send me an SASE.

The varied terrain of Southern California adds excitement to T-hunting. Most hunt boundaries include the flatlands of urban Los Angeles and Orange County, plus the Chino and Puente Hills, some of which are over 1000 feet high. The boundaries of the four monthly two meter Saturday night hunts are all different, encompassing areas ranging from 78 to 2320 square miles. The hidden T could be 50 miles away on these hunts.

The most challenging hunt of all is called the All Day Hunt. But that’s a misnomer—it should be named the All Weekend Hunt. It’s held at least four times a year, starting at 10 AM Saturday from the top of Rancho Palos Verdes. The rule is that the transmitter can be anywhere in the continental USA!

Hiding spots for the All Day Hunt have ranged from the Salton Sea, 228 feet below sea level, to mountain peaks 8000 feet high. It’s not unusual for the hidden T to be in a location such as Death Valley, over 200 air miles away. To provide a deceptive two meter signal back to the starting point, All Day Hunt hiders come up with very unusual transmitting setups. This year in May, K6KYW and N6JF used a 35-element yagi antenna with a 100-foot long boom!

Of course, there are transmitter hunts going on all over the US. In the past few years, I’ve had the chance to talk to hunters in diverse cities, such as Chicago, Phoenix, Daytona Beach, and Boston. All these groups have two meter hunts, but they all do them a bit differently. Some run the hunt like a rally, requiring the winner to have lowest mileage. They say it discourages reckless driving, encourages careful triangulation, and evens out the competition. Sometimes the last team to arrive is the winner in a mileage hunt.

Other groups use time as the winning criterion. They say that time is of essence in a jammer hunt or search-and-rescue operation, so hunters must learn to find transmitters fast. Furthermore, in a time hunt there is no need to worry about the accuracy of competitors’ odometer readings.

In some places, hunts for multiple transmitters are common. In others, one well-concealed rig is enough. Some hunts have strict rules about antenna polarization, power variations, and nearness to paved roads. Others say, in effect, “Anything goes!” Most of the time it’s ‘Every team for itself,’ but in a few towns there are cooperative hunts on repeaters, and bearings from base stations are welcome.

Who can T-Hunt?

Transmitter hunting belongs in the mainstream of amateur radio. Going on a hunt is just as exciting as working a new country. DF setups can be as high-tech as a packet network or as simple as a Novice station. An informal hunting group can build friendships as well as a formally chartered radio club. Ham RDF can be used for public service and saving lives.

When you’ve worked that last country you needed to get on the DX Honor Roll, and you think the challenges are behind you, don’t wait for the ARRL to invent more countries. Build your own RDF gear (it’s not hard; most hunters build some or all of their DF gear), put it in your car, and go on a competitive transmitter hunt. A T-hunter is never able to say he’s done it all, because some hider will always be able to find a new way to confound him.

Drop Me a Line!

There are a number of other considerations for developing hunt rules, which will be discussed in future columns. This is where you come in. I want you to share what hunting is like in your area. Are there lots of small hunts, or a few really big ones? Do the local hunters prefer time hunts or mileage hunts? Continuous or intermittent signals? Sniffer hunts or on-the-road hunts? Night or day? Which bands are popular? What kind of hunting equipment predominates? Who is your local ‘T-hunt guru?’ Would you support a national T-hunt championship? Let’s make this column a forum for a fascinating aspect of amateur radio! Tell me what’s going on in your area, and what you’d like to see in this column. Write to me at PO Box 2508, Fullerton, CA 92633 (SASE appreciated if you want a reply), or send a message to 75236,2165 on CompuServe.

Remember, you can T-hunt even if you don’t have your license yet. All you need to start is a receiver and a directional antenna system. There may be a hunt in your area this weekend. Find out, and if there is, give it a try!

New columnist Joe Moell, K8OV has been an avid ham since the age of 11 and a transmitter hunter almost that long. When not T-hunting with his wife, April WA6OPS, he supervises the design of radar transmitters at a Southern California aerospace company. Joe is a Registered Professional Engineer in California. He co-authored, with Tom Curlee WB6UZZ, the book Transmitter Hunting: Radio Direction Finding Simplified, a 323-page illustrated T-hunting handbook available from Uncle Wayne’s Bookstore.

Photo B. Without accurate map work, a hunter can put on lots of unnecessary miles. Kuby N6JSX occasionally takes time out to carefully plot his bearings. (Photo by Tom Curlee WB6UZZ.)

Photo C. It isn’t enough to have a good vehicle setup in Southern California. You also need to be able to hunt on foot. Here, Clarke WB6ADC makes final adjustments to the hidden transmitter before covering it with brush. (Photo by Tom Curlee WB6UZZ.)
Kenwood

continued from p. 13

detachable change tray just behind the shift lever. Bear in mind my performance evaluation is based on user observations, not on bench tests.

In every case, the TM-221A's receiver was as sensitive as the older TR-7400A. Selectivity was at least on a par with the '7400. The RF amplifier is a 3SK184 GaAsFET, with a bandpass filter in front and a 3-section HI-Q bandpass filter following (essentially a helical resonator circuit). The output drives another 3SK184 acting as a mixer. Two stages of crystal filtering are used at the first IF (10.695 MHz), and another monolithic filter is used at 455 kHz.

What makes it all work is the HI-Q filter and bandpass filter around the first RF stage, since most of the "garbage," such as IMD products, issues from there. Suppressing out-of-band signals to limit compression of the front end goes a long way towards helping you hear that distant repeater! This is a lesson learned the hard way by Kenwood and other manufacturers based in Asia, where RF pollution in heavily-populated areas can be nothing short of astonishing.

The transmitter lineup is fairly conventional. It uses an M57726 hybrid power module with four poles of bandpass and low-pass filtering. Full ALC protection is offered and the low-power output is continuously adjustable from 0-30 watts. High power output claim is 45 watts; I found it at closer to 40. This is largely a function of (1) How long the DC leads to the battery and (2) How heavy a cable is used. The DC leads supplied with the TM-221A are a bit light for nearly 90 watts of DC input, so you may wish to use heavier wire for long runs.

In mobile use, the TM-221A is a piece of cake. The amber backlit LCD display should be mandated for EVERY piece of electronic gear installed in a car. It is equally readable at night or in bright sunlight, unlike the conventional green displays. The display indicates the frequency (or memory channel) in use, selected offset, tone/CTCSS enabled, scan mode, signal strength and power output. Simple enough!

QSY is fast, and even easier when selecting memory channels. One obvious drawback of such a small package is the size of the control buttons! You must be careful not to brush keys when reaching over to make a channel change. An example is the position of the HILO power switch adjacent to the POWER ON switch. I invariably punch up low power when turning the radio on.

Conclusion

I highly recommend the TM-221A for both first-time buyers and seasoned 2 meter FM veterans. It is easy to use, offers just the right amount of features and fits nicely inside today's automobiles with limited dash space. Receiver performance is superior in high RF environments (a selling point I cannot stress enough) and the output power is just right for all kinds of mobile work. Besides... it looks great under the dashboard!

Hazer

Continued from page 11

Actual operation depends on tower guy wire arrangement. All installations should be guyed, wherever possible. There are two methods of tower-end guy wire attachment: (1) tower top (apex) attachment in a conventional manner, or, (2) attached to the top or bottom Hazer main frame by use of the lugs in the kit. When using the Hazer with a conventional tower attachment, temporarily disconnect the two guy wires to allow long beam elements to pass and reconnected for "insurance" as the assembly is completely lowered. When used with Hazer attachment, loosen guy wires only enough to raise the assembly, thereby allowing you to release the safety latch. Remove lower level guy wires, such as those used for 60' towers, to let the Hazer pass. Tag lines (short, lightweight rope), tied to the anchor end of each low level guy wire, can be used to retrieve the guy wires when the Hazer assembly is raised to its operating position.

Conclusion

We have had no troubles with our unit whatsoever. I've spoken with several local Hazer users and they all concur—they've had no troubles with theirs and are delighted with not having to climb their towers to work on antennas! They also concur with this one regret: They hadn't bought the Hazer sooner.

All Hazer kits include all hardware, 1000 pound manually operated winch, 100' of wire rope, top pulley assembly and an instruction sheet. The complete "GME" product line is available in a neat 15-page catalog. Only two pages are used to detail GME products, the remaining pages include specifications, drawings, typical guy wire layouts, photographs, a USA Wind-Pressure-Map, and, of course, an order form with shipping and purchase information. If you contact them directly, please mention where you saw it, and who sent you!

Caution:

Safety of all personnel, equipment and real estate is of utmost importance during any antenna work. It is the responsibility of the installer and/or user to exercise all safety precautions at all times. It may be necessary to obtain professional engineering assistance to insure an installation that complies to good engineering practice and with local and national codes.

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All About Henry

Accurately verify a wide range of inductances with this simple project.

by W. K. McKellips WB4DCV

I had tried building various inductance bridges in the past. Most of the designs worked well on the larger inductances, but are best described as flaky in the lower, microhenry ranges.

Having collected my share of small coils and chokes, I got fed up with buying a new coil for every project when I probably had three of that value in my junkbox. I wanted to measure the values of all those funny looking little lumps of wire, but I didn’t want to pay $150 for an instrument to do so.

How about a kit? The July 1988 issue of Radio Electronics offered a solution: a build-it-yourself digital inductance meter designed by Neil W. Heck. There was one drawback, however—the parts kit costs $149!

The Do-It-Yourself Approach

Finally, I read that story and examined the math behind the concept. The idea was delightful. All you needed was a programmable read-only memory (PROM) chip blasted with 16000 answers based on the formula. The rest of the thing was just an oscillator and a cheap frequency meter.

Well! I already had a frequency meter and a $1000 computer sitting around. All I needed was the oscillator. The formula could easily be incorporated into a simple BASIC program.

Circuit Components

The oscillator is ingenious. (See Figure 1.) It’s an LM-311 voltage comparator IC connected as an amplifier with positive feedback. It’s free-running, but controlled by the inductance/capacitance circuit connected to pin 2. The oscillator will work on almost any inductance/capacitance ratio. For that reason, it’ll measure from 0.05 μH up to at least 20 H, the biggest choke I had in my collection.

The only critical component is the 1000 pF silver mica capacitor C1. Capacitor C1 is large enough to more or less swamp out any stray capacity in the circuit. A silver mica generally rates at 5% tolerance, and has very low drift. That should get you an accuracy of about 5%. If you have an accurate capacitance meter, you can get C1’s exact value, plug it into the program, and get even better accuracy.

I soldered it together on a Radio Shack Experimental’s IC Perforboard, (Cat# 276-150), that measures 2” x 3”. This is what I installed in a Radio Shack Experimenters’ Box, (Cat# 270-233), but I’m sure any small box would do. The binding posts again came from the Shack (Cat# 274-662).

Testing the Tester

After finishing the unit, I used a capacitor bridge to measure C1. The value read, in picofarads, was then plugged into the formula. It doesn’t matter at all what you value you use for the inductance standard LS because the BASIC program figures the value of LS automatically, and uses it for the calculation.

Very short wire runs between the tuned circuit and the binding posts helped keep stray inductance to a minimum. In my version, I found that shorting the binding posts kept it down to about 0.05 μH.

Now You’ve Got It Made

Type in the BASIC program I’ve listed, and save it. Connect the unknown inductance to the binding posts. Turn on the power switch and let the circuit oscillate for a second or so to stabilize, then read your frequency meter for the first frequency: F1. It will be about 600–700 kHz. Write it down. Now push the Test button and read F2 on your frequency meter. Write that down as F2.

Now run your computer program and enter the values of F1 and F2. Voila! There’s the value of the coil on your computer screen. You could probably modify the meter to figure unknown capacitance, but in my case, I already had a capacitance meter, and wanted to keep it simple.

So, go ahead and build something, have fun, and save a pile of money. I sure did!

Program Listing

Table 1. Program listing to use with the oscillator to calculate unknown inductances in coils.

Program Listing Notes

The program is written in Microsoft BASIC. See the program listing.

Line 30: Change the value of C1 if you have a more accurate reading for it.

Line 50: Input your frequency reading in kiloHertz, such as “645.5”. You generally won’t need to enter more than the first four figures.

Line 60: If you want to quit, enter “0” and the program will end.

Line 70: Converts kHz to MHz for the formula to work.

Line 80: This is formula #1 for figuring the standard inductance value, LS.

Line 90: This rounds off all the extra figures for a clean printout.

Line 120: Here we convert LS and F1 to work in formula #2.

Line 140: If you want to quit, or if F2 is larger than F1, the program ends.

F2 will always be lower than F1 because you are adding inductance to the circuit in series with LS.

Line 150: Here’s the second Biggie. This formula figures the value of the unknown inductor, using F1, F2, and LS.

The program was written for an Apple II + but it is so simple that you can probably easily translate it into other BASIC languages.
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RF Concepts Model 3-312 220 MHz Power Amplifier

A great way to boost your signal.

A common saying in ham radio goes something like, "You can never have enough power." Perhaps I can amend that somewhat to read, "It's always nice to have more power," especially on 220 MHz, where there are a variety of operating modes, from weak-signal work to repeaters and packet.

RF Concepts has answered that need quite nicely with the RFC 3-312, a medium-power "brick" with a built-in preamplifier. Following in the footsteps of their very popular amplifiers for two meters, Everett Gracey WAGCB and Ken Holladay K6HCP have brought forth a nice complement to the wide range of 220 MHz transceivers available today.

The RFC 3-312 is designed to accept drive power over a range from 200 mW up to 40 watts, which pretty well covers all the bases. Both hard keying and RF-sensed, VOX-type keying are available, and a preamp is included to help pull out the weak ones. The attractive, black aluminum housing has more than enough heatsink capacity.

The device line-up consists of a pair of Motorola SRF3883 devices with a hybrid combiner operating in Class AB mode. Therefore, the 3-312 is capable of linear operation with any mode of modulation, be it FM, AM, SSB, or just CW. The preamplifier is a Telefunken CF-300 GaAs device driving a U309 buffer amplifier, with the combination yielding 18 dB gain at about 1.2 dB noise figure.

Front panel controls select power, SSB/FM mode, and preamp. Incidentally, I've found that a bit of confusion exists regarding the SSB/FM switch on most solid-state amplifiers. It does not change the mode of operation, only the keying drop-out delay! When in FM, the amplifier still operates in Class AB, not Class C, as some operators apparently think.

Rear panel connectors for RADIO and ANTENNA are conventional UHF types. A four-pin TRW/Jones connector is used for power, while a standard RCA connector enables the hard-keying circuit. The RFC 3-312 is factory wired for positive keying as opposed to negative keying, as the manual claims that "most transmitters have a positive voltage available at their back panel." The good news is that you can remove the cover and change one plug-in jumper when you want to go back to negative keying. This review amplifier was tested with an ICOM IC-375A (that does have negative keying), as well as with a plain old footswitch.

One additional connector is a 5-pin DIN-type that enables remote control of the amplifier's functions. It's similar to the Mirage remote control function. Although RFC does not now make a remote control head, they have a schematic of the jack wiring, and they supply a companion 5-pin DIN plug so you can roll your own. Finally, the dropout delay in SSB mode is adjustable via a hole in the side.

Measurements

See below for the test results. For the preamplifier test, I used an HP-608F signal generator and Boonton RF millivoltmeter; for the amplifier test, an IC-375A as the signal source, two 6 dB pads, two Bird Model 43 at the input and output, and an Astron RS-35M power supply. Note that all measurements were made at 14.3 volts, as opposed to the specified 13.8 volts, so power output may be a bit higher than the average.

The RFC 3-312 certainly has an abundance of power. It easily met the factory specification of 120 watts output for 30 watts drive, and, although I used a slightly higher voltage, I would expect 25 watts of drive to saturate the amplifier at full output.

The preamplifier has enough gain to engage in serious weak-signal work, but may "crunch up" in a high RF environment. The 1 dB compression point of -3 dBm is slightly less than average performance for a GaAsFET design. High-performance units will typically have a 1 dB compression point of better than +3 dBm, and I consider 0 dBm to be about average. 220 MHz operators close to a TV Channel 13 transmitter may experience some degree of IMD products with this design.

Field Performance

The RFC 3-312 got a fairly rigorous workout during the 1988 June VHF QSO Party, as it was at one time or another (1) an intermediate driver stage for an 8877 power amplifier, and (2) a final stage for the 220 FM station. It took us a bit of tweaking, but we were able to coax 1200 watts from the 8877 with the 3-312 driven by the previously mentioned IC-375A. Our 220 SSB/CW station was constantly on the air as we worked over 80 stations in 28 grids with excellent reports.

Conclusion

The RFC Concepts 3-312 220 MHz amplifier is a well-designed piece of equipment that will surely get a lot of use from 220 operators. Workmanship is of the highest quality and the amplifier easily meets the published specifications.
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A Lap-Top Repeater Controller

Full-featured repeater control from a PC-DOS lap-top computer.

Jim Edrington KF5WO

Several controllers have been built around home computers, such as the Commodore, Atari, and Radio Shack. These low cost computers perform basic repeater functions well. However, they lack many desirable features for a repeater controller or regular computer. Adding options to make these low cost computers more useful quickly raises their cost. The cost of adding a disk drive, for example, may be several times the price of the computer.

Until recently, full-featured microcomputers were large and power hungry, taking whole desk tops and requiring noisy fans for cooling. Now available at a reasonable price are a new breed of computers. They are the first to combine the power, features, and standardization (IBM compatibility) with the small size, battery powered capability, and other features desired for a repeater controller. These are the laptops, such as the IBM PC Convertible and the Toshiba 1000 series.

This article describes the hardware and software design of a repeater with the IBM PC Convertible as the controller. This design has been operating for over a year without attention, except for a few days following a lightning storm, that damaged the modem.

Hardware Design

The design goal was to take as much advantage of the computer as possible, reducing custom hardware to an absolute minimum. It is always easier to duplicate software (DISKCOPY A: B:) than to duplicate hardware (buy, bend, solder, test, etc.). A computer, specifically modern laptop models, offer many of the hardware functions needed to build a top notch repeater controller.

- Battery backup built-in, for power transient immunity.
- Low power consumption, which is great for remote sites and long life.
- Built-in clock and calendar features.
- Internal modems for remote control and programming via the telephone.
- Small size, to fit in equipment racks.
- Built-in mass storage, for anything from program load to logging the history of repeater usage.
- Full programmability.
- A sufficient amount of regulated power for external circuits.

Many computers, including the Convertible, offer a speech synthesizer as an option. Speech adds highly desired features to modern repeaters. It allows non-code types to understand the ID, for example, and it reports phone patch operation.

Until the day when someone markets a "repeater controller adapter" for a personal computer (my apologies if there is one of which I'm not aware), some custom hardware will be required. For a repeater equipped with a phone patch, the following functions external to the computer are needed:

- Input to the computer from the radio receiver squelch.

Figure 1. Schematic for the interface between computer and repeater.

Figure 2. Telephone interface for the repeater controller.

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• Output from the computer to key the transmitter.
• A dead-man timer function, to disable the transmitter if the computer or software should fail.
• A tone generator, for repeater ID.
• Audio circuits for de-emphasis/pre-emphasis, level control, and audio routing.
• Some means of remote control, so that a control operator can disable the repeater in case of trouble.
• The telephone interface, with its associated off-hook circuitry, DTMF generator, DTMF decoder with protection, and isolation.

The Computer Interface

Somewhat the computer and the repeater hardware must talk to each other. In computer talk, this is known as the interface. An interface can take many forms, and can vary widely from computer to computer.

To simplify connection to the computer, and to make the connection standard, we routed all computer input and output (except for speech and power) through the printer port. Virtually all personal computers use a Centronics-type parallel printer port. Although this port is normally for output only (eight lines with a strobe), nine of its status lines will work for input as well as output. These lines are normally used for such functions as monitoring the printer's paper supply and on-line status.

Since the above functions require more than 17 lines, multiplexing (using a line for more than one purpose) was necessary. Two of the output control lines were decoded into four select signals using a 74LS139 type decoder chip. These select signals control 74LS374 octal latches, enabling the computer to provide up to 32 individual outputs (four times the normal eight). The computer can read up to 16 input lines by using the four select lines to multiplex data onto four of the input status lines. Only 16 output lines and eight inputs lines are implemented here. For maximum reliability, a separate control line is dedicated to the dead-man timer. This circuit is shown in Figure 1, the interface schematic diagram. The logic used to implement these circuits is the 74LS series. You could use equivalent functions in CMOS for lower power consumption.

The Telephone Interface

A typical telephone interface is shown in Figure 2 and part of Figure 3. You need FCC approval before connecting anything directly to the public phone network. All circuitry on the telephone side of the transformer should be well isolated from other circuitry and the chassis. Keep in mind that the DC voltage on an open phone line is about 48 volts, and that when the phone rings, 150 volts peak-to-peak appears on the line. Keep fingers off!

In Figure 3, when the two op amps (U1A and U1B) are connected to the telephone transformer, they perform the 'hybrid' function which prevents the outgoing audio from appearing as incoming audio. Equivalent circuitry in a telephone receiver allows you to hear Aunt Emma in Osh Kosh, but not your own voice too loudly. U1A drives the telephone line through the transformer. U1B is connected so that the voltage at the output of U1A appears at the inverting and non-inverting inputs (of U1B) equally, thus canceling each other. The voltage at the phone transformer, appearing only at the non-inverting input of U1B, is amplified.

In Figure 1, a relay closes a path for direct current through the primary side of the phone transformer. This tells the phone company that you are "off hook." This relay is also controlled by the computer via the printer port.

Audio Circuitry

The controller must handle four audio sources. They are receiver audio, speech synthesizer audio, dialing tones, and telephone audio. Audio must be routed, at the proper time and level, to the transmitter and/or the telephone.

The audio circuitry of the controller is shown in Figure 3. This circuitry is built around a summing op amp (U1D) with four possible inputs, some switched. The switch is a CD4066 IC analog device (U6) which the computer controls. This way, the proper audio signal is sent to the transmitter and/or the telephone, depending on the operating mode. Note that all outgoing audio is passed through an AGC (automatic gain control) circuit to prevent overdrive. The gain control element is a Cadmium-Sulfide photo detector used as a variable resistor in the feedback path of op
amp U1D. Whenever the output of U4 reaches voltages that exceed the voltage formed by the R3, R4, and R5 network, the LM311 comparator (U2) switches on the LED. This illuminates the Cadmium-Sulfide photocell and causes its resistance to drop, reducing the gain of U1D. Because the reaction time of the photocell is very slow compared to audio frequencies, the result is a gradual change in gain. U1D, as well as all the other op amps, is ¼ of an LM324 quad op amp. We picked this op amp because it operates well on low voltage, permitting all circuits to operate on +5 volts.

Receive audio is passed also to an SSI-202 IC (U4) which detects DTMF tone pairs. The logic signals indicating these tone pairs are passed to the computer interface for auto-patch and control operator functions.

The computer interface controls a 5089 type DTMF generator (U5) that produces dialing tones for phone calls and Morse code identification of the repeater.

Table 1 shows the modes of operation, and the state of all switches and relays in each mode.

**The Speech Synthesizer**

We chose the IBM PC Convertible partly because of the optional Speech Adapter. This does not preclude the use of other computers, as speech devices are available for standard PCs, and could be adapted to most laptops.

The Convertible speech adapter is almost identical in function to the one for the PC Jr (also from IBM). It contains two speech systems, one for canned speech (using the ever present Texas Instruments speech chip) and the other for recording and playing back speech. For this application, only the canned speech was used, since the computer cannot do anything else while the record/playback mode is in operation. This means a compromise in the real-time control of the repeater.

**The Computer**

The Convertible has 256K of RAM, two floppy disk drives (although only one is needed), an LCD, and an internal 1200 bps modem. Snapped on the back (which is how options are attached) are two adapters: a speech adapter and a serial/parallel (printer) adapter. An external power unit supplies 12-15 volts to the computer, which has an internal battery. This battery normally powers the computer for six or more hours, which is adequate for most power outages. In reality, it will probably lose its capacity after a few months of full charge, since NiCd need to be discharged regularly.

A good solution to this problem is to float a small lead-acid battery in parallel with the external power source (with diodes to prevent reverse current flow). Lead-acid batteries will operate for years if not overcharged. Motorcycle or lawn tractor batteries are ideal.

If the computer loses power, it will do no harm. When power is restored, the software and all programmed phone numbers, and other data, are reloaded from the floppy disk. Time functions, such as the computer's internal clock/calendar, have to be reset after a power down.

**Writing the Software**

To get this repeater going, I spent much time writing and debugging software. Software is best understood when viewed from two angles. The first is a distant observation of the high level functions, and the second is a close observation of the details of each function. This is like studying the design of a radio transceiver—first you look at the block diagram to see the overall signal flow, then you look at the schematic to determine the function of each component.

One of the advantages of the full-featured computer, such as an IBM PC or compatible, is the wealth of powerful development tools. Text editors, such as PC-Write, are available at minimal or no cost, and are essential to ease code writing and documentation. Professional level assemblers and compilers are also now available from Borland and Microsoft, among others, for $50 and up.

