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CQ VHF Ham Radio Above 50 MHz

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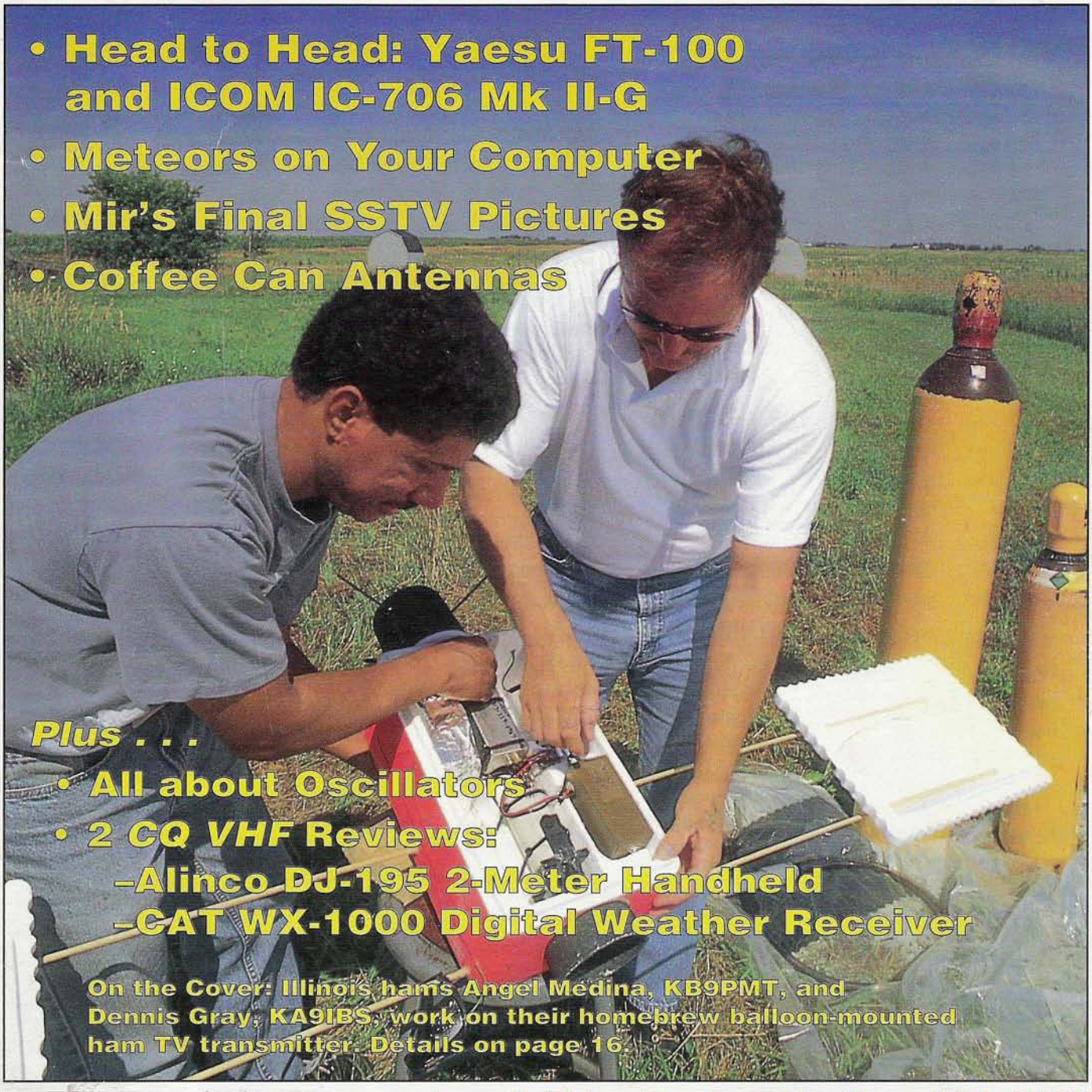
November 1999

- **Head to Head: Yaesu FT-100 and ICOM IC-706 Mk II-G**
- **Meteors on Your Computer**
- **Mir's Final SSTV Pictures**
- **Coffee Can Antennas**



Plus . . .

- **All about Oscillators**
- **2 *CQ VHF* Reviews:**
  - **–Alinco DJ-195 2-Meter Handheld**
  - **–CAT WX-1000 Digital Weather Receiver**

On the Cover: Illinois hams Angel Medina, KB9PMT, and Dennis Gray, KA9IBS, work on their homebrew balloon-mounted ham TV transmitter. Details on page 16.

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FEATURES

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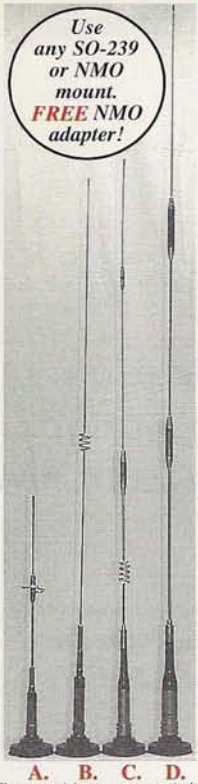
DEPARTMENTS

Next Month: "Truly Portable Packet," by Ray Rischpater, KF6GPE

MFJ *RuffRider*™ High Gain Mobile Antennas



A. B. C. D.
Shown on mini mag mounts, not included.

Each MFJ RuffRider™ mobile antenna comes with MFJ's unique 90 degree "fold-over" feature -- lets you pull into your garage without knocking your antenna over!

MFJ's heavy duty bases are extremely strong to handle super rugged rides and day-to-day highway abuse.

MFJ's *RuffRider*™ High Gain dual band 144/440 MHz mobile antenna series is for the serious mobile ham who demands the highest quality, premium products at reasonable prices.

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Stacked elements with high-Q phasing coils give you outstanding gain. Stay in solid contact!

Phased Radiators

Phased radiators flattens the radiation pattern and concentrates your power to give you *super gain.*

High-Q phasing coils are housed in weather proof high-tech plastic insulation. They're attached to stainless steel stacked radiators by solid metal end sections.

Heavy Duty Base

Rigid, heavy duty solid metal base reduces SWR flutter due to wind vibration. Two Allen set screws securely fastens radiator.

Specially treated center pin provides excellent electrical connection.

Quickly screws off -- helps prevents theft of your expensive rig.

Use SO-239 or NMO Mounts

RuffRiders™ have a PL-259 base mount for quick installation to your heavy duty SO-239 magnet, trunk/hatch, gutter or mirror mount.

A *free* NMO adapter is included for use with an NMO mount.

MFJ mounts are recommended.

All MFJ *RuffRiders*™ are dual band 144/440 MHz antennas and factory tuned for SWR less than 1.5:1 and have 50 Ohm impedance.

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All *RuffRider*™s are covered by MFJ's famous *No Matter What*™ one year limited warranty. MFJ will repair or replace (at our option) your antenna for one full year.

Choose from several different length and gain antennas . . .

A. ***RuffRider Junior*™.** Premium, short 16½" antenna fits in any garage on any auto. ¼ Wave on 2 Meters, ½ Wave, 3 dB gain on 440 MHz. 100 Watts. No fold-over.
MFJ-1402 **$34.95** add s/h

B. ***RuffRider High Power*™.** Just 40" long handles full *200 Watts.* Great for high power mobile amp. ½ Wave, 3 dB gain on 2 Meters, ⅝ Wave, 5.5 dB gain on 440 MHz.
MFJ-1412 **$49.95** add s/h

C. ***RuffRider High Gain*™.** 41½" long antenna gives extra gain with little height increase. Handles 150 Watts. ½ Wave, 3.2 dB gain on 2 Meters, ⅝ Wave, 5.7 dB gain on 440 MHz.
MFJ-1422 **$49.95** add s/h

D. ***RuffRider Hyper Gain*™.** 62½" brute gives a whopping 5 dB gain on ⅞ Wave 2 Meters, ⅝ Wave, 7.6 dB gain on 440 MHz. Our highest gain antenna. Handles 150 Watts.
MFJ-1432 **$69.95** add s/h

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Covers 136 to 175 MHz. Handles 150 Watts. Compact 4x2½x1½". *New!* MFJ-922 **$79.95**

MFJ *RuffRider*™ super heavy duty Antenna Mounts

Trunk/Hatchback *Lip* Mount

MFJ-345 Lip Mount is shown mounted vertically to a mini-van's angled hatchback lip. Note extra-wide mount with reinforcing tab at right -- safely secures heavy antennas. Swivel mount is adjusted so antenna is near vertical away from mini-van to clear luggage rack.

MFJ-345 **$34.95** add s/h

MFJ's *RuffRider*™ super heavy duty solid steel Trunk/Hatchback *Lip* Mount mounts to any lip on your vehicle.

Extra-wide *four* inch lip and large reinforcing tabs on each side safely distributes the load over your vehicle's lip.

Two large set screws on each end of the mounting lip locks your mount in place. A scratch-proof rubber guard protects your vehicle's finish.

Secures large VHF, UHF and medium size HF antennas even at highway speeds.

Mounts on lips at any angle. Two axis of rotation lets you position your antenna vertically, horizontally or at any desired angle. Serrated swivel joints locks securely in place with huge 3/8 inch set screw.

Has SO-239 base mount. Use adapter for NMO. Includes low loss coax with PL-259 connector, Allen wrenches and protection caps for SO-239 and locking screw, One year MFJ *No Matter What*™ limited warranty.

Mirror/Luggage *Pipe Clamp* Mount

MFJ-340 Pipe Clamp Mount is shown clamped solidly to vertical mirror support rod on a pickup truck. Antenna is slightly swiveled to the left and positioned about 30 degrees from vertical to clear cab of the pickup truck.

MFJ-340 **$34.95** add s/h

MFJ's *RuffRider*™ Mirror/Luggage *Pipe Clamp* Mount mounts on support rod of mirror, luggage rack or spare tire carrier of your truck, van, RV or SUV. Mounts on any horizontal, vertical or angled rod or pipe up to 5/8 inches in diameter.

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Convenient *Thumb and Finger* turn knob makes fold-over operation quick and easy. Locks in twelve positions.

Fold down your antenna at night when pulling into your garage and quickly put it back up to its operating position in the morning.

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MFJ's *MaxStrength*™ Hi-Flux Antenna Magnet Mounts

MFJ's *MaxStrength*™ high-flux magnet mounts give you maximum pull strength -- your antenna stays on top of your vehicle at highway speeds.

MFJ-333 **$14.95** add s/h
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Base is *Euro-style*, black poly or chrome finish with a Mylar protective undersheet.

MFJ magnet mounts come with 17 feet of tough RG-58 coax with a PL-259 connector. Easily reaches operating position.

Choose your favorite antenna to go with these fabulous low-profile mounts for outstanding mobile performance.

MFJ-333 BS/BM, $14.95. Light to medium duty magnet mount. Low profile 3.5 inch diameter black base weighs 1½ lbs. For small to medium size antennas.

MFJ-335 BS/BM, $19.95. Medium to heavy duty magnet mount. Super strong 5 inch diameter *chrome* base weighs a husky 2½ pounds. For medium to large size antennas. It's perfect for MFJ's *RuffRider*™ High Gain mobile antennas.

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"We Do This Stuff at Work Every Day..."

Hams continue to design and build leading-edge communication systems—but for the commercial world, not the amateur world. Our challenge is to channel some of these hams' creativity back into ham radio.

One of the things I love about going to VHF conferences is the opportunity to meet, and to learn from, hams working on the cutting edge of communication technology. But all too often in recent years, the exciting, innovative designs these hams describe are projects they're working on for work, for use in commercial telecommunication systems. Ham radio applications seem to be few and far between.

"We do this stuff at work every day....Why can't we do it for the ham bands?"—Paul Drexler, W2PED, talking about a 24-GHz amplifier he's helping to design

A Refreshing Change

So it was a refreshing change this summer, at the 25th Eastern VHF-UHF Conference, to listen as the Packrats' Paul Drexler, W2PED, explained a project he's working on, along with Jon Sorter, KB3XG, and members of the North Texas Microwave Society (NTMS). The project is a low-cost 1-watt amplifier for the 24-GHz ham band. Now, 1 watt is major league power at these frequencies, where normal power levels are in the milliwatt range—about the same magnitude as 1 kilowatt on 2 meters or lower in frequency. But the details of the project are less important than the philosophy behind it.

"We do this stuff at work every day," said Drexler, a microwave engineer. "Why can't we do it for the ham bands?" And he went on to describe the cooperative effort of hams in three states, working with the blessings of their employers, to design and build this amplifier that will eventually sell for a fraction of the price it would bring on the commercial market. In fact, Paul pointed out the importance of ensuring that its eventual use be limited only to ham radio, due to the many contributions, from a variety of sources, of parts, design and test equipment, etc., under the assurance that the project was for exclusively for non-commercial use by hams. The description of the discounts and donations that the group secured—in the interest of advancing technology without a profit motive—was exactly the same as the descriptions I've heard from the AMSAT folks who built the Phase 3D satellite for a fraction of a fraction of what it would have cost to build the same satellite for commercial use, and from the hams at TAPR, Tucson Amateur Packet Radio, who have been able to secure similar favors for designing and building advanced digital products for ham radio.

Why do businesses do this? Because they know that, in the long run, investing in ham radio is an investment in their own future. Hams will take the technology made available to them and—sharing information in a way unheard of in the commercial world, where everything is a closely-guarded secret—find new uses for that technology, or ways to make that technology work better or cheaper, or both. These advances then find their way back into the commercial marketplace, to the eventual advantage of the companies that supported the original project, as well as their competitors.

Aye, There's the Rub

But therein lies a problem. In today's ultracompetitive telecommunications world, many companies that invest in developing new technology claim the rights to whatever results for competitive advantage ("if you did it here, using our equipment, it's ours"). Many hams, who used to refine their ideas and inventions through real-world ham use, can no longer do so without endangering their employer's eventual patent rights. As a result, technology developed *by* hams is often precluded from ham radio use, at least in its early stages. Fortunately, there are still some companies with enough of a forward-thinking attitude to offer a helping hand in the development of new ham radio technology.

Another problem, of course, is designer overload. It takes as much time and effort to design something for ham use as it does for commercial use, with the only difference being that you're not getting paid for your ham-design time. And if you're already putting in 10 or 12 hours a day on your "day job," there's not a lot of energy or motivation left to work on a

By Rich Moseson, W2VU, Editor (w2vu@cq-vhf.com)

ham project (especially when you have competing demands, like a family).

A Prescription for the Future

I spoke with W2PED after his talk and asked him how he thought more hams might be encouraged to take the "stuff they do at work every day" and use it as the basis for cutting-edge *ham* technology. Paul had several ideas, but the main one was this:

> It has to be different from what you do every day, different enough to keep you interested. If you've just spent eight hours at work on Project A, the last thing you're going to want to do is go home and spend four more hours doing the same thing for your hobby. So it has to be different.

This is a good idea, not only for keeping you motivated, but also for preventing the sort of conflicts described above. Use your knowledge and your skills, but don't build the same thing for ham use that you're building for work. The way in which Paul's project is being approached is also good; and again, it's one that's been followed successfully by AMSAT, TAPR, and others—don't try to do it all yourself. Work with other people, perhaps people with areas of expertise that complement your own, and break up the project into separate parts that all come together at the end. This way, no one person is overwhelmed, and you have the benefit of shared knowledge and experience to keep from repeating other people's mistakes.

In this case, we have not only several people working together, but two groups as well: the Packrats and NTMS. If this project is successful, it could become the first of many joint efforts to produce cutting-edge, but low-priced, equipment to encourage hams to try new things; in this case, the upper microwave bands. This sort of technological partnership is an absolute necessity if we as hams are going to continue to meet our FCC mandate to "advance the radio art."

What about You?

Now I know that not every reader of this magazine is a techno-wizard, and there are some of us out there who are lucky if we remember which end of a soldering iron *not* to pick up. But there are also many of you who do "do this stuff at work every day." My challenge to you, as we head into the new millennium, is to start thinking of ways you can take the knowledge you've gained for your job and apply it to your hobby as well. Make it something different, and seek out people and groups with shared interests but perhaps different expertise, and work together to create our future.

A Personal Note

You may have read or heard that I have been named to succeed Alan Dorhoffer, K2EEK (SK), as Editor of *CQ* magazine. I consider this an honor, a privilege, and a great challenge. The plan, for now at least, is for me to continue as Editor of *CQ VHF* as well. Splitting my time between two monthly magazines will be interesting, and may mean that our Managing Editor, Edith Lennon, N2ZRW, will have to take on more of the day-to-day responsibilities for *CQ VHF*. Edith has been our Managing Editor since Day 1, so there should be few, if any, visible changes in the magazine's content or focus. And we certainly will continue to provide you with the best possible coverage of Ham Radio Above 50 MHz. 73,

—W2VU

VHF News

License Restructuring: Still Waiting

At press time, there had still been no decision from the FCC on amateur radio license restructuring, and it's beginning to appear unlikely that a final decision will be made before the end of the year. According to a well-informed FCC source, a draft decision has been written and is currently awaiting approval from (or changes by) Private Wireless Division Chief D'wana Terry. Once Terry signs off on the draft—and we weren't able to get any indication of when that might happen—it must then be approved by the Chief of the Wireless Telecommunications Bureau before being sent to the Commissioners for their consideration and, eventually, a final decision. Check the *CQ VHF* Web site for any updates, which will be posted as soon as possible after we get them.

FCC Relaxes Rules on Spread Spectrum

Nearly two and a half years after issuing a Notice of Proposed Rule Making intended to ease restrictions on hams using spread spectrum (S/S) communication, the FCC has made its decision. In a Report and Order released on September 3, the Commission removed the limitations on permissible spreading codes, along with special station ID requirements and paperwork regulations. However, requests to permit S/S on ham bands below 420 MHz were denied, as were suggestions to allow power levels above 100 watts. In fact, for the first time in the amateur service, the FCC required that all amateur S/S stations using more than 1 watt incorporate automatic power control (APC) systems to ensure compliance with the rule requiring the minimum power necessary for communication. According to the FCC's Bill Cross, W3TN, the APC requirement was not imposed by the Commission but requested by the ARRL in its original petition for rulemaking. "It's in the category of 'be careful what you ask for, you might get it,' " he added.

Other provisions of the FCC decision permit international S/S contacts for the first time (providing the other country has also agreed to allow international S/S contacts), and retain spread spectrum's unique status as a "secondary mode," prohibited from causing interference to stations using other modes, and required to accept interference from stations using other modes. The revised rules take effect on November 1.

FCC: Behave and We Won't Fine You

The FCC has accepted for a four-year suspension the license of Kornwell Chan, W3CI, and has promised to recommend that an unspecified fine levied against him "not be pursued" as long as there are no violations of the suspension. The FCC's letter to Chan also reminded him that he may not operate amateur radio equipment during the suspension, and that he'd better not retaliate against those who filed complaints against him, as it has been alleged that he has done. Without commenting on those allegations, the September 8 letter from the FCC's Riley Hollingsworth, K4ZDH, cautioned Chan that "any such incidents of retaliation for which you are directly or indirectly responsible will nullify this agreement and will jeopardize your Amateur Radio license."

In other recent enforcement actions, the Commission continued to challenge several people who hold multiple club callsigns, ordered one ham to appear for a retest before an FCC examiner, dropped the privileges of another ham from Advanced to General class after he appeared for an FCC-ordered retest and passed his General but did not take the Advanced class exam. The Commission also withdrew a previous letter to Frank Smith, AHØW, alleging interference on HF. "We were wrong to have sent it and request that you disregard it," said the August 19 letter.

StenSat Set for Mid-October Launch

If everything goes according to schedule—a rarity in the space business—another new ham radio satellite may be heading to orbit by the time you read this. "StenSat" is scheduled to be launched on October 15, as part of Stanford University's OPAL (Orbiting Picosatellite Automated Launcher) experiment, according to the AMSAT News Service (ANS) and updates on the StenSat Web page. StenSat is a 12-cubic-inch (yes, inch) crossband FM repeater, with uplink on 145.840 MHz and downlink on 436.625 MHz. It was designed and built by a team of hams headed by Hank Heidt, N4AFL. ANS reported that the team was looking for volunteers to monitor and control the tiny satellite. If you're interested, contact Hank via e-mail at <hheidt@erols.com>. For updates and more information, see the StenSat Web page at <http://www.erols.com/hheidt>.

Volunteer Examiner May Lose License

The FCC has begun license revocation proceedings against Extra class ham and volunteer examiner Andrew Penn, N8JVA, of Linden, Michigan. Penn was notified in mid-August that the Commission intended to designate his station license for a revocation hearing and his operator's license for suspension until the end of its term in 2004.

The FCC letter charges that Penn "added paperwork for 4 applicants who did not pass the required examination elements" at a June 3 test session in Oak Park, Michigan, and that he forged the signatures of three other VEs on four license applications. Penn was given 20 days to inform the FCC of whether he intended to appear at a revocation hearing before an Administrative Law Judge, or chose the option of submitting his license for cancellation if he did not want to challenge the allegations.

In other actions related to suspect Volunteer Examiner sessions, the Commission cancelled the licenses of four amateurs who did not appear for re-examination as previously ordered, and it dismissed the license applications of four people who passed either upgrade or initial license exams at a Yonkers, New York, exam session which is under investigation for possible cheating.

Compiled by the CQ VHF Staff

Space Station Ham Gear Ready to Fly

The initial set of ham equipment scheduled for use in ARISS (Amateur Radio on the International Space Station) has passed its flight qualification tests and has been sent to Kennedy Space Center in Florida to await launch aboard the shuttle. This launch, originally set for December, is on hold while repairs are made to the entire shuttle fleet after a short-circuit during the launch of STS-93 (the last shuttle flight with a working ham station aboard) caused a premature engine shutdown.

In addition, the permanent ham antennas and mounting hardware for ARISS are on their way to the ARISS processing facility at NASA's Goddard Space Flight Center, according to the ARRL, which says the antennas will be assembled there and then go through flight qualification testing. Unlike the ham antennas used on shuttle flights, which were attached to windows on the inside of the orbiter, the ARISS antennas will be mounted outside the space station, with feedlines routed through special feedthroughs to the inside of the service module. The antennas are scheduled to fly on the same mission as the rest of the ham gear for the initial station. That station will let the astronauts operate voice and packet on 2 meters and 70 centimeters. Plans call for eventually expanding the ARISS station to include both HF and microwave capabilities.

Brendan Trophy Still Unclaimed

The latest effort to bridge the Atlantic Ocean on 2 meters has failed. The *ARRL Letter* reports that attempts by teams of amateurs in Newfoundland and Scotland ended a day early due to bad weather in the UK. The tests were carried out between June 26 and July 3, with no signals being heard on either side.

The Newfoundland team, operating as VO1AA, set up its station at Cabot Tower in St. John's, where Marconi had received the first transatlantic radio signal in 1901. The Scottish group, which was using the callsign 2SØICF/P, operated from Ardnamurchan Lighthouse on the westernmost point in the mainland British Isles.

The groups were trying to win the Brendan Trophy, offered by the Irish Radio Transmitters Society (IRTS) to the first two stations making a successful transatlantic contact on 2 meters, without the aid of manmade reflectors or repeaters, or via moonbounce.

British Hams Temporarily Lose 70 Centimeters

Having a secondary allocation on a particular band means that you sometimes have to give priority to the primary user. Some hams "living in selected postal codes" in the United Kingdom learned this last summer, when they lost the use of the 70-centimeter band for a week in July. According to a report from Australia's *Q-News* reprinted in the Hudson Division Loop e-mail newsletter, hams in the affected areas were sent letters reminding them that the amateur allocation on 430 MHz is secondary and that "[a] particular problem has arisen which requires the cessation of all use of communications, attended or unattended, on amateur radio in a specified area for a temporary specified period" (July 4 to 11). *Q-News* reported that the primary user of the band needed the frequencies clear in order to perform tests.

The Shadow Knows...

The AMSAT News Service reports that hams in Germany were able to watch last summer's total solar eclipse via amateur television—from the vantage point of a high-altitude balloon. The balloon, built and launched by students and faculty members at the Pforzheim University of Applied Sciences in Pforzheim, Germany, carried a 2.3-GHz ATV transmitter. The photos, looking back down toward Earth, showed the shadow of the moon passing over Europe. Pforzheim was directly in the path of totality. Photos of the balloon equipment are on the university's balloon Web site at <http://www.fh-pforzheim.de/sofi/>.

Texas Puts the Squeeze on Repeaters

Texas may be the land of wide-open spaces and the second-largest U.S. state, but apparently it's not big enough to maintain 85-mile separation between repeaters on the same frequency—especially in crowded metropolitan areas. The state's frequency coordinator, the Texas VHF FM Society, voted at its August meeting to reduce the minimum separation from 85 to 70 miles and to strongly recommend that all newly coordinated repeaters use CTCSS or other type of tone access to reduce the likelihood of repeater-to-repeater interference.

There had been a proposal to require tone access for all repeaters, but *CQ VHF* Contributing Editor Kent Britain, WA5VJB, a member of the society's technical committee, explained that the group decided to go with a recommendation rather than a requirement, but that any repeater without tone access would have to be prepared to accept any interference it may get from users of other repeaters on the same frequency.

The vote came over the objections of many repeater owners, who, according to a report on Newsline, claimed that the society had no hard evidence showing that reducing the separation distance would not result in a significant increase in repeater-to-repeater interference. According to Britain, the only other possible way to accommodate the growing demand for repeater coordinations would have been to switch from 20-kHz to 15-kHz channel separations. But he said the technical committee found that, especially considering the Texas geography, reducing the frequency separation would have resulted in considerably more interference problems than reduced geographical separation and tone control.

ULS Conversion Snags License Processing

The FCC's conversion of its amateur licensing system to the new Universal Licensing System (ULS), which took effect in mid-August, reportedly slowed down processing of license applications for several weeks. The ARRL reports that a backlog of several hundred applications developed because of compatibility problems between the ULS software and that used by Volunteer Examiner Coordinators (VECs) to file test results electronically with the FCC. In addition, the vanity callsign system ground to a halt—at press time, no vanity calls had been issued since August 4, and assignments had not yet resumed—and there were additional software snags that prevented the online callsign servers (QRZ, Buckmaster, etc.) from updating their files. This problem was beginning to be resolved as we went to press, but the online databases were not yet fully up to date. Hams with questions about pending applications may call the FCC's call center toll-free at (888) CALL-FCC.

CQ VHF Ham Radio Above 50 MHz

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Letters

Your Spot to Speak Out

CQ VHF welcomes comments and suggestions from readers. We'll print a representative sampling each month, and we reserve the right to edit letters for length or style. All letters must be signed and show a return mailing address or valid e-mail address. Writers' names will be withheld from publication upon request. Address letters to: Letters, CQ VHF, 25 Newbridge Rd., Hicksville, NY 11801; or via e-mail to <letters@cq-vhf.com>. Please specify that it is a letter for CQ VHF magazine.

Cheap Yagis Down Under

The following letter was forwarded by "Antennas, etc." columnist Kent Britain, WA5VJB, with this note:

How about this, the Australian Civil Emergency Network has adopted the Cheap Yagi!

Hi Kent,

I (wanted) to tell you that our emergency amateur corp (WICEN) Wireless Institute Civil Emergency Network.....has adopted your wood boom Yagi designs for field use! They are cheap to build and the J-match is certainly risk free and simple to construct...as you told us in your series of articles -- and they do work well.

73, John Patterson VK3ATQ

Packet Basics

The following letter was addressed to "Digital Data Link" columnist Don Rotolo, N2IRZ:

Don,

Thanks for the great article on TAPR (Tucson Amateur Packet Radio) in the September issue. I've known about them and I've been thinking about joining but I didn't have any particulars about their work, so thank you! And as a person who has no experience with packet but a great deal of interest, I'm really excited at the thought of your next month's article on getting started in packet. (Out here in South Dakota, we have very little 2-meter voice traffic, so I'm hoping that packet is more active.) I've got an old computer and an old 2-meter handheld, some junkcard modems and sound cards, so I'm ready. Grin.

Are you gonna cover using a sound card as a TNC? I think I've heard some chatter about this on some mailing lists, but I'm not sure. And can you still get started on packet by using your computer's software as a TNC? Or this method now too primitive? What about using an old modem as a TNC? (You can see I've got lots of questions.)

Thanks for the great articles. Keep em coming!

73
Michael Forinash, KBØRIA

N2IRZ replies: Michael, It's a pleasur to hear from you - thanks for writing! I'm glad you learned something about TAPR. I've been a member for years, and cannot say enough about them.

October and November (there was so much, I had to split it into 2 months) cover getting on the air in the more conventional manner - a TNC or similar. If you wait for December, John Hansen, W2FS, writes a guest column on using a sound card as your modem. He zeroes in on using Windows 95, but the soundmodem driver (under FlexNet) is really meant to run under DOS. If you want to get started before then, visit the FlexNet site <http://home.pages.de/~flexnet> and look for their download page. You want a copy of PCF, SM, and BCT as a minimum. These are compressed files using LHA.EXE - This is widely available on the web, but let me know if you need a copy.

Using the PC as a TNC (with an external modem) is still quite popular, and the BayCom modems are sold by Tigertronics, I'm pretty sure for under $50, maybe even less.

Unfortunately, it's difficult to use a telephone modem over the air - they very much depend on the communication channel to be like, well, a telephone line: Specific signal-to-noise ratio, no PTT, full duplex, certain audio response, etc. 1200 baud might be do-able with an awful lot of work, but higher speeds are simply

not possible, even in theory, because of the factors I mentioned, and others. You don't know how much I'd just love to use phone modems as a cheap source of good modems, but, alas, they cannot be used.

If you run into problems setting up a packet station, feel free to write back!

Vy 73, Don N2IRZ

Heil Helps Solve FT-100 Speaker/Headphone Problem

The following letter was forwarded by author Ken Neubeck, WB2AMU:

Hi Ken!

Enjoyed your review about the FT-100. Wonderful little rig -- IF they can work out all of the early production bugs -- and they will!...At Dayton, (the Yaesu representatives) all but laid out the problem of using our headsets and articulate microphones on the 100....problem is that they multiplex the data control signals and the touch-tone audio (just what I need on 20 meters -- HI!) down the microphone input lines so one cannot simply plug in a microphone...trouble in River City.

All of a sudden the reflectors started filling, my phone was ringing, etc....so as of last Thursday, I am happy to release to the world the new HEIL AD-100-8 adapter that allows one to use our headsets or our new Goldline studio microphone on the FT-100. And let me tell you, Mr. Ken -- with the correct adjustment of the transmit audio equalizer, you can make this FT-100 sound like the 1000MP -- WITH our new studio mic. It is sensational. Of course, the big thrust is that this looks to be one of the most popular rigs for the DXpedition groups and our phones have just been CRAZY about this situation as they all want to take the jewel along BUT -- can't be done -- UNTIL NOW.

So, I thought I would alert you to the AD-100....there are two: an 8-pin male to plug in our 8-pin microphone cable and the AD-100-3.5 that has a female 3.5-mm jack that accepts our headset microphone inputs. We are 12 miles EAST of the great Arch of St. Louis. Thanks for all of your wonderful work. I was the VHF SSB editor for *CQ* back in 1962. Have been on 6- and 2-meter SSB since 1958....yep -- we had to build it all!! In fact, there weren't many on 20-meter SSB but here were about 10 of us nationwide playing on VHF ...I still have my 6n2 THUNDERBOLT and enjoy the heck out of the band. Hate this grid square stuff tho...has ruined the ability to hold a CONVERSATION.... seems as if everyone is off to find more squares...can't talk! Mercy! It is a great place to experiment and that I do with all of the great audio things we play with here in the lab. Hope to chat someday soon. Maybe it will be FT-100 to FT-100 ....Have fun! Tnx es 73

Bob Heil, K9EID

For more information, contact Heil Electronics at (618) 257-3000 M-F 10-4 Central time.

Let's Get (More) Technical

Dear *CQ VHF:*

I started tinkering with electronics in the 1960s. I have completed many electronics courses over the years to keep up with the evolution of electronics. I enjoy winding my own coils, fabricating my circuits, then tearing them back apart to salvage the parts.

Yes, I am connected to the Internet and find this to be boring and a waste of time, as most contacts on-line are not informative (electronics related). Just peddling wares, usually at inflated prices.

When I subscribed to *CQ VHF*, I was wanting to expand my hobby into amateur radio. I was under the impression that amateur radio was more than purchasing store-bought equipment, learning the code, and yakking on the radio.

You've recently had articles on getting new members. I am in agreement with comments that until a point in your life is reached that the kids are raised, the house and cars are paid for, the money for your hobby is limited by other expenses and the time is consumed with activity relating to family.

I have no problem purchasing the equipment -- I could put it next to the $100,000-plus equipment I now have (test equipment).

I personally derive pleasure from the design-build side and operation would be a result of my checking what the receiver or transmitter would do (short lived).

It is apparent that your magazine is not geared toward a person like me, so I will probably not renew when the sub runs out.