The program for this controller was written in Lattice 'C'. The 'C' language has recently become the standard for program development almost everywhere. Certain portions of the program, such as those interfacing with the repeater hardware, were written in 8088/86 assembly language, which is easy to use with most 'C' compilers. Borland's Turbo Pascal would be a good alternative, with its built-in capacity to produce inline assembly language.

**Programming The Program**

When we talk about programming, we must distinguish between the program running in the computer's microprocessor, and the program the user accesses to set the ID (call sign), speed-dial phone numbers, repeater timeout limits, and so forth. I call the latter "user programming."

**Table 1. Controller Operating Mode.**

<table>
<thead>
<tr>
<th>Mode</th>
<th>RCVR</th>
<th>DTMF</th>
<th>IN</th>
<th>PHONE OUT</th>
<th>XMT</th>
<th>KEY</th>
<th>HOOK SPEECH</th>
</tr>
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<tbody>
<tr>
<td>Idle</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Repeat</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Calling Announce</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Patch Dialing</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Patch Transmitting</td>
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<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Patch Receiving</td>
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<td>X</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Voice IDing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Code IDing</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Continued on page 33
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Lap-Top

Continued from page 30

A full-function computer has diskette drives, which gives us lots of memory for all kinds of functions. Whenever the repeater program starts, it accesses the diskette, and reads these parameters into the computer's memory for instant access. Since these parameters are stored in a file on diskette, they are easily saved and duplicated.

An even bigger advantage to storing the user programmed parameters in this manner is that they can be stored in human readable form. Here are some examples of how the parameters appear in the file for this repeater controller:

```
TR = 3
TP = 10
123 = 5552345
911 = 5550987
TI = KFSWO/R
```

This data tells us (and the repeater controller program) that the time limit for the repeater (TR) is three minutes, that the time limit for the phone patch (TP) is 10 minutes, that the speed-dial code 123 calls the number 555-2345, and that the emergency-speed-dial code 911 calls 555-0987. The last line defines the tone identification (TI) used by the repeater.

You can create and change this parameter file by using any computer (including the repeater controller) and a text editor. Keep records of the file just by printing it out. This is best for major changes, or when initially setting up the controller. Alternatively, you may change the parameters from a remote location, while the repeater is operating, via one modem in the repeater computer and another modem at the distant location (at home, for example).

A control operator at home, using a terminal on any computer, can dial up the phone at the repeater site. The repeater control computer's modem answers the phone, establishes communications, and permits the operator to set any desired parameter or phone number, or just check existing parameters. For example, the control operator can see all parameters by typing "?". He can get instructions on how to change parameters by typing "HELP". To protect hackers from disrupting the repeater, a password is required at startup.

The Controller Program

Repeater controlling software must operate in what is called "real-time." This means that external events, which may happen at any time, must be watched and action must be taken immediately following these external events. In addition, the software must perform functions, such as generating Morse code IDs, which require precise timing. A block level flowchart of the program is shown in Figure 4.

The software used here is clock driven. This means that all inputs are read and all outputs are performed on the tick of a clock. This way, we are assured that all inputs are regularly monitored and that actions can be timed accurately. Of course, we need a clock that ticks more than once per second, or we could miss external events (such as a DTMF tone). The IBM PC (and all compatibles) has a clock that ticks approximately 18 times per second, and which can be read by a program by doing a BIOS function. BIOS stands for "basic input output system." It is software built into the computer to provide a standard software interface to devices, such as the printer, screen, and keyboard. For example, it allows software to send text to the screen, regardless of the type of display adapter and installation.

Timing events of any length is accomplished by using a program variable, which is incremented or decremented at each tick of the 1/18-second clock. For example, counting to 180 would take the program 10 seconds, if one count is done at each clock tick. Most of the time, the program is just sitting and watching this clock. When the clock ticks (indicated by a change of time read via BIOS), the software goes into action.

The Clock Strikes 1/18...

Dead-man Timer

The first thing that the software does is toggle (change the state of) one of the printer port output lines to re-trigger the 74LS123 one shot, or dead-man timer. If this one shot was not triggered regularly, it would time-out, shutting down the transmitters and hanging up the phone. This protects us from any computer or software failure which might otherwise leave the repeater on the air, but out of control.

Inputs

Next, the input lines are sampled. These lines are tied to the receiver squelch and the DTMF tone decoder. If any of these lines change state from the last sample (their old state is stored), software "flags" are set. Software flags are simply variables which are either a 0 (meaning off) or a 1 (meaning on). These flags will be examined later in this timing step, when decisions must be made. They are always cleared at the end of each timing step, and before the input lines are sampled at the next 1/18 second tick.

Throat Clear?

At each timing step, another software flag, the "speech-in-progress", flag, is tested to determine if any speech is underway. This is necessary because many phrases we want to say are made up of more than one word or sound from the speech synthesizer. We must therefore queue up the words while the software goes about other things. If speech is indeed under way, the speech adapter is checked to see if it is still busy with the last word we told it to say. If it is busy, we must wait.

If, however, the speech adapter is idle, the software goes to the speech queue, gets the next word, and commands the speech adapter to begin speaking that word. If the speech queue is empty, the "speech-in-progress" flag is cleared.

Making It Talk

As described earlier, the PC Convertible Speech Adapter is used in the canned speech mode. This mode works in the "background," thus allowing the computer to resume normal repeater control once speaking begins. It is limited to 200 sounds in this mode, not all of which are useful in repeater operation. Making it say these words is easy, however. You must write a program to send the Speech Adapter "BIOS calls." This is similar to the BIOS call to read the computer's clock, described previously. The Speech Adapter contains its own BIOS, which allows the following three computer assembly instructions to make it say "DANGER!":

```
MOVBX,09
MOVAX,0201H
INT4DH
```

Here 09 is the number representing the word "danger," 0201H is the hex number meaning "say it now," and the first two instructions place these numbers into the microprocessor's registers. The third instruction is a software interrupt, causing the execution of a program contained in ROM in the speech adapter.

Code ID?

Morse code IDs are generated by software turning the DTMF generator on and off, timed to create dots and dashes. The DTMF generator is programmed to generate single tones, instead of the dual tones normally used for phone dialing. A "code-in-progress" flag is set whenever a Morse code ID is in progress. Morse code characters are queued up in a manner similar to the speech words, and are pulled out by software as the previous character is completed. A lookup table in the program data area is used to convert the characters to the proper series of dits and dahs.

Phone Number?

At each timing step, the DTMF decoder input flags are examined to determine if a valid phone pair has been detected. If so, this tone is queued up, and the "valid tone" flag is set. For privacy, it is desirable to prevent these tones from passing to the transmitter, but in this design, the first tone is allowed to pass. This is because, at times, many voices might sound briefly like DTMF tones. If a second valid tone is not detected within a two-second period after the first, the software assumes that the detected tone was an error, and allows voice to continue (and empties the queue).

If a second valid tone is detected, the audio path to the transmitter is shut off, preventing the tones from being re-broadcast. If no more tones are detected for five seconds, audio is restored and the queue is emptied.

Valid tones are accumulated in the queue as long as the repeater controller detects a valid carrier. When the operator entering the tones releases his key, the tones (representing numbers and other symbols from the tone pad) are examined for meaning. If the number sequence received matches an operator...
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CIRCLE 121 ON READER SERVICE CARD
to the phone line. A six-foot cable with a modular plug comes with the unit.

There are two circuits in this unit not found in many autopatches. One is a VOX circuit that detects when the person on the phone is talking. This varies the sample rate in simplex operation. A noise-operated squelch simplifies connection to the radio receiver. No COR input is needed, just raw non-deemphasized audio straight from the discriminator. A provided CTCSS input can be used as a COR input though, if you'd rather connect it that way.

An audio AGC circuit equalizes the audio level between the phone line and the transmitter.

To minimize possible noise problems, digital and audio circuits are separated on the PC board. One side is digital, the other, audio, with separate voltage regulators for each side.

The Manual
The present manual is basically well written, but falls short in a few areas. Some function descriptions aren't detailed enough. For example, the manual doesn't explain about the CTCSS control input being used as a COR input. Neither does the manual explain why there are three different letter A's in the CW programming chart. There are other redundant letters in the chart. When I called CES (they have a toll free number!) I was told that those letters are for foreign language use. One letter A was supposed to have two dots above it. Another A should have been printed with a bar above it, and so on with the other extraneous letters. Also, repeater controller operation is barely mentioned. The folks at CES assured me that a new manual is being prepared, and should be out by the time this review appears in print.

Setup
You can program the Smartpatch and set its levels only after the patch is fully connected to the transmitter, receiver, and phone line with which the unit is to be used.

Programming both the jumpers and the onboard EEPROM memory was not difficult. Most, but not all, of the jumpers are the pin and jumper block type. JP1 was a little tricky to find—it turned out to be a wire soldered between two holes in the board.

The programming section of the manual appears a bit intimidating at first, but once you get started it's not bad at all. There are plenty of examples to help you with the codes. Plus, all parameters have preprogrammed default values in case you miss something.

It's best to go through the manual and write down all of the programming codes you'll use first so that they can be entered easily once you start. There are timers that limit the time an entry may take, so it's good to have them worked out on paper beforehand.

EEPROM programming can be done locally with the supplied DTMF decoder or remotely via phone line. I enjoyed this part! The patch beeps with a couple of keystrokes to let you know you're proceeding properly. If you make an erroneous entry, it sends you an understandable CW error message.

Setting audio levels properly is a little harder. The writer of the instruction manual assumes that you have on hand an FM service monitor or the combination of a deviation monitor, an audio generator, and an oscilloscope. Although I have the equipment, I tried setting it up by ear. I had everything sounding pretty good, I thought, until I actually tried to make a phone patch call and I couldn't make it work. The phone line wouldn't accept the digits I was dialing. I had to use an oscilloscope to set the level from the receiver into the patch, and the audio level into the phone line.

It took me less than an hour to get operational the first time, and that includes wiring everything together!

Operation
I tested the patch in two different settings. First I tried it in simplex mode with my ICOM IC-245 synthesized two meter transceiver. Then I tried it as a repeater controller and autopatch with a 220 MHz Motorola MICOR based repeater.

In both modes of operation, the patch offers the standard timeout and activity timers, toll restrict, toll restrict override controls, and reverse patch operation.

The connect and disconnect codes can either be the standard * up and # down, or programmable three-digit codes.

Toll restrict can be programmed to work on either the first or second digit dialed. Both digits are programmable. Toll restrict can be totally enabled or disabled, or you can enter a special override code which allows you to make one toll call. After disconnect, it automatically rearms.

Simplex Operation
In simplex mode, the patch worked well with my synthesized ICOM. The default sample window time of 60 ms was more than adequate. I was even able to reduce it to 25 ms with the rig in low power mode.

The constant "kerchunk" I had to listen through when using the patch with a synthesized rig bothered me, but this patch senses when the person on the phone is talking (the VOX circuit) and slows down the sample rate so that the kerchunks are not as frequent when you're trying to listen. The patch samples in between syllables rather than words, and the sample rate changes and slows down between pauses. Dial tone and other telephone signals won't fool it, thanks to the call progress tone filter in the DTMF decoder.

If a crystal-controlled rig had been used with a shortened squelch time constant, the "kerchunk" would have been reduced to a less bothersome "click."

Repeater Operation
With the patch connected to my repeater, I learned its repeater controller functions. There is a transmitter timeout timer and an ID interval timer that must be set, in addition to the autopatch timers. If the Auto ID mode is activated, the repeater call must be programmed into memory as well. A single, non-programmable, courtesy beep can be enabled or disabled. It has an associated programmable "PTT Delay" timer for keeping the transmitter up after the beep.

There is also an autopatch enable control that allows the control operator to enable or disable the autopatch function without affecting its operation as a repeater controller.

The unit has two functions for turning on and off external devices, but strangely, they are not brought to the outside world. CES plans to include an addendum in future manuals that will show you how to access these functions.

Since I had the repeater connected to my home phone line while I tested the patch, I especially appreciated one feature of the patch—it won't allow an interconnect if the phone line is already busy. This is great when your repeater is located in your home and your wife is using the phone. She won't get a rude earful of touchtones from someone attempting to make a autopatch call, nor will her
conversation suddenly end up on the air. This is a definite marriage saver! If you’re not married or don’t care, you can use the jumper provided to defeat this feature.

Reverse Patch

There are two modes of reverse patch operation. The first is “Auto Answer” mode. In this mode, the patch will answer the phone after a preprogrammed number of rings and wait a preprogrammed time for further control codes. The caller can then enter a remote programming code, or a multi-digit security code. If the correct security code is entered, the patch will immediately connect to the phone line. If neither the programming code nor the immediate connect security code is entered, or if the channel is not busy, the transmitter then generates part of the security code. A designated mobile can then complete the connection by dialing in the same code that was transmitted to him.

In the “Non-auto Answer” mode, the patch senses the phone ringing and generates a long beep out over the air. Anyone can then answer the phone by just dialing the regular connect code.

In either reverse patch mode, the patch monitors the receiver and will not allow itself to bring up the transmitter when it senses a signal already on frequency. If a signal is on frequency, the person calling on the phone line hears an error message and the call is then terminated. Software allows you to defeat this feature.

Opinion

This patch performs excellently. Its audio quality is excellent. Programming is flexible and is easily done remotely. I suggest below, however, a few improvements.

First, the instruction manual needs some elaboration in certain areas. Second, CES should consider putting a decent connector on the rear of the unit, and labeling the connector terminals. The terminal block on this patch is on the circuit board inside the unit, requiring cover removal for wire connections. You also have to refer to a diagram in the manual and then count positions to find the right terminal.

Third, CES should move the front panel an LED on the PC board that indicates when a DTMF tone is decoded. In a DTMF-dependent device such as this, a “tone decoded” indicator is as important to monitor as a HOISE or PTT indicator.

Fourth, there should be automatic stop-bit insertion. When I programmed in my call letters, I forgot to also program in a stop bit as mentioned in the manual. This caused several extraneous characters to be sent after my call. Though easily corrected, there’s no reason why internal software can’t automatically insert the stop bit when one exits the programming mode. To completely avoid this stop.

Fifth, though the unit contains the circuitry capable of doing this, it doesn’t regenerate touchtones into the phone line. The patch stores the phone number and redials it as pulses, but not as touchtones. A slight software change here can eliminate one of the bigger headaches in autopatchdom?

In Sum

The above comments fall in the category of nitpicks. The CES 510SA-II telephone interconnect is an excellent autopatch and repeater controller, from a company with an excellent reputation. Before doing this review, I had heard nothing but good reports from friends who own this model. Now that I’ve had the chance to test one myself, I can say that if you’re looking for a good mid-featured autopatch/repeater controller, the Smartpatch II from CES is an excellent choice.

---

### CES 510SA-II Specifications

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<thead>
<tr>
<th>Mode of Operation:</th>
<th>Simplex, half, or full duplex</th>
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<td>+ &amp; # or for three digit codes</td>
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<td>Simplex Sample Window:</td>
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<td>Simplex Sample Rate:</td>
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<td>Call Limit Timer:</td>
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<td>Activity Timer:</td>
<td>up to 42 minutes</td>
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<td>Rptr Timeout Timer:</td>
<td>up to 4 minutes</td>
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<tr>
<td>Rptr Hang Time:</td>
<td>up to 16.6 minutes</td>
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<td>Timeout Warnings:</td>
<td>10 seconds of warning beeps</td>
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<tr>
<td>Toll Restrict:</td>
<td>1st or 2nd digit programmable</td>
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<tr>
<td>Automatic Ring Out:</td>
<td>General or Directed</td>
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<td>Toll Restrict Defeat:</td>
<td>Three digit code</td>
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<td>Five programmable</td>
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<td>Dialing:</td>
<td>DTMF or pulse. Europe pulse DTMF not regenerated</td>
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<tr>
<td>Phone Busy Lockout:</td>
<td>User selectable option</td>
</tr>
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<td>Busy Chan. Xmit Lockout:</td>
<td>User selectable option</td>
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<td>User Control output:</td>
<td>MOSFET drain pulling to ground</td>
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<td>Remote Disable:</td>
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<td>CTCSS Enable - Disable:</td>
<td>Rear connection</td>
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<tr>
<td>Audio Requirements:</td>
<td></td>
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<tr>
<td>Input:</td>
<td>50-2000mV RMS</td>
</tr>
<tr>
<td>Output:</td>
<td>0-1 V RMS</td>
</tr>
<tr>
<td>Interface Signals Req’d:</td>
<td>Ground, + 12V, PTT, Tx audio rcrv discriminator audio</td>
</tr>
<tr>
<td>Programming:</td>
<td>Locally via supplied DTMF keypad, or remotely via phone line</td>
</tr>
<tr>
<td>Dimensions:</td>
<td>8.25 x 1.5 x 9.5”</td>
</tr>
<tr>
<td>Weight:</td>
<td>31bs, 13oz.</td>
</tr>
<tr>
<td>Power Requirements:</td>
<td>10-15 VDC at 300mA</td>
</tr>
</tbody>
</table>

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### Full-duplex, Half-duplex, Simplex?

These terms refer to the way the repeater or autopatch handles audio information. **Full-duplex** means that audio passes into and out of the phone patch at the same time. A normal land-line telephone operates full-duplex because one can talk and listen simultaneously. A repeater is a full-duplex system because it receives and transmits simultaneously. A full-duplex autopatch allows to talk and listen simultaneously.

**Half-duplex** means that information flows in only one direction at a time, even if the transmit path is on a different frequency from the receive path. Most radio transceivers are half-duplex devices. You can either transmit or receive, but not both simultaneously. Most autopatch systems operate in half-duplex mode, not because the repeater and autopatches can’t receive and transmit simultaneously, but because the users can’t.

**Simplex** operation refers to the fact that both transmitting and receiving take place on the same frequency, but not simultaneously. You need only one transceiver for this, not a repeater. A simplex autopatch, after activation, transmits the audio coming from the phone line. Every second or so, the simplex autopatch switches the transceiver from transmit to receive for a very brief time, typically 25-75 milliseconds. If a signal is received during this “sample window”, the autopatch will hold the transceiver in receive mode until the signal ends, at which time the transceiver will be switched back to transmit mode.

A station listening to a simplex autopatch will hear the person on the phone line interrupted by a “click” every second or so. That’s the sample window. To capture the receiver, the transmitting station must hold his transmitter on until a sampling occurs. Then he can talk to the person on the phone. Though it doesn’t have the interactivity of a normal phone conversation, and has the annoying sampling interrupts, it gets the job done using only one frequency, and doesn’t require a repeater. Anyone who has a transceiver can have his own autopatch. Be sure to check out the FCC regulations pertaining to simplex operation before putting such a system on the air.
Wishbook of Circuits

Circuits for QRP, signal generators, and much, much more.

reviewed by Larry Antonuk WB9RRT

Master Guide to Electronic Circuits
by Harry L. Helms
Published by Prentice-Hall
Englewood Cliffs, NJ 07632
Hardbound, 293 pages, illustrated, 1988

The latest entry in the "circuit compilation/wishbook" category comes from Harry Helms. Master Guide to Electronic Circuits is a collection of electronic schematics, each backed up with a short paragraph of explanation. This type of book is quite useful for the person searching for a specific type of circuit. The original source is listed with each circuit, so the builder can go back and find PC board layouts, pictorials, etc. The book also fits the casual reading category—nice for browsing through, for thinking that well, someday, I'd sure like to build one of those.

The circuits contained in the Master Guide are drawn from several sources. Most of the information comes from manufacturer's data sheets and application notes. Hams will like the fact that the remainder of the circuits come from 73, CQ, Ham Radio, and QST. As a matter of fact, these are the only magazines that the author drew from. This makes for a pleasing absence of Flashing-LED and Freezer-Failure-Alarm circuits.

In addition to the expected signal generators and QRP transmitters, though, we do have enough variety to make things interesting. The strong of heart can whip up their own Computer Modem or Bicycle Mileage Computer. Part-time medical doctors might want to build an Electrocardiograph Amplifier, or perhaps a Heart Rate Monitor. Or how about Automatic Cruise Control? You name it, it's probably in there.

The graphics in Master Guide to Electronic Circuits are quite good. The preface lets us know that the schematics don't all match one another because they are still in the style used by each publisher. While this comes across as a light apology, it's actually stating a strong point. Using material directly from the source eliminates another step in the process that could easily introduce errors.

Master Guide, being a good collection of the most current electronic circuits, is a source of inspiration. Used in conjunction with the originally published material, it will save the builder hours of research time.
Getting Rich In
The Ham Market

Every time two hams get together at least one says how about if we were to make this great product to sell to hams—not realizing that the ham "industry" is probably one of the best possible ways to guarantee poverty.

No, not all hams are cheap—not all are living on starvation retirement payments—the fact is that some ham firms are doing remarkably well selling to those few hams who are alive and well—and to the handful of newcomers who blunder into our hobby.

The whole trick to survival in the ham market is in getting your sales message to your potential customers—this is called marketing. Marketing includes making sure your literature is as good as (or even better than) your product—and that your sales pitch reaches those few live hams who are your best potential customers.

I'll bet you thought I was never going to mention 73. Advertising is going to be one of your biggest sales expenses, so give it the serious thought it rates. Advertising is a very well-developed art—billions have been spent on research to find out what works and what doesn't. Indeed I'm working on a video just on how to advertise. In the meantime, if you can take it, I'll mercilessly criticize your literature and your ads—a service no other ham magazine can provide at any price because none of them have anyone with anything even remotely like the 35 years I've had in advertising to hams. Unless you fall into it, it's unlikely you're going to find an ad agency able to help you sell to hams—which is, to be kind, a unique group.

Presuming that sales are of some importance to you, where do you think you'll do best? There are four ham magazines—one for advanced builders—one for contest fanatics—one for ARRL fans—and then there's 73—which appeals to active hams with small construction projects, with the only world DX column, with columns and news about all of the new ham activities such as packet, RTTY, Oscar and so on. The 73 readers buy circles around other magazine readers because they're active and motivated.

So if you decide to try and fight the odds with a ham product, give it your best shot with 73—and let me help you win with powerful, sales-oriented literature and ads. A little mail order business at home is a great way to become independent—millions are doing it. Remember, small business is the real strength of America... and it's about the only practical way to have a crack at making big money these days.

Write or call the 73 advertising people—Richard, Ed, or Jim—and let's get you started with power ads which will make you money.

...Wayne
W2NSD/1
Kenwood 4100A Crossband Repeater Operation

Turn this mobile rig into a mini-repeater.

by Bob Witmer W3RW

Many of us are fascinated by, and find very convenient to carry, the new, very concealable hand-helds. Trouble is, they, like any hand-held, have a limited range, and many areas still have sparse repeater activity. Very often, repeaters accessible from a mobile rig are not so from an HT.

What to do? Well, if you own the Kenwood TW-4100A dual band mobile rig, you can make your own crossband repeater! You can enjoy simplex-to-simplex, and simplex-to-repeater, operation in addition to dual-band mobile operation. All this in a package that doesn’t cost an arm and a leg!

How? It’s one of the better kept secrets in FM Hamdom today: The Kenwood 4100A, along with its advertised features, has built-in crossband repeat capability. It works by the receiver scanning back and forth between the two bands and initiating crossband transmit when it detects a signal. When the signal drops, it resumes scanning. (It has a built-in, three-minute transmit timer.)

Although Kenwood’s sales brochure vaguely refers to this feature, the 4100A manual does not mention it. Close examination of the schematic does reveal some circuitry labeled “RP,” and a variable resistor, VR4, labeled “RPT,” but none of the internal views indicate repeat mode components or circuitry.

I found out this capability was for real at a recent Hamfest where Paul, of Delaware Amateur Supply, mentioned that he had just received the 4100A repeat mode modification information from Kenwood and gave me a copy. However, the information in the “TW-4100 Repeater Operation Supplement,” available to all from Kenwood, leaves out a few details. For example, it does not indicate that you need to adjust the repeat audio level (VR4), nor show where to make this adjustment.

The following describes what I have discovered about implementing and operating this mode.

“You can enjoy simplex-to-simplex, and simplex-to-repeater, operation in addition to dual-band mobile operation.”

Hardware Mod of the 4100A

Modification requires the addition of one internal jumper between two posts. To do this, first remove the screws from the top and bottom covers of the rig. Take care when removing these covers, especially the bottom cover, as the speaker cable is attached to it. Then, just prepare a jumper wire about 3½” long, strip a small bit of insulation off the ends, and jump the two RP posts shown in Figure 3. That’s it!

Well... Not Quite

Sometimes during repeater crossband operation, the TW-4100A may not detect a UHF signal while scanning between the two bands. This happens because the electric field generated by the strong UHF receiving signal cause the busy circuit to malfunction. Fortunately, there is a modification that will take care of this internal RF feedback problem. With less than $5 worth of components and a half-hour’s worth of time, you can insure detection of the UHF signal. Best of all, this mod may be covered under warranty! (Get details on this from Kenwood.)

Refer to Figures 3 and 4.