Sincerely,
Mike Stacy
Longview, TX

Mike—I'm sorry you haven't found what you're looking for in CQ VHF. *As a general interest magazine, we try to have a good mix of operating and technical articles, perhaps leaning more toward the operating side, since many of our readers (like most of today's hams) are more oriented toward operating than designing and building equipment. For a purely technical magazine, I'd recommend our sister publication,* Communications Quarterly. *If you contact our circulation department, they can transfer your subscription for the rest of the term.*

"Goofing Globally"

Dear *CQ VHF*:

I got a Kenwood TH-D7a. It was fun goofing with it locally. Now I'm goofing globally! I saw a message in a mailing list about our last chances for contacting Mir. I decided what the heck, why not give it a try. First morning, no luck. I couldn't get any of my APRS packets back. Second night was another story! I actually made it! I was getting packets back left and right. And I was doing this from my HT with 5 watts! Rubber duck antenna, too. Yowsa! Today I tried again, especially since they were going to pass over twice. The first time I figured would be another packet try and the second time I could try voice since they should be getting up about then. I got out of bed at 4 a.m. and waited for the first pass at 4:32. I sit and wait, trying to hear packets. To my surprise, I hear voice! I'm getting bits and pieces about moving the ham equipment to another module. That was about it, but it was cool. Next pass is at 6:08 so I have some time to think about what I've done so far. All in all not bad for a little radio without a lot of power. 6:08 rolls around and I hear voice again. They moved the equipment to another module and are testing it out. First voice and then packet. I listen and see if they want to talk to anyone else. No dice but it's fine with me. I'll try again. They leave the station Friday so I still have some time!

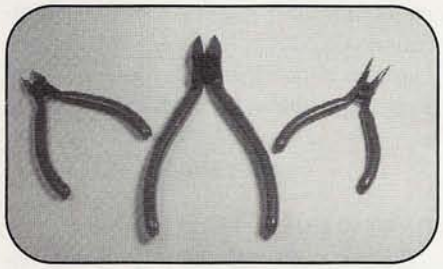
Ryan Szekeres, KB9TQN
Chicago, Illinois

Ryan—Glad you're having so much fun with your new HT! Be sure to check out the final slow-scan TV pictures sent down from Mir in this month's "Orbital Elements" column on page 44.

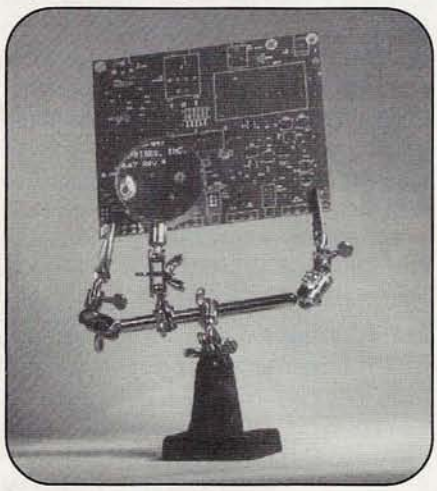
Product Update

MFJ "Helping Hands" Kit Tools

MFJ Enterprises has introduced a line of "Helping Hands" tools for electronics construction and repair projects.



The MFJ-7104 ($6.95) is a 4-inch tapered head diagonal cutter pliers. It's suitable for soft wire below a diameter of 1.0 mm and has green cushion grips. The MFJ-7106 ($11.95) is an all purpose, standard beveled edge, 6-inch wire cutters. Suitable for cutting coax and other thicker wire, it comes with red plastic coated cushion grips. The MFJ-7114 ($6.95) is a 4-inch needle nose-pliers, green plastic coated cushion grips. The VEC-7400 ($14.95) is a tool, with 2-inch magnifying glass, that holds objects at any angle and leaves both hands free. It has six ball joints, nickel-plated fittings, heavy cast-iron base, alligator spring clips, and locking thumb screws.



To order or for your nearest dealer, contact MFJ Enterprises, P.O. Box 494, Mississippi State, MS 39762; Phone: (800) 647-1800; Fax: (601) 323-6551; E-mail: <mfj@mfjenterprises.com>; Web: <http://www.mfjenterprises.com>.

Circle 100 on reader service card

LDG "Hamwhip" Antennas

LDG Electronics, Inc, of St. Leonard, Maryland, has announced the addition of the Hamwhip line of single-band mobile ham radio antennas to their line of amateur radio products. These antennas feature aluminum and fiberglass construction and fit on a standard $^3/_8$-inch antenna mount. The antennas are resonant for each amateur band from 6 to 75 meters and are "in-band" tunable for the lowest SWR on your favorite frequency. These mobile antennas are designed to work perfectly with LDG's AT-11 line of automatic antenna tuners, allowing multiple-band operation from one antenna.

The Hamwhip antennas are black, eight feet long, and handle 600 watts. The external fittings are chrome-plated brass and each antenna withstands the effects of many years of sun and road salts.

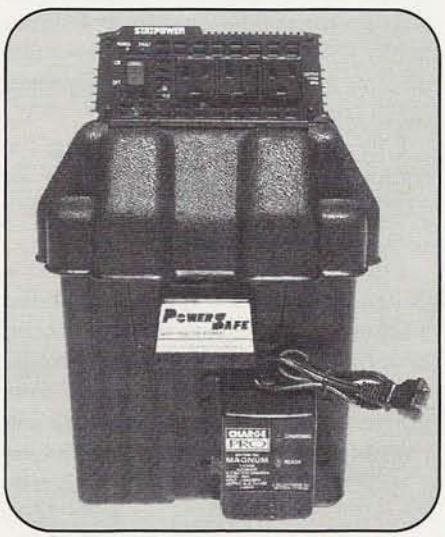
Each Hamwhip antenna retails for $22.95 plus shipping.

For more information, contact LDG Electronics, 1445 Parran Road, St. Leonard, MD 20685; Phone: (877) 890-3003; Fax: (410) 586-8475; E-mail: <ldg@ldgelectronics.com>; Web: <http://www.ldgelectronics.com>.

Circle 101 on reader service card

Cutting Edge PowerSafe 2000™

No, it's not a Y2K Power Sale. It doesn't take a millennial shutdown to need the PowerSafe™ power supply. With the simple addition of that spare 12-volt automotive battery in your garage or a deep cycle marine battery, you can have a complete AC and DC power station. This compact and powerful 12-volt rechargeable system offers a beefy 600 watts of AC power (1200-watt surge) and up to 200 amps of DC power. The PowerSafe's sturdy, vented battery enclosure is suitable for safe indoor use. Three AC outlets, three-port DC cigarette lighter outlet, automatic circuit breaker, a male cigarette plug to energize your equipment, and a fully automatic charger are all included in the system. And, with the compact dimensions of 18 x 10.5 x 9.5 inches, it fits easily under your desk. You can also transport this unit easily in your car for Field Day or other mobile uses.



The PowerSafe 2000 can hold up to a 125-amp hour battery. The fully automatic charger can be left plugged in to keep your battery in top shape without danger of overcharging. It can also be recharged through the cigarette plug in your car, boat, or RV. Cutting Edge is offering a special price of $299.95 (normally $369.95) on the PowerSafe 2000, good through December 31, 1999.

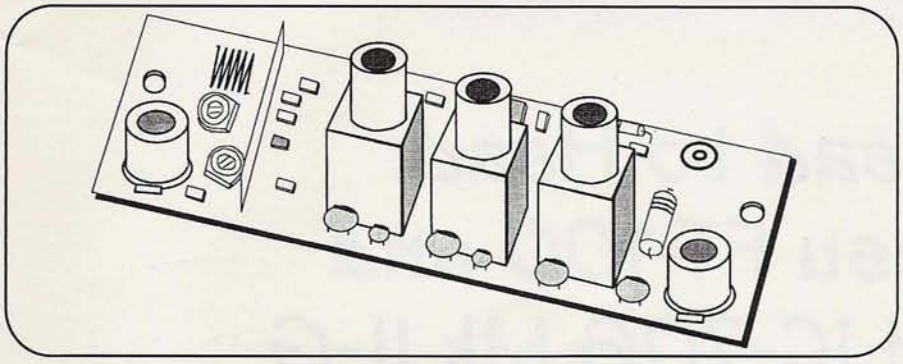
For more information, pricing, or distributor inquiries, contact Cutting Edge Enterprises, 1803 Mission Street, PMB-546, Santa Cruz, CA 95060; Phone: (800) 206-0115; E-mail: <cee@cruzio.com>.

Circle 102 on reader service card

Hamtronics® Low-Noise Receiver Preselectors

If you have an interference problem with a VHF receiver, Hamtronics may be able to help eliminate it. Nearby FM broadcast stations, paging transmitters, or other strong out-of-band signals can overload the front end of your receiver. Adding just a filter ahead of a receiver may block the interfering signals, but it will degrade the sensitivity of the receiver because of its insertion loss. However, the new LNP series of preselectors from Hamtronics has been designed with a low-noise preamp ahead of the filter to establish a low-noise figure before the signal reaches the filter.

The filter circuit comprises a sharp three-pole L-C filter which is optimized



for the particular band of interest, in addition to the input filter in the preamp circuit. The preamp circuit provides just enough gain to override the insertion loss of the filter circuit with a little to spare, so the receiver can maintain its good dynamic range characteristics.

The LNP preselector uses a pc board with RCA style jacks. Normally, the preselector is installed in the enclosure with the receiver, inserted in the 50-ohm signal path between the antenna and the receiver input. It's easy to install and has special RF-type RCA jacks for the coax connections. The pc board is only 1 x 3 1/2 inches, and the unit operates on +12 to +15 VDC at only 10 mA. The pc board also has a provision to add an RF choke to allow the B+ to be fed up the coax when necessary, so the preselector can be installed at the antenna.

Models are available for all popular bands from 132 to 180 MHz, including the 137-MHz weather satellite band and the 144-MHz ham band. Alignment to your frequency is very easy. Net gain nominally is 8 dB and noise figure is 0.6 dB. The price is only $39 for a factory wired and tested unit.

For more details, you can view Hamtronics' entire catalog at their Web site, <http://www.hamtronics.com>, which includes all their VHF/UHF transmitters, receivers, repeaters, converters, preamps, frequency counters, and accessories. For a printed catalog, contact Hamtronics, Inc., 65 Moul Rd., Hilton NY 14468-9535:Phone: (716) 392-9430; Fax: (716) 392-9420; E-mail: <jv@hamtronics.com>. Please tell them where you saw this announcement.

Contact East Fall 1999 Update Catalog:

Contact East has released an expanded, updated catalog for this fall. This new 96-page version displays hundreds of new tools and test instruments for engineers and technicians, as well as hobbyists. Featured are quality products from brand name manufacturers for testing, repairing, and assembling electrical and electronic equipment. Choose from quality proven brand names, including Fluke, Tektronix, Hewlett Packard, Weller, Metcal, OK, Pace, Makita, Xcelite, Loctite, Leatherman, and 3M.

All products are fully guaranteed. Same Day Shipping.

To receive a copy, contact Contact East, Inc., 335 Willow St., North Andover, MA 01845; Phone: (978) 682-2000; Fax: (978) 688-7829; Web: <www.contacteast.com>.

Head to Head: Yaesu FT-100 and ICOM IC-706 Mk II-G

We put the two hottest new all-mode, all-band HF/VHF/UHF mobile transceivers to the test—separately and together. Who's the winner in our head-to-head comparison?

By Gordon West, WB6NOA*
(wb6noa@cq-vhf.com)

No doubt you've heard the saying, "...like trying to compare apples to oranges..." Well, this is definitely *not* the case with the new Yaesu and ICOM HF/VHF/UHF transceivers. Rather, comparing these radios—the Yaesu FT-100 (Photo A) and the ICOM IC-706 Mk II-G (Photo B)—was like trying to compare two brands of luxury vehicles with so many features it would take over 45 days of field testing to find small differences.

We did just that. And *we*, in this case, was a variety of people. I was joined for many of the comparisons by Julian Frost, N3JF, and Bill Alber, WA6CAX; in addition, both radios "hit the road" with me to several hamfests, where visiting hams got a chance for their own hands-on testing (Photo C).

**Gordon West, WB6NOA, is Senior Contributing Editor of* CQ VHF.

Cutting to the Chase

The descriptions of each radio and its individual capabilities can be found in the reviews of each, published here in *CQ VHF* over the last two months (FT-100 in September, IC-706 Mk II-G in October; we're also working on posting both reviews on the *CQ VHF* Web page). So this comparison will dispense with the flowery prose and introductions and cut to the chase. How are these two radios alike? How are they different? Which one is best for *you*? Here are our findings:

Bands and Modes

Frequency Coverage: Both the FT-100 and the 706-G transmit and receive on all ham bands from 160 meters through 70 centimeters. Neither tunes the 222- to 225-MHz ham band for transceiver operation. The ICOM offers sensitive receive performance from 30 kHz through 199.999 MHz, and from 400 MHz through 469.995 MHz. The Yaesu does more. It offers continuous receive

Photos A and B. The Yaesu FT-100 and ICOM IC-706 Mk II-G side-by-side. Which one came out on top in our comparison? You'll have to read the whole article to find out! (Photos by the author)

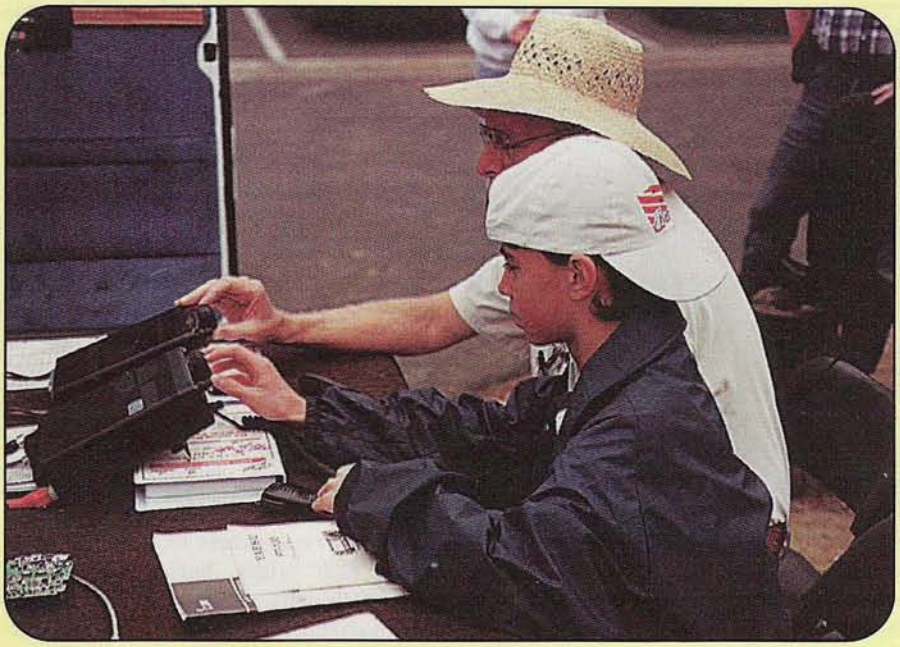


Photo C. We gave "real hams" at several hamfests the opportunity to try out both radios and made note of their comments and preferences.

from 100 kHz to 961 MHz (cellular blocked). For scanner enthusiasts, the Yaesu gives you additional military frequencies, 222-MHz receive capabilities, all the TV channels, plus public safety in the 800- to 961-MHz band.

Modes: Both the ICOM and the Yaesu offer all-mode operation on all bands, including VHF and UHF bands for weak-signal and satellite work. These include AM, CW, FM, RTTY, and SSB.

Optional CW Filters: The optional ICOM CW filters simply plug in. The Yaesu's filters are also optional and installation requires careful soldering.

Transmitters Compared

Power Output: Both ICOM and Yaesu are equal here: 100 watts on high frequency (HF) plus 6 meters; 50 watts on 2 meters; and 20 watts on 70 centimeters.

Cooling System: Both radios ran cool during prolonged transmit periods, with ICOM using one big internal fan, and Yaesu using two small rear-mounted fans. Both sets were able to handle high duty-cycle (70% transmit time) HF and VHF digital modes quite nicely.

Amplifier Switching: Both ICOM and Yaesu offer an accessory jack to accommodate switching a linear amplifier on and off. Most VHF and UHF amps require less than 15 milliamps (mA) of current to cycle into transmit, but some older HF amps may require as much as 175 mA to drop in the TX relay. The Yaesu can handle up to 200 mA of keying current, but the ICOM is rated at only 20 mA. If you need to draw more current than 20 mA with the ICOM, go to RadioShack and get their tiny 1-amp, 12-VDC relay that draws only 12 mA from the loading coil. Then wire it across the normally open contacts of your external linear amplifier transmitter circuit, and that little RadioShack relay will work nicely.

Listening Mode

Receiver System: ICOM and Yaesu both offer double conversion receivers on SSB, CW, and wideband FM. ICOM goes to triple conversion for narrow FM, while Yaesu sticks with double conversion. During our receiver tests, no objectionable intermod was encountered on either radio, even when taken to a popular mountaintop repeater installation.

Intermod Rejection: I was amazed at how well both sets did up at the repeater site. We ran them on 6 meters, 2 meters, and 70 centimeters, and no intermod crept through. Yet other radios we brought along (FM-only types) were overwhelmed by the mass of signals coming from the nearby repeater antenna, and we could barely hear a thing. Yet there we were with these new rigs copying SSB beacons with no noticeable signal degradation. This may have been due to our tuned Yagi antenna systems, but nonetheless, both the Yaesu and the ICOM transceivers worked well on the mountaintop on all VHF and UHF bands.

Receiver Sensitivity and Selectivity: Equal. Despite what you might hear from sales personnel, repeated tests by many different hams could not confirm one receiver as being better than another. ICOM runs a slightly larger speaker than Yaesu, giving a fuller sound. Yet the little Yaesu speaker made CW copying a delight.

External Speaker Jack: ICOM has two external speaker jacks—one on the rear of the radio, plus an additional speaker jack on the detachable front head (more on that later) with a tiny slide switch that changes it into an earphone jack. Yaesu offers one speaker jack, which can also work quite nicely with an earphone, off of an extension cable.

On the Front Panel

The LCD Screen: Both Yaesu and ICOM use a liquid crystal display (LCD) on their control head for maximum daylight viewing, and both LCDs are backlit at night. Both offer adjustable nighttime backlighting, but neither offers automatic backlighting adjustment with a photocell. This is a relatively common circuit, and we were surprised it wasn't incorporated in either unit.

The ICOM uses black numbers and letters on a light green background (Photo D). Yaesu uses royal blue letters on a light blue background (Photo E). The Yaesu baby blue screen was pleasing to the eyes at night, but the big bold ICOM screen, also with slightly taller characters, offered higher definition because of the choice of contrasting colors.

Most surprising was running both remote heads on the dash while wearing polarized sunglasses. One pair of polarized sunglasses caused the ICOM to go black, but the Yaesu display became sharper. Yet another brand of sunglasses caused the *ICOM* display to intensify, while the *Yaesu* display disappeared. When we asked the manufacturers about how they polarized their screens, neither had an answer. Actually, neither had a clue. They both doubted our observations until they put on their *own* polarized sunglasses and saw what happened. If you have a favorite pair of polarized sunglasses, best check out the radio to ensure you can see it with your head straight up and down! (See "Polarization Help" for a possible, but compromised, solution.)

Heat became a problem for the ICOM display, which began to turn black on a

Photo D. The LCD display on the IC-706 Mk II-G is black on a light green background. Users found it easier to see at wide angles and preferred it during the day., but sitting out in the heat makes it all go black.

hot dashboard; while the Yaesu display remained relatively constant with its slightly less-defined, blue-on-blue color configuration. On the other hand, we couldn't see the numbers and letters on the Yaesu when looking from wide angles as we could on the ICOM, so take this into account when you choose your radio and choose where you plan to mount the head. At night, the ICOM head offers back-lit keys (Photo F), while the Yaesu (Photo G) does not.

The Big Knob: No question about it, the ICOM tuning knob has a bigger and better hole for fat fingers, plus a plastic sleeve that turns within the hole as the big frequency knob is changed. There is also a tension adjustment on the ICOM knob. The Yaesu knob had a very nice rubber-like feel, but, unless you use your little finger, it's not as easily turned by the finger hole (you'll have to use the outside rim). Both let you tune to very precise frequencies and in very small steps.

Sub-Tuning Knob: Both ICOM and Yaesu have a smaller left-mounted knob that can also fast-tune or slow-tune frequencies independently of the big knob. The small knob has a click-click-click action that allows you to "feel" each click at a specific number of kilohertz when changing frequency, providing safer driving as you keep your eyes on the road. With both sets, if someone tells you to go up from 146.520 MHz to 146.580 MHz, you can click your way there without having to look down. One note: On the Yaesu, you can adjust tuning steps in both AM and FM modes, but you're set at 10-kHz steps in SSB. The ICOM sub-tuning knob lets you select tuning steps down to a fraction of a kilohertz for tuning in the action on the weak-signal portion of the VHF or UHF bands.

Front Buttons: The ICOM buttons are spaced relatively far apart and away from the spinner knob. Yaesu groups its buttons in close to facilitate thumb action. This is a matter of personal preference; try it yourself and see which layout you like best.

Remote Head Capabilities: The heads of both units can be separated from the rest of the radio with optional $75 separation kits. ICOM uses one connection cable for this option, and Yaesu uses three: one for the display, one for the microphone, and one for the external speaker. Some of our reviewers preferred everything coming off of the single cable from the ICOM head, while others preferred having the mic and speaker separated from the remote head, as Yaesu has done on the FT-100.

Inputs and Outputs

The Microphones: The ICOM mic (Photo H) is pretty "plain Jane": no push-buttons for DTMF, and only and up-and-down set of buttons on the top, plus a lock switch. The back-lit Yaesu microphone (Photo I) *really* feels like a handful of mic, and offers back-lit keys for autopatch calls, capabilities for up-and-down channel changing, but no capabilities for direct frequency entry.

Key Jacks: ICOM uses the large 1/4-inch CW key jack, and Yaesu offers the miniature stereo phone jack. Both sets have fully adjustable keyers built-in; and big-to-little and little-to-big adaptors are available at any RadioShack. If you're going to use an adaptor, use a pigtail so as not to over-stress the CW stereo input jack.

Antenna Ports: Both sets use a "regular" SO-239 coaxial-type antenna connector receptacle. Neither has gone to the N-connector for VHF/UHF operation. ICOM mounts its SO-239s (two of them) right on the rear of their equipment, and Yaesu uses two 8-inch pigtails.

Photo E. The Yaesu FT-100's blue-on-blue display was judged more eye-pleasing than ICOM's and was preferred for nighttime viewing. During the day, it didn't seem to be affected by heat as was the 706 display.

Polarization Help

We weren't the only ones to notice LCD display problems while wearing polarized sunglasses. A blurb from Mitch Bogart, KA1MIT, in the "Hints and Kinks" column of the July, 1999, issue of *QST*, points out the fade-to-black problem he encountered with his IC-706, along with a possible solution. Mitch says Edmund Scientific's Industrial Optics catalog offers something called "retarder films," which double the polarization angle of light that passes through it. He says he tried attaching a piece, rotated 45 degrees, to the IC-706 display and found he could see the numbers once again. However, others who've tried it have noted that it dims the display overall (which is better than not seeing it at all, of course), since the light from the LCD is now passing through two filters instead of one. According to the *QST* article, the retarder film is on page 69 of the Edmund Industrial Optics catalog (stock number H53206). For more information, contact Edmund Scientific at (609) 573-6250.

Automatic Antenna Tuner. Neither unit has a built-in antenna tuner module because there is simply no room inside. But both units *do* support external automatic antenna tuning via built-in automatic tuner *controllers*. ICOM's tuner controller works an externally mounted longwire antenna tuner on HF, and the Yaesu's built-in tuner controller operates their proprietary mobile ATAS-100 screwdriver-type antenna from 40 meters all the way through 70 centimeters. The ICOM automatic tuner system is designed mostly for base or marine mobile use, while the Yaesu system is designed more for vehicular or marine mobile. Both automatic antenna *systems* are options that you must buy as you would with any type of mobile or fixed-base antenna setup.

Power Plug: The ICOM comes with the common 6-pin Molex plug (Photo H) with the center pair of pins for battery negative, and a pair of edge pins for battery positive. The other two edge pins are purposely unconnected in case the power cord is momentarily inserted backward. This is a good precaution because the ICOM requires that the plug go in upside down, in comparison to most equipment that runs this same type of plug and connector.

Yaesu uses its massive, big-blade, land-mobile plug for positive and negative connections (Photo I), and incorporates automotive-style fuses. We're told this plug assembly has worked well in the land-mobile radio business, where hefty connections are required. I don't doubt it! It's big! So big that you might have to look for an extra-large rubber-boot-hole in the firewall of your vehicle to get the plug or fuse connectors through. We had no problem finding a rather large hole in the firewall of our communications van that would accommodate the big Yaesu power connector.

Current Consumption: Just when we thought the two rigs were equal, we found that the Yaesu FT-100 draws about 14

Photo F. At night, the ICOM display's sharp contrast makes the characters easy to see. The buttons are backlit as well, and the backlighting levels are adjustable.

On the Cover

Angel Medina, KB9PMT (left), of Champaign, Illinois, and Dennis Gray, KA9IBS (right), of nearby Danville, Illinois, work on their balloon-mounted amateur television (ATV) transmitter. The setup in the photograph is the product of two years of development and construction, says Angel, who notes that he and Dennis built *everything* except the camera. "That's probably what made it so much fun for us," he says, "that we built it ourselves."

Angel and Dennis have been into amateur radio ballooning for about two years. Their first effort was a homebrew transmitter attached to a helium-filled trash bag! The much more sophisticated unit shown on our cover is carried by a standard weather balloon to heights of up to 90,000 feet. It has made three flights so far.

Inside the Styrofoam box—wrapped in foil at the upper left—is a 2-meter transmitter which serves as a beacon for tracking the unit in flight and finding it after landing. It puts out less than 100 milliwatts (but has been heard as far away as Dayton, Ohio) and sends out beeps as well as voice and CW IDs. There's a temperature sensor attached to the transmitter, and the colder the air is, the shorter the beep. Below the 2-meter transmitter is a cylindrical video camera (picked up at Dayton), which is connected to a 1.25-watt, 70-centimeter ATV transmitter (the aluminum box next to the 2-meter transmitter), and below that is a 12-volt lithium battery that powers everything. At the very top is a turnstile antenna for the ATV signals.

The most rewarding things about the project, says Angel, have been building everything from scratch and making new friends. That, he says, "represents the true nature of ham radio." (Cover Photo by Larry Mulvehill, WB2ZPI)

Photo G. The FT-100's display isn't quite as clear at night as the 706's, but it was preferred for nighttime viewing. The buttons on the radio are not backlit, but the microphone buttons are. As on the 706, backlighting levels are adjustable.

amps for 50 watts output on 2 meters, yet the ICOM IC-706 Mk II-G running 50 watts out was drawing only about 9 amps. A call to Yaesu revealed their intent to offer the most linear 2-meter signal possible over the airwaves, and this extra linearity pulls a little bit more current from the battery source. Both the ICOM and the Yaesu had excellent transmit audio.

Size and Weight: The ICOM weighs in at 6 pounds, including the mic (but less the mounting bracket). Yaesu weighs in at 5 pounds, also including the mic (but not the mounting bracket). ICOM is 10 inches long, versus Yaesu's is 9-1/2-inch length. Both units are around 2 inches high, and both are also approximately 6-1/2 inches wide.

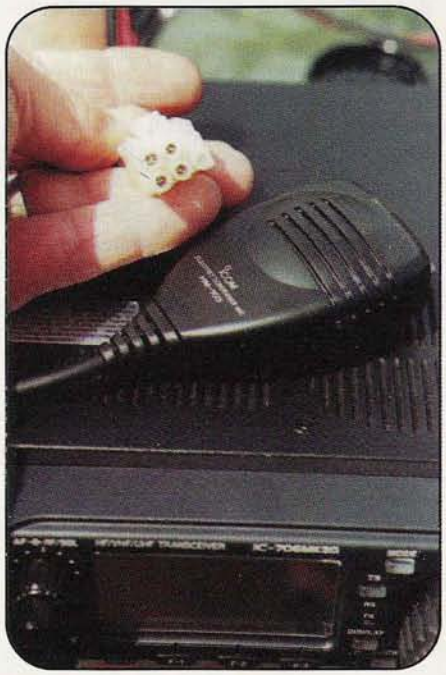


Photo H. ICOM's new 706 features its standard "upside-down" Molex power connector and a "plain Jane" microphone, with no buttons except frequency up/down (on top).

Software Stuff

Memory Channels: Big differences here. Yaesu offers 349 memories, and ICOM only 107. Yaesu also includes a quick memory bank, while ICOM offers memory alphanumerics to name each channel on the LCD display.

Automatic Repeater Offset: Both radios have it. For ICOM, this is a new feature in their 706 "G" series. Both units can also handle "oddball" splits, as well as different configurations for the 6-meter band.

Menus: Lots of behind-the-scenes adjustments are available on both radios, probably more than you'll ever need or care to adjust! ICOM offers 37 different menu items, plus an additional 20 or so options to tailor the radio exactly as you want it. Yaesu offers 66 main menu items, plus an additional 58 items that change sensitive factory settings. The factory menus are accessed by pressing the **A**, **B**, and **C** keys together while turning on the transceiver, then pressing and holding the function key.

These factory menu settings should not be changed radically—things like automatic level control (ALC) play an important part in a good, clean signal without overdriving the very expensive internal power amplifier. Same thing with VHF and UHF sensitivity settings; although

you can increase the receiver sensitivity on both bands by at least one more decibel (dB), you may now be operating in an area where the receiver is also more sensitive to intermodulation interference.

Be very cautious in changing any of the factory settings because it could lead to a fatal problem in how the equipment operates. About the only thing I did was change the HF ALC to *slightly* increase average talk power, yet preserving good-sounding transmitter output without overdriving the internal power amplifier.

Digital Signal Processing (DSP): Both ICOM and Yaesu have built-in DSP circuits. Yaesu also offers DSP microphone equalization, as well as adjustable DSP bandpass. Our reviewers felt the Yaesu DSP had more CW capabilities than the ICOM DSP circuits, but both were easy to operate and adjust, and both did an exemplary job of reducing background hash and minimizing steady-tone heterodynes.

Full CTCSS Decode: ICOM has it straight out of the box, but it's an option with Yaesu. On the other hand, Yaesu offers full-decode digital coded squelch (DCS) on the FT-100, while the ICOM 706-G has no DCS capabilities.

Look, Up in the Sky...

Satellite Operation: Sort of, on both units. Both Yaesu and ICOM can operate split-bands—transmitting on one band, releasing the microphone button, and then having the set receive on another band. But neither set can listen to one band while transmitting on another, so neither of these transceivers should be classified as full-duplex satellite sets. However, if you regularly operate satellite and have memorized uplinks and downlinks, this equipment should be able to make the grade and let you complete satellite contacts without actually hearing your own downlink. But exert great caution so you don't accidentally step on any communications already in progress.

The Biggest Differences

After nearly 60 days of dual-product show-off and hands-on testing at various hamfests, here is what our audience of "hams-on" reviewers perceived as the radios' biggest differences:

• The ICOM LCD display was preferred during the day, but the Yaesu display was preferred at night. In the hot sun, the ICOM display began to turn dark.

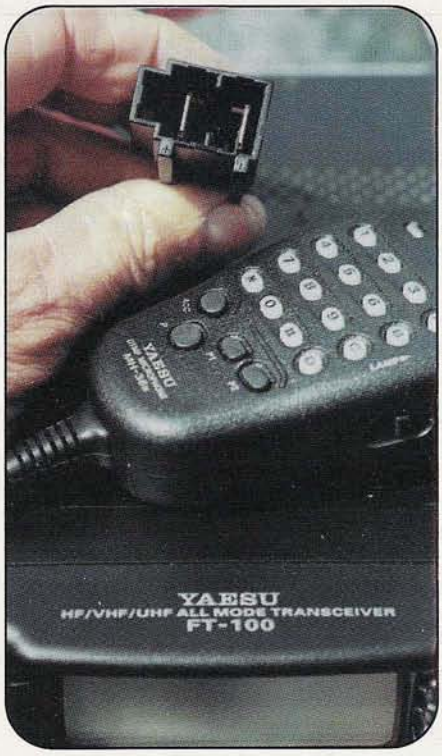


Photo I. The FT-100 uses a giant—and hardy—power connector taken from Yaesu's land-mobile rigs, along with a full-featured microphone that lets you control many of the rig's functions from the palm of your hand. Neither radio permits direct keypad frequency entry.

• It was another even split on how the front panel pushbuttons were laid out. Some preferred the tight cluster around the big tuning knob on the Yaesu. Others, generally with big fingers, preferred wider-spaced ICOM keys.

• Everyone loved the Yaesu's big, back-lit, full-function mic, and almost everyone thought that ICOM could have provided as standard equipment (not as an option) a microphone for telephone autopatch. And everyone was surprised that there was no direct frequency entry on either mic.

• Getting around the menus was a lot different on both transceivers. Everyone liked the capability of going to the "secret" factory menus on the Yaesu by holding the A-B-C buttons in on turn-on, and then pushing and holding the function button. But some reviewers felt that too many menus might be confusing, and those who had previously owned the older ICOM 706 series preferred sticking with the same type menu functions.

• Most everyone liked the richer bass response of the built-in speaker on the ICOM. That is, except for CW enthusiasts who preferred the Yaesu speaker. On

Table.

Feature	ICOM IC-706 Mk II-G	Yaesu FT-100
Amplifier switching	Accessory jack; max 20 mA keying current	Accessory jack, max 200 mA keying current
Antenna connectors	2 SO-239s, on rear panel	2 SO-239s, on pigtails
Automatic antenna tuner	No; built-in controller for (optional) matching external tuner	No; built-in controller for (optional) matching external tuner/antenna system
Automatic repeater offset; "oddball" splits	Yes	Yes
CTCSS encode/decode	Standard/standard	Standard/optional
Current consumption	9 amps for 50 watts out on 2 meters	14 amps for 50 watts out on 2 meters
CW filters	Optional, plug-in	Optional, must be soldered in
DCS (digital controlled squelch)	No	Yes
DSP (digital signal processing)	Yes	Yes
Ext. speaker jack	2 jacks, one switchable for earphone	1 jack, suitable for speaker or earphone
Frequency coverage (ham bands)	160 meters–70 centimeters	160 meters–70 centimeters
Intermod rejection	Excellent	Excellent
Key jack	1/4-inch monaural	1/8-inch (mini) stereo
LCD display	Black on light green; backlit; fades to black on hot dashboard	Dark blue on light blue; backlit; no apparent fading problems
Memory channels	107 + alphanumeric tags	349 (no alphanumeric tags)
Menu options for customizing operation	37 main items + 20 secondary (57 total)	66 main items + 58 secondary (124 total)
Mic (as supplied)	Hand mic; PTT, up/down, lock buttons only	Hand mic; PTT, up/down buttons, backlit DTMF keypad (no direct freq. entry)
Modes	AM, CW, FM, RTTY, SSB	AM, CW, FM, RTTY, SSB
Power output (maximum)	100 W (HF+6 m); 50 W (2 m); 20 W (70 cm.)	100 W (HF + 6 m); 50 W (2 m); 20 W (70 cm.)
Power plug	6-pin Molex ("upside down")	Large 2-blade connector
Receiver sensitivity/selectivity	Both equal	Both equal
Receiver system	Double conversion (SSB, CW, wide FM); triple conversion (narrow FM)	Double conversion (all modes)
Remote control head	Yes (w/ optional kit); single cable for all connections	Yes (w/ optional kit); separate cables for display, mic, speaker
Satellite operation	Possible with crossband operation; no full duplex for monitoring transmissions	Possible with crossband operation; no full duplex for monitoring transmissions
Size/Weight (less mounting bracket)	2 x 6.5 x 10 inches (HWD)/6 lbs	2 x 6.5 x 9.5 inches (HWD)/5 lbs
"Street" price	Approx. $1400	Under $1500

Table. Brief comparison of major features on the ICOM IC-706 Mk II-G and Yaesu FT-100 multimode HF/VHF/UHF transceivers. Features are listed alphabetically.

external speakers, both sets sounded almost identical.

• Hams with previously installed HF equipment using the common 6-pin white Molex plug were happy to find out that ICOM continues to stick with the same plug arrangement. Most everyone was surprised that Yaesu went to a different style plug; yet no one had a problem once they saw how massive the Yaesu plug was and how much current it could handle.

• The Yaesu remote head separates from the body with a single cable feeding the head, and two additional cables for speaker and microphone. ICOM uses only a single micro-cable for feeding the head, the mic, and the speaker/earphone jack. Many reviewers liked this single-cable idea, yet others pointed out that the weight of the cable coming off of the remote head could dislodge it from the dashboard and cause the head to regularly drop to the floorboards.

And the Winner Is...

So who's the big winner in this head-to-head comparison? *YOU are!* These are both excellent radios, similar enough to provide the same major features, but different enough to give you a real choice in selecting the rig that best meets your personal operating style. Among our hamfest reviewers, *everyone* indicated they really couldn't make up their mind until they'd had a few minutes to spend with both sets, spinning the knobs and pushing the buttons, and getting a better "feel" for their next investment. It's indeed a tough decision that we all look forward to making! ■

Picture This!

"Phun Photos"

On The Air, In The Air

Glenn Love, N3WPW, (seen with his radio-controlled airplane) lives in Carlisle, Pennsylvania, where he uses 6 meters for R/C flying, along with two other hams in his flying club. Glenn is a relatively new ham himself, and upgraded to Tech Plus earlier this year. He is "82 plus" years of age, retired from the U.S. Air Force and as a Juvenile Probation Officer.

"Amateur radio is much like building and flying radio-controlled miniature (model) aircraft in that there are so many vocational avenues...to pursue for one's life," he says, noting that older hams need to work harder to introduce amateur radio to young people. "Young people need to be brought into amateur radio to carry on this valuable national resource. I have met in this area a number of men who have been involved for 50 years or more, but it appears that interest is lacking in reaching out with this challenge." Glenn introduced his 15-year-old grandson, Kimball Gontz, to amateur radio during the ARRL-sponsored Kids' Day last June 16. He says, "Kids' Day is a great beginning and begs to become an 'everyday challenge' to our young people—and to 'old people like me.' " (Photo courtesy Glenn Love, N3WPW)

ATV on the Road

Chet Kruczek, W1HGJ, regularly takes his amateur television (ATV) gear "on the road," either with his ni-cad powered "hard-hat cam," which puts out 100 milliwatts on 426.25 MHz; or with a more stable setup, using his 1-watt "portacam," which operates on the same frequency and is powered by a 12-volt, 7 amp-hour gell cell battery. The system includes a one-inch monitor, video graphics identifier, a 10-minute timer, a gray-scale generator and an antenna. Chet lives in East Longmeadow, Massachusetts. (W1HGJ photos)

If you've got a cool snapshot to share with us, but don't have a whole article to build around it, send it in to "Picture This," along with a brief description of who and what we're seeing. If we like it, too, and have the space, we'll print it (no pay, just glory). Send your color prints to *CQ VHF*, 25 Newbridge Road, Hicksville, NY 11801. Please don't write on the front of the photos or use ballpoint pen on the back. If you'd like your photo(s) returned, please tell us so and include an SASE (self-addressed, stamped envelope) with sufficient postage. Thanks!

Meteors on Your Computer

Meteor scatter on packet? You bet! W2EV's "Digital Rock-Plotter" will let you track the meteors you hear. And this month's Leonids meteor shower is the ideal time to start.

By Evhen Tupis, W2EV*
(evman@ix.netcom.com)

An incredible experiment was carried out during the 1998 Leonids meteor shower. Over two dozen amateur radio operators dusted off their terminal node controllers (TNCs), placed them in "beacon mode," switched their 2-meter multimode transceivers to FM, and stood by as the rocks fell from the sky.

The results were quite astonishing. No fewer than a dozen of the participants received meteor-induced signals from as far away as 1,200 miles. No longer could meteor scatter (MS) be seen as the exclusive dominion of the VHF narrow band SSB/CW operator. It was proven beyond a doubt that any licensed ham with a TNC, FM transceiver, antenna, and a Windows™ or Mac™ computer can join in. The 1999 Leonids shower—this month—provides a perfect opportunity to get started.

This system is based on the use of *Unnumbered Information* (*UI*) packets, a system in which TNCs communicate without establishing a formal connection, allowing transmission of information without all of the typical BBS-like "keep alive" traffic that often clogs a packet channel (to learn more about UI packets, consult your TNC operating manual). It is this same UI-based communication system on which the Automatic Position Reporting System (APRS™) is based. In fact, this article will feature the Windows version of APRS software (WinAPRS™) as a basis for chasing meteors and plotting meteor-induced propagation anomalies. The article will concentrate on the operational side of the system. For a brief technical description, see "Explaining the System," elsewhere in this article.

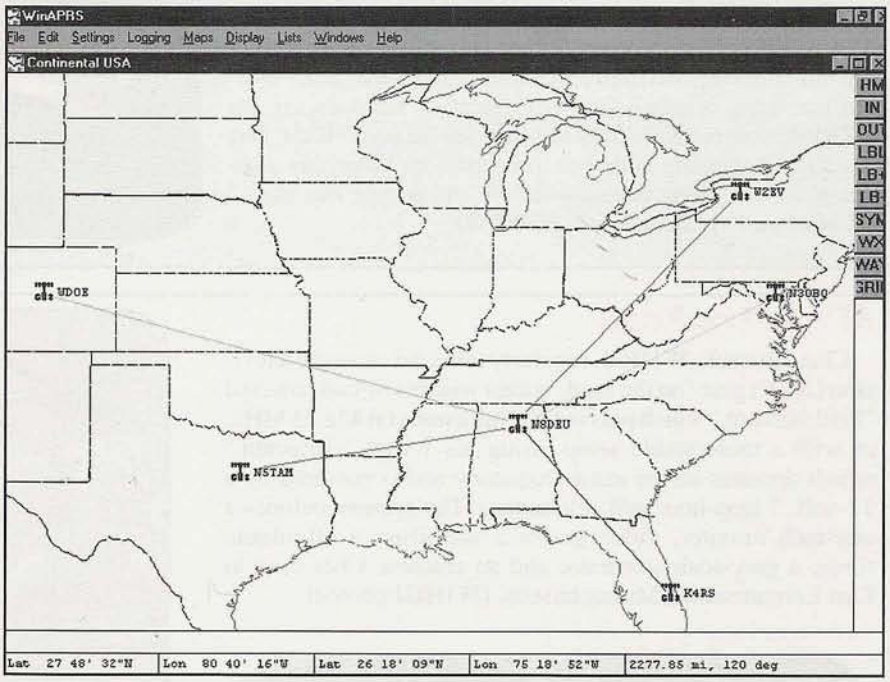


Figure 1. Does this stuff really work? You bet! This depicts all of the stations that reported hearing N8DEU during the 1998 Leonids meteor shower! Will your icon appear on someone's screen this year?

Step 1: Getting APRS Software

Using your computer and modem to gain access to the Internet, surf to the Web site of Tuscon Amateur Packet Radio (TAPR) at <http://www.tapr.org>. There, you will find a section dealing with APRS and software downloads. For the purposes of this article, I'll be referencing the Windows 95/98 version of this software. That is not to say that other versions won't work; I just haven't taken the time to familiarize myself with other versions. Their setup may simply be different.

Download the latest version of WinAPRS and unzip it to the folder of your choice. In order to remain consistent with Windows 9X convention, you may wish to unzip it to C:/Program Files/WinAPRS. During the installation process, several sub-folders will be created as well.

A quick note about WinAPRS: it is shareware. You may use it for as long as you choose, at no cost. However, the unregistered version will not allow you to save your setup parameters. Until you

**Ev Tupis, W2EV, is an active VHFer in the Rochester, New York, area. He is the "founding father" of PropNET, a 6-meter packet network designed to help make real-time plots of band openings.*

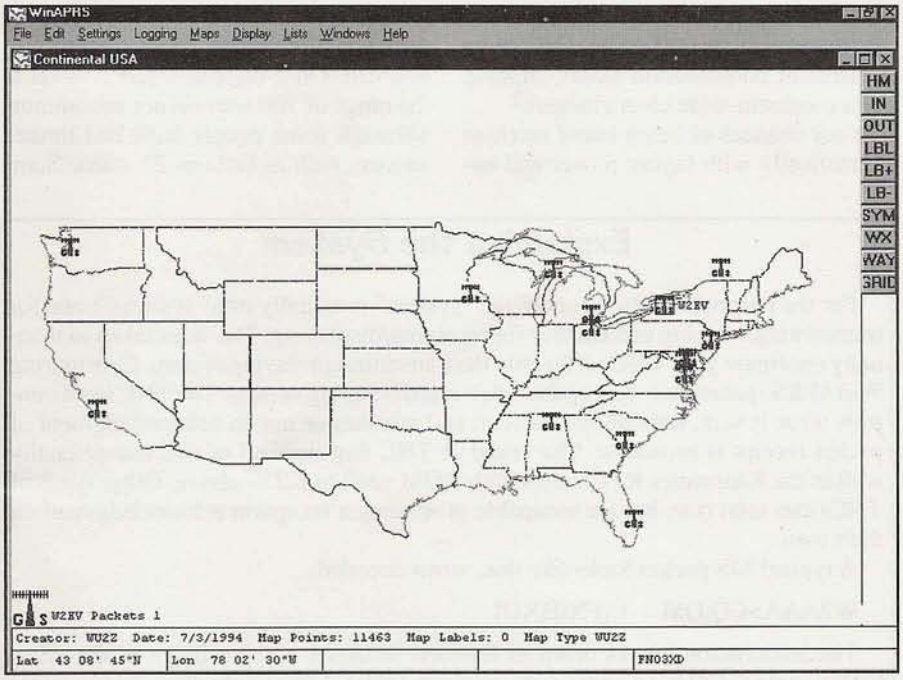


Figure 2. Who had success during last year's Leonids meteor shower? Take a look for yourself! This screen shows everyone who was received by someone, somewhere (the author's is the only station with callsign showing). The best thing is, everyone's chances of success increase as more people participate. There were actually more people who tried, but weren't reported as being heard by anyone. Many thanks to Bob Bruninga, WB4APR, for sharing his archives.

register it, you'll need to manually setup the program each time you launch it. Otherwise, the software is fully functional for our purposes.

Step 2: Configuring Your TNC

Next, make sure that your TNC is connected to your computer and that your computer is able to communicate with it. Launch a terminal program, such as Windows' *HyperTerminal*. Set it to communicate with your TNC, most probably using either Com1 or Com2, and the parameters of 9600 baud, 8-bit word, No parity and 1 stop-bit (8N1). Power up your TNC and make sure that readable text appears in your terminal window. If it doesn't, then use the information in your TNC's manual to troubleshoot. When readable text *does* appear, then it's time to restore your TNC to *factory default settings*.

Restoration to factory default settings is usually quite straightforward. For instance, if you're using a Kantronics brand TNC, the command is: **RESTORE D**. Research this point in your TNC manual if you're using another TNC brand. If you're using a Kantronics TNC, invoking the **RESTORE D** command will cause the TNC to echo gibberish to your screen for several seconds, followed by the request to press "*" to set baud rate. After pressing "*", you'll be prompted for your callsign. If you're planning to operate on 2 meters, enter your callsign with a suffix of "–2". If you're operating on 6 meters, enter your callsign with a "-6" appended to the end. You're now ready to perform a one-time manual TNC configuration. It's considered "one-time" because your TNC should maintain these parameters even after it's powered off.

Refer to Table 1, 2, or 3 for your instructions on this one-time TNC setup. Enter the commands exactly as they appear in the table that is most appropriate for the type of TNC you're using.

There is a distinct advantage to using a Kantronics KPC-model TNC with ROM 8.2 or above for this experiment (see Note #1 at the end this article). If you have multiple TNCs, and one is a KPC, use it. But if you don't, don't worry. Any TNC will work for the basic purpose of chasing meteors. When you're done entering setup parameters, "hang-up" the terminal software and exit back to your desktop.

This concludes the "manual" portion of setting up your station. Remember that you shouldn't have to do this again, as your TNC should maintain these settings even after you power it off. Of course, some older TNCs may not retain their settings. Experiment to determine your TNC's retention personality.

Table 1.

INTFACE TERM
CD SOFTWARE
UITRACE QSL,30
LT 1 [GRIDSQ] (i.e.-[FN03XD], etc.) put it in square brackets
LTP 1 CQ VIA QSL1-1
BLT 1 EVERY 00:00:10

Table 1. One-time setup commands for Kantronics TNCs with ROM 8.2 or greater. This setup is intended specifically for the MS experiment described in the text and not for everyday packet operation.

Setting Up Your Software

Now, launch WinAPRS. You'll be greeted with a pop-up window titled "WinAPRS," showing copyright information. Press <**Enter**>. Another pop-up window will appear, this one titled "TNC Selection." Assure that the radio button for "**Single TNC on VHF**" is selected and press <**Enter**> again. A map of the continental U.S. will fill your window.

Complete the setup by changing the following parameters, all of which will be found in the "Settings" menu: First, select "**Station**" and change the callsign to the exact value that you entered into your TNC earlier (remembering the "-6" or "-2" that you entered before). Then press <**Enter**> or choose "**OK**".

Next, select "**Serial Port**" and make sure the correct serial port is chosen. In WinAPRS, the default is COM1 (as noted in the box next to "VHF" and under the column labeled "Number." If your TNC is on COM2, change the "1" to a "2" and press <**Enter**> or choose "**OK**").

Now, select "**TNC**." Select the radio button titled "**Receive Only**" and the selector button which best describes the brand of TNC you're using (i.e., AEA, Kantronics, MFJ/TNC-2, or Picopacket). Don't be confused by this step. We use WinAPRS to decode packets, but the TNC itself is configured to transmit them. That's why we set up WinAPRS for "Receive Only" mode. When done, select the "**OK**" button.

Next, make sure that your TNC is turned on and still in the "Settings" menu, then select the "**Open VHF TNC**" option. When you do, you may be greeted with a pop-up message which says, "Please set your Lat/Lon in SETTINGS/Station." Ignore that message if it appears and simply press "**OK**." You'll immediately notice a list of commands flashing across the bottom of your window. These are commands that WinAPRS is sending to your TNC, configuring it for proper operation.

Finally, when you're ready to begin transmitting, power up your transceiver, setting it on the correct frequency. *Don't do this until you are ready to begin operation*, as your TNC will cause a transmission to take place as often as the *BEACON EVERY* or *BLT* parameter dictates; and it will begin as soon as you've powered-up your FM transceiver![1]

The Transceiver and the Frequency

If you're operating on 2 meters, the MS channel is *not* the national APRS frequency of 144.390-MHz. Do not operate MS there. Instead, try 147.585 MHz FM simplex. While it's possible that voice operations take place on this frequency from time to time (it's *in between* the more commonly used simplex frequencies of 147.570 and 147.590 MHz), MS operations are short-lived by definition. Even the most robust of meteor showers lasts for only a few days. As a result, packet-based MS operations on this frequency are unlikely to cause problems.[2] Additionally, a "favorite mode" of packet MS operators is to leave the equipment running overnight. Again, the chance of interfering with any other channel usage is minimized.

If you're operating on 6 meters, the MS channel is the PropNET[3] frequency of 53.530 MHz, simplex FM. This frequency is actually coordinated for this purpose—FM packet-based MS and propagation research—in much (but not all) of the U.S. and is presently unassigned to any repeater in areas of the country where a different coordination exists, making for a continent-wide clear channel.[2]

Your chances of being heard increase dramatically with higher power and antennas which bathe the sky in the desired direction. Put simply, use an amplifier if you can. On 2-meters, a power level in the range of 100 watts is not uncommon, although some people have had limited success with as little as 25 watts. Some

Explaining the System

For the purposes of this section, the "system" is actually two "systems": one for transmitting/relaying and another for receiving/displaying. The steps taken to manually configure your TNC set up only the transmitting/relaying system. Configuring WinAPRS' parameters sets up the receiving/displaying system. The TNC itself controls what is sent, how often it is sent, and whether or not an acknowledgment of packet receipt is broadcast. The brand of TNC that does all of this exceptionally well is the Kantronics KPC-series with ROM version 8.2 or above. Other types of TNCs can send fine, but are incapable of sending a reception acknowledgment on their own.

A typical MS packet looks like this, when decoded:

W2AAA>CQ,QSL1-1:[FN03XD]

The information breaks down as follows: W2AAA is the callsign of the originating station; CQ is an unused placeholder; QSL1-1 is an imbedded "request" for the receiving station to retransmit what it hears, a sort-of QSL; and [FN03XD] is the 6-character grid square location of the originating station.

Let's take a closer look at the QSL1-1 parameter. QSL1-1 is actually a request for digipeating once; if it were QSL3-3, then the request would be for digipeating three times. The SSID (-3 in the second case) is what controls the number of "qsls" or digipeats that are being requested. The idea is to have the receiving station retransmit what it heard so that the originating station has a chance to verify that it got through.

Of course, many things influence the success rate of this operation. It's possible that the originating station used 300 watts and a four-element beam, while the receiving station has only 25 watts and a half-wave vertical. Under these circumstances, the chance for a "QSL" is quite low, even if the meteor burn is long enough to have otherwise sustained the contact. If the receiving station is a KPC (with ROM 8.2 or above) and configured as outlined in Table 1, it will perform a single "call substitution digipeat" of the received packet, inserting its own callsign in front of QSL1-1 and decreasing the suffix of QSL1-1 by 1 (to a value of 0 or, in this case, "null"). A –0 suffix is the same as a "null" or nothing. In effect, the receiving station will re-transmit the information that it just received in the form shown below:

W2AAA>CQ,K4RS,QSL1:[FN03XD]

In the above example of a relayed packet, K4RS rebroadcast the packet showing the originating station (W2AAA) and its grid square (FN03XD). If this packet made it back to the originating station, it is a "QSL"—a confirmation of receipt! Remember though, this works *only* if the distant station uses a KPC TNC with ROM 8.2 or above. If not, it won't know how to process the QSL1-1 information in the received packet. In this case, the remote station will still log and display the reception; it will simply remain silent as to sending a "QSL" transmission.

UITRACE is the command that sets up your KPC-model TNC to react to a QSL#-# request when it is made. As setup for MS work, this command tells the TNC to treat the string "QSL" as a request for digipeating, and to do so only if it hasn't heard the same packet in the last 30 seconds. That last parameter is designed to keep the frequency from saturating with duplicate transmissions should an extended meteor burn occur.

In a perfect world, all participating stations would use Kantronics KPCs with ROM 8.2 or above. If you don't already own a KPC-model TNC, you may wish to acquire one. You will find greater successes in the long term. On the other hand, don't avoid participating if you don't have one—get on, make some noise and let others plot you on their screens!

Table 2.

INTFACE TERM
CD SOFTWARE
LT 1 [GRIDSQ] (i.e.- [FN03XD], etc.) put it in square brackets
LTP 1 CQ VIA QSL1-1
BLT 1 EVERY 00:00:10

Table 2. One-time setup commands for Kantronics TNCs with ROM version less than 8.2. See text for details.

Table 3

BTEXT [GRIDSQ] (i.e.- [FN03XD], etc.) put it in square brackets
UNPROTO CQ VIA QSL1-1
BEACON EVERY 1

Table 3. One-time setup commands for TNC-2 clones such as MFJ, etc. This is the closest you'll get to a "generic" setup.

participants run as much as 300 watts. Last year, 2-meter antennas ranged from a simple 5/8-wave vertical (with rare success) to a 10-element vertical beam. Six-meter participation is planned for Leonids '99. Watch for multiple stations running 1/2-wave and 5/8-wave verticals (and a few using their horizontal beams) with 50 to 200 watts.

Tune in Those Rocks

Meteor events can be fickle. Even the "best" prediction is still a guess. The power of this system is that it can run 24 hours a day, seven days a week, throughout a meteor shower event. All you need to do is check the computer screen from time to time to see what's been captured! Figure 1 shows the stations that reported reception of N8DEU on 2 meters during one overnight session of the 1998 Leonids.

Expect better results with higher power, moderately directional antennas, and frequent transmissions. Let the system work overnight or over several days. If you want to save the event for posterity (it's being tracked on a computer, after all), have the system maintain a log of everything that it can decode by doing the following: from the "**Logging**" menu, select "**APRS Logging.**" A log file will be created with the date as a filename. You can later play back everything that happened by selecting "**File**" – "**Simulate.**"

"Meteor events can be fickle. Even the "best" prediction is still a guess. The power of this system is that it can run 24 hours a day, seven days a week, throughout a meteor shower event."

Expand Your Horizons

The 1999 Leonids meteor shower is upon us. Even if you're a narrow band (SSB/CW) operator, this is a great chance for you to join in on a whole new facet of "ping-jockeying." The FM MS frequencies are far enough away from the SSB/CW portions of each band that you may find you can work the rocks, and plot the rocks, at the same time with no adverse interaction![4] And if you're an FM/packet operator who's used to working only the local repeater and/or BBS, here's a great opportunity to literally expand your 2-meter horizons.

Do you have the desire to talk to others who share this enthusiasm for packet-based MS and plotting other propagation anomalies?[5] Join the PropNET *listserve* (an Internet e-mail list) on the TAPR Web site. Among other things, you'll find other folks who have already done it and can help you along. Figure 2 shows all of the packet-based stations that reported activity during the 1998 Leonids. Come on, join in the fun! ■

Notes:
1. If you're using a Kantronics TNC, you can "open" your squelch completely as Carrier Detection is done by the TNC and is not dependent on the squelch state. As a result, KPCs may be able to decode weaker signals than other types of TNC. Other TNCs require that you set your squelch to "just closed." Failure to do so will cause your TNC to think there is a signal on the frequency, and it won't allow your station to transmit.
2. Even so, be a good neighbor. If you find local activity on this frequency, bow to it. These frequencies do not "belong" to packet MS or propagation enthusiasts. We may need to move in the future as better frequency assignments avail themselves.
3. PropNET is a developing service for "real-time" spotting of band openings and will be described in a future article. For further information on this leading-edge amateur radio service, see the PropNET Web site at: <http://www.RochesterNY.org/PropNET>. To join a listserve to discuss packet-based MS operations, as well as the packet-based propagation tracking network, visit <http://www.tapr.org>.
4. This is by design. PropNET, as this use of APRS is called, was carefully housed at the "top end" of the band, so as to allow for minimal interaction with SSB/CW operations should one station wish to hunt rocks on both simultaneously.
5. For more on the technical aspects of the system described in this article, see "An Automated Meteor-Scatter Station," by W2EV, in this month's issue of *QST*.

Communicating with Computers: An Exploration

If understanding how radios work is a piece of cake for you, but computers are one of life's ultimate mysteries, then follow N2OZ as he explores the basics of "computerese" to help you master these machines (instead of the other way around).

By Lew Ozimek, N2OZ*
(lozimekn2oz@erols.com)

Amateur radio is a technical hobby. No matter what we say or do, we cannot escape that fact. Many of us may have memorized just enough engineering data to eke out a passing score on our license exams. Others may have been so technically qualified that they breezed through their tests. This latter group includes the people who now design or modify ham equipment, create test equipment or adapters, and concentrate in difficult engineering specialties. I'm reasonably sure that this last group is a minority in our hobby. But, no matter the level of our technical skill, we face engineering considerations every time we lift a microphone or reach for a key.

Of course, the extent of engineering any of us actually *uses* is a matter of personal choice and the amount of formal training we may have received. In view of the current proliferation of commercial equipment as opposed to the "home-brews" of the past, the requirement to understand the design parameters of our equipment has been reduced—not eliminated. After all, even the ability to tune certain systems properly requires a level of competence, and, if we want to optimize our performance on the air, the specter of engineering keeps popping up.

This technical factor applies to most of the equipment now found in our stations. Some of the newest additions, however, are a far cry from those included in a typical "shack" just a few years ago. The most recent unique unit that comes to mind is the PC, or personal computer, something not yet officially recognized as ham gear. I don't know of any computer technical requirements imposed on amateur license exams nor any that are contemplated

Computers apparently are being ignored as a ham requirement for the present, but probably won't be for long. More and more uses are being developed for computers in our ham shacks, including log keeping, CW sending and receiving, equipment control or tuning, propagation predictions, antenna radiation patterns, controlling antenna beam directions, and equipment diagnosis. In VHF, communication via satellites or by unusual and exotic natural propagation phenomena rely more and more on computers for the most effective operating techniques. The

**Lew Ozimek, N2OZ, had studiously avoided contact with computers until he was recruited to start preparing annual indexes of* CQ *and* CQ VHF. *Once he started using them, he felt compelled to understand them and to help others learn the basics as well.*

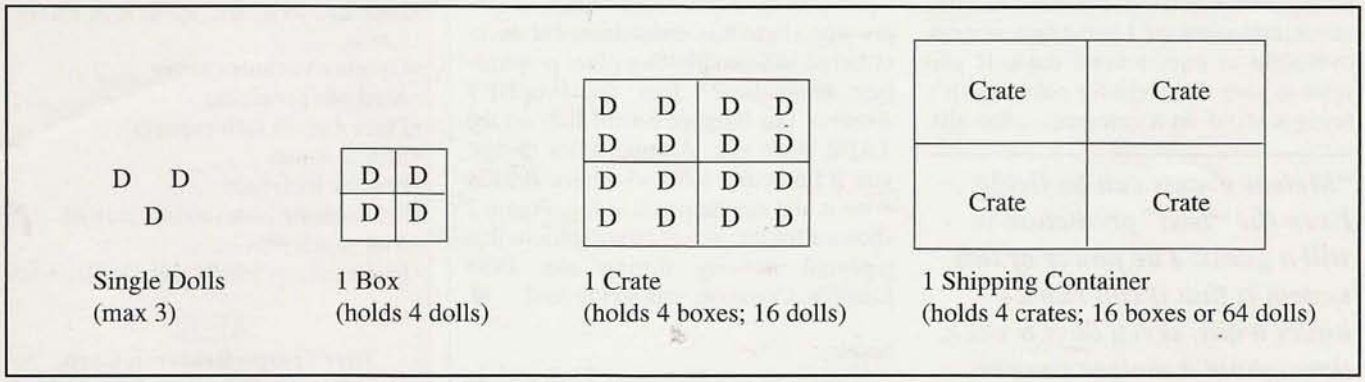


Figure 1. Makeup of shipment of 225 dolls from the Base 4 Doll Factory. See text for details.

Table 1.

Terminology	Definition
Bit	In binary number system, the digit 0 or 1
Byte	8 bits (2^3)
Kilobyte	1,024 bytes (2^{10})
Megabyte	1,024 kilobytes (2^{20})
Gigabyte	1,024 megabytes
Binary	Base 2 number system
Hexadecimal	Base 16 number system

Table 1. Glossary of basic computer counting terminology.

impact of computers is increasing as quickly in ham radio as it is in the business world and at home.

Since computers use technology that is quite different from RF designs, operating PCs and adapting them to our hobby imposes new challenges on our ability to stay technically competent. I honestly can't conceive of the average individual ever doing troubleshooting and repairs on a personal computer (it's too scary a thought unless you're also a trained computer technician or a computer science engineer), even though computers are quite capable of performing sophisticated self-diagnosis. But I do envision a requirement for hams using a computer to understand the principles of computer design and to write or modify programs which control computer performance. I guess that means that we must become at least minimal computer "nerds."

A Look at Computer Basics

When I first began to explore the different facets of computer basics while trying to do more with a PC than to turn it on and run canned programs like Microsoft Word® or Excel®, I determined that the natural starting point was to understand computer mathematics. The fact that computers use only two digits in a binary mathematical system fascinated me. Imagine, only the digits 1 and 0 are required to store and process the large volume of data normally handled by computers. The data can be almost anything, such as numbers, formulas, spreadsheets, forms, and written text. Those two little digits can do it all and do it very efficiently. Just two tiny numbers, how is it possible?

A quick look at history can be helpful in trying to understand the "why" behind the establishment of such a mathematical approach. Since we use a decimal system using the digits 0 through 9, why didn't computer designers just use our system and let it go at that? Apparently, early engineers tried to do exactly that and the first attempts to design electronic computers were based on using the decimal system. But, starting with vacuum tubes and moving through solid-state components, no method of dependably establishing 10 different numeric values could be created electronically. For example, such attempts as the setting of 10 different voltage levels which could be used reliably as arithmetic digits just wouldn't work.

Then in the 1940s, John V. Atanasoff invented the digital techniques used in the first electronic digital computer, ENIAC. Atanasoff used the binary number system created by Ada Lovelace many years earlier. He used those two magic digits, 0 and 1, and he generated these two numbers electronically by determining if a positive voltage was present to create a 1, or if no voltage existed to create a 0. This simple "on\off" or "plus\minus" condition can be easily established and detected in electronic circuits. Even today, this technique is basic to computers and many coding schemes have been developed to permit computers to effectively process those two numbers. How this is done is explained below.

Taming the Bite of a Binary System

Atanasoff's genius demonstrated that working in the binary system was easy for computers, but the binary approach is not easy for human beings. In addition, the translation from binary to decimal is not a simple process, even for a computer. If a binary system was to be used, a method had to be devised to simplify the utilization of computer-generated data. What was needed was a bridge which humans and computers could both use to translate the decimal system to a format capable of easily working with the binary system and vice versa, a sort of "way-station" serving two masters.

The solution was the selection of the base 16 *hexadecimal system*. It's relatively easy for humans to read "hex" numbers and hex is a very natural extension for a computer. It did mandate, however, that anyone interested in understanding computers had to "Think Hex." With that in mind, let's cover the relationship that exists between binary and hex and explore how they fit into our common, everyday decimal system.

Now don't slam this article down and say to yourself "I finished math years ago, who wants to go back to school?" The only math involved are basics like multiplication and division, none of it very fancy or difficult. The rest is just plain old logic. Some of the tables may look scary, but bear with me, it's all easier than you think.