First, remove the covers as outlined above. Then, locate connector number 12 on the composite unit (RX-TX) on the bottom of the transceiver. Now, carefully strip ¼” of insulation from the wire attached to pin 2 of connector 12, approximately ¼” from the connector. 6. Solder the three components, shown in Figure 4, between the wire and ground. A good ground location is the can around TC2 and L8. The mod is done—just carefully replace and resecure the two covers. Don’t forget to adjust VR4.

Key-Step Programming

The following shows the series of keystrokes and control
adjustments you need to make, after the hardware mods, to get the 4100A up and running
as a crossband repeater.

1. Press the VFO/M.CH key to select the
Memory Channel mode.

2. Select the desired Memory Channel af-fer
programming the Tone Frequency and the
Offset frequency. Any channel may be used
except odd, split memory channels 8 and 9.

3. Press the VFO/M.CH key to return to
the VFO mode.

4. Select the desired operating frequency
for the other band. For example, if the
Memory Channel you selected contains a two
meter frequency, then choose a 70 cm
frequency in this step. (See Section 4-2-4 and the
MHz key section on page 8 of the operator’s
manual.)

5. Adjust the SQL control to the threshold
point for each band.

6. Select the DUP shift mode using the SEL
key and the TUNING control. (Refer to
section 4-2-5 in the manual.)

7. If you have the VFO frequency pro-
grammed as the one that will activate
the remote repeater site, you should select the
desired tone frequency and transmitter offset
frequency at this time. (Refer to sections 4-2-6
through 4-2-8 in the operator’s manual.)

Note: For simplex-to-simplex operation set
0.0 MHz for the transmitter offset frequency.

8. Press the SHIFT key. (The DUP indica-
tor will turn ON >.)

9. If you have the VFO programmed to
activate the remote repeater and a subaudible
tone is required for access, you should press the
TONE key.

10. Turn the POWER switch OFF.

11. Press and hold the REV key and turn
ON the POWER switch.

12. Release the REV key. A beep will
sound and the radio will now operate as a
crossband repeater. The receiver will alter-
nate between the two bands continuously. If
squelch opens on one band, the correspond-
ing incoming signal will be automatically re-
transmitted on the other band.

Note: If the transmitter remains keyed for
longer than three minutes, the transmitter
will unkey, and the receiver will begin alter-
nating between the two bands to search for an
incoming signal. This protects the finals and
functions as a built-in time-out timer.

13. To cancel repeater operation, turn the
POWER switch OFF. When the radio is
again switched ON, the radio will return to
normal transceiver operation.

14. Adjust VR4, the repeat audio level pot,
shown in Figure 3. IMPORTANT: This is
not the VR4 shown on page 28 of the 4100A
manual.

15. Set repeat audio level. The best setting
I found was at approximately ¾ full clockwise
rotation.

16. Disconnect the microphone when in
this mode, otherwise the mike is "live," and,
when the transmitter is activated, local audio
mixes with the repeat audio. You can use this
path to mix in CW ID audio.

---

**Operating Considerations**

The 4100A is not designed for continuous
high power transmit operation. Consider the
heat-dissipation environment of your rig’s
installation. The typical mobile installation
on a hot summer day does not provide an
ideal environment! If you are operating from
a base power supply, be sure also to check its
ratings.

---

**"The 4100A is not designed for continuous high power transmit operation."**

The three-minute timer actually runs closer
to two minutes and 15 seconds. At the end of
the time-out period, the transmitter is inter-
rupted for a moment, and the receiver re-
sumes scan mode. This initiates the transmit
cycle again.

The tuning control, and all keys, including
the PTT and UP/DWN switches of the micro-
phone, do not function while the TW-4100A
is operating as a repeater.

When the DCL System is operating, Code
Squelch Operation is automatically acti-
vated, and the TW-4100A operates as a
Digital Code Access Repeater. In other
words, you can’t access the repeater function
unless you transmit the proper DCS code.

Typically, I use the two meter simplex to
440 MHz repeat mode, and I have adjusted
the 440 (70 cm) low power level (VR5) to 20
watts, and the two meter setting to 2 watts.
This minimizes power dissipation in the unit
because of the 4100A’s ‘‘Carrier-drop’’
mode, which tends to keep the transmitter
keyed up for long periods due to the courtesy
beep, time-out timer reset mode of most repea-
ters. See the 4100A manual, Figure 1,
page 28, for the description and location of
these adjustments.

During operation, keep in mind the scan
style mode of the 4100A. Autopatch opera-
tion is a good example of this limitation. The
typical result of initiating an autopatch call in
this mode is the eventual time-out of the
patch—once the patch is activated, it looks for
signals from your transmitter. Unfortu-
nately, the receiver of the 4100A still sees
the repeater transmitter carrier, thereby prevent-
ing transmit operation.

Information is also now available on how to
expand the UHF frequency range to 420
MHz, and the VHF range from 141 to 151
MHz. To do this, however, you first need to
contact Kenwood. Also make sure to review
these sections of Part 97 all which concern
repeater operation, before operating the
4100A in repeater mode:

- Section 97.65 Specifies excluded
frequencies
- Section 97.67(c) Specifies power output
limitations
- Section 97.85(e) Details control operator
requirements
- Section 97.86(d) Concerns Auxiliary
operations.

**Acknowledgement**

Many thanks to Don W3LR for his patience
and cooperation in allowing his 440 MHz
repeater to be used to evaluate this modi-
fication. Thanks also to Kenwood for per-
mission to reprint information from their
‘‘TW-4100 Repeater Operation Supple-
ment’’ and Service Bulletin #926 (dated
12-17-87).

One further mention: The TW-4100A can
be modified for MARS (Military Affiliated
Radio System) and CAP (Civil Air Patrol)
operation. This simple mod requires no com-
pONENT additions to the rig. For instructions
on this mod, send to Kenwood a copy of your
current amateur license and a copy of the
documentation approving you for operations
in these services.

The crossband mode of the Kenwood
4100A provides an operational capability
that is typically unavailable in a package this
compact and low-priced. 

---

**Parts Required for Anti-RF Feedback**

- (1) resistor 4.7 k ohm, ¼ watt
  Part# RD14B22472J
- (1) capacitor, electrolytic 4.7 uF, 16 V
  Part# CE04CW1C4R7M
- (1) diode 1S1555
  Part# V11-00-76-05.
ASTRON POWER SUPPLIES
- HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE

SPECIAL FEATURES
- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A.
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- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS
- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts
  (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- Also available with 220 VAC input voltage

19" X 5¼ RACK MOUNT POWER SUPPLIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS* (Amps)</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM-12A</td>
<td>9</td>
<td>12</td>
<td>5½ x 19 x 8½</td>
<td>16</td>
</tr>
<tr>
<td>RM-35A</td>
<td>15</td>
<td>35</td>
<td>5½ x 19 x 12½</td>
<td>38</td>
</tr>
<tr>
<td>RM-50A</td>
<td>37</td>
<td>50</td>
<td>5½ x 19 x 12½</td>
<td>50</td>
</tr>
</tbody>
</table>
| • Separate Vol and Amp Meters
  RM-12M | 9                      | 12          | 5½ x 19 x 8½ | 16                 |
| RM-35M | 25                     | 35          | 5½ x 19 x 12½ | 38                 |
| RM-50M | 37                     | 50          | 5½ x 19 x 12½ | 50                 |

RS-A SERIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS* (Amps)</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
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<tr>
<td>RS-3A</td>
<td>2.5</td>
<td>3</td>
<td>3 x 4 x 5½</td>
<td>4</td>
</tr>
<tr>
<td>RS-4A</td>
<td>3</td>
<td>4</td>
<td>3½ x 6 x 9</td>
<td>5</td>
</tr>
<tr>
<td>RS-5A</td>
<td>4</td>
<td>5</td>
<td>3½ x 6 x 7½</td>
<td>7</td>
</tr>
<tr>
<td>RS-7A</td>
<td>5</td>
<td>7</td>
<td>3½ x 6 x 7½</td>
<td>9</td>
</tr>
<tr>
<td>RS-7B</td>
<td>7</td>
<td>7</td>
<td>4 x 7 x 10¼</td>
<td>10</td>
</tr>
<tr>
<td>RS-10A</td>
<td>7.5</td>
<td>10</td>
<td>4 x 7 x 10¼</td>
<td>11</td>
</tr>
<tr>
<td>RS-12A</td>
<td>9</td>
<td>12</td>
<td>4 x 7 x 10¼</td>
<td>13</td>
</tr>
<tr>
<td>RS-12B</td>
<td>9</td>
<td>12</td>
<td>4 x 7 x 10¼</td>
<td>13</td>
</tr>
<tr>
<td>RS-25A</td>
<td>16</td>
<td>20</td>
<td>5 x 9 x 10½</td>
<td>18</td>
</tr>
<tr>
<td>RS-35A</td>
<td>25</td>
<td>35</td>
<td>5 x 11 x 11</td>
<td>27</td>
</tr>
<tr>
<td>RS-50A</td>
<td>37</td>
<td>50</td>
<td>6 x 13 x 11</td>
<td>46</td>
</tr>
</tbody>
</table>

RS-M SERIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS* (Amps)</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
</table>
| • Switchable volt and Amp meter
  RS-12M | 9                      | 12         | 4½ x 8 x 9 | 13                 |
| • Separate volt and Amp meters
  RS-20M | 16                    | 20         | 5 x 9 x 10½ | 18                 |
| RS-35M | 25                    | 35         | 5 x 11 x 11 | 27                 |
| RS-50M | 37                    | 50         | 6 x 13 x 11 | 46                 |

VS-M AND VRM-M SERIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS* (Amps)</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
</table>
| • Separate Vol and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load
  VS-12M | 9 @13.8VDC             | 12         | 4½ x 8 x 9 | 13                 |
| VS-20M | 16 @10VDC              | 20         | 5 x 9 x 10½ | 20                 |
| VS-35M | 25 @5VDC               | 35         | 5 x 11 x 11 | 29                 |
| VS-50M | 37 @13.8VDC            | 50         | 6 x 13 x 11 | 46                 |
| • Variable rack mount power supplies
  VRM-35M | 25                   | 35         | 5½ x 19 x 12½ | 38                 |
| VRM-50M | 37                   | 50         | 5½ x 19 x 12½ | 50                 |

RS-S SERIES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Continuous Duty (Amps)</th>
<th>ICS* (Amps)</th>
<th>Size (IN)</th>
<th>Shipping Wt. (lbs.)</th>
</tr>
</thead>
</table>
| • Built in speaker
  RS-7S | 5                      | 7           | 4½ x 7 x 10¼ | 10                 |
| RS-10S | 7.5                    | 10         | 4½ x 7 x 10¼ | 12                 |
| RS-12S | 9                      | 12         | 4½ x 7 x 10¼ | 13                 |
| RS-20S | 16                     | 20         | 5 x 9 x 10½ | 18                 |

ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)
The AR-501, triple mode CW terminal in a small package, is a powerful gear to practice and play with. For the Novice, SWL and Amateur radio operators it detects Morse code between 5 to 30 WPM. Just plug the AR-501 to your receiver to start translating the Morse code onto full 32 character LCD display. Very simple and easy to operate. You ask; for code practice? both receive and transmit? Yes, the AR-501 does just that. It will improve your cord reception and keying technique at the speed you want. More? It operates as an electronic keyer both standard and iambic. More Yet? How about a printer port? You bet, the AR-501 provides parallel printer port for hard copy. You can Log the QSO, and Practice. It will help you immeasurably. We even offer a standalone Niccad operated thermal printer as an option. ACCESSORIES SUPPLIED: The AR-501 Radio telegraph terminal comes complete with Receiver cable, DC Power cable, Miniature Phone plug, Miniature stereo phone plug, Spare fuse, Wall receptacle style power adaptor and Instruction manual. ACCESSORIES AVAILABLE: CC-501 Parallel printer cable — $30.00/DPU-411 Standalone Thermal printer with 8K buffer—$235.00

ORDERING INFORMATION: For fastest service, call 800-523-6366 from 9 A.M. to 4 P.M. P.S.T. Send mail orders to: ACE Communications, Inc. 22511 Aspan Street, Lake Forest, CA 92630. VISA and MasterCard orders and certified or cashier's check or money order shipped within 48 hours of receipt. Rush service by UPS/Overnight, UPS/2nd Day Air and Federal Express is available at extra shipping charges. Purchase orders accepted from Government agencies. CA residents add 6% sales tax. COD is $3.00 extra. WARRANTY INFORMATION: The AR-501 covered by One Year Warranty. Extended warranty service available at the following rates: 3 Years—$25.00, 2 Years—$15.00. SATISFACTION GUARANTEE: If, for any reason, the ORIGINAL PURCHASER is not satisfied with the unit purchased, a full refund of the purchase price will be issued if the unit and all accessories are returned to us UNDAMAGED WITHIN 25 DAYS of the date of original purchase (Invoice date). This policy excludes any additional freight that may be incurred, and in no event modifies or limits the limited warranty.
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*Complete unit, no additional charge.*

**Included:***
- 2-way AUDIO PREAMP
- 2-way SPEAKERS
- 2-way POWER AMP
- 2-way BAND LINK
- 2-way TRANSMITTER KITS
- 2-way RECEIVER KITS
- 2-way CONTROL DIAL
- 2-way KEYBOARD

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*Complete kit, includes all parts.*

**Included:***
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- 1-band KEYBOARD

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- 2-band RECEIVER KITS
- 2-band CONTROL DIAL
- 2-band KEYBOARD

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*Complete kit, includes all parts.*

**Included:***
- 3-band BAND LINK
- 3-band TRANSMITTER KITS
- 3-band RECEIVER KITS
- 3-band CONTROL DIAL
- 3-band KEYBOARD
Ultimate Repeater IDer

Choose from a library of repeater IDs in either CW or Voice.

by P.J. Ferrell K7PF

Every amateur transmitter must be routinely identified—including repeaters. A solid state CW generator issuing the ID in Morse code has been the most commonly used. ID tapes are also used—I recall one famous repeater in Central Washington which had an ID tape featuring a voice so seductive that visitors routinely tried to date the ID generator! And, recently, computer-ized repeater controllers use a speech synthesizer, a solid state device with high reliability.

Thus, any ID generator claiming to be ultimate now should be a solid-state unit that offers both CW and voice, and allows free selection of messages. Figure 1 is a block diagram of the new repeater that uses the ID generator described in this article.

Digital speech comes in many flavors, from near-perfect digital recorders to hard-to-understand phoneme synthesizers. High quality digital speech requires about 8000 8-bit samples per second (64 K-bit PCM). Thus, a 32 K-byte EPROM could hold about 4 seconds of speech of this quality. Data compression techniques, such as Adaptive Delta Modulation (ADM) and Linear Predictive Coding (LPC) have been applied to lower this storage requirement. National Semiconductor and Motorola make ADM chips offering high quality speech with up to an 8-fold reduction over PCM. Texas Instruments makes an LPC chip offering up to an 80 to 1 reduction over PCM (or 10 to 1 over ADM). The same 32 K-byte EPROM could hold up to 30 seconds of ADM speech or up to 5 minutes of LPC speech. The TI LPC Voice Synthesis Processor (VSP) can make both voice and CW sounds, and is the one most commonly found in computerized controllers for amateur repeaters. Efficient speech coding methods such as LPC require substantial signal processing prior to data storage, so that the vocabulary is normally limited to that provided by the chip maker. If this limitation can be overcome, then our “ultimate” identifier will use the TI VSP chip (“TMSS220C Voice Synthesis Processor Data Manual,” Texas Instruments Incorporated, Copyright 1982).

LPC Speech

The details of LPC processing are beyond the scope of this article, but the principle can be clearly understood. Human speech waveforms tend to be predictable (low entropy) signals. Given a series of samples of such a waveform, the next sample can be estimated quite accurately with past data. This calculation is performed at both transmitter and receiver. The transmitter sends only the ERROR, that is, the difference between the
actual and predicted sample values. The receiver simply adds the received ERROR to its own predicted value, giving the same sample value as that obtained by the transmitter. The better the prediction, the less data need be sent or stored. There is no approximation involved here, both transmitter and receiver get exactly the same series of samples (provided no transmission errors occur). This is a form of data compression coding known as "redundancy removal."

The TI TMS5220C VSP does its job by implementing a time varying tenth-order digital lattice filter which models a human vocal tract. This filter is excited by pitch (voiced sound) or by hiss (unvoiced sound). The output of this filter drives an 8-bit digital-to-analog (D/A) converter to produce the synthetic speech waveform. Compressed speech data is processed as frames, with a constant frame rate of about 40/sec. There are five frame types: Voiced (50 bits), Unvoiced (29 bits), Repeat (11 bits), Zero Energy (4 bits), and Stop (4 bits). Using only Voiced frames (50 x 40 = 2000 bits or 250 bytes per second), our 27256 EPROM holds over 2 minutes of sound. In practice, Repeat, Unvoiced, and Zero Energy frames reduce the required storage by over half. This gives us the aforementioned five minutes.

Hardware

The TMS5220C VSP interfaces neatly with a TMS600 Vocabulary ROM (VROM) chip. Several VROMs can be paralleled for a more extensive vocabulary, and only the VROM word address need be supplied to speak the word. In addition to VROM speech, the VSP can "speak external"—speech data can be loaded from an external processor. Since our "ultimate" design uses complete messages rather than single words, externally supplied LPC data is taken from a 27C256 32K CMOS EPROM. Since the host repeater is battery powered, the ID generator is turned off when not needed, and the generator is completely shut down.

In addition to the TMS5220C VSP, a microprocessor is needed to fetch data and operate the identifier. I chose a CMOS Z-80, along with 74HC CMOS logic, for minimum power consumption. Figure 2 is the ID generator schematic diagram. A parallel interface to the repeater's master processor is used. A pair of 74HC374 tri-state latches between the repeater 8-bit Master Bus and the ID generator, form a parallel interface. The repeater's master processor issues commands and reads status using these latches, which must remain on to avoid loading the master bus during ID power down. The TMS5220C VSP is implemented in PMOS logic and requires both plus and minus 5 volts. A series pass regulator (7805) provides +5 V from the switched +12 V, and a small switching supply (dual 7660s) produces -5 V. Analog speech output from the VSP is amplified and level shifted to 0-5 V for repeater audio compatibility using a type 741 op amp. The processor program is stored in a 27C27 EPROM, and all messages are kept in the 27C256 EPROM. No RAM is used at all. In the unlikely event of needing more LPC data storage, you can substitute a second 27C256 for the 27C32.

Firmware

At power on, the power-on-reset signal momentarily lowers both READ and WRITE lines to the TMS5220C for an initial VSP reset. The Z-80 then begins, selecting interrupt mode (IM1) and setting the status latch to zero. A series of reset commands are sent to the VSP, status is set to 11H, and the processor halts with interrupts enabled. Upon receiving an interrupt pulse, execution begins at location 38H. A table of LPC data addresses and byte counts is referenced by the Z-80, and indexed using the requested message number. The table is located at the beginning of the 27C256, at Z-80 address 8000H. Each table entry consists of four bytes: the first two are the LPC data starting address, and the second two are the message byte count. A 2 MHz clock is assumed for the software timing loops. The following commented assembly language program listing covers the detailed operation of the Z-80C ID generator processor shown in Figure 2.

Master Processor Usage

To start an ID message, the repeater master processor powers up the ID generator and outputs a message number request. It then sends a set of interrupt pulses and waits a fixed amount of time for a "VSP is talking" status. Table 1 is an excerpt from the master processor's operational repeater program which illustrates use of the ID generator.

Speech Development System

If it were possible to "cut and paste" word sounds to make desired words, then virtually any message could be put together. Figure 3 is schematic for the developmental system hardware which operates with the resulting frame editor. It uses a TMS5220C VSP and a single 74HC424 buffer chip, and plugs into any PC parallel printer adapter. An audio

---

**Figure 3. Speech Synthesizer development system.**

**Table 1.** This Basic ID generator handler subroutine illustrates use of the ID generator.

<table>
<thead>
<tr>
<th>Routine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STVSP:</td>
<td>MOVE BC</td>
</tr>
<tr>
<td>POP AF</td>
<td>save msg#</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>turn on..</td>
</tr>
<tr>
<td>POP AF</td>
<td>...ID gen wr</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>DEC T</td>
<td>...loop count</td>
</tr>
<tr>
<td>IN H, (IDEN)</td>
<td>...ID processor</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>DEC T</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>...ID proc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Routine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
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<td>POP AF</td>
<td>save msg#</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>turn on..</td>
</tr>
<tr>
<td>POP AF</td>
<td>...ID gen wr</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (IDEN), A</td>
<td>...ID proc</td>
</tr>
<tr>
<td>OUT (EDDC), A</td>
<td>...ID proc</td>
</tr>
</tbody>
</table>

**Table 2.** Partial message for the Seattle repeater shows the voice synthesis processor message # and sound.

<table>
<thead>
<tr>
<th>Routine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move</td>
<td>MOVE BC</td>
</tr>
<tr>
<td>Save</td>
<td>save msg#</td>
</tr>
<tr>
<td>Turn</td>
<td>turn on..</td>
</tr>
<tr>
<td>Indent</td>
<td>indent</td>
</tr>
<tr>
<td>Dec</td>
<td>dec</td>
</tr>
<tr>
<td>Int</td>
<td>interrupt</td>
</tr>
<tr>
<td>Wait</td>
<td>wait</td>
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<td>Repeat</td>
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<td>Indent</td>
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<td>set status</td>
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<td>Stop</td>
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73 Amateur Radio • November, 1988
amplifier to drive a speaker can be added, but the VSP audio output is of sufficient level to drive most headphones. The frame editor loads LPC code and permits deletions, additions, and changes to any parameter of any frame. The resulting code can be sent to the VSP for listening evaluation. When done, the LPC data can be written to disk as a file for later use as a sound, a word, or a phrase, or a complete voice message. The LPC data can be laid out in PC memory, a message table constructed, and the whole thing burned into EPROM for use in the identifier. A partial message table for the Seattle Repeater is shown in Table 2.

Morse messages run longer than the voice version, and thus use many more frames. Only one Voiced (50 bit) frame is needed to set CW tone pitch; all other Morse frames are the short Repeat (11 bit) or Zero Energy (4 bit) frames. Curiously, the LPC data storage is about the same as that for the equivalent voice message. Synthesizer frame timing (40 bytes or 40-second) retains achievable code speed to 36 WPM divided by an integer. We selected 18 WPM, as 36 WPM is too fast, and 12 WPM is too slow.

LPC Data Editing

LPC data is stored in bytes, but the VSP converts it to frames for generating sound. Any LPC data editor must deal with frames instead of bytes, so the editor converts stream-to-frames and frames-to-stream as required. The editor reads a disk file in bytes (stream) and stores it as frames. Frames may be added, deleted, or modified as needed. Other sounds (from other files) may also be added. At any time, the frames in work may be sent (converted back to stream) to the VSP for a listening evaluation. Two frames within the data can be designated (cursor and mark) to define a "block" of frames. The VSP sounding options are: start to end, start to cursor, cursor to end, and start to end, omitting the marked block.

For example, we needed the word "SEATTLE." The following sounds were used: the spoken "C," the word "at," and the word "all." The first cut sounded like "see at all," rather than the desired word. Accent is a matter of amplitude and duration, however, with easy control of these parameters using the editor. The final version of "SEATTLE" sounds as good as any word in the LPC vocabulary. Each finished word may be stored as a binary (stream) file on disk for later use in creating an entire message. Both byte count and frame count are given by the editor. In order to greatly simplify control of the identifier, each message is stored in ROM completer and ready to speak.

Conclusion

Texas Instruments' LPC VSP product line is being upgraded, so TMS5220Cs may be in somewhat short supply. We recommend starting this project with the PC-based speech development system shown in Figure 3. If you can make the TMS5220C generate voice and CW messages to your liking, the rest is pretty standard stuff. The parallel interface can be easily modified, perhaps using a PIO/PIA, or even changed to a serial interface using a UART. The details will depend on access to the repeater control processor.

A copy of the LPC Frame Editor is available to radio amateurs on an IBM compatible DOS floppy disk. TI has graciously allowed us to include a selection of LPC encoded words, along with some phrases we have found useful, each a separate archived file. Documentation and test software is also included on the disk, which is intended for amateur radio use only. The disk is $27 post-paid. Contact RadioRose Consortium, 6021 S. 119th St., Seattle WA 98178.

### Table 3. K7PF's ID Processor Operational Program

<table>
<thead>
<tr>
<th>ID Processor Operational Program</th>
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CIRCLE 334 ON READER SERVICE CARD
Computerized Tuning for TS-830S

Control digital VFOs with your personal computer.

by Robert Fisher KF6DF

Pushbutton tuning has been around for some time—you now find this capability even on microphones! My Kenwood TS-830S is a rig with such capabilities—it has a digital VFO called the DFC-230 Frequency Controller. Two buttons on the top of the microphone control this VFO. Although I used my Kenwood TS-830S, this system works with any rig that uses scanning switches on the microphone.