Applicable Computer Terminology

Before developing the specifics of the three mathematical systems, it may help to define some basic computer terminology. *Binary* is a base 2 system (using the digits 0 and 1), *decimal* is a base 10 system (using the digits 0 through 9), and *hexadecimal* is a base 16 system (using the digits 0 through 15). The fundamentals of each will be covered later. Table 1 presents and defines the relevant terms. Notice the direct relationship among the various terms and the number 2: a *bit* is 2^1, a *byte* is 2^3, *hex* is 2^4, a *kilobyte* is 2^{10}, a *megabyte* is 2^{20}, etc. (Don't turn away from powers; they aren't tough. For example, 2 to the power of 4, or 2^4, is only 2 multiplied by itself four times, or 2 x 2 x 2 x 2).

The fact remains that three different math systems are in use and special conversions are required to handle them. To achieve an understanding of the conversion process, we must be able to read hex numbers, convert hex to decimal, and vice-versa. Then the whole has to be related to binary, the true language of computers. A discussion of place values as applied to any number system, including our common decimal system, will help.

A Place for Everything and Everything in Its Place

Let's use, as an example, a doll factory whose shipping department works on a base 4 system. Base 4 mandates that all packing must be done in "fours" (if it was a base 6 system, for example, all packing would be done in sixes). Shipments may

Hex Number	B	C	D	E	F
Decimal Equivalents	11	12	13	14	15

To convert hex number, start with right digit (use decimal equiv.):

$15 \times 16^0 = 15 \times 1 =$ 15
$14 \times 16^1 = 14 \times 16 =$ 224
$13 \times 16^2 = 13 \times 256 =$ 3,328
$12 \times 16^3 = 12 \times 4{,}096 =$ 49,152
$11 \times 16^4 = 11 \times 65{,}536 =$ 720,896
Total = 773,615 Decimal

Figure 2. Steps in converting the hexadecimal (hex) number BCDEF to a decimal number.

be made singly, in boxes, in crates, or in shipping containers. The base 4 system allows shipping no more than 3 dolls as singles or the packing of no more or less than 4 dolls in a box, no more or less than 4 boxes in a crate, and, likewise, no more or less than 4 crates in a shipping container. The relationship of quantities of dolls and each of the packing entities is shown in Figure 1 (keep the relationships shown in Figure 1 in mind as we continue the explanation).

Now if the company receives an order for 225 dolls, according to the rules noted above, the dolls may be packed for shipment only as follows:

3 Shipping Containers	**2 Crates**	**0 Boxes**	**Singles**
(Holds 192 dolls)	(Holds 32 dolls)		(1 doll)

Believe it or not, we have just developed the base 4 number 3201 (3 shipping containers, 2 crates, zero boxes, and 1 single) for decimal 225. The process followed to create this number is applicable to any base number system.

The digits which can be used in a base system run from 0 to a number one less than the base number. In base 4, then, a 0, 1, 2, or 3 can be used (3 being one less than the 4 in base 4). Figure 1 graphically shows that the packing limitations dictate that no more than three dolls can be shipped as singles because four must be put into a box. Also no more than three separate boxes can be shipped because when the number of boxes reaches four, they go into a crate. Likewise no more than three separate crates can be shipped because when the total reaches four, they go into a shipping container. This is the concept of *place value*, each place (type of container) has its own value (quantity of dolls).

Converting a Base Number to Its Decimal Equivalent

The prior process can be reversed to convert the base 4 number 3201 back to its decimal equivalent as follows:

1. The right hand digit is multiplied by the base number raised to the power of zero (any number raised to the power of zero equals 1).
2. The digit second from the right is multiplied by the base number raised to the power of 1.
3. The next digit to the left is then multiplied by the base number squared.
4. The next to the left is multiplied by the base number cubed.
5. If the base 4 number had additional integers, the sequence would continue by moving one number to the left for each digit and multiplying that number by the base number raised to a power one higher than the exponent or power in the previous step.

It may be easier to do the above in a table. Such a table converting the base 4 number 3201 is:

1×4^0 (or 1×1)	=	1
0×4^1 (0×4)	=	0
2×4^2 (2×16)	=	32
3×4^3 (3×64)	=	192
Total		**225 decimal**

Just like that, we are back to the original 225 number.

Think Hex

Continuing along the same vein, the only acceptable hexadecimal digits which can be used are 0 through 15 (one less than the 16 of base 16). However, only single digits can be used, so the double-digit numbers 10 through 15 are replaced with the letters A through F. The base 16 numbers and equivalent decimal numbers are:

Base 16: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
Decimal: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

When trying to convert base numbers to decimal, preparing a list of the base number raised to increasing powers simplifies the exercise. A partial hexadecimal power sequence follows this pattern:

16^4	16^3	16^2	16^1	16^0
65,536	4,096	256	16	1

Let's go back to our doll shipment example and change decimal 225 to hex. First, find the largest number in the power table which can be divided into the decimal number to be translated (it's always the largest "power" number which does not exceed the decimal number being converted). The largest such number in the above table is 16 (16^1). Dividing 16 into 225 results in 14 with a remainder of 1. The decimal number 14 is hex number E and the decimal number 1 is hex number 1. Combining the two results in a hex number of E1, which represents decimal 225. Now that wasn't too tough, was it? The simplicity of the relationship amazed me.

Converting a Decimal Number to a Binary Number

How about converting the same decimal number 225 to a binary number? In the binary (base 2) system, the sequence of increasing powers from right to left is:

2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
256	128	64	32	16	8	4	2	1

The largest decimal number in the above table which can be divided into 225 (see Note) is the eighth sequential number from the right, 128 (2^7), which divided into 225 equals 1 with a remainder of 97. The next largest number divisible into the balance number 97 is the seventh sequential number, 64 (2^6). This division results in 1 with a remainder of 33. The next largest number that can be divided into the balance is the number 32

(2^5), and one of these can fit into 33 with a balance of 1. The only number divisible into 1 is 1 (2^0). A zero or a 1 must be assigned to every number in the power table starting with the largest power table number used (in the example, the largest is 128 or 2^7), and progressing down to the last number in that same power table, 1. Even though we bypassed 2^4 through 2^1, they still get digits (zeros) assigned in the conversion process. Doing this, decimal 225 is expressed in binary as: 1110 0001.

You can verify this number by translating it back to a decimal number. Starting with the left digit:

1 x 128 (or 2^7)	=	128
1 x 64 (or 2^6)	=	64
1 x 32 (or 2^5)	=	32
0 x 16 (or 2^4)	=	0
0 x 8 (or 2^3)	=	0
0 x 4 (or 2^2)	=	0
0 x 2 (or 2^1)	=	0
1 x 1 (or 2^0)	=	1
Total		225 Decimal

That was a difficult sequence to follow, even with a relatively small number like decimal 225. Can you imagine what the sequence might be with numbers in the millions? That's why it's so difficult for us to handle binary numbers. Base 2 numbers raised to increasing powers grow at too slow a rate. Compare the hex and binary power tables we created earlier. Hex 16^4 equals 65,536, but binary 2^4 equals 16. Hex 16^3 is 4096, but binary 2^3 is 8; and right on down (or up) the line. The expansion of base 16 is obviously much faster than the rate of binary growth. Because of this, base 16 conversion to decimal numbers is a much simpler proposition than binary to decimal since fewer calculations are required.

"The fact that computers use only two digits in a binary mathematical system fascinated me. Imagine, only the digits 1 and 0 are required to store and process the large volume of data normally handled by computers."

Organizing Binary Numbers and Converting Them to Hex

Notice that the binary representation of decimal 225 was written as 1110 0001. The separation of binary numbers into groups of fours was deliberate on my part and conventional in binary.

Binary No.	Conversion to Decimal		Hexadecimal	Conversion to Decimal
1111	$1 \times 2^0 = 1$ $1 \times 2^1 = 2$ $1 \times 2^2 = 4$ $1 \times 2^3 = 8$ Total 15		F	(Hex F = 15) $15 \times 16^0 = 15$ Total 15
1001	$1 \times 2^0 = 1$ $0 \times 2^1 = 0$ $0 \times 2^2 = 0$ $1 \times 2^3 = 8$ Total 9		9h (the h identifies it as a hex No.)	(Hex 9 = 9) $9 \times 16^0 = 9$ Total 9
*0110 1100	$0 \times 2^0 = 0$ $1 \times 2^1 = 2$ $1 \times 2^2 = 4$ $0 \times 2^3 = 0$ Total 6	$0 \times 2^0 = 0$ $0 \times 2^1 = 0$ $1 \times 2^2 = 4$ $1 \times 2^3 = 8$ 12	6C	(Hex 6 = 6, Hex C = 12) $12 \times 16^0 = 12$ $6 \times 16^1 = 96$ Total 108
101 1011 (Add zero(s) in front to establish groups of four: *0101 1011)	$1 \times 2^0 = 1$ $0 \times 2^1 = 0$ $1 \times 2^2 = 4$ $0 \times 2^3 = 0$ Total 5	$1 \times 2^0 = 1$ $1 \times 2^1 = 2$ $0 \times 2^2 = 0$ $1 \times 2^3 = 8$ 11	5B	(Hex 5 = 5, Hex B = 11) $11 \times 16^0 = 11$ $5 \times 16^1 = 80$ Total 91

*Note: When more than one group of binary numbers exists, do not convert binary directly to decimal. It is easier to convert binary (by groups of four) to hex and then convert hex to decimal.

Figure 3. Examples of numbers expressed in binary, decimal, and hexadecimal formats. If this looks like Greek to you, then you probably haven't read the article yet. Go back and read the explanations, then see if this makes more sense.

Table 2.

Character	Decimal	Hex	Binary
0	48	30	0011 0000
1	49	31	0011 0001
Colon	58	3A	0011 1010
Question Mark	63	3F	0011 1111
K	75	4B	0100 1011
L	76	4C	0100 1100
Y	89	59	0101 1001
k	107	6B	0110 1011
l	108	6C	0110 1100
y	121	79	0111 1001

Table 2. Sampling of the standard ASCII character set. There are 127 different characters, representing numbers, punctuation marks, upper-case letters, lower-case letters, and computer commands.

The first group of four digits, 1110, converts to decimal 14 as a stand alone number. The second group of four digits, 0001, is decimal 1 as a stand-alone number. Now decimal 14 is hex E, and decimal 1 is hex 1. Putting the two together gives us hex E1, which is the same hex number we created earlier for decimal 225. That technique is a very simple way to convert a binary number to a decimal number by using our "way-station," hexadecimal! I consider the above to be a 'magic' conversion factor between base 2 and decimal.

Figure 2 is an exercise converting hex BCDEF to a binary number so those readers who are interested can check their ability to translate different base numbers.

Converting Hex to Binary

Converting a hex number to a binary number is as straightforward as converting a binary number to hex and requires little calculation. Just convert *each hex digit* to a four-element binary number and retain the binary numbers in the original hex sequence. Note that the binary numerals must be in groups of fours. If insufficient numbers exist to make complete sets, place enough zeros at the beginning of the left-hand binary number to make up any difference. (For example, if the left-hand binary number was 110, it would be written as 0110.) In the case of hex BCDEF, which Figure 2 showed as decimal 773,615, the change to binary is:

HEX	B	C	D	E	F
BINARY	1011	1100	1101	1110	1111

The resulting binary number of 1011 1100 1101 1110 1111 (equal to 773,615) looks formidable but was actually easy to reach. If you want a real problem, try to create that binary number directly from the decimal 773,615, or do the reverse and convert the binary number to its decimal equivalent. I did both as a challenge and found the process slow and tortured. It was enough to make me want to kiss my computer for taking care of calculations like that for me. Addition-al examples of numbers in all three systems are presented in Figure 3. I suggest that you go through each calculation, as it may help in understanding the process.

"What was needed was a bridge which humans and computers could both use to translate the decimal system to a format capable of easily working with the binary system and vice versa, a sort of 'way-station' serving two masters."

The Arrival of ASCII

One of the first problems faced by computer developers after they adopted the binary system was how to provide a means of coding numbers, letters, punctuation marks, and commands so that computers could process them. The most common coding approach used now and recognized as a microcomputer standard is called *ASCII* (American Standard Code for Information Interchange).

The standard ASCII set covers 127 characters, which include lower-case letters, capital letters, numbers 0 through 9, punctuation marks, special symbols, and control commands for peripheral de-vices. An "extended" ASCII set uses the codes 128 through 255 for foreign alphabets, special language requirements, etc. For all practical purposes, the standard ASCII set covers all of the requirements of our domestic computer applications. The ASCII set was probably first created by generating a list of desired characters and functions and then assigning a decimal designator to each one. Conversion of those decimal numbers to binary and hex completed the circle.

Detailed knowledge of all the ASCII codes involved is not required unless you want to write programs or if you are a technician analyzing computer problems and making repairs. You should at least have an understanding of ASCII, however, because we can't completely avoid the occasional use of or reference to an ASCII number. In Table 2, a sampling of ASCII codes are presented with the applicable decimal, hexadecimal, and binary numbers identified (ASCII codes from decimal 1 through 31 are control characters used to communicate with or to command peripherals).

Computer Memory and Memory Addressing

One interesting area involved in base system math is the way that computers address memory (don't try to memorize any of this stuff, just use it as a reference if it ever comes up). The address is displayed as two hex numbers separated by a colon, such as B620:5. The portion before the colon, B620, is called the *segment address* and the :5 is called the *offset*. The actual hex address is calculated by adding a zero to the right of the segment address and adding the offset to that number. In this example, it becomes: B620:5 = B6200 + 5 = B6205.

The first 640K of memory is called *conventional memory*. Each kilobyte equals 1,024 bytes, making 640K of memory equal to 655,360 bytes (you might want to take another peek at Table 1 for definitions of the computer terms). Each byte is a separate memory address. Each of the 655,360 memory addresses can hold 8 bits of data or program instructions. With the hex number for 655,360 as A0000, conventional memory will run from hex 00000 to hex A0000 minus 1, or 00000 to 9FFFF. Stated in the segment/offset form, conventional addresses run from 0000:0 to 9FFF:F.

The next portion of memory is called *upper memory* and is defined as the portion from 640K through 1024K minus 1.The

"Binary numbers can be quite cumbersome to humans because of their length, but they are a snap for computers. Hex numbers are much shorter than binary and are therefore easier for us to process."

range of this memory then is A000:0 to FFFF:F. This latter number (hex FFFFF) is 1,048,575 bytes, or, by definition, one less than 1 megabyte. As computer increase memory capacity into gigabytes, the importance of using hex and an effective addressing scheme becomes quite critical, especially when we try to convert such data to a decimal equivalent.

Summary

In summary, computers use binary (base 2) and hex (base 16) systems, the first to store and process data, the other to display data. Anyone interested in understanding computers should know how both systems work and to convert from one to the other. You also need to be able to relate both of these to our common decimal (base 10) system.

The size of storage devices is listed in bytes, with each byte capable of holding 8 bits of data. In the binary approach, each bit is either the number 0 or the number 1. Binary numbers can be quite cumbersome to humans because of their length, but they are a snap for computers. Hex numbers are much shorter than binary and are therefore easier for us to process. The process of converting hex to binary, and reversing it, is a simple one, making the hexadecimal system an effective bridge between binary and decimal.

ASCII, the American Standard Code for Information Interchange, provides a recognized set of codes which permit computers to identify letters, numbers, punctuation, and commands and to process them as required. For the U.S., a total of 127 codes are available in the standard ASCII set.

Some Final Thoughts

I hope this exploration shed some light on a subtle but basic aspect of computers. It certainly answered many questions for me and helped to wipe away barriers which may have prevented me from grasping computer fundamentals in the future. If a few windows were opened (and I don't mean Microsoft Windows®), then the entire exercise was well worth it.

This was a first step for me, and perhaps for some of you, in the long process of understanding computers. Continuing to grow in this area will help us learn to use PCs more effectively in our amateur stations. Perhaps, eventually, we'll be able to claim that we have at least partially mastered them. ■

Note:
The explanation applied to the conversion of decimal numbers to binary used division to determine the largest "2 to a power" number in the powers table capable of being divided into the number being converted. This description preserved the technique of division which is applicable to any base system. In the case of binary, however, 1 is the largest number ever used so that the result of any division *can be no larger than a one*. If every division is a one, it is, in essence, simply a subtraction. In the binary example given, dividing 128 into 225 gives 1 with a remainder of 97. If you subtract 128 from 225, the remainder is also 97. Continuing the subtraction process will produce the same numbers used in the earlier example. The subtraction method can be used for any such conversion of a binary number.

Reader FEEDBACK!

Backwards Propagation?

Noted VHF contester Gene Zimmerman, W3ZZ, took issue with a few points made by Ken Neubeck, WB2AMU, in his August feature, "The Sister Bands, 10 and 6 Meters: A Cross (Band) Training Guide." Gene writes:

I am always amazed at how little I know. So I was very interested in some of Ken's comments. On page 14, under the heading "Working Backwards," he says, "Certain modes of propagation, such as aurora (Au) and Tropo, work in the opposite direction of *Es* and F_2. That is, they start out high in frequency and work their way down."

For Au, this is clearly not the case. Au is generated by an ionized curtain at the edge of the auroral oval. As with all reflective propagation (like *Es* or F_2) it must start lower in frequency and go up (see also below). As for tropo, there are certainly instances where it is stronger at a higher frequency to a limited extent -- 432 better than 2 meters - but almost never (maybe never, I'm not sure) 1296 better than 432 or 1296 open when 432 is not. But the vast majority of cases work from lower to higher frequency. The limits of tropo are dependent on the F/l (lower frequency limit) and F/u (upper frequency limit) of the duct. The first amateur band above F/l will be the best, and normally the signals will degrade as you go up in freq. Sometimes, while the duct is forming or dissipating, F/l will not extend to 2 meters or will extend poorly to 2 meters. Thus you hear 222 or 432 tropo and not 2 meter tropo. In general, long distance (>500 km) tropo on 6 meters is rare because F/l is almost always above 6 meters. But Fred Laun, K3ZO, reminds me that when 2 meters has tropo, the close-in beacons on 6 meters (150 km) are almost always much louder than normal. For some reason, the enhancement does not extend out much further.

Ken goes on to say, "Au is rare on 10 meters . . . "

This is also not the case. Spectral spreading on 10 meters is much less than even on 6 meters. Thus, when you hear Au propagation on 10 meters, it does not have the distorted characteristics of VHF Au propagation. Often the ionization is so great that you get auroral-*E* propagation on 10 when you are getting just aurora on 6 and 2. Auroral-E does occur even on 2 meters when the K index is very high due to an intense storm. This was the case for the massive Au in July, 1982.

Finally, on page 15 under "Ease of Portable Operations," Ken says: ".... or working some far away places,, like India or Thailand, via long path at local noon time!"

Long path to VU (India) or HS (Thailand) at high noon local (I assume from W2) during the sunspot maximum??? Assuming an equinox, this would be a path at least partially in darkness versus a much shorter path almost completely in light. So I asked some of my HF friends about oddball paths. They are reasonably sure that there is never a long path to VU or HS at high noon on the east coast. It never gets to that part of Asia. K3ZO's wife is from HS, so he has operated over there many times at their midnight (our noon) and says he has never heard the US east coast on the long path on 10. He says it might happen on 15, but not on 10. There is a skewed path from the northeastern US to VU around 7-8 am local at about 60 degrees (vs. 20 degrees direct path) and a skewed long path to HS (220 degrees) a little earlier than that sometimes, on 10 meters.

Still and all it was an interesting article. Ken, like many others, has called 6 meters the Magic Band, and it is - in great part because almost every kind of propagation known to amateurs occurs there from time to time.

Ken Neubeck, WB2AMU, responds:

Thanks for taking the time to send comments on the 10 Meter article that appeared in the August issue of *CQ VHF*. The type of Aurora that I was referring to is where the signals are severely distorted, and this type rarely shows on 10 meters. Yes, other forms—such as Auroral-*E* that you mentioned—would show up on the HF bands, but their signals would not be distorted like you would hear on 2 and 6 meters.

A number of hams have the perception that they hear Aurora on 2 meters before they hear it on 6. Perhaps this observation occurs as the Auroral curtain extends downward, making all signals on the two bands sound distorted simultaneously. But as Aurora is a distant cousin to Sporadic-*E*, the conventional scientific model is that as the density of the formation increases, the higher the frequency that can be reflected; suggesting that the phenomenon moves up in frequency.

Thanks for the explanation for why tropo is not as common on 6 meters as it is on 2 meters and 432. Your explanation says it all. I apparently mixed up terms in describing some long-distance contacts that I made on 10 meters at noontime during the equinox period in solar peak years. The path involved in this contact is a polar path of some sort and not necessarily long path. During the fall and spring equinoxes, there are some unusual paths on HF bands like 10 and 12 meters that are not usually heard at any other times of the year. The path from Eastern US into Thailand at noontime in the US is an interesting one to try to trace. This particular path would probably not be a conventional east-to-west path as you would see in the late winter afternoon, when East Coast US can work Japan on 10 meters during the peak of the sunspot cycle. Most likely, the signal went over one of the poles, probably the North Pole since that is the shortest path. But I had similar contacts at the same time of year from my QTH in Long Island (41 degrees north) with stations in Jakarta, Indonesia (located at 5 degrees south), where the two possible paths are a little bit closer in distance with the shortest path still being the one over the North Pole. There is no way to know for sure in these cases, particularly since I was using a vertical antenna. But it was probably wrong to conclude that this was a long path propagation mode without further evidence.

I attempted to explain the various propagation links that were probably present for some long range 6-meter DX paths in the January 1999 article in *CQ VHF*, "Mix n' Match Propagation." All of this points out the interesting things that can happen on these bands at certain times of the year. I regret any confusion with terms to describe the paths involved in working DX, particularly since the primary point that was being made in the article was that one can use portable setups with moderate power for both 6 and 10 meters to work long range DX during certain times of the year. 73.

Q & A

Questions and Answers About Ham Radio Above 50 MHz

The following question was directed to "Antennas, etc." Columnist Kent Britain, WA5VJB:

Q: In an August, 1999 article, you showed correction factors for different booms, but not one for my situation. I copied a K1FO design for a 432-MHz 19-element beam.The only thing I changed was the boom shape from 7/8-inch and 1-inch telescoping to 1-inch square for the entire length. I made no other changes. What should I expect? The elements are insulated from the boom.

Rudy Rivera
(via the Internet)

WA5VJB responds:

A: I've seen correction factors of 1.15 to 1.20 for square boom material. So the elements are (1.20/1 - 1) x .2, or about a 1/16th of an inch too long. Might shift the frequency down a tiny bit. The size of the holes for the insulators and the type of plastic used for the insulators are a bigger variable. 73 Kent, WA5VJB

The following question was directed to "How it Works" Columnist Dave Ingram, K4TWJ:

Q: Just a note to tell you I like your columns and also your books. A question: Didn't you write a follow-up book on keys? If so, where can I get a copy? Also, didn't you self-publish a QRP book? Same question.

I'm only a Tech Plus, so I won't be seeing you on 30 meters for a while, but I'm getting my feet wet in CW (made my first contact yesterday), and when my code speed increases, I'll upgrade. I'm starting to collect keys. I've got a 40-year-old Vibroplex, a Chinese Army key, and J-something on a bakelite base. I got your *Keys, Keys, Keys* book for Father's Day, and I also have a Perrera's catalog. Now I stop at every garage sale I see.

Thanks in advance for any info on these books. Keep up the good work.

73,
Dennis P. Skea, KC2CCZ
(via the Internet)

K4TWJ responds:

A: Hi Dennis! Thanks for the kind words. Congrats on starting a keys collection. Yes, I have written *Keys II: The Emporium* , a blowout review of the world's most exotic keys – over $1/2 million worth! Also wrote *QRP Now* – it tells about today's hottest rigs, kits, projects, clubs, contests, and also includes true secrets the QRP success. Both books are self-published and are available direct from my house to yours. Either book is $16 plus $2 postage (book rate), or $16 + $3.20 (Priority Mail), from Dave Ingram, K4TWJ, 4941 Scenic View Dr., Birmingham, AL 35210. 73, Dave, K4TWJ

Do YOU have a question about any aspect of "Ham Radio Above 50 MHz"? We'll do our best to give you a clear, concise answer—or if it's not a question that has just one easy answer, then we'll invite readers to offer their solutions. Send your questions to: Q & A, *CQ VHF* magazine, 25 Newbridge Rd., Hicksville, NY 11801; via e-mail to <q&a@cq-vhf.com> or via our Web page at <http://www.cq-vhf.com>. Be sure to specify that it's a question for "Q & A."

"Q&A" Goes Online!

We've added a "Q&A" page to our Web site, so anyone visiting us on the Internet can pose any question they'd like about Ham Radio above 50 MHz. Answers may come from anyone who has them (not just *CQ VHF* authors and editors) and, just like the olden days on packet bulletin boards, you'll be able to follow a "thread" of questions, answers, responses, and replies on each topic. Just point your Web browser to <http://www.cq-vhf.com> and click on the "Q&A" button on the left-hand side. Then follow the instructions to post questions or answers, or to read what others have posted.

CQ VHF Ham Radio Above 50 MHz

Reader Survey—November, 1999

We'd like to know more about you...about who you are and where you live, about the kind(s) of work you do, and about your ham radio interests and activities. Why? To help us serve you better.

Each month, we'll ask a few different questions and ask you to indicate your answers by circling certain numbers on the Reader Service Card and returning it to us (we've already paid the postage).

And, as a bit of an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to CQ VHF. *This month, we'd like to ask about your non-radio hobbies in which ham radio might play a role.*

	Circle Reader Service #
1. Do you participate in any non-radio hobby/hobbies in which ham radio could play a role?	
Yes	1
No	2
2. If you answered "yes," please indicate whether this hobby is one of the following (circle all that apply):	
Amateur astronomy	3
Amateur radio astronomy	4
Bicycling	5
Boating	6
Camping	7
Chess	8
Computer experimentation	9
Flying (private pilot)	10
Hang-gliding / parasailing	11
Hiking	12
Hunting	13
Motorcycling	14
R/C (radio control) modeling	15
RVing	16
Other	17
3. Do you use/have you used ham radio in connection with one or more of these hobbies?	
Yes	18
No	19
No, but may in the future	20
4. Do you think ham radio's usefulness in "ancillary activities" (e.g., non-radio hobbies) is adequately promoted?	
Yes	21
No	22
Don't know	23
5. Do you know of anyone involved with your non-radio hobby(ies) who has become a ham on the basis of its usefulness in the other activity(ies)?	
Yes—me	24
Yes—someone else	25
No	26
Don't know	27

Thank you for your responses. We'll have more questions for you next month.

What You've Told Us...

Our August survey focused on that issue's "VHF-HF Connection" and asked about your views—as VHFers—on HF operating. First of all, 62% of you currently have at least some HF privileges (42% "broad," 20% "limited"), and of that group, 69% are active on both VHF and HF (24% are on VHF/UHF only, 2% are on HF only, and 6% are not currently active). Your overall feelings toward HF operating are positive, with 46% of you saying it's an important part of your overall ham operating; 23% said you'd never operated there but would like to; and 15% said HF is OK, but not particularly important to you. Only 5% said you could "take it or leave it," while just 2% said "I don't particularly like HF." Another 7% had no interest in HF operating, while 2% had no opinion.

Next, we asked those of you with Novice Technician, or Tech-Plus licenses whether a five-word-per-minute code requirement for General would motivate you to upgrade your license. A majority (56%) said yes, and that didn't include the 16% who said they're already motivated, even if nothing changes. Only 19% said no, while 9% answered "don't know."

Finally, 38% of you found the HF-related articles in the August issue to be very useful; 41% found them somewhat useful; 15% said "not really," and only 3% said "not at all." The remaining 2% hadn't read the articles.

As always, thank you for your responses. This month's winner of a free one-year subscription is Jeff Dover of Cherokee, AL.

Alinco DJ-195 2-Meter Handheld

It repels mosquitoes...it repels burglars...it repels a high price...but this full-featured, single-band handheld just might attract you!

By Gordon West, WB6NOA*
(wb6noa@cq-vhf.com)

With so many amateur radio manufacturers coming out with micro-sized HTs, it was good to see a full-bodied, full-featured single-band handheld from Alinco that would be a nice first-time radio for the beginner as well as a swell HT with all the bells and whistles needed by the seasoned operator. The Alinco DJ-195 (Photo A) is a 2-meter handheld transceiver which also offers wide-band reception from 130.00 to 174.995 MHz, FM only. Sorry, no AM aircraft reception, but we are talking about a full-featured rig that sells for under $199!

"While many of [the menu] items are relatively common to handheld transceivers, there were a few strange ones...that I needed to explore!"

The Alinco transmits from 144 to 148 MHz (see "Beyond the Band Edges"), but keep all of your FM transmitting *above* 144.300 MHz. There is a big flap going around on FM operation in the "weak-signal" SSB and CW areas below ".300," and it is the *band plan* to keep all FM transmissions above 144.300. No FM! Also, avoid transmitting anything between 145.800 and 146.000 MHz, except for space communication. This is the satellite portion of the band, and all terrestrial (earth-bound) communications should be avoided here. Observing the generally accepted band plan, while not (at this point) required by FCC rules, is "good amateur practice"—which *is* required by the rules.

**Gordon West, WB6NOA, is Senior Contributing Editor of* CQ VHF.

The DJ-195 comes with a 9.6-volt, 700-mAh (milliamp-hour), NiCd (nickel cadmium) battery pack that is unique to this HT. Isn't it about time that manufacturers got together and came up with a standard for back-of-set battery packs? Or at least designed all of their own radios to work with a single battery pack? Nonetheless, the 700 mils can easily run the set all day with a little bit of low-power transmitting, and the affixed belt clip with its little lanyard felt secure on my belt. Alinco Sales Manager Doug Wynn, WY6NN, says the company will soon offer an alkaline battery tray, as well.

Features Like You've Never Seen

The DJ-195 can hold 40 memory channels, plus one call channel. And there is *plenty* that you can stuff into each memory channel:

- Receive frequency, any offset split, and split direction
- Simplex operation with or without tone
- Separate CTCSS tone encode and decode ability!
- Digital coded squelch (DCS), a must for some urban repeaters
- Scan skip or scan hold, *for this channel*
- High or low transmit power setting *for this channel*
- Battery save setting *for this channel*
- Alphanumeric channel tag; up to six characters per channel

OK, so the 40 channels may individually hold a lot of things, but is there more? You bet! Just bring up the "**SET MODE**" menu for selecting universal options (press **FUNCSET** on the multi-function keypad; see Photo B). While many of these **SET** items are relatively common to handheld transceivers, there were a few strange ones (down toward the bottom of the list) that I needed to explore! And we will, right after the list.

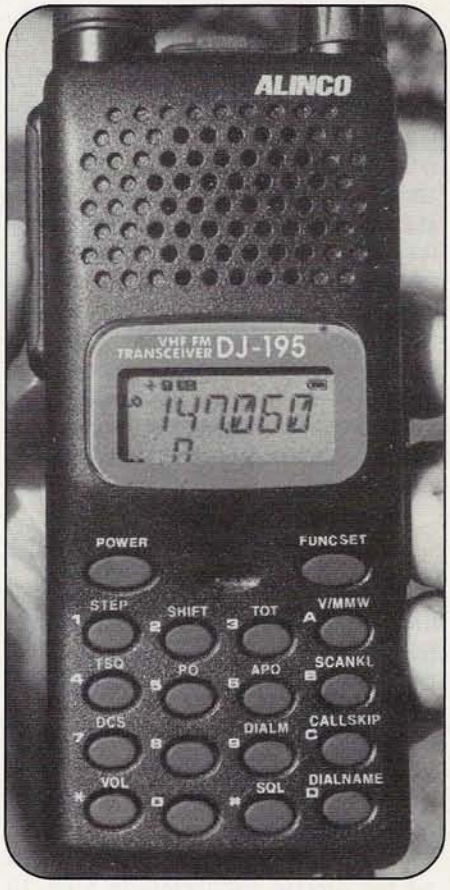


Photo A. The Alinco DJ-195 2-meter handheld is a full-sized, full-featured HT, with a price tag of less than $200. It's also got a few "surprise" features, such as a theft alarm and a mosquito repellent! (Photos by the author)

Here's what you'll find, starting with the "usual stuff":

- Master battery save, on or off
- Timer on the busy scan setting

- Beep sound, on or off
- Tone burst frequency if you go to Europe
- Busy channel lock-out, on or off
- Time-out timer seconds set

Then, we get into the *un*usual features:

- CPU clock frequency shift
- DTMF wait-time setting
- DTMF pause-burst time setting
- DTMF burst-digit-burst time setting
- External terminal control, on or off
- Theft alarm, on or off
- Mosquito repel sound, on or off

Theft alarm? Mosquito repellent? Let's take a closer look at the last group of features here.

CPU Clock Shift

What the central processing unit (CPU) clock-shift setting does is move the unlikely "birdie" off of a particular frequency you wish to monitor with open squelch. A "birdie" is a signal that is generated within the radio. The frequency of that birdie is often determined by the frequency, or clock, of the radio's internal microcomputer (the CPU). I couldn't find any birdies on the 2-meter band, but did discover one while monitoring marine VHF up at 156.300 MHz. I went into the clock-shift setting, rotated the dial one click, and the birdie disappeared. Nice touch!

DTMF Options

DTMF is the generic term for Ma Bell's trademarked "Touch-Tone," and stands for *dual-tone multi-frequency*. The DTMF wait time, burst-and-pause time, and first-digit-burst time are handy functions for some repeaters that might not respond quickly enough to an incoming autopatch sequence. You would need to get together with your local autopatch control operator and let him/her help you set the precise parameters of your 16 transmitted DTMF characters. And wow...up to nine auto-dial channels of 16 DTMF codes may be selected. The instruction book has a complete page on outputting the DTMF codes manually or putting them into the built-in auto-dialer.

An Alarming (and Embarrassing) Feature

I was very embarrassed about the theft alarm mode. When I first started playing around with the DJ-195, I realized that I needed to charge up the battery a little bit more, so I plugged it into the charger and walked away. A few hours later, I came back and unplugged the battery charger from the side of the handheld (Photo C). All of a sudden, a shrill tone blasted out of the speaker, causing all of my eight cats to go running from the house. The only way I could finally silence the tone was to remove the battery pack.

I called Doug at Alinco to find out if I was the only one who had this "problem." He explained, quite politely, that I must not have read the instruction book, and that the tone was there on purpose to discourage someone from bagging your unit when you left it at the house or in the car, plugged in for a charge. *You must turn the unit on before unplugging it to keep it from anti-burglarizing itself.* Or, if you live in a crime-free neighborhood, you can go into the set menu and turn off this dandy feature.

Don't Bug Me!

Now for the mosquito repellent: the idea here is that the radio emits a very high-pitched tone that supposedly annoys certain types of mosquitoes and makes them leave you alone!

I tried it at the Ft. Tuthill Hamfest (a terrific hamfest in Arizona), and I suppose it works because I didn't end up with a single mosquito bite. The van cat was not so happy—her ears were flattened as soon as I turned on the mosquito repellent sound. My wife, Suzy, N6GLF, could easily hear it, too, and so could other younger campers around us. But for us old geezers, the sound is evidently too high-pitched for our tired ears, so I couldn't tell you if it was turned on or off. But, hey, no mosquito bites. (*By the way,*

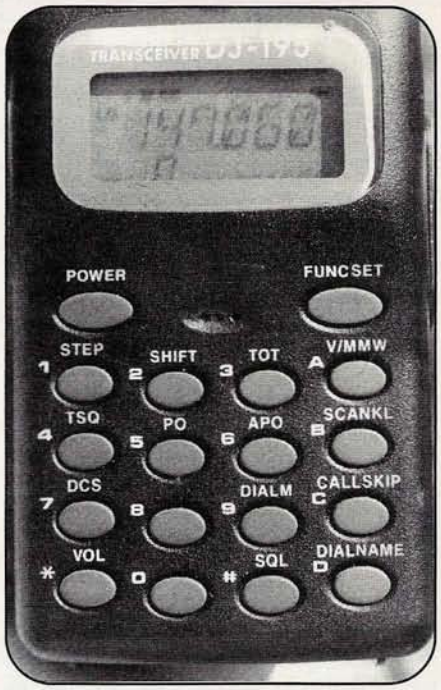


Photo B. The multifunction keypad lets you program all sorts of options into each of the 40 memory channels, punch in VFO frequencies directly, and make autopatch calls through properly equipped repeaters. The ***FUNCSET*** *key accesses a menu with a wide variety of additional customizing options.*

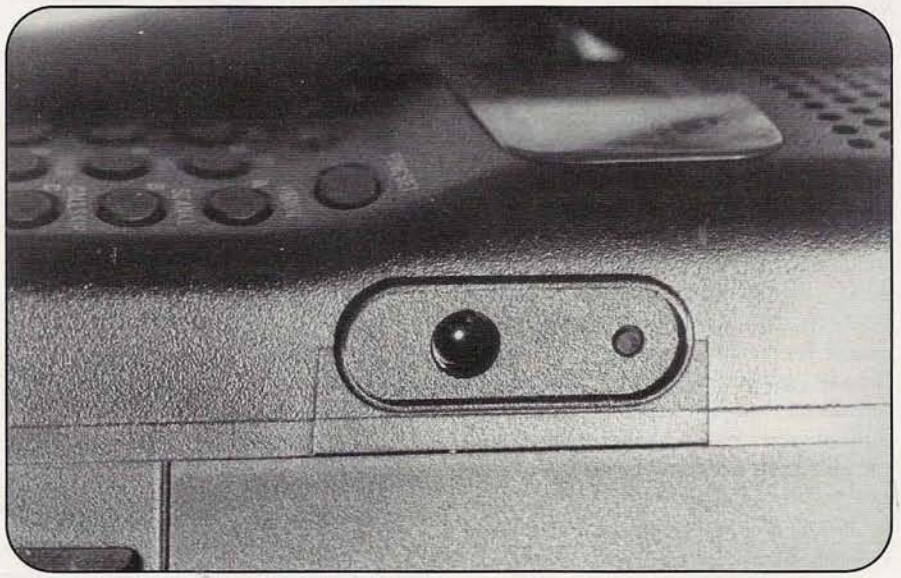


Photo C. Plugging in the battery charger on the side of the radio also arms the built-in theft alarm. If you unplug the charger cord before turning on the radio, a very loud, piercing tone will tell everyone what you're up to.

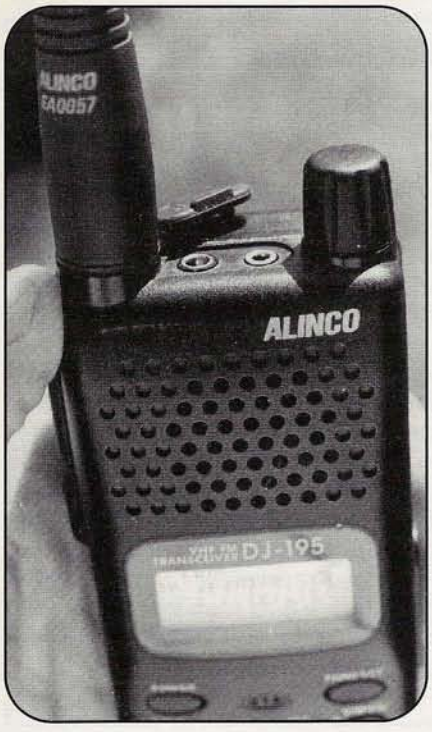


Photo D. There's only one dial on top of the radio, and it controls frequency, volume, and squelch, depending on which keypad buttons you press first. See text for details.

"A few hours later, I came back and unplugged the battery charger from the side of the handheld....All of a sudden, a shrill tone blasted out of the speaker, causing all of my eight cats to go running from the house."

Alinco makes no promises on this feature, so don't start griping if you do get a bite or two, even with the feature turned on. Maybe they weren't the right type of mosquitoes!—ed.)

On the Air

Operating the equipment from a single top knob (Photo D) takes some adjustment time. I prefer one knob for changing channels or the frequency, another knob for volume, and a separate control for squelch. On the new Alinco, the top knob starts out as a frequency/channel selector, turns into a volume knob when you push the **VOL** key, and turns into a squelch knob when you push the **SQL** key. High and low beeps confirm you have activated either the volume or the squelch functions, and that it's OK to turn the top knob.

What all this means is that you really can't adjust volume and squelch when the unit is on your belt. And unless you're using an external speaker-microphone with its own volume control (such as Alinco's EMS-47), it's sort of a pain to have to pull the unit off your belt just to adjust the volume a little bit. But if you're just walking around, playing handheld, one knob for everything is, I guess, something the new ham could adjust to.

Talking about *volume* ...glad to see a manufacturer realizes the importance of a *loud* HT when it's worn on the belt. After you go through the steps to crank the volume wide open, you can easily hear it over any hamfest roar. This is one loud radio!

You have two choices for selecting a VFO frequency: either spin the top knob or punch in the frequency on the keypad. Beeps keep you on track. Repeater splits

"Now for the mosquito repellent:...I tried it at the Ft. Tuthill Hamfest [in Arizona], and I suppose it works because I didn't end up with a single mosquito bite. [But the] van cat was not so happy...."

are not automatic, so you must set them by shift direction (note that the default split is ± 600 kHz, but you may program in any "oddball" split you need). It's easy to plug things into any one of the 40 memory channels, but an even faster way is to ask your local dealer for a quick clone job. (*Not all dealers offer this service, and it would have to be someone in your local area in order for you to get the right frequencies for wherever you live.—ed.*)

Cloning, or copying the memory contents of one radio into another of the same model, is easily accomplished by connecting the speaker jacks of the two transceivers with a stereo mini plug and reading the full page of instructions on easily setting your set to the clone receive mode. The word "pass" displays if the cloning was successful. If you're doing this at night, there is a lamp mode which illuminates the frequency LCD plate. Sorry, no back-lit keys.

More Tone Options

For those of you who live in an area where repeaters are controlled by DCS (digital controlled squelch), rather than CTCSS (continuous tone-controlled squelch system), the new Alinco handheld offers 104 DCS codes. For repeater systems that use the more common CTCSS, the DJ-195 offers the 39 standard tone frequencies. And for those systems that may have a separate decode tone for control ops wishing only to hear autopatch traffic, you may set independent transmit and receive tone settings. Not many handhelds offer this feature, and it's a good one for seasoned operators wanting to take full advantage of repeater output subaudible tones.

And if that same repeater control op wants to record specific calls with a specific tone, there is an external control function that outputs 5 volts at 5 mA (milliamps) from the center terminal of the stereo microphone jack. RadioShack has some dandy low-current, low-cost relays that could easily trigger almost any type of recorder, bell, light, or alarm to take advantage of this function when the equipment is in the full decode squelch mode.

It Slices, It Dices...

Like all good handhelds, it slices, it dices, it scans, it skips, it auto-powers off, it times out, it battery saves, and it clones. It does packet, too. You'll need to adjust the level on your TNC for transmit, and the output level to the TNC is adjusted by the radio's volume control. There's not much left out here on an inexpensive full-featured HT.

If you want to run the equipment from your car's 12-volt lighter receptacle, you'll need to purchase the optional EDC-36 adapter, which contains a nifty alternator whine filter. Soon Alinco will have its own EDC-88 quick charger to pick up the battery contact points on the back of the battery pack. Until then, you can use the supplied wall charger or a compatible drop-in charger from an accessory manufacturer. It's also possible to use Alinco's EDC-63 or EDC-60 chargers, but they'll accept the battery pack only, not the whole radio. You can also buy all sorts of speaker microphone/VOX set-ups, either directly from Alinco or from other suppliers.

And I suppose you could also buy the optional trunking board that fits into the socket behind the little black trap door. *Trunking*, you say? I don't think so on the 2-meter ham band, but it does give us a clue that this powerful, inexpensive handheld probably shares some heavy-duty land-mobile radio circuitry on the inside.

Oh yes, a rubber antenna is included, too! And it uses a regular BNC connection. Whew! Speaking of antennas, I tried the DJ-195 on an outside antenna in a downtown area, and it was relatively clean of any intermod. This is good. Finally, the specs say the receiver is a dual-conversion superhet, and I indeed measured sensitivity at better than .2 microvolts (μV). This, too, is good.

For under $200, the Alinco DJ-195 is a straightforward handheld with ear-busting audio and pleasant reports on transmit. And it might even keep bugs and burglars away! ■

Beyond the Band Edges

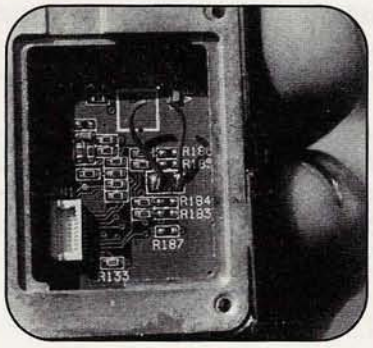


Photo E. Behind the battery case, inside a trap door, lives a blue wire which, when cut, opens up the DJ-195's transmit frequency range outside the ham bands for CAP, MARS, or USCG Auxiliary use. Never transmit out of band without proper authorization.

The DJ-195, like so many other ham rigs, may be modified by the purchaser to transmit outside the limits of the 2-meter amateur band. This is because hams are also involved with other organizations, including the Civil Air Patrol (CAP), Military Affiliate Radio System (MARS), or the United States Coast Guard Auxiliary (USCGA). All of these services use frequencies near—but outside—our 2-meter band.

If you're a member of one of these groups, and you have current authorization to operate on their frequencies, you may extend the DK-195's transmit coverage by removing the snap-on battery pack, lifting the little black trap door, and cutting the blue wire inside (see Photo E). *You are cautioned to never, ever transmit outside a ham band unless you possess current government authorization for that non-amateur service!*

Resources

For more information on the DJ-195, contact your favorite dealer or Alinco, Inc., 438 Amapola Ave., Suite 130, Torrance, CA 90501; Phone: (310) 618-8616; Fax: (310) 618-8758; Web: <http://www.alinco.com>.

Computer Automation Technology WX-1000 Digital Weather Receiver

What's so special about a weather radio? How about one that can automatically relay severe weather warnings on your local repeater? K1ZJH looks at the CAT WX-1000's wide array of features.

By Peter J. Bertini, K1ZJH*
(commquart@erols.com)

"A weather receiver?" That was my first reaction upon learning of Computer Automation Technology's newest product. How would such a device be applicable to ham radio? After all, weather receivers are hardly very new or exciting products to write about. But how about a microprocessor-controlled weather receiver that can be programmed to respond to specific weather alerts in designated areas of your local National Oceanic and Atmospheric Administration (NOAA) weather transmitter's service area? Better yet, imagine being informed of local weather emergencies by simply monitoring your local repeater!

Photo. Computer Automation Technology's WX-1000 weather receiver can link into your repeater system to automatically report severe weather warnings on the repeater and rebroadcast weather alerts.

NOAA Goes Digital

NOAA, parent agency of the National Weather Service, operates a nationwide network of over 425 VHF transmitters in the 162-MHz range. Broadcasting 24 hours a day, these "NOAA Weather Radio" stations carry local weather forecasts, warnings, watches, weather alerts, and other hazard warnings.

Originally, NOAA emergency weather broadcasts were preceded by a 10-second 1050-Hz alert tone. This allowed owners of inexpensive weather monitor receivers equipped with 1050-Hz decoders to keep abreast of the latest weather happenings without having to continuously monitor the broadcasts. While the system worked, listeners were also "alerted" to tests and to watches and warnings outside their local areas (since each NOAA Weather Radio station covers a large geographic area).

The solution was to switch to a new digital system called *SAME*, for *Specific Area Message Encoding*. The SAME system breaks down weather alerts to the county level, and even permits larger counties to be further broken down, by as many as nine subdivisions, to precisely target areas of weather activity. This is done by using *FIP Codes*, short for *Federal Information Processing Codes*. Each FIP Code consists of nine digits, normally beginning with a zero. For example, Brevard County, Florida, is designated by FIP Code 012009. For those counties that are large enough, further subdivision is done by replacing the leading zero with a digit between one and nine (see Table). FIP Codes are transmitted using short packet data bursts.

The WX-1000 Receiver

Computer Automation Technology's WX-1000 receiver was designed to use the SAME system to full advantage. The receiver uses a dual-conversion design with a first IF (intermediate frequency) at 10.7 MHz and a second IF at 455 kHz. Two 10.7-MHz crystal filters and a ceramic 455-kHz filter are used. The receiver is single-channel, crystal controlled. A crystal for your local NOAA weather frequency is included with your order. The front end uses an NE-25118 dual-gate FET (field effect transistor), while the remainder of the receiver is

**Peter J. Bertini, K1ZJH, is Senior Technical Editor of our sister magazine,* Communications Quarterly, *and an occasional contributor to* CQ VHF.

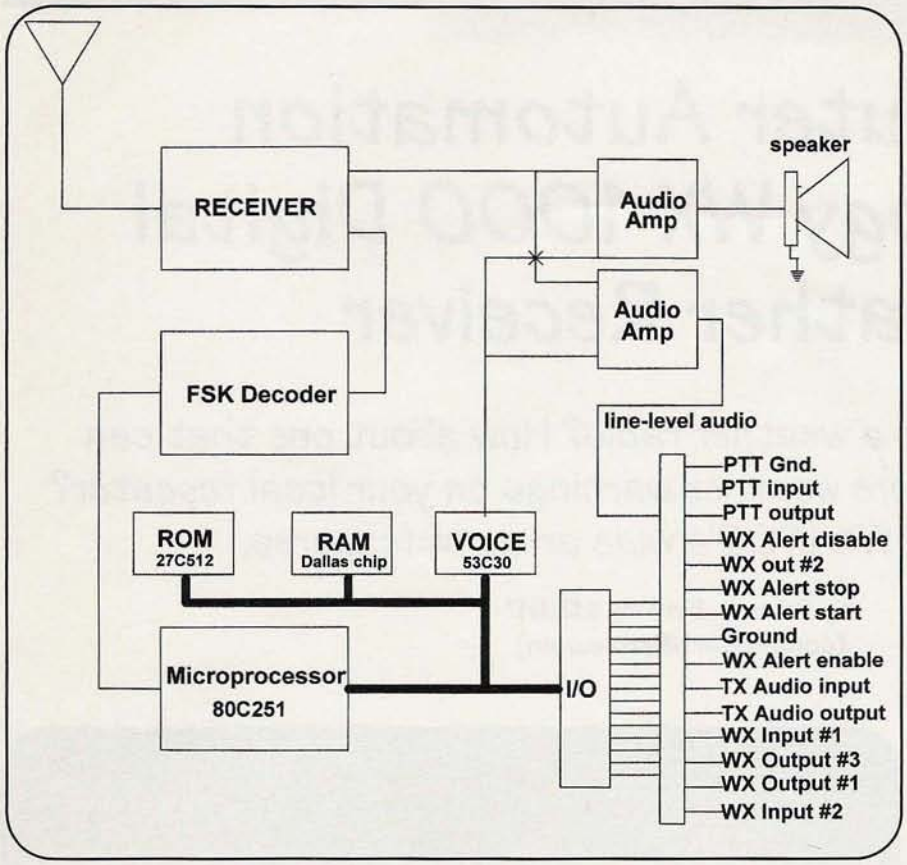


Figure 1. A simplified block diagram of the WX-1000 digital weather receiver.

built around a Motorola MC13135 FM receiver chip.

The majority of the RF circuitry uses surface-mount technology. The receiver sensitivity is specified at .45 µV for 20 dB of quieting. Because the receiver is intended for use in high-level RF environments, extra care was given to making the front end as "crunch-proof" as possible! Since most NOAA transmitters run considerable power and will most likely be line-of-sight to any decent repeater location, the receiver has an internal 20-dB attenuator in the front end that may be used to virtually eliminate any possibility of interference. The board layout is clean and uncluttered, and the design uses state-of-the-art components.

The WX-1000 may also be used as a "stand-alone" unit to meet the needs of utility or transportation companies, broadcasters or local municipalities. This is a commercial-quality unit, designed for mounting in a standard 19-inch equipment rack (see Photo). A 2.5-inch speaker is located on the front panel. Front panel controls include the volume control for the local speaker, as well as two toggle switches. The "Monitor" switch activates the front panel speaker. The momentary "Reset" switch resets the receiver and flashing red "Alert" LED. The receiver requires an external power source supplying 12 volts at 100 milliamps. A 2.5-millimeter coaxial power connector is included. Power may be taken from the repeater, or an inexpensive "wall-wart" plug-in supply may be used. A second (green) LED on the front-panel indicates power.

Programming the WX-1000

As you can see in Figure 1, a block diagram of the WX-1000, the actual RF receiver is a small portion of the hardware end of this product. The hardware includes an FSK (frequency shift keying) decoder, microprocessor, RS-232 computer interface, voice synthesizer, ROM (read only memory), and non-volatile memory. The WX-1000 configuration program is included with the receiver and requires a Windows 95, 98, or NT operating system. As NOAA changes or adds FIP Code information, updated software reflecting these changes is available for download at the

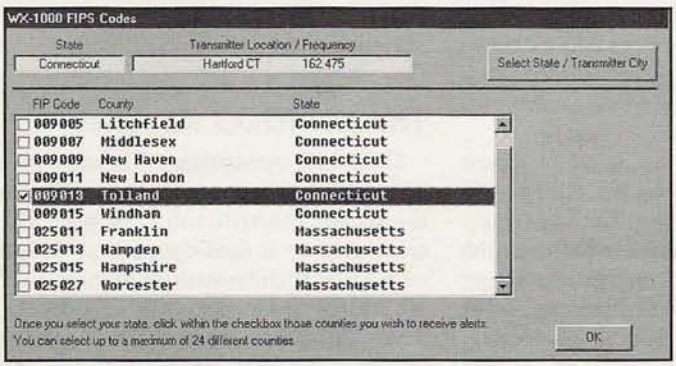


Figure 2. A partial listing of the Connecticut and Massachusetts counties served by the NOAA WXR 162.475-MHz transmitter on Soapstone Mountain, in Somers, Connecticut.

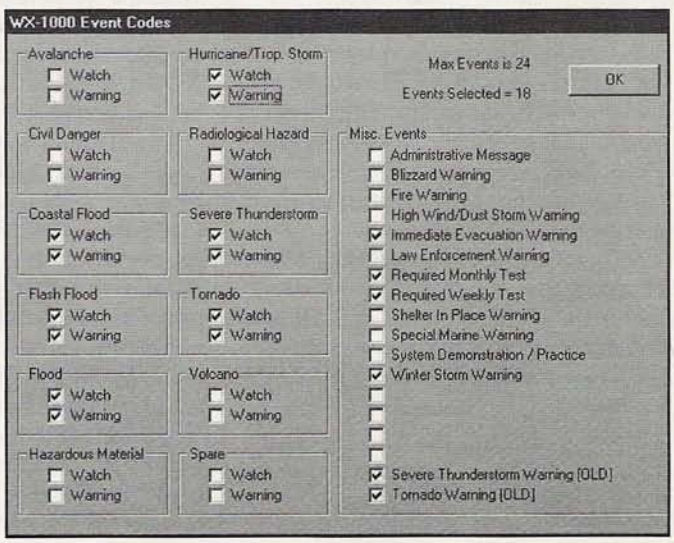


Figure 3. The Events screen lets you choose which types of severe weather warnings should activate the receiver, as well as other events which may trigger it into action.

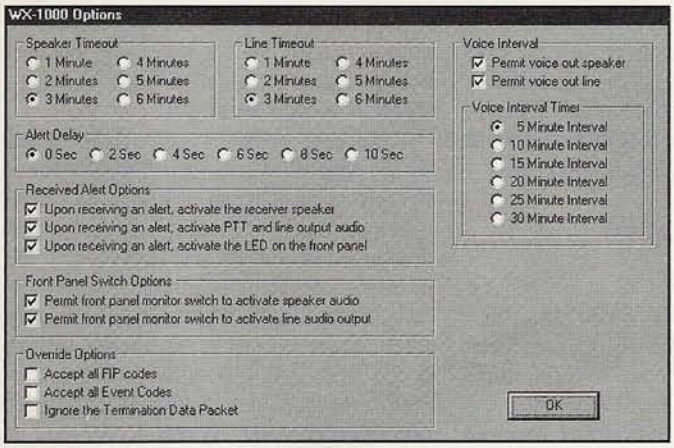


Figure 4. The Options screen allows setting various timers, control options for the speaker and line outputs, front-panel switches and alert options, and overrides for FIP and Event Codes.

"Upon receipt of an alert packet, the WX-1000 determines what action, if any, is necessary. For example, the alert message can be passed through the local speaker or to the repeater transmitter via the line level output, depending on the options selected."

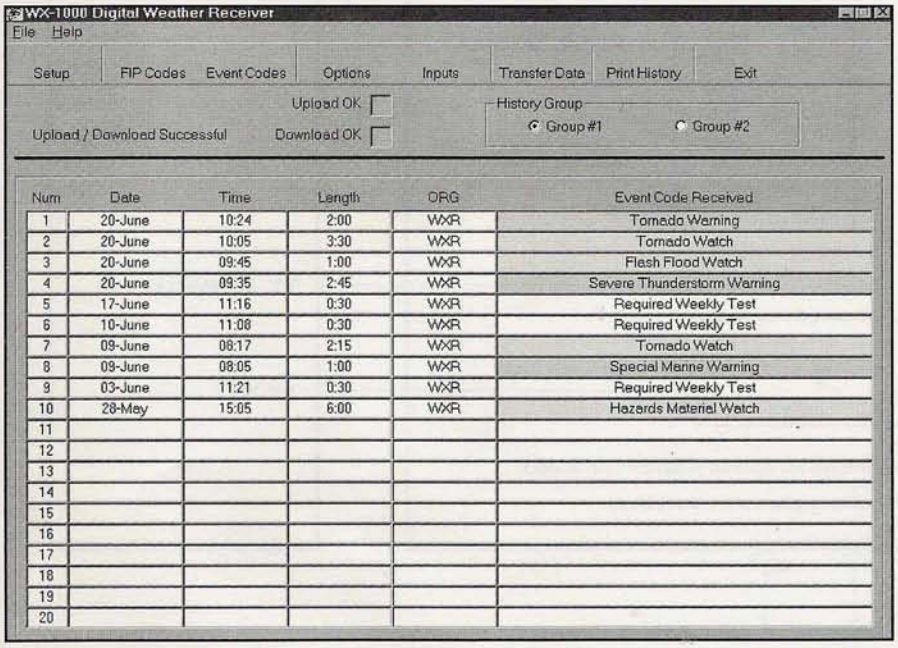
Computer Automation Technology Web site (see "Resources").

To be of use for your area, the receiver is easily programmed using a serial port for communications between the receiver and a computer. A set-up screen allows you to select the computer serial port and the time zone in which the receiver will be used. The FIP Codes supply the date and time in UTC format, and the receiver adjusts for the proper time zone. A nine-pin RS-232 connector is on the rear receiver apron.

Once everything's connected, you begin programming by using the *FIP Code Entry* window (Figure 2). Here, you choose the appropriate state, county/counties, and transmitter location. Once this is done, the *Event Codes* window (Figure 3) lets you select what types of severe weather situations the software should listen for, and whether it should respond to a Watch, a Warning, or both. In addition, as shown in Figure 3, a variety of other miscellaneous events may also be selected.

The next window (Figure 4) is for setting the *WX-1000 Options*. Here, you can set various timers controlling the local speaker, line-level output to the repeater, and whether the synthesized voice messages (and the related time-intervals) go to the local speaker or line-level output. You may also opt to allow all FIP Codes and Events to trigger the receiver.

Once the receiver configuration is set in the computer, the **Transfer Data** command loads the FIP Code information to receiver, and at the same time downloads information on the last 40 alerts. The downloaded Alert History, shown in Figure 5, may be output to a local printer. Note that the receiver clock and calendar are set using the computer clock and calendar as a reference. Once the data are loaded into the WX-1000, the information is maintained in non-volatile memory in a special memory chip that contains its own internal battery backup. The 40 most recent events are stored.



Num	Date	Time	Length	ORG	Event Code Received
1	20-June	10:24	2:00	WXR	Tornado Warning
2	20-June	10:05	3:30	WXR	Tornado Watch
3	20-June	09:45	1:00	WXR	Flash Flood Watch
4	20-June	09:35	2:45	WXR	Severe Thunderstorm Warning
5	17-June	11:16	0:30	WXR	Required Weekly Test
6	10-June	11:08	0:30	WXR	Required Weekly Test
7	09-June	08:17	2:15	WXR	Tornado Watch
8	09-June	08:05	1:00	WXR	Special Marine Warning
9	03-June	11:21	0:30	WXR	Required Weekly Test
10	28-May	15:05	6:00	WXR	Hazards Material Watch
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Figure 5. The event log stores the 40 most recent weather events. This information may be downloaded via the serial port for a historical record of past weather events.

When an Alert is Received

When an alert is received, the date, time, duration, and type of alert are stored in the non-volatile memory. Upon receipt of an alert packet, the WX-1000 determines what action, if any, is necessary. For example, the alert message can be passed through the local speaker or to the repeater transmitter via the line level output, depending on the options selected. The receiver will continue monitoring until the termination packet is received, or until the **speaker timeout** limit is reached. At the same time, the WX-1000 provides relay contacts to activate the repeater transmitter to permit rebroadcasting of the NOAA weather message. Rebroadcasting NOAA transmissions on amateur frequencies is specifically permitted by current FCC regulations. Extra relay contacts are provided to allow breaking the audio path to the repeater transmitter and giving the WX-1000 audio full priority.

Synthesized Voice Messages

The duration of an alert or warning is contained in the FIP Code packet. The time is sent in 15-minute increments for the first hour, and 30-minute increments for the remaining time of the alert. Once an alert or warning is in effect, the front-

Table.

County Subdivisions

0	All portions of county
1	Northwest
2	North Central
3	Northeast
4	West Central
5	Central
6	East Central
7	Southwest
8	South Central
9	Southeast

Table. In counties too large to be covered by a single SAME code (see text), the leading zero in the code is replaced by one of the digits above, depending on the location within the county.

panel LED will flash on the receiver's front panel. The internal voice synthesizer will announce through the repeater and local speaker the nature of the alert at intervals ranging from 5 to 30 minutes, as set by the Voice Interval Timer in the Options menu. A few examples of the voice synthesizer messages include "Severe Thunderstorm Watch," "Tornado Warning," and "Hazardous Information Warning." An alert may be canceled at any time with the front-panel "Reset" switch, or by an **Alert Disable** command issued through the repeater controller.

The WX-1000 and Your Repeater

Figure 6 shows a basic interface between the WX-1000 and a typical VHF or UHF repeater system. Note that only four connections are involved, using the transmitter PTT and audio lines from the repeater controller. Most high-end controllers allow the user to activate controller "outputs" to interface with other on-site equipment. If available, a controller output can be used to reset the receiver at any time during a weather activity. Of course, since Computer Automation Technology also makes the CAT series of repeater controllers, it is only natural that the WX-1000 is designed to fully interface with the CAT300DX or CAT1000 repeater controllers! When used in conjunction with the WX-1000, the user inputs on both of these controllers can be programmed to automatically load a memory file that contains specific weather net parameters when an alert is received.

Another possibility is using the "**Alert Stop Output**" signal from the receiver at the end of an alert to initialize a normal memory load to the controller. A good deal more information is provided in the manual, which maybe downloaded for free from the Computer Automation Technology Web site. And, while you're at the Web site, take a look at the WS-1000 interface, which allows using certain Peet Brothers "Ultimeter" series or Davis "Weather Wizard III" weather stations to monitor conditions at the repeater site through a CAT-1000 controller! Interfacing between the receiver and repeater is done via a 15-pin dB-style connector on the rear apron of the receiver. A 15-pin plug and hood are provided with the receiver.

One More Time...

Whew! Well, that's a lot of information to digest in one sitting! Let's take a quick look at how I've been using the

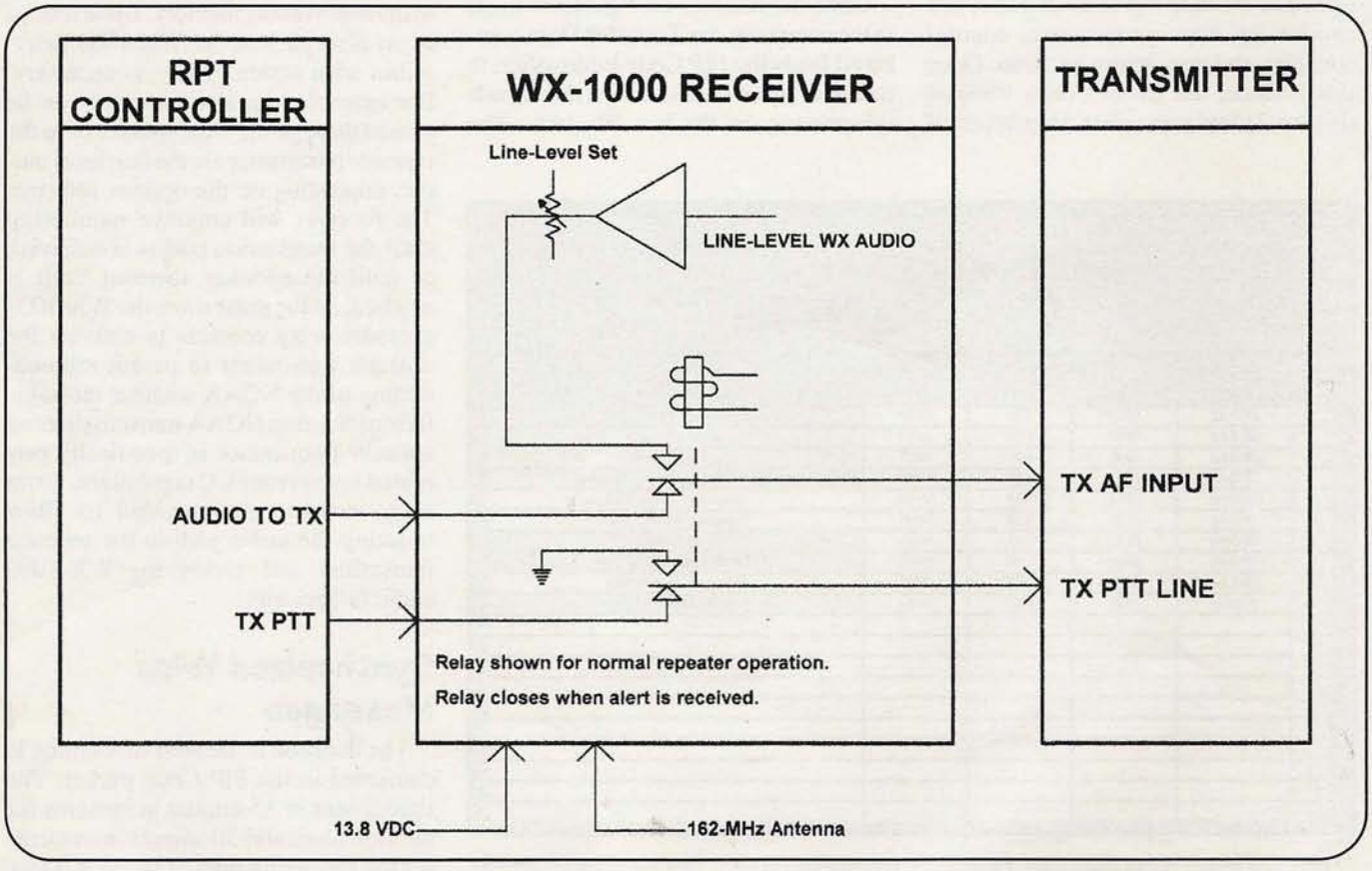


Figure 6. Only four wires are needed to connect the WX-1000 to a basic VHF or UHF amateur repeater system.