I developed a scanning system that uses simple computer operations. It is a software program that generates tones to send to two tone decoder ICs. Each decoder controls the scanning of the band. An optical coupler takes the place of each microphone switch used for frequency scan. See Figure 1.

The Computer Hook-Up

I used the TRS-80C Color Computer to generate the audio for the PLL tone decoder chips. Any computer that generates audio through software programming, however, will work. Use the audio output either from the monitor’s earphone jack, or from the audio input to the RF module in the computer itself. A shielded cable connects to the input of the 567 PLL ICs.

The Computer Program

Most computers can use a simple BASIC loop program for this system. A tone that activates one PLL is used for up scanning, and another tone is used for down scanning. BASIC commands preselect the tone frequencies. Each loop cycle generates a tone pulse. When using the frequency controller, a pulse changes the frequency by 20 Hz. Thus, five pulses change the frequency by 100 Hz, the smallest frequency unit displayed on most rigs.

Leaving the tone on for more than a few seconds switches the unit to fast scan, allowing rapid frequency change. The user can select 20, 100, and 1000 Hz steps, and fast scan. (See Figure 5.) In BASIC, the INKEY$ function scans the keyboard for the selected keys, and branches off to the loop that selects the scanning increments. Additional loops change tone frequency for minor variations or drift in the PLL locking frequency. Thus, if the PLLs were first set to 1000 and 2000 Hz, and drift, tapping the up or down arrow slightly shifts the high tone. Hold down the Shift key for the low tone adjustment.

Controller Hook-Up

The PLLs drive optical couplers. (See Figure 2.) These couplers are made from an infrared LED and a photo transistor held together with shrink tubing. Two of these units are needed. The cable is soldered to the 8-pin connector plug used for the DFC-230 Frequency Controller. See Figures 1 and 3.

Using the Computer

I found this method of computer-controlled scanning easy to use and adaptable to other computers. This is because only tones control the scanning system. You can also use a variety of rigs—with no modifications needed—with this system. Just buy the proper plug seen on the end of the microphone cord. The user can wire the microphone plug in parallel and scan the band manually, as well as by

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**Figure 1.** Schematic for computer/TS-830S transceiver interface. Circuit can be modified for use with other transceivers.

**Figure 2.** LED and optical detector mounting and orientation.

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computer. By wiring a stand-up microphone into the plug, the operator can use computer control of scanning while he talks. He can fine-tune his signal in 20 Hz increments with Receive Incremental Tuning (RIT) while holding the transmit frequency constant. This fine-tuning procedure works well on RTTY, AMTOR, packet, and SSB.

"SPACE BAR" tunes in 100 Hz steps. The "@" key performs 1 kHz frequency changes. The "F" key selects fast scan when going from the AMTOR or RTTY, to packet subbands.

Table 1.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>RS Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>567 PLL ICs</td>
<td>276-1721</td>
</tr>
<tr>
<td>1</td>
<td>Circuit board</td>
<td>276-168</td>
</tr>
<tr>
<td>1</td>
<td>Mike plug, 8-pin</td>
<td>274-025</td>
</tr>
<tr>
<td>1</td>
<td>Optical diode, detector pair</td>
<td>276-142</td>
</tr>
<tr>
<td>2</td>
<td>10kΩ 15-turn mini pot</td>
<td>271-343</td>
</tr>
<tr>
<td>2</td>
<td>10kΩ 270° pot</td>
<td>271-218</td>
</tr>
<tr>
<td>2</td>
<td>5kΩ 270° pot</td>
<td>271-217</td>
</tr>
<tr>
<td>2</td>
<td>2.2 µF (25 VDC) capacitor</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.1µF disk capacitor</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.047µF disk capacitor</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1µF (10 VDC) capacitor</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1&quot; long, 1/2&quot; dia. heat shrink tubing</td>
<td></td>
</tr>
</tbody>
</table>

The Circuit

The builder can wire the circuit on a pre-drilled circuit board, as shown in the parts list. It uses two 567 PLL tone decoders. Each one switches on the infrared LED. This turns on the photo transistor, which lowers resistance across the pins shown to start the scanning process. Each 567 PLL is adjusted to the frequency selected for up or down scanning. Pin #8 pulls low when the program selects the proper tone. You can select any tones between 1 and 2 kHz. They can be as narrowly spaced apart as 200 Hz. See Figure 1.

The power supply is a simple 5-volt regulated supply. I used a plug-in transformer with a rectified DC used for portable calculators. A three-pin regulator provides 5 volts.

Conclusion

I found this system very simple and easy to use. I did not have to make any modifications to the rig or the frequency controller. All you need to do is trace the wires from the microphone scanning switches to the pins on the microphone plug. The photo switching transistor should be sufficient to jump the switches. If not, use a reed relay instead.

So, enjoy building this simple system! It’s a nice one-evening project, and who can resist having another neat gimmick to show off in the shack? More importantly, this project should help take away some of the mysticism and fear you may have about interfacing microcomputers with ham gear.
H am radio operators, by their very nature, like to explore. "Tuning around" and becoming familiar with a new band is one of the more pleasurable aspects of amateur radio. The lack of activity on some of the less common bands is mainly due to one problem—the difficulty of obtaining the necessary equipment. The necessary investment of time and/or money is often too great to justify. While you can often either borrow or build equipment for new bands, either solution has its drawbacks. Finding commercial hardware becomes more and more of a problem the further away from 80-10 meters you want to operate.

The 1750 meter VLF band is one such obstacle. Also known as the Experimenters' Band, it is, by definition, the domain of the home-brewer. "1750 meter appliance operator" is the original oxymoron!

What to do just "tune around" on 1750 meters? What if you've been introduced to LF Engineering Company, Inc., a simple solution to these problems. The L-101S Receiving System is a combination of active antenna and receiving converter. Used in conjunction with a 3.5 to 4.0 MHz receiver, the system provides coverage from 3 to 530 kHz with no antenna tuning required.

The heart of the L-101S Receiving System is the new L-400B Active Antenna. Housed in a 26" x 1" sealed PVC probe, the antenna comes with a 50-foot RG-174/U cable. The L-400B represents a breakthrough in LF antenna technology—a field sensitivity 20 dB greater than the original L-400, with equal or greater broadcast intermodulation rejection. These figures are possible due to a proprietary design 18 dB amplifier and a lumped-constant low-pass filter, both the result of several months of research and development. The dynamic range of the L-400B is 110 dB, and it can operate in the linear region with signal levels of up to 200,000 microvolts. Extended RF and ESD protection is included.

The L-101B VLF Converter makes up the rest of the receiving system. The converter comes housed in a 4" x 2" x 1.5" box, and uses RCA-style connectors. The unit covers 2 to 500 kHz with no returning, and produces either 3.5 to 4.0, or 4.0 to 4.5 MHz outputs. Powered by a standard nine volt battery, the unit will operate for one year before replacement is necessary. The L-101B was designed with a JFET mixer to provide a higher than normal input impedance, resulting in higher gain and wider dynamic range, without compromising intermod rejection.

Using the receiving system couldn't be easier. The antenna is easily clamped to almost any existing structure. The RG-174/U cable is thin enough to be easily concealed. Antenna cable is included, but the converter to radio cable is not. In most cases, this will be a male RCA to PL-259 jumper. Once you're connected, the system is operational. Simply tune across the 10 meter band to hear a variety of operators, beacons, and airports.

In my case, light dimmers, electric fans, and thunderstorms! I guess this means I will have to be patient enough for winter to come—but at least I'll have enough time to get my VLF transmitter on the air.
Low Power Operation

full, bright sun. The standard test for a photovoltaic cell was designed by the DOE (Department Of Energy) and the Jet Propulsion Laboratory. The standard test for peak watts include a cell temperature of 25°C, an insulation of 1000 watts per square meter, and an air mass of 1.5. Insolation, by the way, is the amount of sunlight striking the earth.

We now have to add two more conditions to our PV system. These are the nominal operating cell temperature and standard operating conditions. Nominal operating cell temperature is the temperature reached by a cell while it is functioning under standard operating conditions. Standard operating conditions include insulations of 800 watts per square meter, air temperature of 20°C, and a wind velocity of 1 meter per second. The panel would be oriented toward solar noon. The panel is measured open-circuit voltage.

What does all this mean? In the real world, we almost never find ourselves under full sun conditions. The ambient temperature is always higher, making the normal cell temperature much higher than expected. The results? The peak power of our panel will normally be reduced. If you purchase a 37 watt panel, you’ll see about two-thirds of the potential output. On the other side of the coin, under better-than-standard conditions, you’ll see more power being generated than the panel should be producing.

The Tilt of the Array

Now that peak power is no longer a mystery, we can move on to peak sun hours. Under a normal day’s sun, we only get an average of four to six hours of energy producing sunlight. The amount of time the photovoltaic array produces full power depends, on where you live. Here in Ohio, I get about 4.5 hours in the summer and about 3.1 hours in the winter.

When building a photovoltaic array consisting of several panels, consider the tilt angle of the array. In the past, I never worried too much about tilt angle. However, with the improvements I have made on my array, I started to see a drop in power as we moved closer to summer. A good rule of thumb for tilt angle would be to add the latitude plus 15 degrees. This orients the array toward the low altitude angle of the sun in winter when the least amount of insolation is available. This is 30 degrees away from the best “summer tilt.” If your loads are greatest during summer, then by all means re-tilt the array for the summer loads.

Battery Charge Regulation

In a photovoltaic system, charge controlling protects the battery(ies) from over charging. For example, if you have a small panel and average size battery, and you place some type of load on the battery now and then, you don’t need a charge controller. Using a 105 amp per hour battery with a 0.8 mA panel, and operating on the weekends, you won’t need a charge control system. Thirty amps into a large battery array, however, does require charge controlling.

“Energy storage is the key to solar electric operation.”

There are two basic systems for battery regulation: relay and solid state transistor switching.

The first type uses a relay to control the flow of current from the array. The second type uses a transistor switch. If the batteries are low, the control logic energizes the relay, or turn the transistor on, so current from the array can flow into the batteries. This is called series regulation. The control element—the relay—is in series between the array and the batteries. As charging progresses, the battery’s terminal voltage rises. Using information from the battery monitor, you can approximate battery state of charge.

The controller logic monitors the battery terminal voltage and decides when to stop the current flow by opening the relay or shutting off a transistor switch in a solid state series controller. In either relay or solid state series controller logic, the battery’s terminal voltage flattens out near the end of its charge, and no longer accurately reflects the state of charge.

In a solid-state series regulator, the transistor must pass the full current from the array. Heat sinks it well.

Shunt type regulators operate by diverting array power from the batteries as they reach full charge. This can be done in many ways, but the two most common methods are: shorting the panel to ground on the panel side of a blocking diode (shunting shunt mode); and dissipating the energy as heat in the shunt transistor (linear shunt mode).

Energy Storage

The shunt mode controller has the advantage of allowing the batteries to float to maximum charge. This controller logic never completely stops the current flow. The shunt controller, however, stops all current when the battery voltage reaches full charge. Using only this one-step logic, the battery may never reach full charge. Most of the better series controllers also use a smaller, float regulator to charge the batteries the remaining 10% or so.

Usually the charging process stops just above the voltage at which electrolytic gassing occurs. This slight gassing mixes the electrolytes, which prevents their stratification and the consequent loss of battery capacity. Mixing the electrolytes is especially important in very large batteries, and that’s where we’ll pick up in the next column—energy storage and batteries.

In keeping with the theme of this column, I bought some small one- and two-watt Sovonic photovoltaic panels. They have no frame, but include a blocking diode. Both panels are flexible and quite rugged. Price for the one watt panel is $22.50, which includes postage in the USA and Canada. The two watt panel goes for $37.50. Power output for the one watt panel is 0.70 mA at 14.4 volts. Double the current for the two watt panel. I have only a few panels, so rush your orders.

Anniversary

This issue marks two years of QRP in 73. I want to thank everyone who has sent in comments and photographs. There is quite a bit more coming down the pike. I hope to have some receiver projects soon. We will be doing more building, also. The DiY (Do It Yourself) keyer was a big hit.

Let’s hear from you about your experiments with QRP and solar panels!
Life On A Megacycle

HF Aboard the Winnebiko

by Steven K. Roberts N4RVE

If you have been following these tales of my high-tech nomadness for awhile, you’re getting a good image of the Winnebiko II—that 12-foot, 275-pound, 54-speed, solar-powered assemblage of gizmology that has become my electronic home. I’ve pedaled it 16,000 miles around the US, and am now hauling it to and fro in an old school bus, visiting hamfests and sponsors. Next spring, we’ll hit the road again with a team of fellow nomads.

An increasingly important part of this life is ham radio. Not just the obvious convenience of two meters, but “classic” ham radio as well—HF. In this, the 9th article of our series, I’d like to discuss some of the issues involved in running 3-30 MHz while living full-time on the road.

Well, in last month’s article I explored the various motives that drive us hams to do what we do. Near the end I admitted to feeling about a dozen of the seventeen mentioned…many of them quite strongly, given the sweat involved in making ham radio a part of my nomadic lifestyle. 2 meters, of course, is at the appliance/survival level—it keeps me in touch with Maggie, local hams, and the reassuring presence of autopatch facilities when I feel the need for security.

But what about HF?

First of all, why go through the hassle? Why haul a 25-pound “radio pack” up mountains? Why spend hours erecting dipoles just for the pleasure of uttering plain-tive QRP calls into the cacophony of the airwaves?

Is there survival value in stringing a wet noodle in Montana trees, plugging together a few cables, and hunkering over a buttered Argonaut while Maggie conjures camp gloopa? Perhaps, in an extreme case, we might need medical help in the wilderness someday. But that’s not what it’s about, nor is it the pure fun of making contacts, nor the twisted pleasure in coloring in counties on my US map whenever I work a new one. And were it only the technical satisfaction of making an unlikely lash-up work, the thrill would have faded by my tenth QTH.

A Global Home

No, the value of this goes to the very heart of my wanderings, touching the same cravings that, five years ago, led me to trade my security for freedom and hit the road. A traditional home wasn’t enough…I wanted a global one.

And, of course, it’s now a question I hear almost every day: “What do you call home?” The answer has three parts…

On one level, home is the bike, the trailer, Maggie, and all the stuff we haul around with us. Home is also the whole world—a giant neighborhood that we prowl, visiting old friends and making new ones. But there’s a third level, every bit as important as the other two: Dataspace. That’s the vaporous global culture of electronically linked brains, made up of computer networks, BBS systems, the packet culture, and the planet-wide community of ham radio operators whose voices crackle through the bike’s headphones whenever I say something like “N4RVE, bicycle-mobile QRP, QRZ?” Thanks in part to this series in 73 Magazine, electronic doors open every time I go on the air and the security that comes from having an extended electronic family goes a long way toward delaying the urge to settle down.

But enough rhapsodizing. I get a lot of questions on the air about my bicycle-mobile HF rig, so here are a few details.

Pedaling The Megacycle

First of all, I should emphasize that this article comes at a time when the Winnebiko II...
is undergoing major surgery...and will appear in a few months as the new improved Winnebiko III. The HF system is evolving along with everything else, and I have to resist the temptation to tell you all about the NEW stuff before it’s installed and working.

The heart of my present HF station is the Ten-Tec Argonaut 515 which, after a few months of flaky connectors, seems to work better and better the more it’s abused. I carry an external audio filter, also by Ten-Tec, as well as one of Bob Heil’s excellent headsets.

CW input is a function of whether or not I happen to be mobile. When in camp or visiting someone’s house, I use the MFJ “Pacsetter” keyer, built around a smooth Benchner paddle. This is heavy, of course, with a steel block to keep it in one place on the desk. I’m machining a light aluminum base that can Velcro to a plastic work surface or snap onto the door of the HF area in the new trailer.

For CW mobile, I use the handlebar keyboard and a piece of Morse-generation softtop to the bike’s speech synthesizer, but then I’d never get to experience the magical rhythm of “Ben’s best bent wire,” or be able to participate in the shave and a haircut that terminates so many QSOs. There’s pleasure in both extremes—feeling the bits between your toes and watching layers of machine intelligence do the work for you. Perhaps the best of both worlds: Decode incoming CW with a computer, log it to RAMdisk, and then regenerate perfectly-timed code (complete with spelling correction) for the brain’s arcane pleasure. Hmm...

Anyway, the big issue that always arises in discussions of bicycle-mobile HF is the antenna. For a long time, I believed that mobile whips should be useless at QRP levels, especially with the dubious counterpoise of a bike (albeit a 275-pounder). I thus restricted my operation to campgrounds and backyards where I could uncoil my ropes and dipoles, terrorize neighbors with crescendo whistles, and finally escape, and squawk all night to get a return on my investment. It does work well...with Q-5 reports common, and frequent skepticism about my power levels. But I need to operate while pedaling.

Some time ago, I acquired an armload of Hustler mobile verticals, with super resonators and a folding mast. I gave it a try on 15 meters from somewhere in North Dakota (a QTH that added 10 dB to my 3 watt signal). Surprise...within a minute I had a three-way QSO going with Long Beach and New York. We chatted into the county-hunter’s net bicycle mobile. You’ll quickly spot differences in performance that can be hard to quantify. And, of course, you’ll strengthen friendships, swap equipment and ideas, and learn more than ever about the hobby. Even though I’ve never had any kind of stable ham shack of any course, you’ll strengthen friendships, swap equipment and ideas, and learn more than ever about the hobby. Even though I’ve never had any kind of stable ham shack of any kind, I frequently find myself in a consulting role—and I’ve done time in so many others, I recently spent time with a good friend in Wisconsin whose HF rig didn’t “feel” right...it turned out he was running a vertical with no radials.

I’m writing this month’s column at the QTH of one of the big guns, K0PP in Deer Lodge County, Montana. Ken is an ARRL Section Manager, as well as the owner of the finest antenna farm I’ve ever seen (tribander, monobander, Zepp, 160 vertical, OSCAR, various VHF beams, and a forest of 75-foot towers). Driving all this is a TS-940 and a homebrew kilowatt. Ken’s a hot CW DXer who can blister along at 30-40 WPM.

But he tuned up the linear, aimed the antenna east, and turned me loose. “Uh, me? A kilowatt?”

He grinned. Tentatively, I CQed. Instant response from the east coast. We chatted awhile, most of it comprised of my marveling at the rig and his marveling at a 40-over signal from Montana. Then, on a whim, I said QRZ after his final...and the roar of tangled voices was a sound I’d heard many times from the opposite perspective.

For four hours I sat in the hot seat, on a roll, buzzing with excitement. With the bike pulsed by kilowatt signal, I was in a rare state, I had a glimpse of how DX stations live. I started feeling guilty over ragchews, knowing that a dozen or so squirming stations were muttering “come on, come on” with every lull in the QRM. I started responding to two or three calls at a time: “New Mexico, go ahead; Tango Yankee, you’ll be next.” And I twinged a bit when a QRP station in Georgia got over his delight at Montana only to say, “Steve? That doesn’t sound like a solar-powered bicycle-mobile rig.”

Used to being a whisper in the wilderness, I was suddenly the most powerful thing on 20 meters. Strange and wonderful...and a little frightening.

But the best part was watching another few pieces fall into the infinite puzzle—seeing not only a new aspect of the hobby, but also learning about great circle bearings, radiation off the sides of tribanders, the nature of passband tuning, the subjective difference between 100 and 1000 watts, the etiquette of big-gundom, the use of a rotor brake, and countless other little things too small to enumerate but, in aggregate, a major education. And that’s what it’s all about, and why I recommend that you make a point of learning at a furious pace instead of falling into the tired habits that can make any hobby, along with its practitioner, seem old.

I sometimes forget that learning is the essence of this journey, for it is not so much passion as necessity. Without the stimulus of change and new signals, I’d never have found in the motivation to so actively pursue new information. Try this: Open doors with HF, pass through them, and explore whatever you find. Make the bandwidth of your participation in this hobby as wide as possible. Visit other stations, and get to know both rig and operator. Push past the same old skeds and contests, for the more interesting we become as a culture, the more we will attract interesting people. There’s a critical mass somewhere, and it’s becoming increasingly clear that it’s not going to be reached through traditional public education.

But we of the networks and airwaves are in a unique position to find it, for we are dispersed across the planet, yet we communicate freely. Think of it as a kind of intellectual responsibility to our species, as well as a whole new level of electronic fun. Yep, bicycle-mobile HF sure is inspiring.

See you somewhere on the air, on the road, or in the vapors of Dataspace? 72

[NOTE: For reprints of earlier articles in this series ($3 for all eight) or a copy of Computing Across America ($9.95 plus $2 for shipping), write to Computing Across America, 1306 Ridgeway Avenue, New Albany, IN 47150.]
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The **Kansas City Tracker** is a hardware and software package that connects between your rotor controller and an IBM XT, AT, or clone. It controls your antenna array, letting your PC track any satellite or orbital body. The **Kansas City Tracker** hardware consists of a half-size interface card that plugs into your PC. It can be connected directly to a Yaesu/Kenpro 5400A/5600A rotor controller. It can be connected to other rotor assemblies using our Rotor Interface Option.

The **Kansas City Tuner** is a companion product that is used in satellite work. It can provide automatic doppler-shift compensation for digital satellite work. Using our new F-Trak feature it can also slave the uplink radio frequency to the downlink radio’s frequency. The **Tuner** is compatible with most rigs including Yaesu, Kenwood, and Icom. It controls your radio thru its serial computer port (if present) or through the radio’s up/down mic-click interface.

The **Kansas City Tracker** and **Tuner** include custom serial interfaces and do not use your computer’s valuable COMM ports. The software runs in your PC’s “spare time,” letting you run other programs at the same time.

The **Kansas City Tracker** and **Tuner** programs are “Terminate-and-Stay-Resident” programs that attach themselves to DOS and disappear. You can run other DOS programs while your antenna tracks its target and your radios are tuned under computer control. This unique feature is especially useful for digital satellite work; a communications program like PROCOMM can be run while the PC aims your antennas and tunes your radios in its spare time. Status pop-up windows allow the user to review and change current and upcoming radio and antenna parameters. The **KC Tracker** is compatible with DOS 2.00 or higher and will run under DESQVIEW.

### Satellite and EME Work

The **Kansas City Tracker** and **Kansas City Tuner** are fully compatible with AMSAT’s QUIKTRAK (3.2) and with Silicon Solution’s GRAFTRAK (2.0). These programs can be used to load the **Kansas City Tracker**'s tables with more than 50 satellite passes. We also supply assembled & tested TAPR PSK modems with cases and 110v power supplies.

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AMSAT-OSCAR-13 is providing hams all over the world with satellite activity only dreamed of during the seventies. Its high apogee (point of orbit farthest from the earth) is now drifting northward, revealing the potential for great DX. When the satellite’s position is favorable, stations in Europe and Asia can work each other. This should be true of most of the northern hemisphere by 1993.

The maps of groundtracks forecasting future orbital characteristics into the 1990s, that appeared in the September column, need to be modified. When the satellite controllers of AMSAT-DL (W. Germany) raised the perigee (point of orbit closest to the earth) to 2645 km, they also affected the date on which the satellite will achieve its most northern apogee. Orbital plots show this to be about five years from now. Causing it to take ten years for the orbit to again have apogee over the equator. The general appearance of the groundtracks as seen in the September column will not change, just the dates associated with the maps.

Simply, The Best

This satellite, A-O-13, is the greatest accomplishment of the amateur satellite program. It achieved the orbit envisioned by its designers over a decade ago and most of the onboard systems perform flawlessly. Some concern still exists with the temperature sensitivity of the RUDAK packet radio experiment and the desense to the Mode L 23-cm uplink band by terrestrial radar, but as many hams have discovered, activity via A-O-13 is fantastic. Weekend activity via Mode B (70 cm up and two meters down) sounds like 20 meters with good band conditions.

In addition to typical one-on-one QSO’s, other activities are beginning to appear in the passband. Nets and contests have been announced.

AMSAT nets have been active on Friday nights on both Modes B and L. Since the satellite is not always in a favorable position at the same time every week, these nets aren’t easily scheduled. Check the AMSAT bulletins via packet networks, the bulletins on the 75-meter and 20-meter nets, and the Amateur Satellite Report for times and frequencies. Those interested should also check into the Space Education Net, held every Saturday. Again, check AMSAT sources for more information.

Contesting

The first contest to be announced for the hamsat community is a continuation of a program started on AMSAT-OSCAR-10 several years ago. It is the K2ZRO Memorial Station Engineering Award program. In this test of operating skill and equipment performance, a control station sends and repeats numeric code groups at different power levels. The satellite operators measure the receive sensitivity of their satellite station for comparison with other participants. Those who can copy the satellite’s beacon can get started in this program.

The challenge of this program comes when the satellite enthusiast pursues endorsement stickers for station improvements on both Mode B and L reception. While the first code group is sent at beacon level, the power uplink is dropped by three dB, cut in half for the next. Subsequent levels are sent three dB down from the previous one until a level is sent causing it to be so low in power that the noise floor of the transponder enters into the equation. The ZRO Test, as it is commonly called, is the best opportunity to test system performance. For more information on this activity, send an SASE to me with two units (45 cents) of postage on a #10 (business size) envelope. Be sure to mark your request “ZRO brochure.”