"The internal voice synthesizer will announce through the repeater and local speaker the nature of the alert at intervals ranging from 5 to 30 minutes, as set by the Voice Interval Timer in the Options menu."

receiver for the past few months as an example. Since I live in Connecticut, I've programmed the receiver for the Hartford NOAA station on 162.475 MHz, using the FIP Code of 009013 for Tolland County. It's winter, so I've selected Winter Storm Warning in the Event Codes. At 5:00 p.m., NOAA issues a Winter Storm Warning for my county for the next five hours. The announcement is preceded by the FIP Code packet data burst which contains the county, type of activity, and duration of the warning.

The WX-1000 responds to the Winter Storm Warning by activating the local speaker for the duration of the warning announcement. The speaker remains active until a termination packet is received at the end of the transmission, or until the Alert Message Timer times out, whichever occurs first. At the same time, the WX-1000 seizes control of the repeater transmitter's audio and PTT lines, rebroadcasting the NOAA winter storm message over the repeater system. The receiver also stores the warning data in non-volatile RAM memory to permit retrieval of historical data on download.

The receiver also knows that the warning is in effect for five hours, or until 10:00 p.m. EST. Depending on the interval set for the voice synthesizer message, the repeater will key up at fixed intervals and announce "Winter Storm Warning" until 10:00 p.m. This activity can be canceled by the front-panel "Reset" switch, or through an input on the rear apron interface connector. At 10:00 p.m., the front-panel **Alert** LED stops flashing, unless you've already done a reset.

Let's go one step further and imagine that the repeater is equipped with a CAT1000 or 300DX controller. When the alert is received, the receiver also generates an Alert Start Logic Output signal. This may be used to initiate a macro command in the controller to execute a special "weather emergency" memory load. This memory may be set to kill scheduled synthesized repeater announcements, allow for extended time-out timers, a minimum of IDs—anything that would enhance a formal net operation. The memory load may also contain a hardware output command that is used to control the WX-1000 Weather Disable Input; so once a Skywarn net is activated, the receiver can't interrupt with further alerts. Otherwise, at 10:00 p.m., when the Winter Storm Warning expires, the receiver will issue an Alert Stop Output. This may be used to initiate a memory load back to normal repeater operation.

Weather-on-Demand is available by grounding the Weather Enable Input line on the WX-1000. A user may access the weather at any time by activating a user hardware output from the controller to control this line.

The Bottom Line

The WX-1000 receiver sells for $399, which includes the three-disk Windows program, necessary connectors, and a crystal for your local NOAA weather frequency (you must specify the frequency when you order). A bound manual is also included; and all schematics and a full parts list are contained in the manual. If you live in an area where tornadoes or other severe life-threatening weather conditions are common, or if you are actively involved in Skywarn activities, this receiver is a "must have" for your repeater group. ■

Resources

For additional information, or to order a WX-1000, contact Computer Automation Technology, Inc., 4631 N.W. 31st Avenue, Suite 142, Fort Lauderdale, Florida 33309; Phone: (954) 978-6171; Fax: (561) 488-2894; Internet: <http://www.catauto.com>.

Final SSTV Photos From Mir

Another era has ended in the history of ham radio in space. The ham station aboard Russia's Mir space station is silent for the first time in recent memory, as the final Mir crew returns to Earth... but not before sending back some photos via ham radio.

This month's column is compiled from reports by the AMSAT News Service (ANS) and SpaceNews, along with personal reflections (and photographs) from Farrell Winder, W8ZCF...

AMSAT News Service, 8/30/99:

News agencies around the world all reported the same story - for the first time in over 10 years, there's nobody in space. Todd Halvorson of the newspaper Florida Today told ANS that "in an emotional overture to a fiery grand finale, an international crew (Photo A) left Russia's aging space station Mir early Saturday morning (August 28), reducing Earth's orbital population to zero." The crew's departure also signaled an end to amateur radio operation aboard the Mir station. Mir had been occupied for 3,641 consecutive days.

The departure followed a hectic two weeks in which the crew shut down station laboratories, filled up its garbage scow and switched off all but essential systems. A new crew, meanwhile, is being trained for a short mission that might be needed to make final preparations for what would amount to a burial-at-sea. The schedule calls for cosmonauts to fly to Mir in February or March of 2000 and to oversee the arrival of a fuel-filled Russian space freighter. The freighter would periodically fire onboard thrusters, nudging Mir into a lower orbit of about 125 to 135 miles above Earth. The crew then would abandon ship and return to Earth before the freighter gives Mir a powerful last push into the upper atmosphere, where it would burn up and fall in pieces over the Pacific Ocean.

Mir has placed some incredible numbers in the record books, starting with orbits: Mir orbits the Earth about 16 times a day, for total of more than 77,000 to date. The station has been aloft for almost 5,000 days, going back to the core component launch, and has seen nearly 100 passengers, including seven NASA astronauts, a Japanese journalist, a British candymaker, and several other foreign visitors. Mir was also the setting for the longest stay in space by Cosmonaut Valery Polyakov (recording 438 days in 1994-95). Many of the visitors were ham operators who were very 'radio-active' from the station during their stay.

Many satellite operators posted comments about Mir on the AMSAT-BB (AMSAT's Internet e-mail reflector -- ed.). Jeff, W4JEF, essentially captured the thoughts of many with his posting; "may the memory of the fun we've all had with Mir remained etched in our minds for years to come."

ANS congratulates the Mir space station and all who flew on her for their outstanding achievements.

From SpaceNews, 8/30/99: Message From Mir

Prior to his departure from Mir, French Cosmonaut Jean-Pierre Haignere provided the following comments -- and a slow-scan TV (SSTV) picture -- to Farrell Winder, W8ZCF, via amateur radio last Thursday (August 26):

Hello to all of you, we are very busy in the station but since the amateur radio is close to us we are trying to tie it altogether in with the work. We are sending a picture now (see Photo B). OK, we are preparing and packaging the cargo and preparing the Mir to leave altogether, doesn't give us so much free time. We would like to thank those Radio Amateurs who were faithfully on the frequency either to get our picture or to send some or to send us a lot of packets. Thanks a lot for this great support either to the American or the Canadians, ah, would have liked to talk to the Eskimos as well, but never-the-less thanks to you, we are leaving tomorrow, we may have some other opportunities but obviously not with each of you and therefore it would be nice to meet you on the ground.

Photo A. The final SSTV photo sent to hams on Earth from the Mir space station, showing the crew members waving goodbye. Photos courtesy Farrell Winder, W8ZCF.

W8ZCF's Photos

CQ VHF asked W8ZCF for permission to reprint the above message, and for a copy of the photo described. Farrell was kind enough to send us three photos, along with his OK to publish the contents of his message, and the following background information -- including a suggestion that there may yet be one more opportunity for hams to contact the Mir:

Yes, it would be OK for you to print the text of Jean-Pierre's comments. I have attached the last amateur radio SSTV picture sent by the crew (Photo A). I have also attached the picture (Photo B) that JP sent when he said, "We are sending a picture now" (see above). It shows Flight Engineer Sergei Avdeyev and Jean-Pierre. Sergei is on the exercise machine. Jean-Pierre remarked earlier that all of the

Photo B: Slow-scan television (SSTV) image of Sergei Avdeyev dressed very comfortably, and Jean-Pierre Haignere in his dark uniform. This picture was one of the last sent from Mir, taken in the Core Module (earlier photos had shown the Priroda module, which was already closed when this picture was taken).

crew was doing extra and vigorous exercise in preparation for the transition to Earth.

(As you may recall), the Mir amateur radio SSTV was conceived and put together by Dr. Don Miller, W9NTP, Hank Cantrell, W4HTB, and Farrell Winder, W8ZCF. We were assisted by Dr. Dave Larsen, N6CO, and Miles Mann, WF1F, in getting approval for the project from Sergei Samburov, RV3DR. Then Miles got the equipment delivered to Russia, visited there, and assisted in training the cosmonauts in the use of the SSTV equipment.

The crew did a superb job in sending thousands of pictures. The quality of the pictures was usually excellent and as good as could possibly be expected from the SSTV Robot 36 mode of transmission. The crew is to be greatly thanked and commended for their extra efforts to compose a great series of pictures and send these to us on Earth. We even sent a few uplinked pictures, to the crew's delight.

We will be standing by while Mir goes "solo" for the planned next six months until around February, 2000. Then, if and when Mir is visited by a new crew, we will be very anxious to know if the amateur radio packet/PMS (personal message system) and the SSTV system will be operational.

Photo C. Ham station R0MIR -- the amateur radio packet and SSTV setup aboard the Mir space station, as it was set up before the final long-term crew returned to earth in late August. See text for equipment description.

"We think the crew did a superb job in sending thousands of pictures. The quality of the pictures was usually excellent ... The crew is to be greatly thanked and commended for their extra efforts to compose a great series of pictures and send these to us on Earth." — Farrell Winder, W8ZCF

One day, JP sent us a picture of the "kit," as he called it, of the amateur radio equipment aboard Mir. It turned out to be a fine picture (Photo C). The SSTV system is on the right, and starting from the bottom -- where two LEDs are activated -- is the Tasco TSC-70 color scanner, followed by a 5-inch LCD TV screen, then the Kenwood TM-V7A and the audio controller, which sends the R0MIR ID and activates a picture every two minutes. On top is the Kenwood TM-733 used for packet and PMS. On the left is the Toshiba laptop, which is part of the packet system (it is not used with the SSTV). The microphone is used to talk to us between pictures.

We hope to make our Mir SSTV experience available to be considered for the International Space Station (ISS) so that ISS might also use this, or a modified system, for the ISS crews.

Our thanks to the AMSAT News Service, SpaceNews, and especially to Farrell Winder, W8ZCF, for sharing this material with us. ■

Leonids '99

The 1999 Leonids meteor shower in the middle of this month may be the celestial "light show" of the year, and the opportunities for meteor scatter contacts are bright, as well.

For years, the middle of November has held a high place on my list of favorite times of the year, although it wasn't until a handful of years ago that I realized that there was more than one reason to impatiently wait for those frosty Michigan mornings to arrive.

November was always a month expected to provide opportunities to bring home venison for the ultimate in family dinning. All those shooting stars I witnessed on my way to my deer stand, in complete darkness, were only moments of brilliant light that, if I was lucky, would prevent me from catching a tree branch in the face. Now, as one who looks for every opportunity to make a weak-signal VHF contact into a new grid square, those "shooting stars" have even greater significance.

Tempel-Tuttle and the Leonids

Looking back into the old logbooks, there was a definite pattern that I didn't recognize until just a few years ago. What I had attributed to random meteor scatter contacts were actually new grid squares logged thanks to the Leonids meteor shower. And what's even better is that we can look forward to that same shower every year.

Every November, the Earth passes through debris from the periodic comet Tempel-Tuttle. Tiny pieces of this debris enter our atmosphere and burn up as meteors. Since the display of meteors, or shooting stars, seems to originate in the constellation Leo, they are termed *Leonid* meteors. Every 33 years or so, this comet returns to our neighborhood, and there's a possibility that the meteors-per-hour rate of the Leonids can get substantially higher than usual. The comet passed our way only last year, resulting in a near meteor-storm in 1998 (see Photo A). This should be a *super* year as well.

Photo A. The 1998 Leonids meteor shower provided incredible opportunities for VHF-active hams work new grids via meteor scatter.

Last year's "Leo" log entries included 2-meter contacts from my QTH in Michigan (EN72) to Florida (EL98), running 100 watts into a 15-element Yagi up 45 feet. While we enjoyed excellent north-south propagation, others in North America were enjoying other random direction hook-ups. I refer you to the many excellent operating reports contained in the pages of the February, 1999, issue of *CQ VHF*, pages 44 to 47. They

Introducing Dave Bostedor, Jr., N8NQS

We are pleased to welcome Dave Bostedor, Jr., N8NQS, to our staff as "Weak-Signal News" editor. Dave is a third-generation VHFer: his grandfather was W8KYP; his father, Dave, Sr., now a Silent Key, was K8WKZ, and his mother, Patricia, is formerly N8PYO and currently holds her late husband's callsign, K8WKZ. Dave, Sr. was a very accomplished VHFer, earning VUCC #1 and DXCC #8 on 6 meters.

Dave, Jr., says growing up in an active ham family has given him "43 years of association with VHF amateur radio communications," even though he's been licensed himself for only eight years. He currently holds a General class license. Dave has mounted grid-square expeditions into W6 (DM02), W2 (FM37 and 38), VE2 (FN17 and 18), VE3 (EN87, 88, 97–99), and KP2 (U.S. Virgin Islands), and has been active as a rover in various VHF contests. He finished 10th in the U.S. and Canada in the 1992 ARRL September VHF QSO Party, and #1 in the class in the 1993 CQ World Wide WPX Contest. Dave is also founder and editor of the *Great Lakes VHF/UHF Newsletter*, is trustee of Great Lakes VHF/UHF Contest Club station KC8AAZ, and is active on 6 meters, 2 meters, 70 centimeters, and HF. I believe Dave will be a valuable addition to the *CQ VHF* staff.—W2VU

By Dave Bostedor Jr., N8NQS (n8nqs@cq-vhf.com)

include success stories of the many excited weak signal ops who used the "rocks" to work states and grid squares they had waited years to contact.

Some highlights, in case you don't have that issue handy, included Larry, NØLL, in Kansas, working W1AIM in Vermont on 2 meters for state #47; Dave, W6OAL, in DM79 (Colorado), working 126 QSOs on 6 meters in two action-packed days; and, a direct quote, "The South African Radio League (SARL) reported that 2-meter DX records for that country were repeatedly set and broken during the 1998 Leonids."

Astronomers at the California Institute of Technology predict that this year's peak will occur around 0148 UTC on 18 November. The peak can last several hours, and the rate of meteors per hour can run from 200 to 5,000 "rocks" per hour. The fevered pitch of this year's Leonids activity could rival that of 1998. So where will I be on November 18, at 0148 UTC? In my shack, calling, "CQ Leo – CQ Leo..."

Six Meter F_2

This could be the start of something big! Reports of 1998 F_2 propagation on 6 meters marked the start of a very exciting period that all 6-meter DXers have been anticipating. It will be especially exciting for the many new hams, licensed after the peak of sunspot Cycle 22, who will get their first opportunity to really "hook up" with DX from a multitude of nations on "the Magic Band." So, what can they (and the rest of us) expect?

First, a chance to work DXCC countries we've only dreamed of. From the east coast of the U.S., the opportunity is the greatest to work Europe, Africa, South America, and many other island nations. The west coast states can count on working strong Asian, Australian, South American, and South Pacific stations. The central states will be able to work South America with ease, while swinging their beams back and forth, east to west, pushing the limit of their equipment's ability to reach out and touch someone new in other directions.

Second, this peak of Cycle 23 will provide many stations, with 48 states worked and confirmed, their first real chance to pick up those last two—generally Alaska and Hawaii for most hams in the U.S.

Third, it will be a time to renew old acquaintances from cycles past. As we meet our old friends, you can find some of us creeping away from the heavy traffic an F_2 opening will bring about, perhaps finding obscure frequencies away from the action, to bring each other up to date with what's been going on over the past eight or nine years.

Whatever your pleasure, this cycle is bound to bring many opportunities to go where you've never gone before. And, when the pileups occur, don't be timid about jumping in. As my dad used to say, "The meek may inherit the Earth, but they won't work much DX."

Table. NJØM EN 34 Perseids Box Score

Date	Time (UTC)	Callsign	Grid	Distance (miles)	Mode	Notes
8/12/99	1301	VE2SWL/6	DO21	1064	SSB	New grid
8/12/99	1316	KØRI	DM78	721	SSB	New grid
8/12/99	1321	K7LNP	DN30	1010	SSB	New grid
8/12/99	1420	NØVSB	DM79	687	SSB	New grid
8/12/99	1651	WZ1V	FN31	1057	SSB	
8/13/99	1201	WA1OUB	FN43	1116	SSB	
8/13/99	1548	KC7IJ	DN44	836	SSB	New grid
8/13/99	1725	K4ZOO	FM08	869	SSB	New grid
8/13/99	1755	K2SPO	FN13	825	SSB	New grid

Table. "Box score" of 1999 Perseids contacts by John Hill, NJØM, of Minneapolis, Minnesota (EN34). John is one of the few people, it seems, to have had any success at all during the "classic" August meteor shower.

Meteor Scatter Q & A

The following question and answer about meteor scatter fundamentals were posted on the Internet, and both writers were kind enough to allow us to reprint them here:

Q: I am new to meteor scatter and would like to try to listen for some activity during the shower. Can someone tell me where most of the SSB or slow CW is done, especially random contacts so that I can try hearing them? Thanks,

—Scott Olitsky, AC3A,
Buffalo, NY FN03pa

A: First things first, and hopefully you have most of this set up. For 2 meters, turn your rig to 144.200-MHz USB (50.125-MHz USB on 6 meters). If you have a horizontally polarized Yagi, aim it southeast (or south to southwest if you're on the east coast!). If you have a preamp, turn it on. Hopefully, your antenna is up at least 20 feet, 40 works better. Just keep the rig "in the noise" at a comfortable, slightly in-the-background, volume level. Turn up your RF gain to maximum, and keep your squelch fully open.

Listen for rather quick surges of someone calling. It will appear out of nowhere, and it may just be a word or three on 2 meters, but bursts of 5 to 30+ seconds are common on 6 meters. Some 2-meter "burns" will last surprisingly long, but these are still rarer than on 6 meters. If you want to follow a nearby station who is working a sked (pre-scheduled contacts), talk to him/her and ask what time and frequency so you can listen in. If you can hear "his" side of the sequences, it will help you understand how it's done. Some skeds will be over in 2 minutes; some will not complete until 20-plus minutes. Some skeds are arranged on 75 meters, usually on 3815 or 3818 kHz. Have your "zulu" (UTC) clock handy. Meteor scatter is an amazing thing. Have fun at it!!

—Rick Glaese, N7ANL

Perseids Accomplishments

The 1999 Perseids meteor shower wasn't the big "star" that it's been in the past, with more disappointment reported than success stories. Here's a representative sampling from the Internet.

From Bjorn, SM7SRJ, JO87 (Sweden):
So far all skeds with (distances over) 2,000 km are NC (no contact). Skeds complete now: S57EA, DHØGHU, I3LGP, S55AW, 9A4FW. One random: S51AT. Had lots of rain here and static noise now and then.

From Oscar, CO2OJ, EL83 (Cuba):
Had 5 skeds for Thursday morning on 2 meters, but only completed one with K4HJE, EM96, between 0730 and 0800. Copied in that sked a couple of pings, several weak bursts, and a couple of S9 long bursts. However it almost failed. I copied his "roger,

roger, roger" only at minute 57!! I didn't hear a single ping in any of the other four skeds. Thanks to KDØPY, KC8LGL, K4SSO, and N1RWY for the effort. Hope to try again during the Leonids.

From Brian Derx, N5BA, EL29 (Texas):

Lousy morning...5 skeds, no completions—From EL29 to EM47, K4SSO, nothing; EN43, W9FZ, complete calls first 15 seconds, then nothing; DL81, XE2YVW, nada; EN81, WA8WZG, nothing; EM86, K4JP, nothing. By nothing I mean *nothing*, no ping, no hint of anything. I know geometry plays a part in this, and I couldn't stay after 5:30 a.m. local because I had to go to the salt mines, but ping-less was such a cruel blow. Guess we'll just have to charge harder in November. Good luck to all.

From Arliss Thompson, W7XU, EN13 (South Dakota):

Well, I ran a ton of skeds but have only 4 QSOs to show for it, and one of those was a random. The schedules accounted for 28.5 hours of operation over the last 3 days. True, most of my time was spent on 222, but even so, I found the results dismal. I didn't spend much time on 2-meter randoms, but activity there seemed way down when compared to years past. At one point last night, I ran a series of schedules over 4 hours on 2 and 222, and only heard one ping during that entire time.

One of the (few) highlights was hearing KQ6DI (CM97cq) on a 10-second burn on 222 this morning (1427 UTC). Although we didn't complete the QSO, it was exciting in that the distance is about 80 km farther than the current 222 MS distance record. Other than that, just hearing someone sending calls constituted a highlight this year. And believe it or not, I had a good time! Looking forward to the Leonids.

From George Dowell, KØFF, EM49 (Missouri):

Finished with 16 QSOs, all on 2 meters, all but 1 random, and there I tail-ended someone's sked. This was a weak showing compared to the last 5 years, allowing less than half of the contacts that I usually make...(later).... Well...after I thought it was all over, I turned the rig on again and worked K1DY and then K5AM for a total of 18 on 2 meters. All SSB, all random. Thanks to all for your patience.

From Paul Kelley, N1BUG, FN55 (Maine):

I'm seeing a lot of reports indicating the Perseids this year (at least in North America) were very poor. I would have to agree, although I may have missed the best times.

I was concentrating on 222, and had only one completion, short range at that. But since this was my first time working meteors on 222, that was an exciting contact! I heard very few bursts and often went hours without so much as a ping. Between 222 skeds, I listened on 144.2 and was amazed at how little I was hearing, compared to past years. At 0430 on the 13th, I blew up my 222 receive system, thus ending operation on that band. Murphy! I ran a few skeds on 144 MHz, but completed none there. Terrible is the only way to describe the meteors from my perspective. Leonids, here I come!

From Dave Bostedor, Jr., N8NQS, EN72 (Michigan):

I guess I was spoiled by the 1998 Leonids. Or, perhaps, I was simply expecting too much. I was determined to make random contacts, without skeds. I completed none. I've had more success running random rocks most any time of the year. I heard only partials the whole week. Never heard enough to put a call with a locator. Come on Leo!

From Frank, W2FCA, FN22 (New York):

Sounds like my results. I had four skeds. Two yielded nothing. One with Tom, KØVSV, had a bunch of little bursts but no Q. I had a sked with Holly, NØQJM, and all I had was one itty-bitty ping. Grumble. But—I'll be around in November I may get the "Blue Whizzer Flu" and have to stay home on the Leo peak.

From John Hill, NJØM, EN34 (Minnesota):

This was my second Perseids. Last year, after reading all the glorious fanfare about this shower, I was really pumped up for it. Either someone was overstating the facts or I misinterpreted them. There were no new grids, waiting like wheat before the scythe, to be mowed down. Being relatively new to MS, I sat intimidated the few times 144.200 erupted for a brief period. Boy, did I feel dumb taking three days vacation for it. It did prepare me for this year's Perseids, though.

First off, from last year's observations, it was ludicrous to make skeds more than a few minutes in advance. No software I tried last year or this year was even close (± 6 hours) at predicting any paths. As a matter of fact, I was surprised that the authors of those programs did not revise the data files for this year, considering the behavior of last year.

How was it this year? Great! I nailed down 7 new grids on 2 meters (180-188); see Table. New grids are hard to come by lately. Were they handed up to me on a platter? Heck no! I had to work for them, but the opportunities were there, not only on the 12th, but the 13th also. The point is, don't look back. Each year is a new year. Four of five QSOs on 8/12 had multiple nice burns. All QSOs on 8/13 were "one burn wonders" with many minutes of nothing. I didn't keep track, but I believe about five skeds were not completed. Three QSOs were "one burn wonders" on .200. Yes, I took two days vacation this year, but with no expectations. Just a game plan. A big thanks to the stations I worked who were also at home these two days. If I can get seven new grids this time next year, then it will be a big success to me again. The Rocks and 144 Prop Web pages were a big help in determining where to look. I highly recommend them [see "Resources"]. 73 and see you in the Leonids.

From Olli Droese, DH8BQA (Germany):

Just returned from my 3 weeks of holiday wherein I spent about one week devoted exclusively to VHF amateur radio....So far, here are my results of the Perseids meteor shower from JO73cf....[List deleted for space; Olli worked 23 stations in 22 grids and 14 countries between August 9 and August 13, including 15 CW QSOs and 8 SSB QSOs. All of the SSB QSOs and one of the CW contacts were random].

Found no sharp maximum this year and reflections in general not as good as I am used to concerning Perseids. As I have *not* been QRV in last year's Leonids, I'm for sure not influenced concerning long reflections, hi. Anyway, this year, people spread out ±10 kHz around 144.200 MHz, so it was a lot easier to do some quick random SSB QSOs! If even more people will follow, it might be even easier!

MS Operating—the Basics

In brief, meteor scatter (MS) schedules are prearranged attempts to make contact, and exchange some type of information with acknowledgment, by bouncing radio signals off the column of ionized air left behind by a falling meteor. The reception of both calls, some sort of information, and confirmation by both stations is required for a QSO to be considered complete. It is standard procedure for the westernmost station to transmit for the first and third quarter of each minute of the schedule, and listen for the easternmost station during the second and forth quarters. Most schedules are run for 30 minutes. The exchange includes both callsigns and signal strength information (generally "S2"), with "Rogers" as the confirmation.

Many random (non-scheduled) MS operators will be heard exchanging callsigns and grid locators, with a "Roger 73" to close the deal. This is especially true when bursts are long, and a quick contact seems achievable.

—N8NQS

Possible New 2-Meter DX Record

Clint Walker, W1LP, activates rare grids on a regular basis—he's an officer on a ship that regularly plies the seas on both sides of the Americas. On August 21, 1999, he made contact on 2 meters with Paul Lieb, KH6HME, in Hawaii (see last month's "Weak-Signal News" column for more on KH6HME), at a distance of 2,945 miles. Here's Clint's report of the contact, relayed by Mark Ammann, KMØA:

Hola,

After trying all day on CW, and hearing the 2-meter and 432 Hawaii beacons on and off for 36 hours, I finally completed with Paul, KH6HME on 2 meters SSB with 52 signals at 0740 Z 8/21. We switched to 432 but never made it. The 432 beacon had been S-5 only 15 minutes before Paul made it to the beacon location on the Mauna Loa volcano. It is amazing how the band automatically dies after Paul starts the 2 hour trip to the volcano.

A nyhow, here are the stats on the 2M QSO we did make...
KH6HME (BK29GO) on Mauna Loa at 8,000 feet; W1LP/MM (DL51CE) south of Baja Mexico. Distance: 4,745 kilometers or 2,945 statute miles.

KH6HME: 60 W (2) 7 element Yagis; W1LP: 200 W (1) 9 element Yagi 80 feet above sea level.

73, Clint W1LP/MM

Concerning the recent discussions on HSCW vs. AF-Keying: In about 30% (!) of my skeds, people were not on the correct frequency! So it usually took some time to find them 0.5-1 kHz away...do not know how many NIL skeds might have been completed if we could only find each other??? So I think *everybody* should check his/her own frequency readout in general, and after correcting it, then take the -2 kHz adjustment for audio-keying to be on the correct frequency. I checked mine *before* the Perseids and I knew that I had -200Hz shift to Zero Beat, and could easily correct it...you know, equipment gets older! Many thanks to everybody QSOed for another very enjoyable event.

Digging and Scratching

It is with a great sense of honor, and a real appreciation of the responsibility involved, that I accepted the offer to be Weak-Signal News columnist for *CQ VHF* magazine. As I dig and scratch for all the weak-signal news I can uncover, I look forward to bringing forth news and reports that will excite, motivate, and challenge the readers of this column.

You can all help me achieve this goal by sending in news items that you feel would be consistent with all aspects of weak-signal operations. Your operating reports are also requested. Whether your pleasure is DXing, hill-topping, contesting, MS, EME (and the list can go on much farther), let me know what you're doing and where you're going. You can contact me via the Internet at <n8nqs @cq-vhf.com>, via postal mail to my *Callbook* address, or by telephone at (517) 784-0325. 73,

—Dave, N8NQS

Amateur Radio Public Service—A 50-Year Review

Ham radio's role in public service and emergency communications has grown significantly in the past half-century—with VHF becoming an ever-more important "piece of the puzzle." WA3PZO takes a look back...

My life for the past year has been almost nothing but preparing computer systems and programs to be ready for the year 2000. At work, it's been going down a checklist probably longer than a DXCC countries list. PC upgrade...check. Software upgrade... check. Computer code rewritten...oops. Computer code rewritten again...check. Contingency plans in place...check. We're down to that "T-minus 60 (days) and counting" that many of us have become so used to hearing as another spacecraft prepares to go into orbit.

At a recent club meeting, I was reminded that Philadelphia had celebrated its 300th anniversary in 1982. We're already into the next 100 years. So what does this have to do with ham radio? It prompted me to go back in the archives and look back at amateur radio public service.

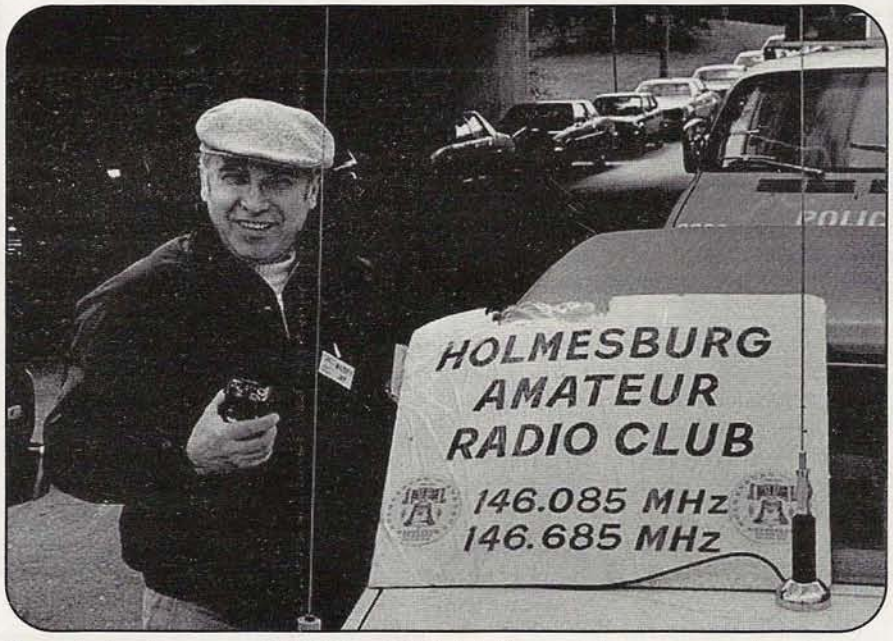


Photo A. Jay Kuperman, WA3IFY, of Philadelphia provides communications during a marathon in the early 1980s. (Photos courtesy Holmesburg Amateur Radio Club)

50 Years Ago

In 1946–47, the new 50- and 144-MHz ham bands became available. Mobile operation was becoming more popular with the advent of surplus equipment. In the early days, it was not a question of where you were going to hide your HT, but more where were you going to put the groceries once you had the radio installed in the car. Many radios had control heads next to the driver and the transmitter and receiver were put in the trunk of the car.

Bill Orr, W6SAI, wrote for *CQ* magazine's 50th anniversary issue and described early amateur radio public service efforts devoted to relaying messages across the U.S. In the 1920s and 1930s, long-distance communication links existed to relay messages across the country. This network, while refined over the years, still exists as an integral part of amateur radio public service, the ARRL's National Traffic System.

At the end of World War II, over 25,000 amateur radio operators had served in the Armed Forces and an equal number were employed in the war industries. They formed the nucleus of a new group of public-service minded hams, and the War Emergency Radio Service, a branch of Civil Defense, paved the way for post-war emergency communications on a local level. ARRL Emergency Coordinators were appointed with close ties to the American Red Cross and local Civil Defense units. Gradually, hams equipped themselves with surplus generators and portable communications equipment for use in natural and man-made disasters.