Other activities are in the works. The SATFOX hunt will offer a satellite-based foxhunt unlike any other transmitter hunt here on earth. Participants must use Doppler calculations and other measurements to determine the location of a terrestrial transmitter uplinking through the satellite.

Keep In Touch With The Times

Operating times for satellite activity change seasonally. The orientation of the spacecraft with relation to the earth is constantly modified for optimum sun angle. Unlike A-O-10 which can no longer be controlled due to memory loss, A-O-13’s on-board computer is programmed to keep the satellite’s solar array aimed at the sun. This causes the aiming of the satellite antennas to change, thus different portions of the orbit yield the best operating times for Modes L and S (70 cm up and 13 cm down), which have highly directional helix antennas. The satellite controllers here and overseas also program the computer to turn on the directional modes, when the satellite’s antennas favor the earth. In late September the first schedule changes due to “offpointing” went into effect. Check the nets and ASR for updates.

Mucho Dinero

OSCAR 13 was not cheap, straining the financial resources of AMSAT-DL and AMSAT-NA (North America). Both organizations have many new ideas and projects that must wait until adequate funding can offset the huge expense incurred by OSCAR 13. Estimates of A-O-13’s value range from $250,000 to $750,000. A commercial or military satellite of the same caliber could cost as much as 10 to 20 million.

That $250,000 estimate doesn’t include many expenses due to travel, transport, licensing, insurance, and launch-related costs. It also assumes that surplus equipment from A-O-10’s development was used. The transponders in A-O-13 are the flight spares from A-O-10.

Although the ride to space was free, terrestrial transportation of the spacecraft was not. Just sending the satellite across the ocean a few times cost $20,000. Long before launch, A-O-13 had seen several countries on three continents. There were also travel expenses for the specialists involved in satellite construction.

AMSAT received very good rates for insurance. The premium was about 12 percent. AMSAT-DL and AMSAT-NA split the nearly $300,000 cost of covering a nomi-
Shifts in weather and computer programs are important during early evening. During the early evening hours, and skip on the A.Q (10) in useful charts, early winter atmosphere density went to zero during Phase 3A was built during come on the 10-20 meter bands. Sea level pressure at a site with the four Micosats in late 1989. The actual date could be as early as January, 1989. AMSAT Director Tom Clark's W31WI reports that a structural model of a Micosat was subjected to flight vibration qualification tests in late August. It passed at 14G with no problems. The idea for Micosat-style sizer and the fourth is a CCM (charge-coupled device) camera experiment. Last month's 'Ham sat' column reported a launch of the four Micosats in late 1989. The actual date could be as early as January, 1989. AMSAT Director Tom Clark's W31WI reports that a structural model of a Micosat was subjected to flight vibration qualification tests in late August. It passed at 14G with no problems. The idea for Micosat-style packet-radio satellites first came up in early 1982, just after the first ARRL Networking Conference. This type of satellite would provide non-real-time worldwide communications using digital store-and-forward techniques via low-earth-orbit satellites. Today, Fujii-OSCAR-12 is an example of the type of communication system anticipated for the packet Micosats. Uplink and downlink formats would be nearly identical with Mode J operation using 1200 baud FM up with PSK (Phase Shift Keying) down. In late 1987 the mechanics of the basic Microsat structure went from the ideas of premier satellite builders Jan King W3GEY and Gordon Hardman K3ED, to a fully-documented set of designs by Dick Jansson W34FAB. The complete structure uses five 8" square module trays, 1.6" thick, stacked to create the inner satellite frame. A packet Microsat would include modules for receivers, batteries, the CPU (central processing unit), memory, and a transmitter. The CCD camera experiment could use some of the parts, but would also include a camera. The individual modules connect to the system via high reliability DB-25 connectors. In early October, three papers concerning the Micosat Program were presented to the 7th ARRL Networking Conference. Tom Clark's paper gave an overview of the projects' goals. Another by Lyle Johnson W47GD and Chuck Green N8ADI described the flight CPU for the Micosat. Harold Price K6K and Bob McGwier N4HY presented the third paper with a description of the multi-tasking software that will be used to control the onboard systems. For complete details of the inner workings of the Micosat program from AMSAT-NA, get a copy of the conference proceedings published by the ARRL. In just a few months the first group of Micosats could be in orbit. Thanks to design simplicity, many more Microsats could easily be built on short notice for future launch opportunities.

Number 19 on your Feedback Card

Propagation

by Jim Gray W1XU

Jim Gray W1XU
PO Box 1079
Payson, AZ 85541

November 1988

DX conditions for November are expected to be quite good on all HF bands. The general rule is to listen to the east of your location between 10 AM and 2 PM local time on the 10–20 meter bands. As the earth rotates and the sun moves westward, skip conditions gradually move west with the sun. Between 4 PM and 6 PM local time, expect to hear stations to the west of your location. On the bands between 10 and 30 meters, look for excellent Pacific DX in the lamplight hour and early evening. On the very good days when the magnetic field is quiet and the solar flux is high ("A" factor below 5 and "SF" factor above 135) expect to hear DX stations to the west of your location up until about 10 PM local time.

Early morning hours just before, just after, or at sunrise are the best times to work Pacific and fall DX (because of fewer daylight hours), you will still find many good openings and opportunities this month.

Using the charts in conjunction with WWV transmission at 18 minutes after each hour is quite simple: record the Magnetic Field index (A) and the Solar Flux value for the time of day you listen. The values are usually updated every several hours or so.

Look for trends as well as values. Trends are given when WWV reports solar activity (low, moderate, or high) for the last 24 hours and expected values for the next 24 hours. It also reports geomagnetic field activity (quiet, unsettled, active) for the same periods. The best time to operate is when the geomagnetic field is Quiet and the Solar Flux is High.

In November, only 25–50% of the days will be good DX days. Use the daily calendar to note Good, Fair, or Poor (G,F,P) indications. Do not believe implicitly in the daily forecast, as Mother Nature always has a way of fooling the prognosticators. Historically, our forecasts have proven correct 75–80% of the time. At best, they are guides rather than rules. Remember that geophysical conditions are ever-changing, and that the most fun (and frustration, too) often occur at unexpected times.

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The Nye-Viking MB-V-A 3000 Watt Antenna Matcher

A solid easy-to-use tuner.

A tuner is a tuner is a tuner. Right? Wrong! The transmitter or linear amplifier may be happiest when looking into a 50Ω resistive load, but most real-world antenna systems don’t provide this. One of the big measures of tuner quality is its ability to create an acceptable load from a variety of antenna systems.

In 1984 I found myself with a six-slinky dipole, three to a side, fed in the center with a 450Ω ladder line. The 4:1 balun handled high power, and the wire loaded up anywhere from 1800 kHz to 29.9 MHz. The biggest problem with RF was on 40 meters. When I loaded up a new amplifier, the next thing heard, seen, and smelled was the RF ammeter frying away in the Maxwell Transmatch.

Considering the replacement of antenna matchers, I debated whether or not to build my own. After perusing blurbs of various flavors of antenna matchers, I took my chances and ordered an MB-V-A. The unit arrived in several days, in superlative packing. It could have been parachutted into New Hampshire without denting the merchandise.

Immediately upon arrival, I removed all the covers to see what the guts were like. Very impressive. I had no trouble believing the claimed rating of 3000 watts.

Six Features of the Nye MB-V-A

The components of the MB-V-A are different from other matchers I’ve inspected. First, the roller inductor is constructed by using an air-wound form, with the roller situated on the inside of the coil form, hanging on an arm which is rotated at the front end by a gear-driven assembly. This makes the roller turn faster than the hand crank. Whereas other roller inductors I’ve dealt with developed considerable momentum when spinning, this design is instantly controllable and easy to spin. The gear assembly affords some drag so that it doesn’t feel cheesy. The control knob and associated planetary escutcheon on the front panel is calibrated completely around, and is of wide enough resolution to permit easy recognition and subsequent relocation when tuning up on the same frequency. The spinner knob is huge (2¾” in diameter), with an easily operated spin attachment (¾” by ½”) on the front—great for guys like me with big hands. The skirt on the knob has a white line for easy resetting by noting where it lands at resonance.

Second, the variable tuning capacitor looks big enough to see service in broadcast equipment! Having experienced the syndrome of not enough plate separation in past days of building (I wondered what was being arc-welded when the RF jumped), I was overjoyed to find that Nye didn’t skimp on their capacitors. The diameter of the entire variable, when fully unmeshed, approaches six inches, and is a good seven inches from front to back. The bearings are pre-lubed, and have a good feel when going around. They are driven by the 2-½ control knob on the front panel. The panel itself has a good bushing, so there’s no side play on the shaft—something that happens with flexible insulated shaft couplings. The escutcheon is calibrated completely around, with two scales going from zero to one hundred in opposite directions. This enables the user to register and duplicate settings on both rotational segments of the variable capacitor. The black phenolic control knob has a white line on the skirt, immediately above the zero escutcheon dial registration, for easy placement of the dial’s position when hunting for a number in a hurry.

Third, the tuner affords four values of fixed capacitance, above that offered by the variable itself, that may be switched in or out. As the manual states, there are “five different amounts of parallel capacity” available for the operator’s use. The sections of fixed, high-voltage capacitors provide 160 picofarads each, and are switched by an interlocking arrangement controlled by four pushbuttons in the middle of the lower panel. This pushbutton system is extremely hefty, and from the looks and feel of it, will provide years of trouble-free service. The sections of fixed capacitance are shunted in and out of the tuning circuit by this mechanism, and the switch contacts themselves are silver-plated and spring-loaded.

Although the Nye Company expressly advises against hot-switching these capacitances in and out, I feel they are covering their equipment’s protracted serviceability, especially for the types out there who would switch stuff in the RF output line at full power. Maybe five or so watts would be no problem, or even 500 by the looks of the switch gear, but I’ll accept their recommendation anyway, and shut down when I fool with the buttons.

Fourth, the antenna switching arrangements found on the front panel are marvelous for tuning up. The five buttons are arranged as A direct, 2nd A, B, C, and D through the MB-V-A. The corresponding connectors on the rear apron are denoted A, B, C, and D. This feature allows the operator to access a dummy load by just pressing a front panel control, which bypasses the internal circuitry of the tuner. So tune up the exciter and linear, and then switch in the antenna system to a radio that’s looking for a 50Ω non-reactive load. And do it with one button. That’s great. The switches connect to the rear apron in the following manner:

“A” is direct through, and appears on a UHF-type SO-239 panel connector.

“A, MB-V-A” uses the tuner circuitry in the above rear apron connection.

“B” through the tuner circuitry, appears on another UHF-type SO-239 panel connector.
Most of us soon tire of a rubber duck’s marginal performance. Too often we are unable to work through a favorite repeater from certain locations in the neighborhood. Also, it’s nice to more frequently be able carry on conversations in the low power mode rather than in the battery draining high power position. If so, then Orion Hi-Tech may have the solution to your problems.

The Orion 146 MHz half wave antenna is specifically designed for handheld talkies. Finished in shiny chrome and equipped with a standard BNC connector to attach to your HT, this telescoping antenna measures nearly 42¾" long when fully extended. When collapsed for storage, its length is a more manageable 8¼". For comparison, the rubber duckie that came on my Kenwood TR-2500 is just over 7" in length. No doubt about it, the Orion is a large antenna when mounted on a handle talkie, making it essentially a rigid antenna.

With the Orion’s big size comes big performance. I did not attempt to measure the gain of this antenna. An HT half wave antenna design, however, generally has about 6 dB gain over a standard rubber duckie. Signals that were marginal to unreadable became easy copy when I replaced my stock HT antenna with the fully extended Orion. With the Orion in place, I was able to work stations who otherwise found my signal to be too “scratchy” when using the rubber duckie.

What are the drawbacks? The large size is an obvious factor. The antenna collapses to a size that is slightly longer than a standard rubber duckie, but it is not functional in that configuration. It is also rigid rather than flexible. The Orion half wave is no different from similar antennas offered by other manufacturers in this regard. The connector and the antenna are essentially one piece. Orion Hi-Tech may want to consider using a double spring BNC connector on the antenna for added flex. Exercise care when using any antenna of this size when mounted on an HT.

The Orion Hi-Tech half wave antenna is specified to handle 10 watts with a 10 MHz bandwidth, which should be more than adequate for all 2 meter HTs. It carries a 90 day guarantee. In addition to this half wave HT model, Orion Hi-Tech manufacturers a full line of other antennas.
New Products
Compiled by Linda Reneau

PRODUCT OF THE MONTH

UNIDEN CORPORATION OF AMERICA

Uniden's President HR·2510 Mobile 10 Meter Transceiver covers the 10 meter band from 26 to 29.7 MHz. You can operate on CW, AM, FM, and both sidebands, and choose steps of 10 or 1 kHz, or 100 Hz. Other features include preprogrammed 10 kHz channels, backlit LCD display, receive scanning capability, microphone with channel up/down select, frequency lock, auto squelch, noise blanker, RIT, and RF gain control. Ports to hook up key and external speaker. You can check your transmit power, received signal strength, modulation, SWR calibration, and SWR with the multi-function LCD meter. Suggested list price through distributors is $400. For more information, contact Uniden Corporation of America, 4700 Amon Carter Blvd., Ft. Worth TX 76155; 817-858-3300. Circle Reader Service number 201.

ELECTRON PROCESSING, INC.

The SHMAGUE, new from Electron Processing, Inc., is a sensitive audio signal tracer that picks up a current's magnetic field. By holding the SHMAGUE's wand near an object, you can listen to these signals without electrically or physically contacting them. Besides tracing audio signals on PC boards, you can safely identify AC power lines. The SHMAGUE comes in a 5.3" x 4" x 1.5" housing. The magnetic wand is connected via a six-foot cable. Powered by a nine volt battery, and complete with internal speaker and volume control, the SHMAGUE is portable. A phono jack is provided for your scope or counter. Pricing starts at $60 with quantity discounts. Electron Processing, Inc., PO Box 708, Medford NY 11763. Sales Department, 516-764-9798. Circle Reader Service number 203.

INTERNATIONAL RADIO INC.

International Radio Inc. announces the IRI Tuning Upgrader which comes in three models for the TS-440, the TS-940, and the TS-930. The Tuning Upgrader lets you fine-tune incoming stations with ease, yet also move across the bands in seconds. Uses low-power CMOS circuitry. Has a speed indicator LED. Comes with clear instructions for installation. Correctly installed, the IRI Tuning Upgrader will not void your Kenwood warranty. If you do not wish to do the installation yourself, International Radio can do it for $22.50 plus shipping. Each model is $34.95 plus $5 postage. Specify TU-440-541, TU-940-539, TU-930-540. International Radio Inc., 751 South Macedo Blvd., Port St. Lucie FL 34983; 407-872-6868. Circle Reader Service number 213.

ACE COMMUNICATIONS

Ace Communications, a subsidiary of AOR, Ltd. of Tokyo, announces a 100 channel hand-held receiver that offers complete public service band coverage. It is 5¾" x 2½" x 1¾" and weighs 12 ounces. Frequency coverage is 27-54 MHz, 108-174 MHz, 406-512 MHz, and 830-950 MHz. This covers all police, fire, and emergency bands, plus the new services above 800 MHz. Frequency stepping increments are 12.5, 26, and 30 kHz. The AR-900 has twenty-five front panel keys, five banks of twenty programmable channels each, pairs of upper and lower limits for program scan, and five search memory locations. All information is stored in three permanent memories that retain their contents even after the batteries are disconnected. Antenna connects via a BNC connector. Extra features include first channel priority, keyboard lock-out, and a blue-green display backlight for night use. The LCD display offers 22 prompting annunciators. Price is $299. For more information, contact ACE Communications, Monitor Division, 10707 East 106th Street, Indianapolis IN 46256; 317-842-7115. FAX 317-849-8794. Circle Reader Service number 202.

CREATIVE CONTROL PRODUCTS

The UAI-10 Universal Repeater/Link Audio Interface board from Creative Control Products features DTMF Mute and link Monitor-Mix adjustable control. Audio inputs consist of repeater, link, control receiver, CW/Tone, and an auxiliary input for other audio sources. Audio outputs consist of repeater, link, and DTMF output for the DTMF decoder. Control inputs to the UAI-10 consist of +8-15 VDC, repeater COS (high or low selectable), DTMF mute, and auxiliary output from your controller for the link mute function. A jumper comes with the UAI-10 to enable you to mute or pass DTMF tones out the link transmit audio. Introductory price, $44. Creative Control Products, 3185 Bunting Ave., Grand Junction CO 81504; 303-434-9405. Circle Reader Service number 204.

Number 22 on your Feedback card

64 73 Amateur Radio • November, 1988
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CIRCLE 337 ON READER SERVICE CARD

73 Amateur Radio • November, 1988 65
G AND G ELECTRONICS OF MARYLAND

Various products formerly manufactured by Microlog are now available from G and G Electronics of Maryland. The ART-1, AIR-1, and AIR-1 software are among these products. The SWL allows you to copy worldwide shortwave radio signals on your C-64/128. The SWL alone is $64. The AIR-DOS disk, which allows you to save data, is $15. The MORSE COACH is $49.95. Package price is $99.95. G and G Electronics of Maryland, 8524 Dakota Drive, Gaithersburg MD 20877; 301-258-7373. Circle Reader Service number 216.

AMERICAN RELIANCE INC.

The AR-6400P Automatic Cable Tester from American Reliance, Inc., tests cables and wire assemblies of up to 128 test points, and it is expandable to a total test capability of 512 test points by the addition of plug-in I/O boards. It has a built-in parallel printer port, cable included, so that it can print test results and lists of wire. The AR-6400P sells for $995. The 6401FX Universal Test Fixture is available as an option for $100. Connectors on the fixture include two each of 9, 15, 25, and 36 pin "D" types, and 37 and 50 pin Centronics types. American Reliance Inc., 9241 E. Valley Blvd., Rosemead CA 91770; 818-287-8400. Circle Reader Service number 209.

L.L. GRACE COMMUNICATIONS PRODUCTS

The Kansas City Tracker, from L.L. Grace Communications Products, is an interface card and software package that plugs into the I/O bus of an IBM or compatible, and connects to your elevation-azimuth or azimuth-only rotor control box. It can control the Yaesu/Kenpro 5400A/B and 5600A/B Az-EI rotors, or it can connect to other rotor controllers with the Rotor Interface option.

The Kansas City Tuner compensates for a satellite's Doppler shift. It can interface to ICOM, Kenwood, or Yaesu radios through the serial port or mike-click inputs. The KC Tuner can tune both links simultaneously.

From Electronic Specialists, Inc., come the "Pocket Protectors" for portable computer protection. The AC Power Pocket Protector (LTP-101) combines filtering and spike/surge protection at 39,000 surge amp suppression.

The Modem Pocket Protector (LTP-201) combines multi-element spike suppression with RF filtering and balun noise filtering. Each unit fits neatly inside a pocket. Price of the LTP-101 is $65, and the LTP-201 is $46. Electronic Specialists, Inc., 171 South Main Street, Natick MA 01760; 800-225-4876 or 617-655-1532. Circle Reader Service number 207.

A & A ENGINEERING

Now among the many electronics kits and assemblies A & A Engineering has to offer, is the Digicom>64 by Barry N. Kutner, M.D., W2UP (see his article in the August 1988 issue of 73). The Digicom>64 is a software-based packet radio system for the Commodore 64 which emulates the functions of a TNC. The PCB only is $10.65; the PCB and disk, $14.95; the kit with PCB and disk, $49.95; assembled board, $79.95; and disk only, $6. A & A Engineering, 2521 W. La Palma, Unit K, Anaheim CA 92801; 714-952-2114. Stan J. Andrzejewski W6UCM, President. Circle Reader Service number 215.

L.L. GRACE COMMUNICATIONS PRODUCTS

The KC Tracker and Tuner can accept orbital positioning information from either GráfTrak or QuikTrak. Software is Terminate-And-Stay-Resident (you can run other programs while your antennas and radios are controlled), and includes programs for automating PBBS antenna aiming to a user-defined azimuth and time. Vision-impaired users will appreciate the built-in Morse code sender that can announce rotor positions and satellite-pass status. L.L. Grace Communications Products, 41 Acadia, Voorhees NJ 08043; 609-751-1018. CompuServe 72577,1107. Circle Reader Service number 210.

ELECTRONIC SPECIALISTS, INC.

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**TECH TIPS**

Non-Liquid Fix for the C-64 Stutter

With all respect to Bill Clarke WA4BLC, I believe I have improved, on his suggestion, about the best way to fix the Commodore 64 with a stutter problem.

As Clarke mentioned in his article (73 Magazine, July 1986), the C-64 has become a fixture around the ham shack. It serves such important purposes as word processing, logging, QSL design, and RTTY communications. Such a hardworking, useful instrument is bound to experience the occasional service problem, and one of the most common is the missed or repeated character.

The problem is the contacts under the keyboard develop a nonconductive coating that causes the stutter malady. The results take different forms, but they are usually aggravatingly apparent in embarrassing typographical errors on RTTY, or frequent use of the delete key in word processing.

**“Remember the Golden Rule—keep water away from electrical circuits.”**

To remedy the situation, Clarke suggests the use of a mildly abrasive bathtub cleaner. Remembering my electrical basics, it goes against my grain to coat a circuit board with a liquid solution that is also an excellent conductor. Remember the Golden Rule of keeping water in all forms away from electrical circuits? So when I developed a similar problem with my C-64, I started looking for an alternative fix.

I followed Clarke’s instructions about removing the three screws on the bottom, disconnecting the plugs and wires to the keyboard, and unscrewing the 23 tiny screws that hold the keyboard together. Carefully lifting the circuit board, I turned it over to reveal the green side with the contact points that require cleaning to fix the problem.

Here is where Clarke and I differ. Rather than taking a wet approach, my fix involves using a very dry pencil eraser in the same way used to remove pencil marks from paper. I recommend a Pentel Clic Eraser, which is a white, pencil-shaped eraser in a plastic holder. It is easily found at most office supply outlets. The eraser works so well on pencil mistakes (like they were never there), that I suspected it would clean the circuit board quite well, too. Guess what? It does the job perfectly, quickly and keeps the board away from the kitchen sink and possible short circuits.

By rubbing the eraser over the shiny contacts on the circuit board, and after the keyboard is reassembled, it will work as good as new.

So enjoy using the C-64 in all of its many versatile applications in the ham shack. And if and when the keyboard develops the stutter problem, feel confident that the user knows what caused it and how to fix it. Also remember that this has probably saved the user $30 to $100, for the technician repair cost, each time it is performed.

**ERRATA**

**Welcome Newcomers**

Refer to the October 1988 issue, page 4. Look in the “Glossary” for the definition of frequency. Frequency is measured in cycles per second. One cycle per second is called one Hertz (Hz). Frequency is not “given in meters per second, commonly termed Hertz.”

Also, refer to the definition of the electromagnetic wave spectrum on the same page and in the same section of the October issue. The last line should read that the microwave portion of the spectrum is typically set at “...1,000–300,000 million cycles/second...” The word “million” was left out—which makes quite a difference!

**Antenna Systems—September 1988**

A minor typographical error in this article by John Lawson W3ZC, on page 11 pp10, operator j is incorrectly identified as the “square root” of 1, and, unfortunately, appears quite often in engineering.** The square root of 1 is obviously still 1. Operator j is actually the square root of MINUS 1, and as it is physically impossible to quantify a square root as a negative number, it is properly referred to as an “imaginary number”.

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We’ve had so many phone calls from people wanting our famous 73 code tapes that we’ve decided to bring them back! Isn’t it about time you dust off that keyer and sharpen up your code skills? Order now...

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**”The Stickler”**

6+ wpm—This is the practice tape for those who survived the 5 wpm tape, and it’s also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

**”Back Breaker”**

13+ wpm—Code groups again, at a brisk 13+ wpm so you’ll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language at only 13 per. You’ll need this extra margin to overcome the sheer panic universal in most test situations. You’ve come this far, so don’t get code shy now!

**”Courageous”**

20+ wpm—Congratulations! Okay, the challenge of code is what’s gotten you this far, so don’t quit now. Go for the Extra class license. We send the code faster than 20 per. It’s like wearing lead weights on your feet when you run; you’ll wonder why the examiner is sending so slowly!

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- The Stickler $6.95
- Back Breaker $6.95
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Packet radios are specifically intended for use in remote, unattended applications for long-term service. Compatible with any digital format, they turn around transient to receive and retransmit in less than a millisecond while holding keying transients within the channel. A digital sampling AFC tracks transmitted signals in frequency to maintain low error rates over long periods of time. In addition, they chose crystal oscillators and temperature-compensated circuitry for reliable operation at unattended sites.

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- RF data antenna switching
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- Provides both 120 and 24VDC
- Complete with all applicable sections of Part 15 FCC Rules.