Two of the first tests of emergency radio communications, Orr wrote, were the 1946 Alaska earthquake and the 1947 Texas City explosion. These established amateur radio emergency services as a national asset. The 1950 New England hurricane and the 1952 Ohio River flood resulted in large volumes of emergency radio traffic by amateurs. These floods,

By Bob Josuweit, WA3PZO (wa3pzo@cq-vhf.com)

hurricanes, fires, and earthquakes emphasized the necessity of voluntary emergency communications, supplied in part by individuals, clubs, and traffic nets.

Better Short Distance Communications

In 1955, Hurricane Diane devastated the eastern seaboard. There was a need for more mobile units, better short-distance (VHF) links, and improved communications with the fire and police emergency networks. Two years later, teams of radio amateurs established back-up VHF links to augment the overwhelmed California emergency communication circuits as government officials battled major forest fires. By 1959, amateurs were training with the Red Cross and conducting their own drills to be better prepared for the next emergency activation. Orr says, "As amateur radio grew and expanded, so did the ham's ability to live up to the doctrine of 'Public Interest, Convenience or Necessity,' on which the existence of amateur radio was based."

Public Service Goes FM

In the 1970s, 2-meter FM repeaters became popular, and public-service minded hams saw potential uses for repeater operation. It took a while, though, for the National Traffic System (NTS) to catch on. NTS was the main avenue for moving messages across the state and across the country. The NTS plan provides a means for systematizing amateur traffic handling facilities by making a structure available for an integrated traffic facility designed to achieve two principal objectives. These are the rapid movement of traffic from origin to destination and the training of amateur operators to handle written traffic and participate in directed nets.

However, at the state or section level, the NTS was limited to 75-meter phone or 80-meter CW operation. Since most of the nets convened in the amateur general band, most newly licensed hams were excluded from participating in traffic handling. In addition, propagation sometimes made it impossible to pass messages over short distances. This is where repeaters stepped in. There were many local hams who didn't have 75-meter capability but who wanted to handle traffic. By having regional nets on VHF, hams operating on the section traffic nets could bring their messages to the local net

Photo B. Hams relayed vital information to summon medical assistance for run participants. This photo is from the 1980s, but the scene could be the same today.

and have the messages delivered by nearby hams. These local nets met on different schedules. Some were once a week, others met three times per week, and some—like the Dallas Amateur Radio Club's NTS training sessions on its 2-meter repeater—are on every night.

The extended range offered by repeaters also let hams providing communications for an event to leave their cars and use a "portable" radio in the field. In today's terms, "portable" is relative. Some of the early 2-meter HTs weighed several pounds and were commonly called "bricks." These so-called bricks offered the choice of a few channels (perhaps six) and were crystal-controlled. Many of the radios had an output power of 5 watts.

The Decade of "Thons"

As public service operation on repeaters became more and more popular, hams found that they were able to use their new-found toys to provide communications for just about anything. At the same time, charity and fund-raising events began to spring up all over the place. Most of these events involved lots of participants doing just about anything to raise money for their favorite causes.

Hams were soon married with walk-a-thons, marathons, triathalons, jog-a-thons, run-a-thons, bike-a-thons, etc. (Photo A) Their job was to provide logistical communications, call for medical help, if needed (Photo B), and make sure that no one got lost. Two of the early "thons" that brought national attention to hams helping out were the 1980 Winter Olympic Torch Relay and the New York City Marathon. For getting the Olympic Flame from Yorktown, Virginia, to Lake Placid, New York, the hams involved with the run were awarded an Olympic Appreciation Medal. This is the same as a Bronze Medal except that it was not won in competition. The Director of Communications for the Winter Olympics described the communications provided on the Torch Run as the most difficult event of all Olympic activities.

The specialized skills of ham radio operators were also recognized at a national level. Amateurs were asked to participate in a new medical program called the National Disaster Medical System (NDMS). The system was there to support the movement of casualties out of a disaster area to a non-affected city (a possible disaster in which NDMS would be activated is after a major earthquake). NDMS was also to be activated in times of war if casualties needed to be placed in civilian hospitals. Several amateur radio operators were asked to make a presentation on their skills as trained communicators to members of the Joint Chiefs of Staff. Within a year, Kuwait was invaded and the drums of war were beating. Amateurs immediately began to plan for operations in a military scenario. The question was raised as to how we would support casualties coming back to the U.S., and hams were part of the planning. Fortunately, the plans never had to be activated.

The '80s also saw the development of digital communications. Suddenly it was possible to pass written messages anywhere via packet radio. Traffic handlers took advantage of this. Packet radio provided error-free transmission at relatively high speed for its time (1200 bps). Emergency communication groups took advantage of the technology to pass large volumes of data between various disaster operation centers.

In Recent Years...

In the past five years, hams have provided emergency communications for many disasters. Some of the major disasters that hams provided communications for include Tornadoes in Oklahoma, Kansas, Ohio, Arkansas, Florida and Tennessee; Hurricanes Brett, Fran, Georges, and Mitch; flooding in Texas, Georgia, California, and the "500-Year Flood" in Grand Forks, North Dakota, and East Grand Forks, Minnesota; plane crashes in Pennsylvania, and off of the coasts of New York and Nova Scotia; and blizzards and ice storms in the Northeast and Midwest. As hams, we have been serving—and continue to serve—in the public interest.

Large-Scale Health and Welfare

At deadline, Turkey was still cleaning up after a massive earthquake that killed over 14,000 people and left thousands more injured and homeless. The Salvation Army Team Emergency Radio Network (SATERN) was running a health-and-welfare traffic operation as a result of requests from individuals in the U.S. seeking information on friends and relatives in earthquake-stricken Turkey. The Salvation Army World Services Office had been receiving requests since the quake hit. The earthquake, described as one of the most powerful this century, measured 7.4 on the Richter scale. SATERN set up a method of accepting inquiries via the Internet and sending the inquiries on by amateur radio.

Back to the Balkans

We've been covering amateur radio in the Balkans for the past few months. With over 30,000 people injured in Turkey, we wondered what it was like to handle really *large* volumes of public service communications. Dejan Tusup, YT6DTM, who is from Montenegro, supplied this information on his experience during the war in Bosnia:

Back in 1993, when the war in Bosnia destroyed all other means of communications, radio-amateurs in Montenegro organized a network of clubs to help all people in Bosnia (Serb, Muslim, and Croat) who lost contact with their parents elsewhere. The best organized was 4N6G, which was operating from the headquarters of our radio amateur association [SRCG]. I am proud to be one of the first radio amateurs from Montenegro who did such a thing, from radio club YU6GAS, which is located on the roof of the University of Montenegro (at the time, I was in Podgorica all the time, because of my study).

Later we organized 4N6G. It was the only club in all of the former Yugoslavia that called people locally like other clubs did, but made calls around the world. The Montenegro government sponsored our telephone line, because the bills were about $2,000 per month. The 80-meter band was used for these communications. We were very popular in Sarajevo area, because a lot of Muslim families had relatives in Germany, Austria, the U.S., and Australia. I remember working 12 hours a day, even sleeping there.

At one time, there were so many people, that we had to form a line and to put a restriction to only one call per person. Can you imagine a situation when you have a room full of people begging you to help them, and you have only 10 minutes of time left, because radio amateurs from Bosnia had other clubs to work with.

There are two situations that I will always remember. The first one was when some Serb from Bosnia found me on a frequency working with a Muslim radio amateur from Bosnia. He said some terrible things to me, like traitor, etc., and I had to beg him to let me finish because he had a very strong signal. The second one was when an old man came to call his son in Sarajevo. I connected him, but then he wanted to call his daughter in Tuzla, also. I couldn't explain to him that I am working with a friend from Sarajevo who couldn't call Tuzla, and that I would have to find some other amateur from Bosnia to connect me, but to do that I must lose precious time with Sarajevo, because I had 20 other people waiting for connection with Sarajevo. He didn't understand me, he thought that I had some kind of telephone which can call anywhere. He begged and begged, but I couldn't help him. Then that old man asked me for my name. When I said my name is Dejan, he said " Now I know why you don't want to help me, it is because I am a Muslim. " I almost cried, but one of the other radio amateurs that were there in the room said to that old man: "I am a Muslim too, and I tell you, he can't help you now, come back tomorrow when we have Tuzla on frequency. Well, I mostly had a great time working in 4N6G, we helped an estimated 30,000 people on both sides, and found a lot of friends in Bosnia and Croatia. I can say that those two years were the best part of my life.

Acknowledgments

Some of the information supplied in this article is courtesy of *CQ*'s 50th Anniversary issue, January, 1995, the ARRL, and YT6DTM.

Do you have a story to tell? Drop us a note about your public service activity to <WA3PZO@cq-vhf.com>. ■

ATV Innovation in Dallas

Some of the most innovative ham TV in America is happening in Dallas, Texas. N5EM visited some ATV-active hams there, and came away quite impressed with what he saw.

This past July, it was my pleasure to visit with one of the ATV repeater groups in the Dallas area. One of the newest ATV repeaters there is the AB5IG repeater, whose creator and trustee is Lee Rhoden, AB5IG. I had the opportunity to spend several hours with this group and was treated to a tour of the repeater site as well as personal visits with four of the repeater group members in their shacks.

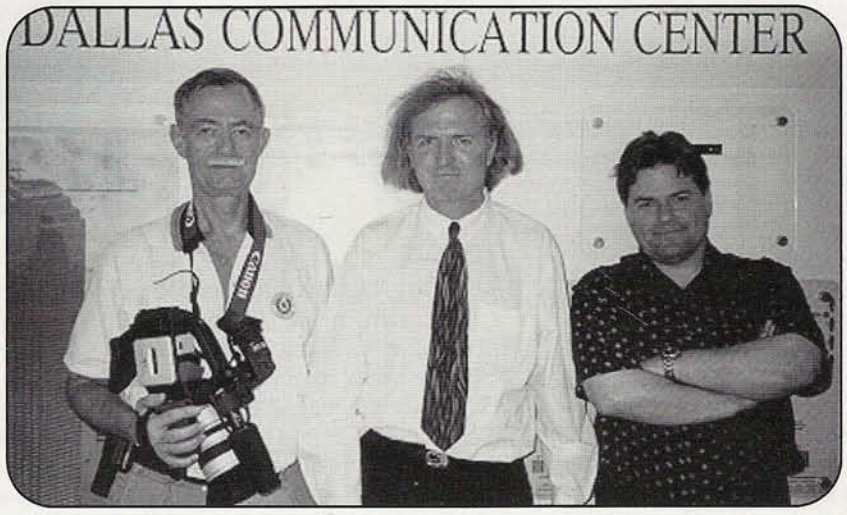


Photo A. Rick Albury, K4TTT, Lee Rhoden, AB5IG, and Bryan McGee, AB5LQ, in the Dallas Communication Center. All three are active members (and Lee is trustee) of the innovative AB5IG ATV repeater system.

A Passion for Television

First stop on the tour was a visit to Lee Rhoden to see his own ham shack. It's significant to realize that Lee has a passion for television. I don't mean just *amateur* television. I mean anything to do with television. When Lee was growing up, his dad had the first TV in their community. Lee remembers the neighbors gathering in his dad's shop, sitting in folding chairs and watching the new and exciting medium of television. Today, Lee's passion for television shows itself in many ways. Most noticeable is his vast collection of vintage television equipment. My "tour group" included two other members of the AB5IG repeater group, Rick Albury, K4TTT, and Bryan McGee, AB5LQ (see Photo A); and we were all intrigued by our walk through the history of television from its beginning to the present day. One of many rare items in Lee's collection of vintage equipment is an original 1931 scanning disk television receiver (Photo B). It was fascinating to see these many fine pieces of television history and to listen to Lee's expert description, as well as his explanation of their historical significance.

Of course, we're interested in *amateur* television, too! Compared to the vast array of collectibles, Lee's ATV operating position (Photo C) seems modest. Yet, from this position, Lee can receive the AB5IG repeater while continuously uplinking NASA TV video on a separate channel. In addition to the main 1.2-GHz FM transmitter used for general-purpose ATV repeater access, Lee has a 24-GHz, 100-milliwatt Gunnplexer microwave link to the repeater site. This allows a continuous feed (of NASA TV, for example) on one of the repeater's two 2.4-GHz AM output channels. Users have access by remote control (DTMF input) to select various video sources and configurations of the primary user channel. Lee's shack is also equipped for amateur satellite operation, with his satellite station feeding a separate azimuth-elevation mount with 2-meter, 70-centimeter, and microwave antennas. Even with his passion for

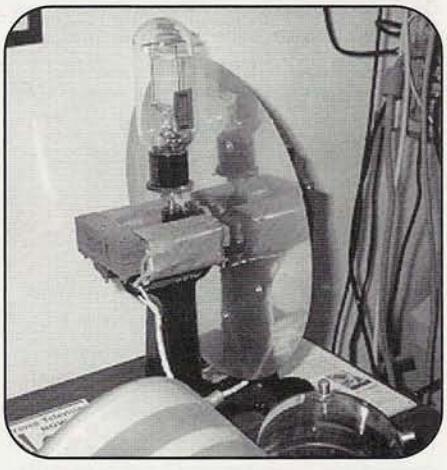


Photo B. This original 1931 scanning disk TV receiver is only one of the many impressive items in KB5IG's large collection of vintage television equipment.

By Ed Manuel, N5EM (atv@cq-vhf.com)

Photo C. The "modest" ham shack of Lee Rhoden, KB5IG, which is set up not only for ATV, but for satellite operating as well.

Photo D. Lee, KB5IG, just below the two 50-watt amplifiers and the rest of the immaculate AB5IG ATV repeater system. →

ATV, Lee is not a one-dimensional amateur operator!

Finally, Lee took us into his media room (home theater) for a demonstration of high-definition television (HDTV). This was my first opportunity to actually view HDTV. Dallas is one of the top 10 television markets in the U.S. and, as such, was required to be on-line with HDTV this year. With Houston—where I live—the number 11 TV market in the U.S., there doesn't seem to be any hurry to get HDTV equipment at my house! I must say that I was impressed with this demonstration. Even more impressive is Lee's plan to put a third, fully digital, 2.4-GHz channel on the AB5IG repeater. This will definitely require a return visit to Dallas to see and document!

Visiting the Repeater Site

Following the visit to Lee's ham shack, we drove to downtown Dallas for a visit to the actual repeater site. The repeater is located atop the tallest building in Dallas with the antennas at approximately 800 feet. I've been to many building tops and seen many "commercial" radio installations, and all too often they're characterized by sloppy appearance. In fact, most of the "amateur" installations that I've seen look better than many commercial installations. This was a refreshing change.

The first thing that comes to mind when stepping into the room where the AB5IG repeater is located is that this is a *professional* communications location. There is nothing at all that could be called "amateur" here. One aspect of locating your equipment in a room marked by professional installations is to make sure your installation fits in and looks professional. It's simply a fact that where mission critical installations (such as police, fire, and Internet) are located, neat, clean installations go a long way in making the host comfortable with your system. In this case, however, total professionalism is a *requirement*, not just a good idea.

The electronics of the AB5IG repeater system, including the two 50-watt 2.4-GHz television transmitters, the 1.2-GHz FM receiver, and the 24-GHz FM receiver IF, are contained in two equipment racks. The two 2.4-GHz transmitters feed a diplexer, which feeds a large Heliax (hardline) feedline to the 2.4-GHz transmit antenna, located on the roof at the most central portion of the building. The 1.2-GHz receive antennas are four flat panel phased arrays located on the four sides of the building. Miscellaneous antennas for VHF and UHF reception are located in the ceiling space of the equipment bay.

Of course, no ATV repeater system would be complete without an assortment of switching, processing, and control equipment. One of the highlights of the control system is the cable TV head-end control unit. You may have seen the output of one of these devices when looking at your local cable system. It includes a rolling billboard programmed to display information, and it can display four video sources on a single screen. This is often populated by four on-site camera views of the repeater system. Also available to

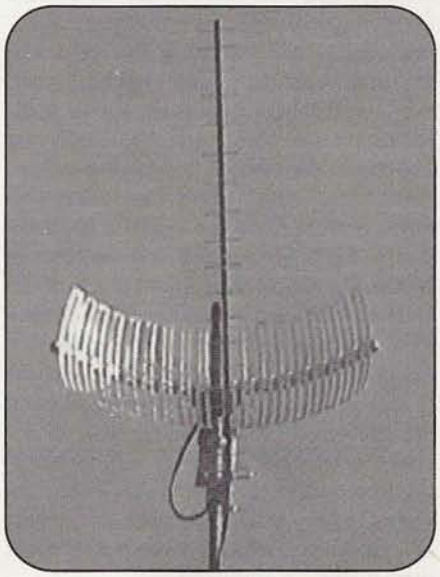


Photo E. One of the great benefits of using microwave frequencies for ATV operating is that antennas can be quite small and often look just like standard TV reception antennas. Here we see a 1.2-GHz Yagi and a 2.4-GHz dish.

the user is a selection of video sources, including weather radar and the video output of an APRS (Automatic Position Reporting System) node.

I mentioned Lee's plan to add a third—digital—2.4-GHz television channel. There's room in the existing racks to accommodate this equipment (Photo D), which will feed two 50-watt amplifiers into the third port on the existing combiner, where the signal will be squeezed into a highly linear 50 watts. Lee already has the equipment and is just waiting for that magic ingredient: time!

In a previous column, I mentioned that the decision to go in a certain direction is often dictated by the availability of a critical piece of equipment. The AB5IG group was able to gain access to a quantity of Conifer 2.4 -GHz television downconverters. These turned out to be easily modified for use on amateur television. Coupled with a small dish antenna, they provide a very small, high-quality method for receiving the 2.4-GHz ATV signals. The operating frequencies were selected to convert down to channels 9 and 11 on a standard TV set. It is impressive how small a complete amateur television antenna system can be when nothing more is required than a 1.2-GHz Yagi and a small 2.4-GHz dish (see Photo E). Frankly, these installations look like commercial television systems, not amateur systems. That could be a significant benefit to someone who has restrictive covenants prohibiting amateur antennas.

The Tour Continues

The next stop on my whirlwind tour of the AB5IG group was the home of Mont O'Leary, KØYCN (Photo F). Mont is an officer of the Dallas Amateur Radio Club (DARC). He became interested in ATV as a result of the AB5IG group's activities, and he has essentially become ATV's ambassador to the largest ham club in the Dallas area. Hopefully, that club will find possible applications for ATV in the many activities it already supports. What you can't see in the photo of Mont's fine station is the very large Henry amplifier just behind him. Mont is a serious HF operator as well as an ATVer.

Following my visit to KØYCN, I went to the home of Rick Albury, K4TTT. Rick's interest in ATV is just as avid as Lee's, but there the similarity ends. Where Lee is interested in the technology and in assembling a world-class ATV system, Rick is interested in the creative side of television. I'm sure most ATV operators will agree that it's common to find hams who'll assemble an ATV station and get it on the air with a couple of cameras and maybe a computer and VCR. It's *uncommon* to find ATVers who become fascinated with creating interesting and well-done video material for others to view. Rick is just this kind of television operator.

The centerpiece of Rick's station is a Videonics MX-1 Digital Video Switcher. This switcher is a good example of the direction technology has taken the art of

Announcing

Millennial Cumulative Microwave Contest

The North East Weak Signal Group -- in an effort to encourage microwave activity year-round --is sponsoring a cumulative microwave contest throughout the year 2000. The goal is to work as many stations in as many grids as possible, and to encourage new microwave operators. The contest runs from January 1 to December 31, 2000. Here are the complete rules:

Rules:

1. A station may be worked once in each 4-digit grid square on each band above 900 MHz from a 4-digit grid square in any calendar month. In subsequent calendar months, you may repeat contacts between the same grid squares as long as one station is more than 10 miles from any previous location.
2. Either station may move to another 4-digit grid square for additional contacts.
3. Exchange is 6-digit grid square, or 4-digit grid square with penalty. If an operator doesn't know what planet he is on, it doesn't count.
4. All contacts must be at least one kilometer and between different 6- digit grid squares, with the exception of a station's initial contact on a band, which may be any distance. All modes are permissible.
5. Grid circling and other manufactured contacts are prohibited. If it feels like a manufactured contact, don't do it.
6. There is no rule 6.
7. Any form of liaison is acceptable: lower frequencies, internet, telephone, cell phone, semaphore, or whatever.
8. Equipment may only be used for one callsign per calendar month, except for members of immediate family. Thus a spare rig may be loaned out to different operators, but only one operator per month. (A new vanity or upgraded callsign is the same operator.)
9. Cooperation and amateur spirit are encouraged. This isn't a DX contest.
10. Any mode that allows exchange of information is permitted, within rules of the FCC or other licensing authority.
11. Have Fun!

Scoring:

1. Each contact scores one distance point for each kilometer distance between the 6-digit grid squares, as calculated by the BD program.
2. If only 4-digit grid square is exchanged, then distance is calculated to the corner 6-digit square which produces the smallest distance.
3. EME contacts use terrestrial distance if grid squares are exchanged, as above. If only TMO reports are exchanged, ten the contact is scored as 500 distance points.
4. Multiplier: Each unique combination of 4-digit grid squares between which a contact is made is a multiplier of one for each band below 24 GHz, and a multiplier of two for bands at 24 GHz and up. All colors of light count as one band.
5. Bonus points: Each new callsign worked scores 100 bonus points. If a station changes callsign during the year, each may be counted. (This relieves other stations of keeping track of all the vanity changes.)
6. New band bonus: Any contact made on a band where the operator has never ever made a contact before scores an additional 1000 bonus points. This means once in a lifetime for each band.
7. TOTAL SCORE = distance points X multipliers + bonus points.

LOGS: should be submitted by January 31, 2001 to N.E.W.S. Summaries will be posted on the internet as received so you know the logs aren't lost. The internet site will allow interim results to be posted during the year to encourage activity.

AWARDS: The highest total score in North America will receive a gaudy trophy. If there is a higher score in the rest of the world, a second trophy will be awarded. Second and third place entries will receive a plaque, and fourth thru tenth places will receive a certificate. All entrants will be listed on the internet.

Photo F. Mont O'Leary, KØYCN, is an officer in the Dallas area's largest radio club as well as an active ATVer. He's become the unofficial "ATV Ambassador" to the Dallas Amateur Radio Club.

video production. Experienced ATVers are probably familiar with the side-effects of switching between non-locked video sources. Traditionally, if you wanted to make completely smooth switches between different video sources, you had to have those sources *locked* to one *sync generator*. This is called *genlocking*. Without genlocking, the video loses sync when sources are changed, and the picture rolls until video synchronization can be reestablished.

By taking the input video (either composite video or S-Video) and first digitizing it, you can now rely on the switcher to provide many benefits, including different wipes from source to source and chroma key dropout. Everyone has seen the effect of chroma key dropout. Some, however, may not realize just how it is done. With the MX-1, all video information in a scene that's of the same color and brightness can be digitally removed. This is what is done when you see the local weatherman standing in front of a computer generated weather map. Actu-ally, the weatherman is standing in front of a scene that is uniformly colored (usually blue or green) and illuminated. That information is digitally dropped out and the video of the weatherman is then superimposed over the weather map. (*Chroma keying predates the digital age, but the basic principle is the same.—ed.*)

"It is* uncommon *to find ATVers who become fascinated with creating interesting and well-done video material for others to view. Rick [K4TTT] is just this kind of television operator."

Rick demonstrated this very simply in his ham shack with the MX-1. Using a very simple frame made from a couple pieces of wood and a tripod, Rick suspended a piece of green Spandex behind his chair. Spandex is an interesting material because it does not easily wrinkle when stored, which helps keep it uniform in appearance and texture. Since his illumination of the backdrop was not consistent from top to bottom, it took several passes with the chroma key dropout to completely remove the background. But, when completed, Rick merged the view of himself with an off-air APRS map from the AB5IG repeater. It appeared that Rick was in front of the APRS screen, pointing to different stations spread out on the map. All in all, it was a very impressive demonstration.

The MX-1 is not inexpensive. They sell new for around $800, and I've seen them selling used on E-bay (the Internet auction site) for around $500. As with all other modern technology, it's likely that the price will continue to drop and the features will continue to increase. I believe that this technology will soon become more common in our ATV shacks. I know I've started thinking about getting one.

How's Your On-Air Presentation?

You might want to consider stepping into this next aspect of the amateur television hobby. After you have your station technically up to date and have solved the simple challenges (consistent signal, good video, proper levels, good audio), why not start thinking about how you can improve your on-air presentation? One subject I mention frequently is the need to continually find good content that's interesting, original, and different. That need still remains, of course. But start to think about the *presentation* of that material and how you actually "look" to other ATVers (no, not whether your hair is combed or your shirt is clean). I don't mean to imply that everyone needs to run out and buy a digital editor/switcher. Like everything else, this is a matter of personal interest. But I think the availability of modern tools for video will bring this into more and more shacks. Perhaps some of these are in your future.

Rick is always ready to show ATV to an interested amateur. He recently took a significant part in the ATV booth at the Arlington, Texas, ham convention. This booth was very impressive, not only for the equipment on display and live video of the AB5IG repeater, but also for the high level of enthusiasm evident in all the people showing it off. This, of course, is just what is takes to keep ATV alive and growing in amateur radio. Enthusiasm is always contagious.

After visiting with Rick, we moved to the shack of Alan Andrews, KD5FJK. Alan is involved in many different aspects of the hobby, including the use of ATV in the realm of public service. He showed an interesting video made during a recent bicycle race. There is virtually unlimited application of ATV to these public service activities. What ATV needs are champions who'll take ATV to these events and offer simple demos to show event organizers and officials the possibilities. I believe Alan represents that group of champions that we need to move video out of the realm of curiosity and into the mainstream of event communications.

Alan is also one of those hams who is constantly tinkering with the technology. His business involves commercial security and he seems to have one project after another created from interesting items that have come his way via business. You can be sure that there will always be a neat project on his bench.

Thanks for the Eyeballs!

I want the folks with the AB5IG repeater to know that I had a great time visiting their repeater and shacks. It's always great fun to have those in-person "eyeball" QSOs. It's even more fun when they're about ATV! I'd like to take this opportunity to personally thank the folks who made my trip so much fun. I was disappointed to miss two of the members of the group, John Sanders, AB5ZR, and Lee Bengston, KD5DAT. You can be sure I'll make it to your shacks on my next trip to Dallas. And to Lee Rhoden, AB5IG, Rick Albury, K4TTT, Bryan McGee, AB5LQ, Mont O'Leary, KØYCN, and Alan Andrews, KD5FJK, a big thanks for the Texas hospitality. ■

Hamfest Calendar

The following hamfests are scheduled for November, 1999:

Nov. 6, BeachFest '99, Back to Basics Fleamarket, Old Myrtle Beach Air Force Base, **Myrtle Beach, SC**. Talk-in: 147.120 [+600]. For information, contact Jim Wood, (843) 238-0800; or e-mail: <KF4CJE@w4gs.org>; HomePage: <www.w4gs.org>. **(exams)**

Nov. 6, Hamfest and Computer Show, East Lake Chamber of Commerce Building, **Sorrento, FL**. Talk-in: 147.255. For information, contact Chuck Crittended, KE4EXM, P.O. Box 615, Altoona, FL 32702; Phone: (352) 669-2075; E-mail: <capias@gate.net>. **(exams)**

Nov. 6, Annual Hamfest, Garfield County Faigrounds (Hoover Building), **Enid, OK**. Talk-in: 147.150+ or 440.400+. For information, contact Tom Worth, N5LWT, at (580) 233-8473, <N5LWT@hotmail.com; or Fred Selfridge, N5QJX, at (582) 242-3551. **(exams)**

Nov. 6, 15th Annual "6.91 Friendly Fest," Waukesha County Expo Center Arena Forum, **Waukesha, WI**. Talk-in: 146.91- (the friendly repeater) and on 146.52. For information, contact Milwaukee Repeater Club, P.O. Box 2123, Milwaukee, WI 53201; Web: <http://www.execpc.com/~mrc/~friendlyfest.htm.> **(exams)**.

Nov. 6, 1st Annual Hamfest, Belleville Area College, **Belleville, IL**. Talk-in: 147.120. For information, contact Skip Mize, KA9VKE, at (618) 277-9767; or e-mail: <fiuinc@peaknet.net>. **(exams)**

Nov. 6, Interstate Repeater Society Hamfest and Flea-Market, Manchester, NH. For information, contact St. John's Church, 305 Kelley St; or call Paul Gifford, K1LL, at (603) 432-1538; or e-mail: <K1LL@juno.com>.

Nov. 7, 1999 Hamfest, Linglestowns Fire Hall, **Livingstown, PA**. Talk-in: 145.470 and 146.520 simplex. For information, contact KE3TM, at (717) 566-8895 or write 619 W. 2nd Street, Hummelstown, PA. **(exams, handicapped accessible)**

Nov. 7, Annual Hamfest, the Starlite Club, **Kaukauana, WI**. Talk-in: 146.52. For information, contact FCARC, 1912 Russet Ct., Apt. #7, Appleton, WI 54914, Attn: Chad Pennings, N9PRC, Hamfest Chairperson; Phone: (920) 993-0485. **(exams)**

Nov. 13, 1999 Alabama ARRL Convention and 22nd Montgomery Hamfest and Computer Show, the Coliseum at the South Alabama State Fairgrounds, **Montegomery, AL**. Talk-in: 146.24/84, call W4AP. Ragchew 146.32/92, 147.78/18, 449.50/444.50. For information, contact Hamfest Committee, c/o 2141 Edinburgh Drive, Montgomery, AL 36116-1313; or call Phil (334) 272-7980 (after 5 p.m. CST); E-mail: <wb4ozn@worldnet.att.net>; Web: <http://jschool.troyst.edu/~w4ap>. **(exams)**

Nov. 13–14, 27th Annual Hamfest & Computer Expo, Allen County War Memorial Coliseum, **Fort Wayne, IN**. Talk-in: 146.88 (-). For information,call (219) 484-1314 (general info.); or send SASE to AC-ARTS/Fort Wayne Hamfest, P.O. Box 10342, Fort Wayne, IN 46851; Web: <Http://www.acarts.com>. **(exams)**

Nov. 19-20, Annual Hamfest/Swapfest, St. Martin Community Center,**Ocean Springs, Mississippi**. Talk-in: N5OS, 145.11 MHz (-). For information, contact Phil Hunsberger, W9NZ, at (228) 872-1499, or Stan Hecker, N5SP, at (228) 875-0222, or Phil Hunsberger, 1207 Lancelot Ln., Ocean Springs, MS 39564. **(exams)**

Nov. 20, 1999 Annual "Auction of Ham Radio and Electronics Equipment", Newton Masonic Hall (2nd floor) **Newtonville, MA**. Talk-in: 146.64 (-) Waltham repeater. For information, contact Eliot Mayer (W1MJ), (617) 484-1089 or <W1MJ@amsat.org>.

Nov. 20, 1999 RMRL Hamfest, Jefferson County Fairgrounds, **Golden, Colorado**. Talk-in: 144.62/145.22 MHz. For information, contact Ron Rose, NØMQJ, at (303) 985-8692; E-mail: <nømqj@arrl.net>. **(exams)**

Nov. 28, Radio Fest and Electronics Flea Market, DuPage County Fairgrounds, **Wheaton, IL**. For information, call (815) 436-7090, or (630) 393-3937; E-mail: <alf3148@megsinet.net>.

Operating Notes

For late October and November, 1999:

October	
30–31	ARRL International EME Competition, 1st wknd (see Rules, last month's issue)
31	Very good EME conditions
November	
3	Taurids meteor shower peak
17	Leonids meteor shower peak (possible meteor storm)
21	Good EME conditions
27–28	ARRL International EME Competition, 2nd wknd (see Rules, last month's issue)
28	*Excellent* EME conditions

EME data courtesy W5LUU. More contest info is available on the CQ VHF *Web page at <http://www.cqvhf.com/navhfcon.htm>.*

Want a Good Microwave Antenna? Drink More Coffee!

Looking for a highly effective microwave horn antenna? Look no farther than your pantry! Food cans (empty, of course) can be just the right size to give you lots of gain—just watch out how much YOU gain by emptying the cans!

It was about 12 years ago and I was looking for the right-sized feed for a 3456-MHz dish antenna I was building. I did the calculations, then went into the kitchen cupboard with a ruler, measuring cans, and said, "Uhhh Dear, can we have the stewed asparagus for dinner?" Hey, the can was the right size!

Believe it or not, plain old run-of-the-mill coffee cans (see Photo), soup cans, etc., can be just the right size to serve as excellent microwave horns antennas (see last month's "Antennas, etc." column for more on horn antennas in general). How do you calculate the correct size that you'll need? One of the most useful articles I've ever seen is from the May, 1976, issue of *Ham Radio* magazine. Norm Foot, WA9HUV, put together a family of charts and curves for cylindrical feed horn antennas. Going into his charts, you could come up with the optimum diameter feedhorn for any frequency. I highly suggest digging up a copy of this article if you can find a friend with a collection of *Ham Radio* magazines. Or if you are patient, a complete set of *Ham Radio* will soon be available on CD from CQ Communications. For the moment, I'm just going to stick with what we can do with 3-pound and 1-pound coffee cans.