SPECIFICATIONS:
- Data rate: 0 - 19,200 baud
- Digital format: any format incl. NRZ and NRZI
- Receiver sensitivity: 20mV, 200kHz at 10dBm
- Rx bandwidth: 30kHz
- Transmit power output: 2W min.
- Frequency: 3.5 to 5.5 MHz
- Power supply: 12VDC

Digital telemetry: 9.6 v/s for 1 beep/1 Hz
Squelch response time: 1s
Squelch output: 40 dBc, max
Power supply: 12VDC
Operating temperature range: -30 to +50 degrees C
Antenna connector: BNC
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Dx

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DXing on 160 Meters

Contacts that are routine on 15 or 20 meters can range from difficult to impossible on Top Band. Yet despite the obstacles (or perhaps because of them), hundreds of DXers have worked more than 100 countries on the band, enough to qualify them for the first single-band DXCC award: 160-meter DXCC.

Antennas For 160 Meter DXing

Far more than on other bands, the antenna for 160 meters can make or break a DX contact. Unfortunately, the simplest antennas to put up are the least effective for 160-meter DXing. Specifically, tying the feeders of an 80-meter antenna together and operating through a tuner will produce an antenna that emphasizes local, rather than DX contacts. Similarly, a low dipole or inverted-Vee makes a poor DX antenna on Top Band. An antenna design that works fine on higher bands is often a marginal performer on Top Band, because a horizontal antenna should be at least one wavelength in the air for the best DX. On Top Band, that’s more than 500 feet high!

The beginning 160-meter DXer can make contacts with a loop, inverted-Vee, or half-wave sloper, especially if the apex of the antenna is 80 feet or more in the air. Hanging a full-wave loop off the tower is one of the simplest approaches to a 160-meter DX antenna.

If the DXer already has a tower or other tall support, however, an inverted-Ell or Tee antenna is much more effective than low loops. Construction of an inverted-Ell is simple: run a wire from the ground to near the top of the tower, and then out horizontally as far as necessary to resonate on 160. The longer the vertical portion of the antenna, the better it will work for DX. With two high supports (such as suitably spaced trees), a Tee antenna is often very effective. In either case, a simple tuning network can lower the input impedance of the antenna to near 50 ohms. Both antennas require good-to-excellent ground systems to work well, a factor often overlooked by DXers.

By far the best antenna for 160-meter DXing is a vertical with a good ground. Since few amateurs can erect a 130-foot, quarter-wave vertical, some type of shortened antenna is the norm. Shunt-feeding an existing tower, or loading short verticals are typical approaches to DX-transmitting antennas, especially if operated against a good ground system. The enterprising Kansas City (MO) DX Club once used helium balloons to support their 128-foot vertical!

What constitutes a good ground? A salt-water marsh, 132 ¼-wave radials, or a copper plate 250 feet in diameter, work well. The 160-meter DXer will more likely put down as many radials, as long as possible, and hope for the best. One top-bandner has buried old washing machines, refrigerators, and more than 5 miles of elevator cable under his vertical!

Receiving Antennas and Noise

Unfortunately, the best antennas for transmitting on 160 meters are among the worst for receiving. Vertical antennas concentrate much of their radiation in low angles for best DX, but they are also very susceptible to noise. QRN is often the limiting factor in top-band DXing, so most 160-meter DXers erect separate antennas for receiving.

The best antennas for receiving DX on 160 meters are terrible antennas for transmitting: beverages and small loops. Either of these antennas will be as much as 50–60 dB worse than a dipole, so they are useless as transmitting antennas. The good news is that they receive noise even worse than they receive DX signals, so they produce a higher signal-to-noise ratio than other antennas.

For DXers with access to lots of real estate, the beverage antenna works very well. Active Top Band W8HAD runs three 1000-foot wires out over his farm after harvest every fall, and rolls them up in the spring before planting season. The beverage can be as simple as a long wire stretched out in the desired direction. Terminating the beverage with a resistor to ground at the far end will make the antenna unidirectional, but most DXers omit the terminating resistor, and live with the bidirectional characteristics of the beverage. The beverage will work even if it must bend around houses, is stuck in a gutter, or run along fence posts. The important thing is total length (at least a few hundred feet), and some sort of matching and amplification system at the receiver end.

“But far the best antenna for 160-meter DXing is a vertical with a good ground.”

To get maximum performance from a beverage, the Top Band DXer should make a small 9:1 impedance matching transformer out of a ferrite ring, and use a preamplifier to boost the very weak signal levels. The DXer must also make some arrangement that prevents accidental transmission into the receiving antenna, or be prepared to buy a lot of replacement preamps. Using the separate receiving antenna jack on the rig (or modifying the rig for such a jack) is the best bet. If the DXer takes the simple approach of installing a separate switch to change antennas between transmit and receive, he will transmit into the wrong antenna while calling some rare DX, with disastrous results.

Space-restricted DXers can resort to a small loop antenna. By rotating the loop, the DXer can reduce much of the noise that would otherwise mask weak DX signals. Hint: try tilting the loop, as well as rotating it, for minimum noise. As with the beverage, some means of impedance matching, preamplification, and receive/transmit antenna selection are essential for best performance.

Finding and Working DX

One of the frustrating aspects of 160-meter DXing is that not all countries allocate the band to amateurs. With Loran-C use declining in the US, the stateside hams have access to more of the band, and fewer power restrictions, but other countries still use the frequency range for radio location, and discourage or prohibit amateur use of the band. Among the countries with no 160-meter amateur operation are Lebanon, Liberia, and Morocco. Up-to-date allocation data is available free from IARU Headquarters (c/o ARRL), or for $4 from N7CKD.

Because many countries restrict Top Band amateurs, much DXing is done with wide splits. The DX stations transmit in the 1825–30 kHz range, and listen near the bottom of the band: 1800–1810 kHz. This split is too wide for most RIT controls, so the 160-meter DXer needs a second VFO or other means for using wide splits. Unfortunately, many local ragchewers hover around this “DX window,” often covering up the DX stations.

Some Asian countries (notably Japan) restrict their amateurs to a narrow “window” high in the band, typically 1900–1912 kHz. Again, these stations listen for contacts near the bottom of the band.

During the daytime, high absorption limits 160-meter contacts to a few hundred miles at best. Serious DXing on Top Band is a nighttime activity, with DXing often improving as the night wears on and man-made noise sources are turned off. Even at night, absorption limits DX, especially over the noisy polar path. The best times for 160-meter DXing are the long nights in the middle of the winter, when the absorption is extremely low. The bottom of the sunspot cycle provides the best DX opportunities, thanks to lower absorption.

Gray-line propagation provides a big boost to weak 160-meter signals. The Top Band DXer looks for DX to the east at his local sunset, and to the west at local sunrise. He also has access to sunrise/sunset times for other countries. The best time to work European DX is sunrise in Europe, for example.

Many active Top Band DXers spend much of their operating time on higher bands, especially 20 meters, talking to DX stations about getting on 160 meters, and arranging schedules. “When are you going to be on 160?” is a frequent question directed at DXpeditioners, for example.

DXing on Top Band is a challenge, and the casual operator will soon tire of the static crashes, incessant noise, the local ragchewers transmitting on top of rare DX, and the hams themselves. But for the dedicated DXer, 160 meters offers many rewards and satisfactions. Try it this winter!
Going Horizontal

When someone talks of going mobile with their VHF or UHF rig, what does that bring to mind? For many hams it implies FM and repeaters, with a ¼- or ½-wave vertical antenna secured to their vehicle’s roof with a mag mount. To them, 2 meters is synonymous with FM. Though repeater operation may be fun, there is more to the world of mobile operation at VHF and above than autopatches and squelch tails. What I am referring to, of course, is SSB (and even CW)!

If you never tried working SSB on 2m while mobile, you may be wondering why anyone in their right mind would forsake the vast network of repeaters that exists in this country, and attempt to work other stations directly. One reason is that, under weak signal conditions, sideband has a considerable signal-to-noise ratio advantage over FM. With enhanced conditions, the folks on FM may be commenting that the signal from the repeater seems just a bit stronger today, while a couple of MHz away SSB operators may be working stations several states distant. Sound like fun? It is!

A Catch

If you want to try operating from a mobile on VHF SSB, be aware that it may not be quite as simple as flipping a switch from FM to USB on the multimode transceiver. While FM repeater operation is universally vertically polarized, most base stations on the narrow-bandwidth modes use horizontal polarization. Simply going from FM to SSB without changing the form of the feed to the antenna brings in several types of antennas that are relatively omni-directional, and yet are horizontally polarized. These antennas are adaptable for mobile use, are easy to build, and can be designed for any of our VHF/UHF bands. This month’s column focusses on four examples of such antennas.

"20-dB is a lot of signal strength to give up."

"X" Marks The Spot

A schematic diagram of the turnstile antenna appears in Figure 1. This antenna consists of two dipoles mounted at right angles to each other and fed 90 degrees out of phase. Placing a quarter-wavelength of feedline between the feedpoints of the two antennas effects the phase shift. Remember to take into account the velocity factor of the coax used for the phasing section when computing coax length.

The matching section shown in Figure 1 was designed for the 2 meter band using the short BASIC program that appeared here in the August 1988 issue. Most versions of the turnstile use a 75Ω phasing section, a 50Ω quarter-wave transformer, and a 75Ω feedline. The use of a series-section transformer allows the use of a 50Ω feedline, as shown. Photo A shows a completed turnstile. Since a car’s roof looks like a large reflector at VHF, an turnstile mounted too close to the vehicle will have most of its signal directed vertically upward, rather than toward the horizon. When possible, place this antenna (and the others described here), at least ½-wave-length above those reflective surfaces.

Heavenly Alternative

Another common VHF/UHF SSB mobile setup is the halo antenna. It appears in Figure 2. The halo is basically a half-wave dipole that is bent to form a circle (or, as shown in Photo B, a square). It is frequently fed via a gamma match. The version I built for the 2 meter band (Photo C) used a ¼" diameter gamma rod 5" long, spaced ¾" from the ¼" diameter radiator. The match’s capacitor was approximately 20 pF. The dimensions of the matching device, and the value of the series capacitor necessary to obtain a 1:1 match, will vary with the antenna’s height above ground. The above numbers
Given the high cost of materials, Leader RF signals your card be filled with some gain over a halo. See Figure 3 for the loop schematic. Feed-point impedance is reportedly about 50Ω (RSGB VHF/UHF Manual), making coaxial feed via a 1:1 balun convenient.

**Lambda Loop**

The lambda loop is similar to the halo in that both are dipoles formed into loops. The lambda loop, however, is one-wavelength in circumference, which gives it some gain over a halo. See Figure 3 for the loop schematic. Feedpoint impedance is reportedly about 50Ω (RSGB VHF/UHF Manual), making coaxial feed via a 1:1 balun convenient.

**The Big Wheel**

This antenna is certainly an attention-getter. W1FVY and W1UD developed the big wheel years ago. Its name aptly describes it—it consists of 3 one-wavelength elements bent in the manner noted in Figure 4 and connected in parallel. The result, effectively, is that the center portion of each element is a ½-wavelength radiator with a ¾-wavelength feeder. The three elements together are thus three ½-wavelength radiators in phase.

**Figure 4.** The big wheel antenna (a), with detail of one of the elements (b) and the matching sub (c). Dimensions shown are for the 2m band, but they can be scaled for operation on other frequencies.

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QTH-DX

Leon Fletcher N6HYK
274 Webster Drive
Ben Lomond CA 95005

Where Small is Great

A couple was driving across Europe. He asked, "What country are we coming to?"

She answered, "I don't know, I'll check the map."

He replied, "Don't bother, we just left it."

That chestnut, repeated often by visitors to Luxembourg (LX), is a gag that fits.

At its widest spot, Luxembourg is only 35 miles across, and from north to south, it is just 51 miles long. The speed limit on the country's motorway is 75 miles per hour.

Luxembourg, covering 996 square miles, is smaller than Rhode Island. Yet 23 other independent countries are smaller still.

Luxembourg's population is about one-third of Rhode Island's population of 367,000 inhabitants, or roughly the same as Portland, Oregon or Baton Rouge, Louisiana. Close to one-fourth of the people live in the city of Luxembourg, which has a population of 100,000, nearly the same as Durham, North Carolina or Reno, Nevada.

The complete, official name of the country may be the most regal in the world. The Grand Duchy of Luxembourg. Such dignity is appropriate.

Fairytail castles seem to be everywhere. Seventeen are listed in the nation's official tourist booklet. All of the ancient structures are open to the public. The Grand Ducal Palace, built in 1580 in the city of Luxembourg, is especially notable.

For centuries, that city was one of the strongest fortresses in the world. But between 1867 and 1883, many parts of its ancient defenses were dismantled. Still preserved, however, is the Casemates, a 14-mile network of underground passages dug through solid rock, which tourists can wander through daily from March to October.

Who Will Rule?

Despite Luxembourg's elaborate preparations to defend itself, various European powers ruled it for many years. In 57 B.C., Julius Caesar led his legions through the country. In the fifteenth century, Spain took over the land. In 1717, Austria ruled, and in 1795 France annexed it. Finally, in 1815, the Congress of Vienna granted autonomy to the country. After that, for more than a hundred years, Luxembourg declared a policy of neutrality.

But Germany ignored that position, and overran the tiny land during both World War I and World War II. In WWII, some 60,000 Luxembourg homes were destroyed in what we call "The Battle of the Bulge," and what Europeans call "The Ardennes Offense." 19,000 Americans were killed and 62,000 injured while fighting the Nazi invasion. Luxembourgers remember.

Memorials, museums, and other moments of those supreme sacrifices dot the entire country. One of the major roads leading out of the capital is named Boulevard General Patton, in honor of the American commander who led the US Third Army. The road leads to the military cemetery of Hamm, some three miles out of Luxembourg, where 5,100 American Soldiers are buried.

One of the graves is that of General George S. Patton, Jr., who died in 1945 in an auto wreck in Germany. The burial site was selected by his widow, who said, "I know George would want to lie beside the men of his Army who have fallen."

Other Luxembourg memorials to Americans who fought there include the Patton Museum in Ettelbruck, a monument in honor of the 6th US Armored Division in Heinerscheid; in Medernach, a monument to the Ninth U.S. Armored Division; and another museum in a stone chateau built in the twelfth century, in the resort town of Claireaux.

But after the tragic experiences of World War II, Luxembourgers decided on a new policy: they renounced neutrality by joining NATO. Still, the nation takes seriously and works hard to follow its motto: "Mir woelle bleiwe wat mir sin," "We want to remain what we are."

"Memorials, museums, and other moments of those supreme sacrifices dot the entire country."

Present Day

What they are, according to the New Book of World Rankings, is very near to the top of all nations in the world in several key factors. Their literacy rate is the third highest. On a per capita basis, they spend more on education than any but four other countries, rank third in the world in number of passenger cars, and tenth in number of telephones. Their homes are the seventh most spacious in the world. On a per-resident basis, Luxembourgers lead the world in production of beer and steel.

One steel company, ARBED (Acieries Reunies de Burbach-Eich-Dudelange), employs one out of every seven workers in the country. ARBED also provides one-fifth of the nation's gross national product and one-half of its exports.

Luxembourg is a land for linguists. French is the official language, with some use of English. In any case, they speak French and German. French is the language widely used in administration.

German is the literary language, used the most for commerce and the press. The everyday spoken language is Luxembourgeois, also called Letzbuesch, a mix of German, French, and Dutch. Nearly everyone also speaks French and German, and many residents speak English. In primary schools, instruction is in German; French is added in secondary schools. At the age of 12, students select between two "sections" of study: technical education or classical; if they select classical, their studies include Latin and English.

There are 369 hams licensed in Luxembourg, one for every 995 residents, close to half as many per capita as in the United States. Licensed stations include four schools, three relay stations, two scout groups, and one each for packet radio, the Police Association International, the Bavarian DX Club, and the Shack (sic) du Reise Luxembourgeois Mensdorff.

Highlights for visitors include exploring the ramps which encircle the ancient town of Vianden; watching, perhaps playing, open air chess in Remich; touring the famous rose gardens in Walferdange; sampling the country's 23 major museums; attending the strawberry and apple festivals in Steinwels; observing the international canoe competitions in Kautenbach; visiting the shooting grounds in Hesperange and Schifflange; or attending the windsurfing school in Isenborn-Lutzhauten.

Then there's sight-seeing the remains of a Roman camp in Aalburg; cross-country skiing around Perle; touring The Caves Cooperatives, which store three million liters of wine, in Wormeldange; or trying the "very mineralized waters" in Mondorf-les-Bains, which, local publicity claims, are good "for the treatment of complaints of the liver, gall bladder, stomach, and intestines, as well as rheumatism in all its forms."

Despite such variety, or maybe because of it, there are more Luxembourgers, according to The People's Almanac, living in Chicago than in Luxembourg City. 77
SPECIAL EVENTS

Ham Doings Around the World

GROVERS MILL NJ
OCT 30-31

The GE Astro Space Division ARC will operate W2JQR from 1400Z the 30th to 0200Z the 31st from the first Martian landing to commemorate the 50th anniversary of Orsen Wells' "War of the Worlds" broadcast. Suggested frequencies: CW—3.535, 7.035, 7.153, 14.035, 21.135, 28.135 MHz and phone—3.950, 7.235, 14.285, 21.355, 28.400 MHz, as operators and conditions allow. For QSL and certificate, send QSL and legal-size (for certificate) envelope to Alex Montare KA2VLP, Astro Radio Club, MS 410-1B, GE Astro Space Division, PO Box 800, Princeton, NJ 08543-0880; 609-426-3564.

MELROSE MA
NOV 1-20

The Quannapowitt Radio Association of the Boston Northern Suburbs announces its 40th Anniversary QSO Party on the above dates from 0000 UTC to 2400 UTC. Work at least one QRA member on any amateur band, and in any mode permitted by the participant's license. QRA members will identify themselves by sending "QRA." To claim the QRA 40th Anniversary Certificate, send your QSL and business-size SASE to Jerry Chetwynd WfUZK, 124 Forest St, Melrose MA 02176. Claims must be received by February 28, 1989.

HOQUIAM WA
NOV 5-6

The Grays Harbor ARC will operate from the City of Aberdeen Museum of History from 1600Z on the 5th to 2400Z on the 6th, to commemorate the 100th birthday of the city. Look for W7ZA on the lower 25 kHz of the general phone bands, on 15-60 meters, on 28.310 MHz, on the Novice portion of the 10 meter band, and on the first 25 kHz of the general CW bands. For a special QSL card, please send SASE and QSL to ARS KATAIR, Joe Ledesma, 516 6th St, Hoquiam WA 98550.

CONCORD NC
NOV 6

The Cabarrus Amateur Radio Society will hold its 10th annual Hamfest at the New National Guard Armory on 146.520 MHz AM to 6 PM. Dealer set-up at 6 AM. FCC examinations by pre-registration only. Prizes, forums, auction. Tickets, $3 in advance, $4 at door. Flea market tables, $5 each. Talk-in on 146.055—146.655. Concord Hamfest, 2015 Applegate Drive, Concord NC 28025.

AURORA IL
NOV 10

The City of Lights mini-certifcate commemorates the 5th anniversary of a Chapter of the Ten-Ten Int. Net, Inc. You may obtain the full-size certificate for $1 plus two stamps. Send your 5-year number to our new C.M. Earl Henlyn WBNYNYC, 1960 No. Marywood Ave., Aurora IL 60505.

VICTORIA AUSTRALIA
NOV 12

The Australian Ladies' Amateur Radio Association is holding a 24-hour contest on the above date from 0001 UTC to 2359 UTC. YLs working anyone. OM worked YL can only. 3.5, 7, 14, 21, and 28 MHz bands only (write for more specific information). Phone and CW Certificates awarded in nine categories, plus the Mrs. Florence McKenzie CW Trophy award. For details, contact Mrs. Marlene Perry VK3JAW, 218 Ninth St, Milford, 3500, Victoria AUSTRALIA.

MILWAUKEE WI
NOV 12

The Milwaukee Repeater Club is sponsoring the 4th annual "6.91 Forever" Fest from 8 AM to 1 PM at Serb Hall. Sellers are admitted at 7 AM. Easy access, swapfest bargains, exams. Tickets, $3, four-foot tables, $4. Talk-in on 146.91 and 146.52. To save $1 per ticket or table, send payment with permission November 5 to the Milwaukee Repeater Club, PO Box 2123, Milwaukee WI 53201. For information, call 414-444-4589 (24-hr. answering machine).

HOQUIAM WA
NOV 12-13

The Grays Harbor ARC will operate from the Tall Ship Shipyard at the Grays Harbor Historical Seaport from 1600Z the 12th to 2400Z the 13th, to commemorate the launching of the Lady Washington. Look for W7ZA on the lower 25 kHz of the general phone bands on 15-80 meters, on 28.310 MHz, in the Novice portion of the 10 meter band, and the first 25 kHz of the general CW bands. For a special QSL card, please send an SASE (#10 preferred) and QSL to ARS KATAIR, Joe Ledesma, 516 6th St, Hoquiam WA 98550.

NORTH HAVEN CT
NOV 13

The South Central Connecticut ARA is sponsoring its Hamfest and Computer Flea Market in the North Haven Park and Recreation Center on Linesly St. from 9 AM to 3 PM. Admission, $2. Tables, $12 in advance, $15 at door. Talk-in on 146.01-61. VE exams, commercial exhibits, refreshments. Wheelchair accessible. For information, contact Brad Oestreich W1ATAS at 203-265-6478 from 7 to 10 PM. Or write SCARA Flea Market, PO Box 81, North Haven CT 06473.

MELROSE MA
NOV 18

The Quannapowitt Radio Association of the Boston Northern Suburbs is celebrating its 40th Anniversary on 7 PM on the above date. Informal dinner, speakers, door prizes, and raffle. The meeting will be in the Wakefield-Lynnfield United Methodist Church in Wakefield. Talk-in on 147.075. The entire radio amateur community, spouses, and guests are welcome. Contact Jim Chetwynd WfUZK, 124 Forest St, Melrose MA 02176.

SUMTER SC
NOV 19

The Sumter Amateur Radio Association will sponsor a late fall Hamfest at the SC National Guard Armory on North Pike Road in Sumter. Activities include VE testing (bring photocopy of license), ATV seminar, indoor flea market. Handicap access. Advance tickets, $3. At door, $5. Talk-in on 147.015. Contact SARA, PO Box 193, Sumter SC 29151-0193. Or call George Mudd K4KQZ at 803-773-5053.

GRANITE CITY IL
NOV 19-20

Starting at 1800Z on the 19th, the Egyptian Radio Club W8AIU will go in search of the great Piass bird. Work W8AIU or Egyptian Radio Club member for certificate. Suggested frequencies: CW—up 50 kHz from bottom of bands; phone—lower portion of the general 80-15 meter bands; and Novice—28.428 MHz. For certificate, send large SASE to W8AIU, PO Box 562, Granite City IL 62040.

MONTGOMERY AL
NOV 19

The Montgomery ARC will host the 11th Annual Central Alabama Hamfest at the Garrett Coliseum. Free admission, free parking, and overnight RV parking with $5 night hook-up. Flea market and dealer set-up at 6 AM. Tables, $7 each. Doors open from 8 AM to 3 PM. Novice through Extra Class FCC exams. Bring a copy of current license for upgrades. Talk-in on 146.241.8 W4AP/RPT. Other local repeaters are: 70.15, 449.50/444.50, and 149.32/92 with patch. Contact Montgomery Hamfest, PO Box 3141, Montgomery AL 36109. Or call Al W4CNO at 205-272-9130. For table reservations: Jiggs KAJZA at 205-365-0380 or Fred KBAJX at 205-263-9557. For dealer information: Randy N4LZK at 205-832-4596.

RALEIGH NC
NOV 19-25

The Raleigh Amateur Radio Society club station W4DO, as W200DW, will conduct a Constitution Special Event from 0001Z on the 19th to 2359Z on the 25th on all the HF bands. On Friday the 19th, they will operate from the State Capitol. Stations checking in will receive a commemorative card embossed with the state seal and descriptive literature. Your card will be given to the North Carolina Centennial Commission to archive and display at the Tercentenary Celebration. Send #10 SASE to RARS, PO Box 17124, Raleigh NC 27619.

MASSILLON OH
NOV 20

The Massillon ARC will sponsor Auctionfest '88 at the Massillon K of C Hall on Cherry Road from 8 AM until 5 PM. Sellers set-up is at 7 AM. Admission is $3.50 in advance, and $4 at the door. Many tables are available at $7 per eight-foot space. Free parking. Advance tickets at 11 AM. Talk-in on WBNP 147.781.8. For information and registration, contact Massillon ARC, PO Box 73, Massillon OH 44648. SASE please.

GREENSBORO NC
NOV 25-27

The Mark 4 Radio Club is sponsoring its Hamfest from 9 AM to 5 PM and 9 AM to 3 PM, respectively, at the National Guard Armory. Some features are exams, Christmas craft exhibitors, paved tailgate and flea market area. Advance tickets, $4. At door, $5. Inside tables are $12 each. $2 unlimited flea market space. Talk-in on 145.250 (—0.600) if back on air, 147.030 (+0.600) backup. 146.500 simplex local. For information and registration, contact Fred Redmon N4GQD, 3109 Goodall Dr., Greensboro NC 27407; 919-852-9244 between 9 PM and 11 PM only. For tickets, contact Henry Hughes K4APLA, 2811 Gwendolyn Rd., Greensboro NC 27407; 919-252-0632. For exams, contact T.E.A.R.C., Jim Williamson N04T, 3504 Stonehurst Place, High Point NC 27260; 919-889-0637.
KRP-5000 REPEATER

Word is spreading fast. "Nothing matches the KRP-5000 for total performance and value. Not GE, not even Motorex." RF performance really counts in tough repeater environments, so the KRP-5000 receiver gives you 7 helical resonators, 12-poles of IF filtering, and a precise Schmitt trigger squelch with automatic threshold switching. The transmitter gives you clean TMOS FET power.

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CIRCLE 295 ON READER SERVICE CARD

CES 510SA-II FEATURES:
• Simplex sampling for fixed station operation
• Half or full duplex operation for repeater use
• Variable sample window and sample rate in simplex
• Mobile access via single-or multi-digit DTMF codes
• Remotely programmable functions include connect code, activity timers, and toll restrict

Regardless of your autorepealr requirements, the CES Model 510SA-II will supply reliable, long term service for amateur fixed station or remote repeater sites.

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931 S. Semoran Blvd. Suite 218
Winter Park, FL 32792

CALL US TOLL FREE 1-800-327-9956

RF performance really counts in tough repeater environments, so the KRP-5000 receiver gives you 7 helical resonators, 12-poles of IF filtering, and a precise Schmitt trigger squelch with automatic threshold switching. The transmitter gives you clean TMOS FET power.

The first choice in Transmitters - Receivers - Repeaters - Power Amplifiers - Voice Mail Systems

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Tom (W6ORG)
Maryann (WB6YSS)
Great ATV Software

I have compiled a list of personal computer programs that seem ideal as a video input feed to enhance your amateur television studio operations. I include the postage and handling for all prices listed.

EPXY Designer Series (Stock number EP-1550-1) has a neat, complete package program for the Fast Scanner titled Home Video Producer. It retails for $35. A 46-page, easy to read instruction manual and 14 film clips are included. The version I have is for the IBM PC and clone, but EPXY makes the same package for the Apple IIe, IIC, or IIgs and Commodore 64/128 computers. You can pull up all kinds of large letter and picture graphics from menu windows, and create movie effects, such as fades, wipes, corner inserts, time delays, etc., on the film clips.

The Home Video Producer feeds color composite video into a VCR for tapping, which gives the ATVer a way to inject the screens he produces into the fast scan transmitter. There are special birthday, wedding, vacation, and sports title sequences. It even has a Hollywood director's clapboard! You can obtain the IBM version directly from Computer Direct, 22292 N. Pepper Road, Barrington, Illinois 60010. For the Apple and Commodore versions, write the software manufacturer: EPXY, 600 Galveston Drive, Redwood City, California 94063.

I advise you also to check out StoryBoard. I have heard that it is one of the best IBM computer packages for ATV graphics. Marty Fitzgerald WD6BCE of the Davenport BRATS ATV Group has a version of it, and amazes us all with the neat and dazzling StoryBoard presentations. Write to him and include an SASE for more information.

Then there's Banner for the Radio Shack Color Computer. In this program, jumbo size letters fill your TV screen as they go scrolling by (right to left). They show any one of nine colors, black and white, or in an all-color mode in which each letter is a different color. The Typewriter screen mode lets you type in what you want "live"—good for giving out P-signal reports, etc. A colorful Demo program shows capital and lowercase letters, stops and starts, pauses and varies text speed. There is an on-screen Help section. Breaking into the Test of the demo message shows how to create your own messages. The program is very good and generally easy to use. It's only drawback is that it uses a cassette to save text screen messages. It would be great if it were changed to a disk save format. Banner is available from Spec-Com Software, PO Box H, Lowden, Iowa for $23.

Also from Spec-Com Software, for the CoCo, is a special "ATV Disk Package," #102. This disk is full of dozens of useful ATV graphic programs and utilities, including colorbars, marquees, 3D message generator, and a large CQ Eyeball program, the A5 Symbol ID'er, and many others, for $32. Include an SASE for the latest IBM, CoCo, C64 Computer Software Catalog.

For $16, Griffin Enterprises, PO Box 6104, Sumter, South Carolina 29150, sells a neat VCR Tiller program for the Radio Shack TRS-80 Color Computer. Answer a few questions, and a full screen, excellently designed, large Hollywood clapboard appears with all your information in it! This is great for inserting information about DX openings or special events on your VCR tapes. A large, white-letter, black-background 5-4-3-2 Countdown is also available.

The ATV Bulletin Board is a full color, multi-size, large letter four-way moving, active screen message generator, just like the one you see on your local cable TV channel. Text is programmed easily from BASIC, then loaded into the machine language routine. Put the club's latest messages in the large body text (10 full screens), call signs of members or authorized users in either of the smaller top or bottom display screens. All screens move independently of each other. Sample BASIC program is included with each order. Price is $42, from Spec-Com Software.

Bill Brown W8BELK of the Findlay, Ohio, ATV Group, just came out with a video ID board design which has up to four custom designed pictures stored in an EPROM. An ad and short article appeared in the May issue of The USATVS Journal (page 27). Figures 1 and 2 show examples of the finished screen graphic product depicting the recent W9PRD and W8BELK Helium Balloon flights. These pictures are in color, of course. Bill and his brother use CoCoMax (another fine program by Colorware, 78-03 Jamaica Ave., Woodhaven, New York 11421) and a video camera digitizer to take pictures off VCR tapes, photos, etc., and store them in the EPROM. You can add graphic titles as well. The completed circuit boards are $89. For a catalog of drawings, call or write Elektronics, 12536 T.R. 77, Findlay, Ohio 45840; (419) 422-8206. Packet via N8ET BBS.

I know a lot of ATVers have similar programs that are great for the Fast Scan TV mode. How about writing and telling us about them? Tell us (in detail) how they work, what computer they work on, and where to get them. I'll publish these in future columns. Have you ever seen the screen capabilities on an Amiga computer? Check with Jeff K9TQGX in Lafayette, Indiana on this—Wow!

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Also available at Henry Radio & All Ham Radio Outlets!
ROBOT 400s for the new Color 1200 models, all the inexpensive black and white units quickly got gobbled up for $100 or less.

There is a tremendous supply of discarded ROBOT 400 circuit boards around the country. Enterprise SSSW wizards should buy up these boards for $25 each and make stand-alone home-brew units! What’s in a power supply, anyway? Tune into the Saturday afternoon SSTV Net, still on the 14.230 MHz calling frequency with Don Miller W9NTP and Brooks Kendall W1JKF.

I hear that AEA is working on a stand-alone SSTV converter at a very moderate price. If that great company gets involved, Slow Scan might just come alive again and take over the low resolution marketplace. There’s the Fred Sharps (W8ASF in Cleveland) and the Tom Hibbins (KB9MC in Desoto, Wisconsin), who keep adding switches and mods to their 400s, never letting them die. It’s all for the fun of it, and that’s what it’s all about!

Facsimile interest still steadily grows. It’s a lot of fun to watch incoming FAX pictures, or to send FAX pictures over ATV! Want to get on FAX cheap? Get a TRS-80 Color Computer, a disk or cassette, and the Martin Goodman WEFAX program, and you’re in business! However, some of the established FAX boys are concerned that these computerized, low resolution 2–4 gray level pictures might detract from and degrade “real” FAX visual communications. While I sympathize with them, I welcome the new spirit and interest of those getting into FAX with home computers, even at low resolution levels. Once they Packet ATV

Packet radio has a place on the ATV mode as well. Our ATV Group sponsors a highly elevated, high power Packet digipeater running Kanterm Software on a Commodore 64 computer. The video from the Commodore is fed into one of our twenty TV screens in our remote transmitter Mode-A. We get a kick out of “watching” our own signals enter the system as well as being able to “see” it.

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"There’s a resurgence of good old B & W SSTV activity on 14.230 MHz."

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are hooked, and someone sends them a high resolution facsimile photo in the mail, most will get further in debt by purchasing more sophisticated receiving equipment. Then the real fun begins!

By the way, Greg Mengell now edits The Journal of the Environmental Satellite Amateur User’s Group.

what the digi is hearing! Forty column print is good enough to view all the text thirty to forty miles away on a P3–4 picture. Those wishing to experiment with this should use white letters on a dark background.

ATV Helps OSCAR

This idea helps those hams who enjoy both ATV and HP DXing, but who don’t have a personal computer. There are many satellite tracking programs available; AMSAT put out a number of excellent ones. Some have text readouts only and some have video displays of world maps showing where the bird is now located. Get one that shows the video display of the world—these are best for ATV. Host one of your remote transmitter TV screen windows to this function with a dedicated computer and keep the inputs up to date. You will immediately see interest in satellites increase as the ATV group begins to see this screen and ask the usual questions. How neat for OSCAR trackers and users to be able to go to an ATV screen, see immediately where the bird is, and then go work on it! The same goes for DX groups on MINIMUF and Grayline projections. You got the ATV system up and running—now find ways to make it entertaining and useful for everyone!

We should have the scores from the August USATVS North American FSTV Contest in our next issue. You did enter and give the gang some points, didn’t you? 27

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CIRCLE 308 ON READER SERVICE CARD

73 Amateur Radio • November, 1988 79
Bill Pasternak WA61TF
28197 Robin Ave.
Saugus CA 91350

[Ed. Note: This month we present a special article dealing with the methods that will be used to reverse the FCC order that reallocates the lower 40% of the 11/2 meter band to land mobile use. It is authored by 220 Notes editor Art Reis K9XI—one of the nation's leading authorities on the subject of the 11/2 meter reallocation debacle...de WA61TF]

How To Oppose Docket 87-14

The Department of the Office of Engineering and Technology (OET) of the FCC thinks it has decided the ultimate fate of the 220-222 MHz band (which it has not), it is our turn to go onto the offensive in this battle. There are actions we can take to turn the outcome to our advantage, but there are also those best left to the proper people.

The most important thing we should not do is file any lawsuits on this matter in any court. This is the one time that not only do we have to trust the ARRL, but that we can. There is a time and a place for everything, and in this instance the place is with the League's General Counsel, Chris Imlay N3AKD. The time is whenever Counselor Imlay knows that it is time to file.

What Not To Do

Here are two things you should know. First, the ARRL's Washington attorney is very good. He is a young, aggressive, communications law specialist. He knows the Washington DC courts better than you or me. Nobody practicing general law can match his expertise.

Second, the League Board of Directors has decided to do what it has to do to deal with this situation in the best possible manner. Those of us who are in a position to know the facts, understand the strategy involved. It has an excellent chance of working as long as others don't interfere with the game plan. The quickest way to destroy our counteroffensive against the FCC is to have the wrong folks file suit against them. Let the League do it, and at the proper time.

What Joe Ham Can Do

Once the League has filed suit, anyone can intervene on its behalf. If you or your organization wishes to present facts you feel are germane to the suit, start working now to get them ready for filing. If you give yourself or your group time to do your homework, you will be prepared to present your arguments at the appropriate time, and you will have done your part to help in the war to keep 220-222 MHz all amateur. To the courts, that is all you can do! But isn't that enough?

Write Your Congressmen and Legislators

We can't seem to do enough to hammer home the importance of writing to your senators and representatives to mobilize their support against the FCC. Even at this late date, your letter to Congress counts! Make sure to target it to that staff person who has the FCC as part of his or her assignment. If you do not hear from your elected representative (and, shockingly, a number of them do not answer their mail!) write 'em again and again. It's a great way to show we indeed act in earnest. Remind them of the upcoming election and the considerable voting block the 400,000+ number of US hams represent. Remember—we support these people to represent the interests of the people—you and me!

Urge your congressmen to support Concurrent Resolutions 127 (Senate) and 317 (House). These resolutions express the Sense of the Congress on the issue of amateur radio frequency allocations. Remember that the FCC, in their action on General Docket 87-14, just slapped in the face the very Congress which approves their money for them. The FCC's action flies in the face of House Resolution 317 and Senate resolution 127, issued in June and July 1988, which specifically state that the FCC should leave amateur radio frequencies alone. If your senators and representatives have not become co-sponsors of these resolutions, write them, urging them not on the stick and do it.

The following four, key legislators need to hear from you:

U.S. House of Representatives:


Investigating the OET

As many hams have been advocating for quite some time, we need at least two investigations of the Office of Engineering and Technology—one by Congress, and one by the Justice Department.

The best way to get the ball rolling is to start an outside investigation. The trouble is to find an investigator with enough credibility to ensure a follow-up. The ARRL is not a good choice since that kind of action might jeopardize their tax-exempt status. Another organization within the hobby, such as a major magazine, would be much better suited for this.

Colonize the 220-225 MHz Band

Finally, the last thing you can do is to colonize all of the band from 220-225 MHz. Why do that, in the face of the FCC's news release urging us to vacate the 220-222 MHz portion? Because this fight is far from over!

The more use we make of all the band, the harder it will be for the FCC to justify taking it away from us in court. If you have plans for packet backboning, weak signal work, linking, or for remote bases on 220-222 MHz, make these plans a reality now. Encourage your ham friends to do the same.

The FCC, for all its lip service, has shown no respect for our service, either in this matter, or in the rewrites of Parts 97 and 15. By using the band right up to the last day instead of turning tail and running, we will give them something to think about for any possible future actions which they may take against us. This fight has started will take years to finish. Time is on our side!

"Save 220" NTRN

A few years ago, teleconferencing together a few hundred repeaters to talk over important ham radio situations was a common occurrence. Rich, and Lou Appel KO1OU spent many evenings bringing amateurs throughout the United States and Canada some of the most interesting, informative and entertaining sessions ever to hit the hambands. When Rich left, however, the net slowly disappeared.

If all goes as planned, on Sunday evening, October 2nd, the first NTRN in several years will have taken place. The "Save 220 And All Of Our Hambands Teleconference Radio Net," will have had a list of experts on the panel, including co-host Joel Schroeder W9JUV of Ham Radio Magazine, ARRL Counsel Christopher D. Imlay N3AKD, noted weak-signal communications expert Rojer Cox WB9QDF, 220 MHz Spectrum Management Association President Karl Pagel N6BVU, Rusty Landis KA0HPK of the Indiana based VHF/UFH Information Exchange, plus a series of experts representing EME and packet radio interests. Back-up distribution for this conference was slated to be over the AMSAT OSCAR 13 satellite. Unfortunately, this was beyond our range.

Look for announcements here of future NTRNs and participate!...de WA61TF

80 73 Amateur Radio • November, 1988
No-Coder

After having read your editorial in the March 1988 issue of 73, I felt I had to write concerning the “no code” amateur license.

I have supported the concept of such a license since it was broached to the FCC and received such publicity in the amateur world.

I am extremely interested in our hobby and spend as much of my precious spare time with it as I can. There is no doubt in my mind that we need to encourage our nation’s youngsters to join our hobby and enjoy all of its benefits.

I have been teaching amateur radio classes for Novice through

Number 34 on your Feedback card

Letters

From the Hamshack

No-Coder

Advanced for more than six years. Though electronics may interest some students, amateur radio is not the drawing card. Though the classes do have all ages from 12 to 75, including women, the interest in communications, the modes and methods are far away from CW. The students are exceedingly interested in all theoretical aspects, as well as the practical areas about which we teach. With the availability of all the digital aspects of amateur radio from RTTY to Packet including satellites, CW sits far back in the modes of interest.

I am firmly and strongly in favor of a license without the requirement of learning Morse Code, but stressing theory and practical usage. We will attract a large number of superb hams and it will give the hobby a great boost. Like learning about all of the other areas, or using any of them, a ham can learn and use CW if he so desires. Why must he be forced to?

I certainly would like to see a new no-code proposal receive a favorable ruling.

Edward N. Ludlin, MD K2IK
Cherry Hill, NJ

More No-Code

The August edition of 73 came today, the first edition of any radio magazine I subscribe to that has arrived, and I subscribe to them all.

You probably don’t remember me. I have jousted with you a couple of time in the past, on whether CW should remain a requirement of ham licensing and a bit about being behind in product reviews (referring to the Ten-Tec Paragon.)

Well, you made up all your past mistakes with the product review of the Radio Shack PRO-2004 Scanner in your August issue. I have often wanted to modify my PRO-2004 so that it could scan the parts of the 800 MHz band that were removed. The review of the scanner in the August issue includes sufficient information to enable me to do just that (at my own risk, as you said, huh.)

This assistance will insure that I will continue to be a 73 subscriber for many years to come. The views on CW continue to be misguided, though many other ideas pronounced in “Never Say Die” are on the mark. Thanks for having the guts to publish “The Hidden Secrets of the PRO-2004.”

William B. Levin NJ7G
Colonel US Army (Ret)
Tacoma, WA
AL-80A LINEAR AMPLIFIER

The AL-80A will provide a signal output that is within 1/2 "S" unit of the signal output of the most expensive amplifier on the market—and at much lower cost.

The Ameritron AL-80A combines the economical 3-500Z with a heavy duty tank circuit to achieve nearly 70% efficiency from 160 to 15 meters. It has wide frequency coverage for MARS and other authorized services. Typical drive is 85 watts to give over 1000 watts PEP SSB and 850 watts CW RF output. A new Pi-L output circuit for 80 and 160 gives full band coverage and exceptionally smooth tuning.

Size: 15½"D. x 14"W. x 8"H. Wgt. 52 lbs.

AL-1200 LINEAR AMPLIFIER

WITH EIMAC 3CX1200 TUBE

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AL-84 LINEAR AMPLIFIER

The Ameritron AL-84 is an economical amplifier using four 6MJ6 tubes to develop 400 watts output on CW and 600 watts PEP on SSB from 160 through 15 meters. Drive required is 70 w typical, 100 w max. The passive input network presents a low SWR input to the exciter. Power input is 900 watts. The AL-84 is an excellent back-up, portable or beginner's amplifier.

Size: 11½"W. x 6"H. x 12½"D. Wgt. 24 lbs.

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CIRCLE 314 ON READER SERVICE CARD
Never Say Die
Continued from page 6

ting ham radio growing, nothing is going to change. Why should it?

UPS—1: Amateur Radio—0

You mean they actually took part of the amateur 220 MHz band away for United Parcel? Hey, they can't do that! Oh really? Well, it did take a while for us to lose it, but we managed.

I remember several years ago when I proposed that we set up the middle 3 MHz of 220 as a no-code entry ham band for newcomers in order to get some activity in it—use it or lose it. The FCC liked the idea and tried hard to get a no-code license going. The League got their member clubs to kill off the FCC’s plan, with our old timers cheering their victory. I hope the ashes of that victory taste good now.

As I reported in my editorials, the FCC was extremely concerned about the drop in new hams, particularly when their Long Range Planning Committee (LRPC) looked over the potential for providing emergency communications and found that amateur radio—and only amateur radio—had the potential for providing this badly needed service.

The LRPC also found that the volume of traffic that any serious emergency would generate was way beyond the capability of what a few hams, working with 40-year-old technologies, could possibly handle. More hams were needed. We needed a whole lot more hams. We also needed to encourage these new hams to develop reliable automated high speed communications systems, something old timers will obviously fight to the death to keep from doing.

After researching the situation, the FCC decided that the only viable solution to getting more hams was to do away with the code test, that youngsters everywhere agreed was their major stumbling block. When this proposal was killed by the ARRL, the FCC disband the LRPC and the amateur radio National Industry Advisory Committee (NIAC) and gave up even trying to solve the emergency communications problem, despite its critical importance to our country.

I wrote about the above situation in my editorials every step of the way and warned that the next step was obvious: the FCC would parcel out our ham bands so they could be used more productively. I was called “controversial” for writing such obvious rubbish.

So what band do you think will get pruned next? Let’s see, we’ve recently lost a big chunk (25 MHz), 30% of the 1300 MHz band, and now 40% of the 220 MHz band. Anyone want to take bets on the FCC finding better uses for 430 MHz? Heck, I wouldn’t buy futures on any of our microwave bands. They’re worth billions on the market, and we flat out aren’t using them. We don’t even have a prayer of getting the new and young hams we’d need to get activity going on our microwave bands. No, without some major changes in the ARRL resistance to no-code, I don’t think we’re ever going to really need or use our most valuable ham bands—the microwaves.

Now don’t go panic and start selling your two meter HTs off cheap. There’ll be a good market for these for many years—a very lucrative market. As long as we continue to outlaw drugs, there’ll be an increasing need for two meter ham gear to coordinate smuggling and drug deals.

My Take

I’ve heard all the complaints about the kids, but they’re the product of their parents—and that’s you. It’s you who have turned your kids over to the TV set. It’s you who’ve let our educational system turn to mind rot. So let’s not blame the kids. If they’re lazy it’s because we’ve taught them to be lazy—or, more likely, we haven’t bothered to teach them anything.

How do you teach kids to work hard for what they want? One way is by not giving them things they haven’t worked for. I know that’s a novel concept. Do you mean to tell me that showering things on a kid is going to spoil the kid? Ridiculous!

You train kids the same way you do animals. You convince them that what you want them to do is what they want to do. You show them the benefits of doing what you want. No, punishment doesn’t work with animals, nor with kids. You give positive reinforcement when they do right and urge them on to do better when they do wrong, which they will.

If we want kids to get interested in amateur radio we have to convince them that there are some benefits—like it being fun. Right now we’ve convinced them that getting a ham ticket is a major drag. The few that are curious enough to come to a ham club are, at the very best, ignored. More likely they are both ignored and are bored to tears, finding the club is merely an old-man’s preserve.

I’ve a challenge for you. Every one of you at one time or another comes into contact with a youngster in the 10–15 year range. Get off your big high horse and talk with this youngster and get his or her perspective on amateur radio and let me know what you find.

Then, if you’re a glutton for misery, let’s see if you can convince this small person that he or she wants a ham license. Then explain about the code and let me know what happens. Come on, come out of your shell and find out about the real world of the late 80s. Find out why your grandchildren aren’t interested in ham radio. Most of ’em aren’t doing anything else much.

Buying A License

Since my editorial mentioning that a growing number of VECs have been selling ham tickets I’ve had a string of phone calls and letters (usually with $50 bills enclosed) asking for the names of these VECs so the callers can buy their licenses.

Now, before you get all upset over this, and I know you’ll try, you should know that each of these people have what they felt were legitimate reasons for buying their licenses—in every case it was the code. For instance there was one chap of 70 who’s had seven heart by-pass operations and who’s doctor has forbid him from tackling the code—the tenseness involved could kill him.

This chap has petitioned the FCC for a special dispensation. The FCC’s response: drop dead. So now he’d like to find a VEC willing to help him out.

My explanation to all these callers—and there are often several a day—is to get in touch with W5YI, who has set himself up as the VEC king, and who knows far more about the situation than I.

To those who are aghast at VECs taking advantage of this business opportunity, I might point out a couple of things. First, outside of Puerto Rico, where the discounting seems to have gotten out of hand, with thousands of extra licenses being sold cut rate, VECs have been more circumspect, and thus most are still in business. The FCC has put the lid on Puerto Rico only a year or so after my report on the subject in 73. Speedy for a government agency.

Considering the recent loss of 40% of 220, I wonder if even the most fanatic old timers aren’t beginning to question their religious convictions? The pool of amateurs is leaking like a sieve, with the number of newcomers down 19% in just the last year. Will the day come when we’ll be petitioning the FCC to allow CBers to use some of our unused ham bands just to keep them from being sold to business interests such as UPS?

Such an idea is preposterous, obviously. Who wants all those crummy truckers on our valuable 900 MHz band, right? Well, it’s unlikely we’d attract the truckers, but we might look like fun for some of the kids who satisfy their urge to communicate by opting first for CB, and then find it such a hassle that they get all over the urge before they ever even hear about ham radio.

Death before dishonor is the slogan. We’d rather see amateur radio given away to Motorola and General Motors than compromise our religious beliefs about the code. Being a firm believer in the therapeutic value of strong religious beliefs, how can I honestly raise any objection? No, I believe we should start making ham club flags with code keys on them that we can use during our ham union meetings after all our bands are long gone.

Why am I so hepped up about keeping the code? Some say it’s because I’m selling Morse Code tapes—the very best ever made by a long shot—and it’s my personal greed that makes me so adamant about the code. My tapes have helped tens of thousands of hams get their ham licenses. I can’t say painlessly, because my tapes are the most bitchin’ ever made. They are an exercise in self-torture. But they

Continued on page 86
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CIRCLE 186 ON READER SERVICE CARD

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Never Say Die
Continued from page 84

shock knock down the time it takes to learn the code. They are not for people with seven heart-by-pass operations. They probably wouldn’t live a day after getting ‘em.

You think you’re upset with Wayne Green? You should talk with anyone who’s used my code tapes. They may have their Extra Class license, gotten fairly and squarely, but they’ll sputter in anger at the fiddliness of my tapes. Heh, heh! But the money that pours in for the tapes is used for a good cause. It goes to match up for the boycotting of 73 by several major advertisers who prefer to get fewer sales per ad dollar spent in another ham magazine that shall go unnamed, but which is fast sinking due to the poor ad results it provides. It would be unethical to mention which magazine this is.

The whole Novice code thing is moot anyway. My sales of Novice code tapes have plunged to near zero as a result of the recent article in 73 that explained how to pass the Novice license without even bothering to learn the code. And, with 10 meters wide open these days, what are newcomers waiting for? Pass the word.

ARRL Declares War On FCC

The League, in a move that could easily move the FCC to step up their re-allocating of relatively unused ham bands in retaliation, seems to be at war with the FCC. President Price, apparently not concerned by the ramifications of his statements, said, "We’ve lost a battle, but not the war.” He went on to threaten carrying the battle to Congress, into the courts and to the administration. Just what we need, the ganttlet thrown down.

Is it smart politics to threaten to harass the FCC to force them to do what we want? Mightn’t this lead to some thoughts of getting even? Hey, we’re dealing with the landlord here—one who is in the comfortable position of making all our laws. If we cause too much aggravation we could get thrown out.

So should we, as ARRL members, enlist in this holy war by the ARRL against the FCC? I suspect we might do better to learn from this one and, for a change, do our homework. If, instead of trying to fight the FCC on the 220 proposition, we’d come to them with a practical plan for utilizing the band, I think we might have won the day.

We’re wide open for further cuts of our bands. We’re flat out not using six meters these days. There are only a handful of active hams there. How many six meter construction projects have you seen in QST in the last five years? And what about 900 MHz? How many projects for getting on that band have you seen anywhere? A couple of our ham manufacturers have stuff for 1296 MHz, but outside of a few moonbounce groups, what are we using the band for? As far as I know, 99% of the world activity on 1296 is in Japan.

If the League would use some of its millions of dollars, that has saved for a rainy day, to get us more hams—younger hams—instead of spending it on a legal war with the FCC, that has the almost unlimited resources of the government behind them—wouldn’t we be better off? What do you think?

I’m a big fan of the ARRL, and they do a lot of great things, but I wonder if this war they’ve chosen against the FCC might not turn out ten about this, so I guess it’s time to re-explain the facts of life. First, in case you missed what’s been going on, we’re now giving our own license exams and we’re supposed to be self-policing. So stop wasting the FCC’s time when you have a beef and do the self-policing. All bitching to the FCC does is get rid of our frequencies to someone who will cause them less trouble, and there are stacks of commercial services and their lawyers just waiting to explore our every weakness. Why bother with a bunch of whining, troublesome old men who are doing little of value for anyone, including themselves?

I’ve had several occasions where I’ve needed help while driving. I remember once I was driving to New York to visit my folks for Thanksgiving. The traffic in Connecticut was terrible, so I wanted someone to call my folks collect for me to let them know I’d be an hour late, and not to hold dinner. There was no possible way to stop the car. I tried several

... anyone with any interest in personal progress (should) read at least 50 magazines a month."

repetters, but was turned down by all of them. So I went to CB and got fast, happy service. They even called on their dime instead of collect!

Wanna a pity? Here we have a hobby that holds the keys to the world of electronics and communications. We have a hobby that not only allows, but encourages us to educate ourselves, and we waste this incredible resource almost totally by using it purely for our own personal entertainment—with not a little back-biting thrown in.

Isn’t it odd? Here we have most of the religions of the world telling us that love and friendship are important. You want love? You get on the air and try to help someone and see how many angry, bitter ops are all over your case. If you want to help get medical supplies to Africa, you’ll have someone jamming you. Max Meyers W2BB is gone now, but I’m sure we have no shortage of volunteers to take over his nastiness and perpetuate it.

I suggest an investment in one new piece of ham gear for the shack. This is a large mirror to hang over the rig so you can take a good look at the chap who is broadcasting from there. You really want to suffer the agonies of hell? Invest further in a cassette recorder and tape your end of a few contacts. The hell will come when you sit there in front of your mirror and listen to yourself, when you force yourself to hear what the chaps you’ve been contacting have had to listen to. I’ll bet you can’t stand it for two minutes. Repent!

When’s the last time someone told you that the contact with you was really fun? That they honestly enjoyed it? Let’s see, was it 1963 or 1953? We were all off the air in ‘43, so it wasn’t then.

As you sit there sarcastically putting things and people down, or, worse, mindlessly reciting your rig and antenna setup—instead of trying to find out what your contact is interested in—perhaps you’ll understand why amateur radio is a dying hobby.

Let’s take this self-policing to heart. And self-regulating. This means starting with yourself. Are you spreading fun and love over the air, or anger? Other than getting even for something which is your own personal devil, I don’t know of any rational excuse for not being fun to contact. If the only jokes you know are ethnic or dirty, buy a better joke book. If all you can do is complain, do it into your tape recorder, not over the air.

Now, about having interesting contacts. How many magazines do you read a month? Kami, in his book "Trigger Point," says he reads 150. He recommends that anyone with any interest in personal progress read at least 50. If you read Discover, Popular Science, Business Week, Newsweek, Fortune, Scientific American, Analog (the fact article), New Age, National Geographic, Car and Driver, Consumer Reports, US News, Insight, Kappan, Educational Digest, New York, The New Yorker, Reader’s Digest and Omni, it’s a start. If those don’t give you enough to talk about for the next month, you have an even worse problem than I thought. I scan through 250 magazines a month—computers, electronics, audio, photography, music, ham, communications, skin diving, cars, business, education. And I read a few books, too. I want to understand as much as I can about as many things as possible—don’t you?
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Lap Top
Continued from page 33
access password, tones which follow will be interpreted as control functions, permitting the control operator to enable or disable the patch or repeater. If the number sequence is a prefix and valid phone number, the phone number will be echoed back by the speech synthesizer, and the call will be placed. Numbers beginning with 0 or 1 are rejected, to prevent long distance calls. A three-digit “speed-dial” number (including 911) will be recognized, and if a matching pre-programmed phone number is found, that number will be dialed. The program, with up to 640K of RAM available in the computer, can store phone numbers for three-digit speed-numbers from 000 to 999.
Once a phone call is established, detection of a 0, 1, or # terminates the call immediately.

Mode Control
All the above input flags and control flags are examined by the mode control logic, to determine if the operating mode should change. For example, if during the IDLE mode the receive carrier on flag is set, the mode control logic will clear that flag and change the mode to the REPEAT mode. This results in the transmitter being keyed and the receive audio being routed to the transmitter. Table 1 shows the major operational modes of the software.

Another example is when the receive carrier off flag is set, indicating that the repeater user has released his key. The next mode depends on several prior conditions. If, for example, the DTMF tone queue contains a valid access code and phone number, the next mode will be the OFF HOOK mode. This will cause the phone to be taken off hook to get a dial tone, and the phone number will be placed into the speech queue, to echo the number back to the user.

Station Identification
Four types of IDs, controlled by 3 software counters (which count the 1/18-second clock ticks), are generated. If the repeater has not been used recently, the software will generate an ID a few seconds after it is first keyed up. The ID will be CW if the input carrier remains, or voice if the user releases his key and removes the carrier. At this time, two timers will start, a convenience timer and a mandatory timer. If the repeater user releases the key after the convenience timer expires, but before the mandatory timer expires, the controller software will use this opportunity to do a voice ID and both timers will be reset. This timer is usually set to between five and eight minutes. If the mandatory timer expires (it should be less than ten minutes), and the user has not removed his carrier, a CW ID will be generated.

These three timers will satisfy the requirements that the repeater identify itself at the beginning of, at least every 10 minutes within, and at the end of, each QSO.

Normal mode switching is delayed or interrupted whenever the ID is generated, to prevent it from being cut short by other time-outs or user action.

How Well Does It Work?
As stated in the beginning of the article, this design has been operating for nearly a year with only a few minor teething problems. At present, this approach is probably slightly more expensive than a special-built controller. At the rate the prices of micro-computers are falling, however, it may soon become much less expensive. The problems one might expect when using a computer near high power RF transmitters did not appear, and the computer did not affect the receiver.
The program to drive the lap-top repeater is too lengthy to publish here. It’s available in machine-readable form from the author, on either 3½- or 5¼-inch diskettes, for $5.
This type of design is far more versatile than the usual controller, and could be expanded almost limitlessly. For example, you could attach a printer to log repeater operation and phone calls. Almost any computer accessory could enhance repeater operation. Controlling the repeater uses only a fraction of the computer’s power, so the rest is on tap for whatever the programmer can dream up.

End of Coverage

Parts List for the Laptop Repeater Controller

All fixed resistors are ¹⁄₄ watt, 5%.

<table>
<thead>
<tr>
<th>Part</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, R2, R3, R4, R5</td>
<td>10k ohm</td>
</tr>
<tr>
<td>R6, R7, R8, R9, R10</td>
<td>20k ohm</td>
</tr>
<tr>
<td>R11, R12, R13, R14, R15</td>
<td>27k ohm</td>
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<tr>
<td>R16, R17, R18, R19</td>
<td>47k ohm</td>
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<tr>
<td>R20, R21, R22</td>
<td>100k ohm</td>
</tr>
<tr>
<td>R23, R24, R25</td>
<td>220k ohm</td>
</tr>
<tr>
<td>R26, R27</td>
<td>2M ohm</td>
</tr>
<tr>
<td>R28, R29, R30, R31</td>
<td>10M ohm</td>
</tr>
<tr>
<td>R32</td>
<td>10k ohm</td>
</tr>
<tr>
<td>C1, C2, C3, C4</td>
<td>0.1µF, 50v</td>
</tr>
<tr>
<td>C5, C6</td>
<td>0.047µF, 100v</td>
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<td>C7, C8, C9</td>
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<tr>
<td>C10, C11, C12</td>
<td>30µF, 20v</td>
</tr>
<tr>
<td>Q1</td>
<td>2N2222 NPN Transistor</td>
</tr>
<tr>
<td>U1, U3</td>
<td>LM324 Op Amp</td>
</tr>
<tr>
<td>U2</td>
<td>LM311 Comparator</td>
</tr>
<tr>
<td>U4</td>
<td>74HC240 DTMF Decoder</td>
</tr>
<tr>
<td>U5</td>
<td>74HC4519 DTMF Generator</td>
</tr>
<tr>
<td>U6</td>
<td>74HC139 SPS T</td>
</tr>
<tr>
<td>U7, U8</td>
<td>74HC374</td>
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<td>U9</td>
<td>74HC240</td>
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<td>U10</td>
<td>74LS1123</td>
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<tr>
<td>U11</td>
<td>SN75432</td>
</tr>
<tr>
<td>Relay</td>
<td>12v coil, SPST</td>
</tr>
<tr>
<td>Transformer</td>
<td>600/600 ohm audio</td>
</tr>
</tbody>
</table>
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CIRCLE 67 ON READER SERVICE CARD
Notes from FN42

Hambassadors (correspondents) take note: Themes for the 12 issues of 73 Amateur Radio for 1989 which you might want to keep in mind as you send us your reports are as follows. Remember we must have reports HERE two months in advance: November 1 for the January issue, December 1 for February, etc. January—Workbench/Gadgets; February—Product Reviews; March—Satellites; April—VHF and above Antennas; May—Education/Licensing/Upgrading (What is going on to promote amateur radio to young and old?); June—Field Day/ORP Operation; July—Microwave/ATV; August—Packet Radio; September—HF Antennas; October—DX; November—Annual Holiday Shopping Guide; December—HTs.

A Word to the Wise: Don't be silly enough to believe all you hear or read about W2NDS/1. It is an election year in the USA, and Wayne is a candidate. We respect the constitutional right of free speech when criticizing, but sometimes it is exercised by individuals who misuse the privilege. This is an individual (unauthorized) editorial statement from the RP part of CCC. (For those who missed last month's column, CCC means the entire "all-C-ing" editorial staff of the magazine, acting as super-editor for the material sent in to us by our international Hambassadors.)

November's events around the world: 1—National Day, Algeria, Antigua (24th for Zaire); 3—Culture Day, Japan; Independence Day, Panama (18th for Morocco, 22nd for Lebanon, 25th for Suriname, 28th for Albania); 4—Flag Day, Panama; 7—Revolution Day, USSR; 8—Queen's Birthday, Nepal; 11—Veterans Day, USA; Armistice, France; Remembrance Day, Canada; 12th for Bermuda, 13th for Great Britain, and (Volksstauragent) Germany; 14—D-Day, Belgium; 15—Proclamation of the Republic, Brazil; 17—Army Day, Zaire; 18—National Holiday, Oman; 20—Revolution Day, Mexico; 23—Labor Thanksgiving Day, Japan; 24—Thanksgiving Day, USA; 29—Proclamation of the Republic, Yugoslavia.

Roundup

Great Britain. A "self-financing organisation that sponsors a varied award programme based on working [hearing, for SWLs] stations in Great Britain & Northern Ireland" recently presented a Diamond Award to "the first ever claimant from North America... Jim Thurber K5KQ" of Clarkson, New York (for 1100 areas logged). The Worked All Britain Awards group, which was started in 1969, makes donations to help disabled and handicapped hams. The WAB Awards are based on areas worked; the more than 4,000 areas are those created by the National Grid Reference (NGR) in Great Britain and the Irish Grid. They are 10 km by 10 km in size, up to 100 in each of the sixty-one 100 km by 100 km "large squares." The former are identified by 00–99, the latter by letters. Examples: SP42, G82.

The Awards are Basic, Bronze, Silver, Gold, Platinum, and Sapphire, for which the requirements are stations logged in 100, 200, 400, 600, 800, and 1000 areas, respectively (for European stations the requirements are 300, 500, 750, 1000, 1500, and 2000 areas, respectively). There are other area-based awards also, including (for non-European stations) the W.A.B Overseas Introductory Award calling for 25 areas and 10 (of the 75) counties. A WAB special record book may be purchased.

For further information write Membership Secretary Brian Morris G4KSO, 22 Burdell Ave., Sandhills Estate, Headington, Oxford OX3 8ED, England, or Dave Bird AA6DB, 11226 Quinn St., Downey CA 90241, USA.

Ireland. Baile Atha Cliath (Dublin, that is), in its celebrations of "One Thousand Years as a City" (see Roundup, p. 98, April issue), worked Dublins all over the world on March 17th. The Millenium Amateur Radio Committee reports contacts with Dublins in Australia, New Zealand, the USA (in Georgia, New Hampshire, Pennsylvania, Texas, and Virginia), and on Banana Island off Sierra Leone. The call was EI1000; a pre-stamped QSL card from the Irish Postal Service is available direct at PO 2223, Dublin 1.

Israel. From Ron Gang 4X1MK: The four stations for the 40th Anniversary in April (of both Israel's independence and the IARC), 4Z4B, 4X40A, 4X40R, and 4Z40C, made tens of thousands of contacts, and QSL cards have gone to all stations QSO'd. A special certificate is available to any who contacted all four stations—application with documentation and US$5 or ten IRCs should be sent to Anniversary Certificate, IARC, P.O. Box 4099, 61040 Tel-Aviv, Israel.

4X1RU1 (ex 4Z4RU) is the call of Jim's packet gateway station tying the national 144.675 MHz network with HF on 14.1075 LSB. Alon 4Z4ZB also has 4Z4SV1 running a BBS on the same frequency in the evenings. Packet has caught on by leaps and bounds in Israel, and one out of every ten stations now has packet capability.

Kenya. From Rod Hallen KB7NK, 5Z4BH (Box 55, APO New York 09675): The Radio Society of Kenya (RSK), IARU-affiliated, is a very active group indeed. Consisting mostly of Europeans and Americans, it is working to get Kenyans involved, with classes in basic electricity and Morse code. There is no Novice license now, but the club is working to rectify that. It also sponsors an SWL program and issues identifiers (e.g., RSK-001, RSK-002, etc.). The club has one 2-meter repeater in Nairobi and soon will have a 70cm one on Mount Kenya. An FM repeater is planned. There is no reciprocal licensing with the U.S., but licenses are routinely issued (a 2–3 month process) to anyone holding a General or higher class license from his home country, or to anyone passing a Morse, theory, and regulations test. Licenses are renewable annually.

CCC invites 5Z4BH to be a roving Hambassador for Africa—but where will we mail his free subscription? One of his main interests is DXpeditions ("being one, that is, rather than working one"), and for the next four years he "will be traveling extensively in East Africa and would like to operate from as many countries as possible." Bill KE3A will be handling his QSLs.—Ed.
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Republic of South Africa. [Welcome, our new Hambassador, Peter Strauss ZS6ET, who will appear in our January issue with licensing and packet information!] He wrote, "While on a business trip from Johannesburg to East London I found a copy of 73 by accident. I have not seen [it] for years..." In 1985, a real collectors item, at US$5 [in Johannesburg] for the April 88 issue." ZS6ET recently received the Amatateur of the Year Award from the South African Radio Amateur Foundation for his achievements in the foreign licensing field leading later to bilateral agreements with the US, Germany, Switzerland, Portugal, and Israel. At present he is the public relations representative for the Packet Radio Working Group of the SAR League and the spokesperson on foreign license affairs for the Johannesburch branch of SARL. He is also S4ZET and DF4YE, and ex A22PS.

Taiwan. In last month's list of special assistance to hams visiting other countries, the offer of Tim Chen V2A/V2B should have appeared. See the March issue, column 2, page 90, and his column—which did not appear in that issue but in May, page 96.

World. The International Telecommunication Union (ITU) has published three new economic studies which may be obtained in English, French, or Spanish for the costs listed below by writing the ITU Sales Service, Place des Nations, CH-1211 Geneva 20, Switzerland.

For 33 Sfr—The Benefits of Telecommunications to the Transportation Sector of Developing Countries: a case study in the People's Democratic Republic of Yemen. For 33 Sfr—Contribution of Telecommunications to the Earnings/Savings of Foreign Exchange in Developing Countries: a case study of the Kenya situation.

As his farewell report, Jim sent in a long, detailed article on Willis Island, "...a tiny coral outcrop in the Coral Sea" now celebrating its 67th anniversary as one of the Bureau of Meteorology's remote Observing Offices. We will use parts of it over the coming months, but not its last paragraph, because that belongs here. 

—Ed.]

Finally, after five years of being the WIA's Official Correspondent, and having written in that time over 60,000 words, trying to give the rest of the world an insight into Amateur Radio down under, I now feel it is time to step aside for some new blood to take over with new ideas and/or a different approach. Thank you for reading the "Aussie column" over the last five years. Cheers and beers for the last time, mate! Jim VK3YJ.

CHINA

Chang Han-Dong (BY4AOM) Institute of Estuarine and Coastal Research East China Normal University Shanghai 200062 People's Republic of China

BY, BT, and BV. Maybe you have worked several of these China or Taiwan ham stations. Soon you will hear the voices of BZ and BG. So far as I know, BZ will be earlier; it is the prefix of private calls and must be worked at club stations. BG is the prefix for private stations, and because of the price of SSB equipment, most of BG stations will work in CW. Some of my friends are going to make CW transceivers. When BG stations appear on the air, it means that Chinese ham radio will enter a new stage.

Please call 650674. When you come to China, maybe you hope you can operate in BY. In fact, many hams ask me about this when I work on the air. Yes, it's possible. When you arrive in Shanghai, bringing your license, you could call BY4AA's telephone number and you will be told the requirements and how to get to the station. BY4AA is the club station for the CRSA branch and has many high-quality rigs. You can work in not only CW and SSB but also SSTV, OSCAR, and RTTY. The manager of the station is Xu Lu (we call him Zulu); other members are Chen (YL), Wu (OM), and Zhou (OM). So please call 650674.

Shanghai's 2-meter net. Last month the first 2-meter net in Shanghai opened—it also was the first VHFAmateur net in China. The prefix is B4, and the net consists of 26 2-meter FM stations. How this came about is interesting.

One year ago, when BY4AY (the club station for the Center of Shanghai Children Science and Technique) was set up, many other organizations hoped to set up club stations. However, first among many knotty problems was the lack of HF transceivers and any equipment special to amateurs; professional equipment is too expensive. But BY4AY learned from the Shanghai Post Office that there were obsolete 2-meter transceivers in its repository and there was a plan to sell them. So BY4AY bought them, changed the crystals for amateur bands and adjusted them. Now they have 10 fixed frequencies and 10-Watt output power, and 26 secondary schools and branches of the Shanghai Childrens Center bought them and set up the net. It is planned to extend the net, and to use it to attract more people into ham radio.

No Bureau in China. Last month a member of our club came back from Beijing city with a package weighing 3 kilograms. It was all QSL cards from all over the world; some, we were surprised to find, mailed a year or more ago. Amateur radio is now in China and we do not yet have a strong organization. BY1PK is the club of the CRSA (as W1AW is of the ARRL), but lacks members or funds to be a QSL service. So hams should send QSLs direct. Here is a list of some BY stations. (Table 1.) If you don't know the QTH you contacted, send your card to another station in the same city. We hope the CRSA will provide a QSL service as soon as possible; foreign hams too.

Addresses in China for QSLing.

<table>
<thead>
<tr>
<th>BY...</th>
<th>PO Box</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>4SZ</td>
<td>51</td>
<td>Su Zhou</td>
</tr>
<tr>
<td>5QA</td>
<td>507</td>
<td>Fu Zhou</td>
</tr>
<tr>
<td>4AA</td>
<td>205</td>
<td>Shanghai</td>
</tr>
<tr>
<td>4AOM</td>
<td>227</td>
<td>Shanghai</td>
</tr>
<tr>
<td>4RN</td>
<td>2405</td>
<td>Nanjing</td>
</tr>
<tr>
<td>4AY</td>
<td>5304</td>
<td>Shanghai</td>
</tr>
<tr>
<td>8AA</td>
<td>6106</td>
<td>Beijing</td>
</tr>
</tbody>
</table>

Table 1.
The symposium was such a success that the RSGB quickly announced a second Data Symposium to be held the weekend of July 8–9, 1989, also at the Harrow School.

The growth in the amateur population continues, seemingly without end. At the time of this writing [August] callsigns in the series G6 J... and G7B... are being issued.

Norfolk Island

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island, 2899
Australia

Our flag. When Norfolk Island gained a measure of self determination back in 1980, our flag also came into being. It is flown proudly from all our public buildings, alongside the Australian flag which, of course, represents "the last say" in important matters like foreign policy, communications, etc.

Our stamps. It has been many years since we started issuing our own postage stamps to boost local finances. We still receive, however, a number of SASEs with Australian stamps—strangely enough mostly from mainland Australia! Many Australians have only a hazy idea of what and where Norfolk Island is. They often confuse us with Lord Howe Island which is in fact classified as a part of New South Wales. These SASEs have to be bulk-mailed to friends on the mainland to be mailed there.

Your IRCs. While on the subject of stamps and SASEs, keep in mind that one IRC means surface mail postage, and surface mail leaves Norfolk Island only every couple of months, meaning you might have to add two months to the usual two or three months it may take for surface mail sent overseas from Australia. While in 1988 we enjoy excellent communications through regular air service, direct overseas dialing, telex, and facsimile, surface mail is surface mail, and the Earth is just as large as it was at the beginning of time! And by the way—be sure your IRCs are stapled on the left hand side by the issuing post office. They are not legal tender without the stamp.

Amateur radio activity on the Island is a bit up and down. We have lost Phil VK9NP, who returned to VK2 in February. VK9NS and VK9HC were also removed from the DXpedition to Howland Island, KH1, and the QSLing took up a lot of time, keeping us off the bands.

Our tiny post office is coping well with the thousands of items of mail. It does happen that we find a little notice in our box about "an item too large for the box awaiting collection inside." This turns out to be a large mail-bag jammed full of mail. One recent peaceful Sunday Jim opened the box and got a shock when a hand appeared out of the box with a batch of mail. He thought it was the Adams Family "Thing." It was a member of the postal staff who saw daylight appearing in the box and took the opportunity to get rid of some of the overflow.

Visitors. Bruce VK9AD, son of VK9NS, visited over the Christmas period and was quite active, but as there usually is adequate activity from Norfolk Island, real DXpeditions here do not take place these days.

Harvey Brain made a surprise visit strictly for holiday purposes. Oldtimers will remember him as VQ9V and VQ9HB from the Seychelles, operating from St. Brandon and Agalea in 1963, followed by Farquar Island and Desroches Island later. He also was VQ8HCB when operating from Chagos in 1964. He lives in New Zealand now.

******

Two hundred years have passed since March 6, 1788, when a small group of convicts and their overseers stepped ashore on the uninhabited Norfolk Island and began to clear land to establish a settlement. So Norfolk Island, like Australia and the U.S., is celebrating a Bicentennial. It has been 200 years of ups and downs, booms and busts, but the people here today are proud to see their flag as a symbol of a tiny island which has emerged as a modern, largely self-supporting and economically independent community of the 1980s.
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Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.