Photo. 1200-MHz and 2300-MHz horn antennas made from coffee cans. Your next feedhorn may be as close as your kitchen pantry.

1296 MHz— Lots of Coffee

You can turn a coffee can into a quick and simple horn antenna with 8.5 dBi gain for 1296 MHz. Its bandwidth is very broad and this horn can be used as is from 1100 MHz to 1500 MHz. It works great in SSB, CW, FM, ATV, satellite, and even SETI (Search for Extra-Terrestrial Intelligence) applications.

Take an empty 3-pound coffee can and drill a hole for the coax connection along the solder seam 4 1/2 inches from the bottom (see Figure 1 for other dimensions). Now mount a Type "N," BNC, or SMA connector in your hole. Inside, solder the probe to the coax connector (the probe is the actual antenna element, generally cut to 1/4-wavelength at your proposed operating frequency). You want the probe to be sort of thick; #16 copper wire, 1/8-inch copper or brass tubing, and 1/4-inch-wide strips of .032-inch sheet brass have all been used and have all worked well.

One is good, so two is better, right? Yep, in this case. The probe is pretty close to the opening of the 3-pound coffee can,

By Kent Britain, WA5VJB (wa5vjb@cq-vhf.com)

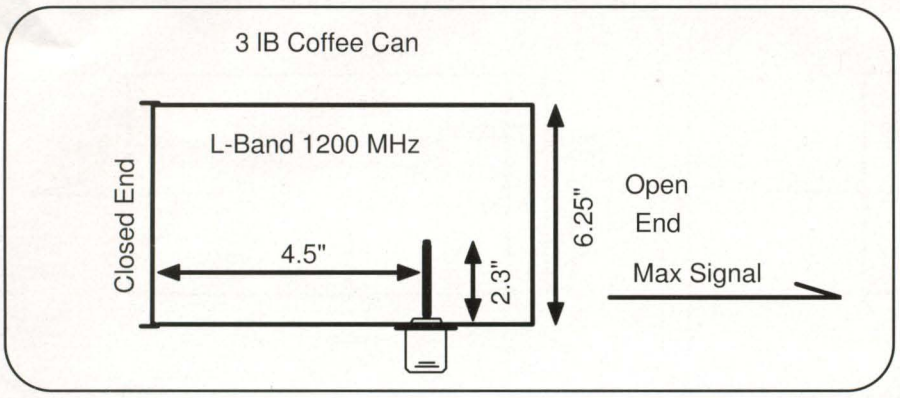


Figure 1. Dimensions for a 1200-MHz horn antenna made from a 3-pound coffee can.

adding a second 3-pound coffee can will improve the gain from 8.5 to 10.5 dBi (see Figure 2).

Just cut the bottom out of the can (I'll assume the top has already been removed and the contents have already been consumed), so you just have a steel tube. Attach the second can to the first and extend the horn. You don't have to completely solder the gap between the cans. I've found that a couple of spot solder points work fine. I've also used that aluminum wallboard tape with good results, and have even used duct tape once or twice. The super glues I tried didn't work well at all.

Now, I know exactly what you're thinking (I tried it over 15 years ago). If one can is good, and two are better, let's go for three! Without going into waveguide theory, I can tell you that it won't work. When I tried using three cans, overall gain dropped to only 7 dBi.

I have taped these to poles and stuck them up in the air for "rover" contacts. I nailed one to a rafter in my roof, pointed it at a local 1200-MHz repeater and used it for several years. And a dozen years ago, W5DBY in Ft. Worth, Texas, worked a station near Miami, Florida, on 1296-MHz SSB. For many years, this 1,100-mile QSO was the U.S. 1296-MHz tropo record. And yes, W5DBY was using a 3-pound coffee can duct taped to his tribander for this record QSO.

2.3- and 2.4-GHz Horns

In Figure 3, you'll see a 3-pound coffee can configured as a 2.3-GHz horn. The antenna runs about 10.2 dBi gain on 2304 MHz, and, while I haven't measured the gain on 2400 MHz, the results should be similar. You *don't* want to put a second can on this version and extend its length. I tried it, the pattern was horrible.

A 1-pound coffee can also make a pretty good antenna on this band (see Figure 4). Gain is between 6.5 and 6.8 dBi, and I've been using a set of these 1-pound can antennas for five years now on 2.4-GHz spread spectrum.

Cans and Dishes

While simple and practical antennas in their own right, these coffee can antennas really shine when they're mounted at the focus of a dish. A single 3-pound coffee can feed makes a great 1200-MHz dish feed for SSB, CW, ATV, or AMSAT Mode L. The single 1-pound coffee can feed works best as a 2.3-GHz or 2.4-GHz dish feed. Just what you need for AMSAT Mode S.

The orientation of the probe determines polarization of the antenna. When the probe is vertical, then the antenna is vertically polarized. Mount the probe horizontally and the antenna is horizontally polarized.

Radomes

Having had various cans in the air for nearly 20 years, I can tell you from personal experience that these cans make ideal nesting sites for the local avian population. So some sort of radome, or cover, is a good idea if you're mounting it outside. The plastic lids that originally came with the coffee cans are only good for a few months, they then break down from exposure to ultraviolet light.

A plug of about 1-inch thick Styrofoam works well, as does some of the bird netting available at many hardware stores. Whatever you use to cover the opening, keep it thin. Something thick, like glass or even Plexiglas, will be lossy.

If you're permanently mounting the can outside, I strongly suggest painting it with one of the spray epoxy paints. It will last years longer and the light gray colors will draw less attention to your antenna.

CW = 10-dB Gain

If I can make only one suggestion to new No-Code Techs, it would be to learn enough code to a least recognize your own callsign before getting too active on the higher bands. The number varies a bit, but basically it takes 10 times as much power to make an SSB QSO than it does to make a CW QSO. So 1 watt of CW goes about as far as 10 watts of SSB. Ya like FM? You're going to need *40* watts of 5-kHz-wide FM to go as far as a 1-watt CW signal. Now just imagine how far 1500 watts of CW can go!

CW gets through when nothing else will. When UHF and microwave stations are trying to get hooked up, they typically start on CW. When signals are heard, the signal is tuned in a bit better, the antenna is peaked, and the call is returned on CW. If the signal is still pretty weak, make sure you keep transmitting back for 30 seconds or so. This gives the

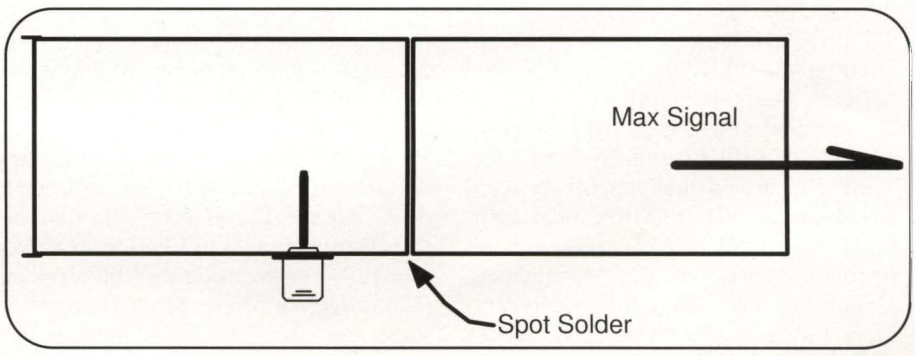


Figure 2. Extended 1200-MHz horn antenna. This is made with two 3-pound coffee cans (drink up!) soldered or taped together.

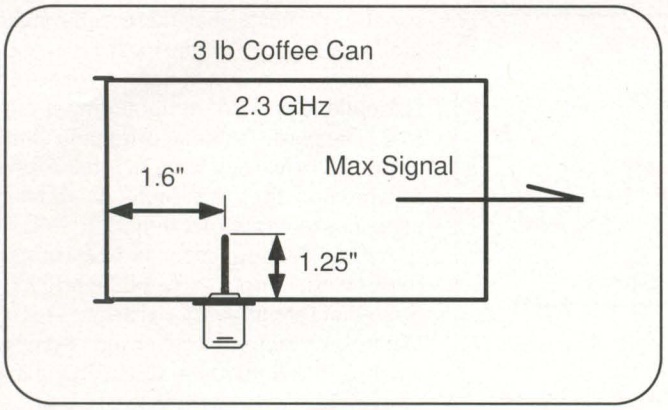


Figure 3. A 3-pound coffee can set up for 2.3 and 2.4 GHz use.

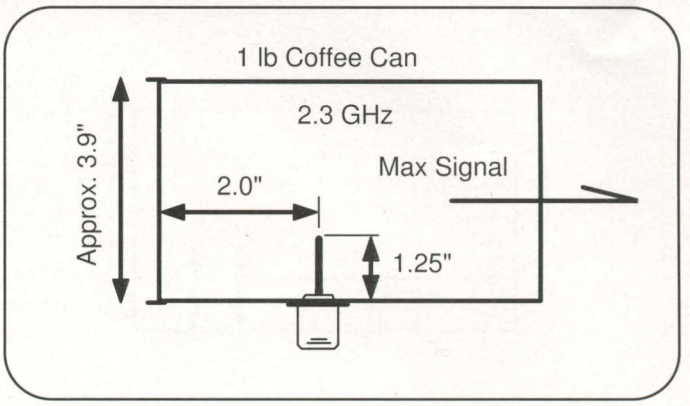


Figure 4. Here's how to set up a 1-pound coffee can for 2.3 and 2.4 GHz. This can be helpful if using 3-pound cans makes you too jumpy!

other station a chance to peak up his or her antenna on your signal. If signals are now solid copy, of course flip over to SSB; if not, you can probably finish off the QSO on CW.

Now I realize that many of you can be afraid of those long CW QSOs. On the higher bands, though, we're not going to be chatting about gardening tips or our bypass surgery. It's just going to be your call, their call, and the numbers in the signal report. Hey, if you're going out portable for a contest group, or to give someone a new grid/state/county, you only have to recognize their call and your own. This is far easier than copying five minutes of text. Just remember, knowing those 10 letters or so in CW is worth an extra 10 dB!

ATV Interference on UHF Bands

There has been some interesting but erroneous information published recently regarding the interference potential of ATV signals on the UHF bands (see "Reader Feedback," September, 1999, *CQ VHF*), particularly ATV signals centered on 434.000 MHz. The writer cited his credentials as an ARRL Technical Advisor and a member of his local coordinating council's technical committee. Well, I'm also a member of my local coordinating council's technical committee (Texas VHF FM Society), a member of the ARRL Spectrum Management Committee, and was, until quite recently, a Video Applications Engineer for Tektronix. And I feel the need to set the record straight.

The actual power in the video sidebands is highly dependent on the video content. These sidebands peak 27 to 25 dB below the video carrier on commercial broadcasts, not the "more than 40 dB down" figure that has been commonly quoted. And since hams tend to, shall we say, push the modulation limits, 20 to 25 dB below the video carrier is really more typical of an amateur ATV signal at 2 MHz from the carrier frequency. Even these numbers are not truly representative of the interference potential of NTSC video signals (the standard for TV in the U.S.). When monitored on an SSB re-ceiver, the video signals come out as a series of pulsing carriers every 15 kHz. So the RF energy is condensed into carriers, not uniformly spread out as a spectrum analyzer might suggest. Allowing for the modest beam antennas most ATVers use, and the typical 150-watt amps, this gives a 434-MHz ATV signal the same interference potential as a pulsing 10-watt CW signal into an omnidirectional antenna.

The use of vestigial sideband (VSB) filters would limit the bandwidth of the ATV signal and greatly reduce this problem, but simple VSB filters cannot be used on the cheaper ATV transmitters. One side of the ATV signal goes through the filter, and the other side of the signal is blocked or reflected back by the filter. This means the ATV transmitter is operating into a high SWR and video linearity suffers, i.e., a pretty bad picture comes out. There are several technical solutions to this problem, such as filtering the video at an earlier stage, using absorptive rather than reflective filters, better transmitter stages, etc., but these would increase the price of the cheaper ATV units and are rarely used.

The next problem is finding out who is tearing up a UHF band with an uncoordinated ATV signal. It's a bigger problem that one might first think. First, you've got to rig up an ATV station just to see his face or read his call card! Plus, you'll need 20 to 30 dB more signal to read his call card than the signal level that will open the squelch on a repeater or heterodyne an SSB/CW QSO. In the past, these uncoordinated ATV stations have torn up hundreds of square miles and been very difficult to find.

Interference from ATV signals were a common problem and numerous complaints have been filed with coordinating bodies in my area. Fortunately these complaints have fallen off as NTSC AM ATV falls in popularity. The new FM ATV video systems have a 17- to 23-dB advantage over AM ATV. This means the new 2-watt FM ATV system goes farther than an old 100-watt AM ATV station! (To give you some idea of how popular AM video is among professionals: can you name a communications satellite that transmits AM video back to Earth? Unless you work in the satellite TV business, chances are you can't. It's one satellite, it's in geostationary orbit over India, and it transmits PAL—the European standard—not NTSC, AM video.)

Aim High!

That's about it for this month. Remember, our microwave frequencies are extremely valuable to commercial interests, and, unless more of us start using them on a regular basis, we'll be in danger of losing them.

—73 de WA5VJB

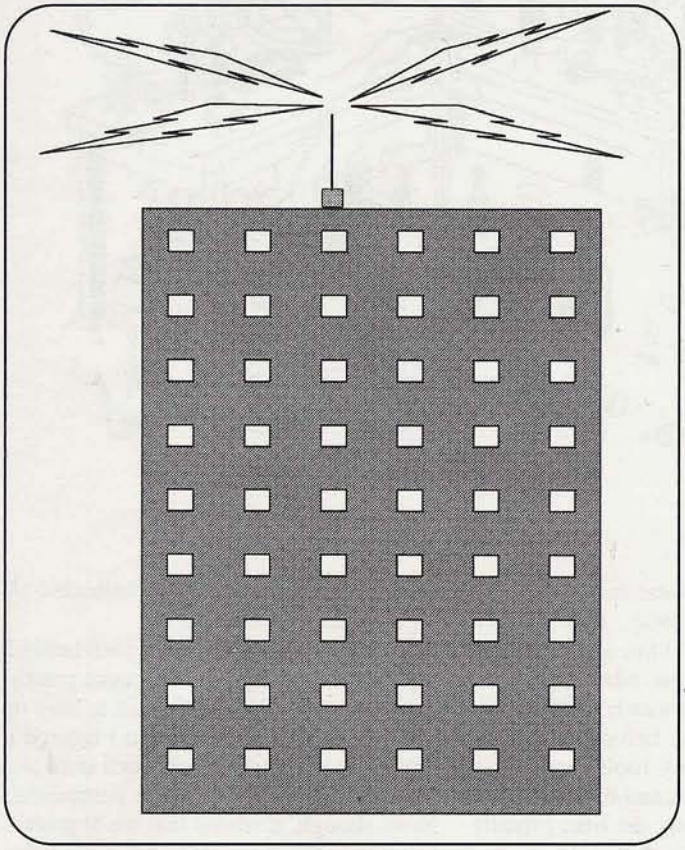
Six-Meter Beacons Revisited

We've looked at beacons in the past from a 6-meter DXer's perspective. Now, let's take a look at the beacon owner's unique problems...

Previous articles in *CQ VHF* have touched upon the importance of propagation beacons and how they're like navigational buoys of the airwaves. In this column, we'll cover some of the situations and challenges that beacon owners have to deal with in keeping a 6-meter beacon running.

A Home Away from Home

One of the biggest problem for a 6-meter beacon owner is to find a permanent location where it can run continuously. It's difficult to have a beacon running at your home QTH since the beacon, even at a few watts out, will overload your receiver's front end should you choose to operate "live." Consequently, many beacons are located some distance away from the owner's home station.



The rooftops of high buildings can make good permanent locations for beacons.

A number of beacons that fall into this category come to mind. One of the older beacons that I first heard on 6 meters is the W5VAS/b, in New Orleans. It has about 50 watts output and is located on the rooftop of a commercial building, nearly 200 feet high. The rooftops of high buildings can make good permanent locations for beacons. Sometimes this works out better than being on top of a hill or mountain, as access is better and there may be less damage from the elements.

Another beacon in this category is operated by Mario Karcich, K2ZD. This beacon is located 400 feet above sea level in grid FN20, 25 miles southeast of Mario's home QTH, along with several commercial transmitters on the rooftop of a 22-story high-rise apartment building in the New Jersey Palisades across from New York City. His beacon is an old GE commercial transceiver with 20 watts output into a 5/8-wave vertical antenna.

Ownership Problems

Mario points out some of the things that beacon owners must contend with. For a time last year, there was an intermittent problem in the power supply that re-quired repairs and forced the beacon to be off the air. Still another problem occurred when Mario installed a horizontally polarized AEA halo antenna on a mast for the beacon. It worked very well, but, within a few weeks, the beacon was suddenly off the air. When he visited the site, he found that the strong winds that come up the Hudson River had ripped the halo off of the mast and it sailed off into the Atlantic Ocean. Mario ended up using the vertical because of the reduced profile for better wind resistance.

A Thank-You Card?

All of us who use 6 meters benefit from these beacons being on and alerting us to any openings on the band. We should be appreciative of the effort of the beacon owners. They appreciate receiving a QSL card with a signal report on how loud their beacon is heard from your location. Be sure to applaud and thank them for their efforts. ■

Do *you* have a 6-meter adventure to share? If so, we'd love to hear about it. Just contact us by mail or e-mail.

By Ken Neubeck, WB2AMU (wb2amu@cq-vhf.com)

Your First Workbench

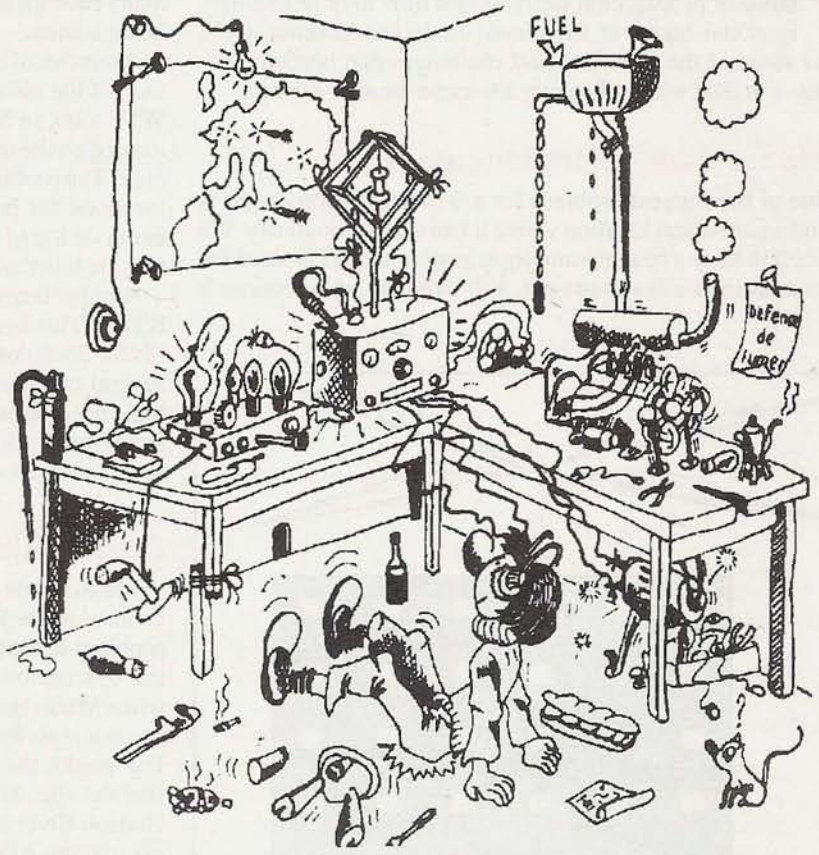
Building things is part of ham radio's tradition. Doing it on the kitchen counter isn't! Here are some tips on buying (or even building) your first workbench to give you a place to build your first project.

If you were born with a screwdriver in each hand, you can skip this column. If you had a father who taught you how to fix everything in the house, you can skip it, too. This month's column is a special edition for the mechanically challenged, for the electrically inept—in short, for the nerds out there like me.

Dad's Workshop

In his day, my dad was an excellent mechanic. He could fix anything that went haywire in the house or garage. Those were his strong points. His teaching skills lacked a bit—his most frequent statement to me was, "Stay out of the way. I'm working." So, my idea of doing repairs was to hand it over to my Dad and leave. It would be fixed when I needed it next, whatever "it" was.

"...my idea of doing repairs was to hand it over to my Dad and leave. It would be fixed when I needed it next, whatever 'it' was."



The one area where I did learn a little about maintenance and repair was electronics. I became interested in radios and how they worked when I was in grade school. And it was an area in which Dad did not have a lot of experience. I built several kits and one HF transmitter from scratch. Of course, this was all courtesy of my Dad's tools and workshop.

A Workbench of My Own

Flash forward 10 to 15 years and we find our hero in a bind: how do you fix something in your house that is broken? Dad is 700 miles away, and it's too embarrassing to call him, anyway. You ask questions of anyone who might have a clue. You read. You watch Wally on TV (Wally was Bob Vila before Bob Vila). For several years, my tools rested in a bunch of plastic trays and one rusty tool box. Somewhere along the line, I finally figured out that you really do need a workbench for repairs and projects. It's sort of like a sacred area dedicated to repairs and projects.

When we moved last year, I left behind my workbench because it wasn't practical to move it. We didn't plan to stay in this house for a long time, so I figured I would do without a workbench until we moved into something more permanent. Now, though, it seems that we'll probably stay in this house for a while. For the last year, I've kept my tools in boxes on

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shelves in the garage. Shades of the days of my first apartments.

Is there a downside to this? You bet. Who wants to do a construction project when it means digging through boxes to find the needed tools? What spouse is going to be happy with a little construction project on the kitchen counter? So, for the last year, there have been no neat little projects built. And repairs have been minimal—only if something essential broke. A ham without a workbench is like an airplane without an airport.

So, when this temporary house became a little less temporary, it was time to stop "living out of boxes" where my tools are concerned. First, I looked around the garage and realized that there was about four feet of wall space available if I were to get rid of some junk. There is no electrical outlet on this wall, but that can be handled. And lighting is poor—again something that can be remedied.

All I had to say to Wendy was that it would be a way to get my tools organized and the garage cleaned up a bit. She was all for it. Your situation may be different. You may not have a garage or basement area. That can be a real limiting factor in an apartment, for instance. But if you do have the physical space, then you should consider adding a dedicated workbench. Tools buried in a box stacked on some shelves are just not likely to be used.

"Somewhere along the line, I finally figured out that you really do need a workbench for repairs and projects. It's sort of like a sacred area dedicated to repairs and projects."

Choosing Your Workbench

Once I'd decided on a workbench, the first thing I did was a little comparative shopping. I never considered building it from scratch—carpentry is not a strong trait in my genes. I went to a couple of the "mega home centers" ubiquitous in all urban areas, but I didn't find anything I liked. They had workbenches, and at a good price, too. Unfortunately, they lacked some features that I wanted (they were open frame construction without drawers). I wanted to be able to put the tools out of sight beneath the workbench top. And I wanted drawer space for storing all those odds and ends that we tend to collect in the ham "junk box."

On to Sears. Here I found what I was looking for at a reasonable price. Sears carries a line of prefabricated metal workbenches ranging from about $100 to $180. The bottom of the line would suffice, although it was not ideal. It had three large drawers on the right and a hinged door on the left. Behind the door were two shelves. A wooden top completed the unit. But I decided to do a little more looking before committing. Before I had a chance to visit any other stores, a Sears flyer showed up in the mail advertising a sale on, among other things, workbenches. Obviously, it was an omen from the Universe. As it turned out, I bought a slightly better unit (same size, but five drawers and a metal sheet covering the wooden top) for $119.

Assembly time for a workbench like this is a couple of hours. There are a lot of nuts and bolts to tighten, so a ratchet comes in handy (battery-powered ones really speed up assembly). Just follow the directions. For the time being, a heavy-duty extension cord strung across the ceiling of the garage is supplying power.

I mounted one of those 12-inch deep wire shelves to the wall behind and above the bench. That gives me a place to store a small bench grinder and drill press when not in use, which is most of the time, and it provides a very good place to install a fluorescent "shop light" fixture. I'm not crazy about fluorescent lighting, but it's cheap. Sometime in the future, I may swap this fixture for a suitable incandescent one, but it will do for now.

Obviously, a workbench is a versatile and functional unit that lends itself to all sorts of household repairs—do everything you can to perpetuate this little white lie with your spouse. Never let on that the primary purpose, the real purpose, is to have a sacred space to play around with your electronic toys and construct new ones. Eventually, your spouse may notice that 99% of the work done here involves your hobby. Keep close mental track of that other 1% so that you can list the wonderful things you've done at your workbench if its use comes up in the heat of an argument.

Next: Tools

A well-stocked workbench should have a number of tools in addition to the ordinary drill, screwdrivers, and wrenches—especially if you're planning to use it for electronics projects. One of the first things you'll want to add if you don't already have one is a multimeter of some sort. These measure voltage, resistance, and current, and come in both digital and analog varieties, each with its own strengths. If you have to choose between one or the other, my inclination would be to go with the analog. If you're going to work on RF circuits, you'll need a FET-VOM (Field Effect Transistor Volt-Ohm Meter) or some similar unit that can handle RF. Ordinary meters fold in the presence of RF.

You can get perfectly adequate units at RadioShack, or you can look through the ham magazines for companies that sell industrial grade units. Obviously, the latter will cost considerably more. Another good source is hamfests. Here you'll find a variety of used test equipment; just make sure it works before money changes hands. *Let the buyer beware.*

Watt's That?

One of the most useful tools a ham can have is a wattmeter. Some meters allow you to switch power ranges over some band of frequencies. These inexpensive units can be a good choice if your operating is confined to one band or a couple of bands. But if you like to try different modes, different power levels, and different bands, your best bet (though again, more expensive) is a unit that uses plug-in "slugs" for different frequency ranges and power levels. The meters and slugs are available new or at most hamfests. Once you have the basic meter, you can add new slugs as your interests grow.

Since most of the ham equipment today runs on 12 volts DC, you'll probably want to add a regulated 12-volt supply, capable of providing at least 10 amps. Look through the ham magazines for the companies selling power supplies. Again, great used bargains show up at hamfests all the time. Just make sure it works!

One item that many hams overlook that's closely related to the power supply is an AC line monitor. This is simply a meter that plugs into the AC line and tells you if the voltage is within tolerance. The electric utilities in the U.S. are excellent, but sometimes the wiring in a house goes haywire. An AC line monitor can save you from making major mistakes chasing problems that aren't there. (I once almost replaced a refrigerator because some lunatic had done a lousy job of splicing the cable running from cir-

"One item that many hams overlook that's closely related to the power supply is an AC line monitor. It...can save you from making major mistakes chasing problems that aren't there."

cuit breaker box to the outlet—not to mention that it was a monumental fire hazard!) You can get one of these handy monitors for less than $10 at RadioShack. Highly recommended.

Soldering Equipment

At least one good soldering iron is a must, too. For work with circuit boards, small wires, and such, you'll be best served with 25- to 40-watt unit. There's a range of soldering irons on the market that fit this bill. At the low end, you have ones that consist of nothing more than an AC cord, a handle, and a heating element molded into a single package. The next step up are units that allow you to plug different size heating elements into the handle. Or you can get one with a variable temperature control built into the base unit. The more versatile the unit, the more it costs. How much soldering will you be doing, and what features do you really need? (Incidentally, you could substitute a butane gas torch/soldering iron for the electrical one if you will only be using it sporadically.)

You'll probably want a higher-powered unit for working with larger components and antennas. A 140-watt soldering gun will work for medium duty jobs. These guns are readily available in hardware stores, K-Mart, etc. Since we're still stuck with UHF connectors for our antennas, a major use of soldering equipment is to put PL-259s onto coaxial cable. A 140-watt gun is barely adequate for this job, but you can do it with practice. A better choice, if you can find it, is a large soldering iron capable of at least 100 watts. These relics from bygone days have tips that are about 3/8 inch in diameter. They produce plenty of heat to quickly solder the braid to the barrel of the connector. If you come across one of these gems at a hamfest, grab it—of course, *make sure it works*!.

By the way, if you're going to do repairs on circuit boards and such, you'll need some means of removing solder. Solder wick is one inexpensive means of doing this, but it doesn't always get all of the solder out of holes in the board. A solder sucker of some sort will do better. The least expensive and effective is the simple squeeze bulb that resembles a baby's ear syringe. A better choice is the spring-loaded variety that develops a vacuum when you press a trigger. If money is no object, then go for a soldering station that includes a vacuum desoldering tool. Not only is it highly functional, but it will make you the envy of all the hams around. And you can tell your spouse that it's useful in sucking dust particles out of DVD players, resulting in much sharper images.

Cutting and Grinding... and Perfecting

Although it doesn't suck away solder, a high-speed rotary tool (those made by Dremmel or similar) can be used to cut away all sorts of things. I've used one for years. Mine came with a set of different bits for grinding, shaping, polishing, and sanding. By far, the most useful attachment, though, has been those miniature cutting disks. Those little devils will cut through almost anything. And you can get into tight spots with them that would be impossible for a saw or file. I don't use this tool that often, but when I do, it's worth its weight in gold.

There are other tools that can make life simple at the workbench. A frequency counter is a good example. As time goes by, you'll want to add more equipment and gadgets to your workbench. But without the workbench, why bother? Who wants another tool or gadget that will just be stored in a box on a shelf in the back on your garage? It's just like a baseball team—a good bench can make all the difference! ■

Oops

This isn't really a correction, but a clarification. The fact that KC0AMO's signal-strength tests ("Which is Really Better -- AM, FM, or SSB?" Sept., 1999 issue) were conducted on 144.260 MHz, what the authors termed a "lightly populated frequency" -- and included FM transmissions in the "non-FM" portion of 2 meters -- ignited a most incredible "flame" storm on the Internet W6YX VHF reflector.

Most at issue, it seemed, was that we reported this fact without editorial comment reminding people that the frequencies below 144.300 MHz are informally reserved for weak-signal modes, such as SSB and CW. One writer suggested that, if we hadn't mentioned a specific frequency, there'd be no problem. So, it seems, the problem wasn't so much that the experiments were conducted where they were, but that we reported it and didn't comment on it.

Here's our comment: In 20/20 hindsight, it would have been better if Sara and her dad had used a "lightly populated frequency" above 144.300 for their experiment. That said, the only regular use we're aware of for 144.260 is as a 10-GHz liaison frequency, where microwave operators meet to work out the details of pointing their 10-GHz antennas at each other. Apparently, there was no 10-GHz activity that afternoon in their area, since Sara and her dad were listening in three modes, and most certainly would have changed frequencies if they heard any activity.

Now the real question is this: Which is more important -- maintaining the spectral sanctity of a frequency no one else was using at the time? Or encouraging a 14-year-old girl to use ham radio as the basis of a science fair project? -- W2VU

Getting Started in Digital Communications—Part 2

Our packet basics series continues this month with a look at making the connections between your computer, your TNC, and your radio... and at making your first connections with other stations over the air.

Welcome to Part 2 of our "Getting Started" columns. Last month, we discussed the kinds of equipment we needed to get started in packet radio, the predominant data mode on VHF and above. This month, we'll take a moment to review connections and walk through our first QSO. Lastly, we'll take a brief look at some of the things we can do with packet.

Last month, we looked at the basic equipment we need to get on the air (see Photo A): a radio, a computer, and a specialized piece of equipment to tie those two together. Most often, you would use a *terminal node controller* (TNC), which performs two major functions: assembly (for transmit) and disassembly (for receive) of packets, and the modulation/demodulation of the digital data. You can think of a TNC as a kind of modem for radio, similar to the modem you might use with your telephone line.

There are many alternatives to using a TNC, with some of the simpler ones using your computer for part of the work (making the hardware less costly), and some—which tend to be more expensive—that can work in other digital modes. With new TNCs available for $120 and used ones in working order available at hamfests for under $50, they're quite affordable, not to mention plentiful. Because of this variety, it's impossible to write a fixed set of instructions that will apply to every kind of hardware you might encounter. So, I'll repeat my advice from last month: Get a copy of the user manual for whatever hardware you end up with and read it!

Because nearly every TNC operates in a similar manner—many are based upon the very popular TNC-2 design from TAPR (Tucson Amateur Packet Radio)—our discussion this month will focus on TNC operations. Some TNCs and fancier "data controllers" have optional software that makes them easier to use, much like Windows™ makes DOS™ easier to use. However, you should understand that a plain-vanilla terminal program, such as Crosstalk, Procomm, or BitCom, will work just fine if you don't mind a little bit less convenience in the user interface.

Photo A: The N2IRZ packet console, which runs on an old 4.77-MHz 8088 PC, an ancient AEA PK-232, and an even more ancient ICOM IC-25H radio. Not pretty, perhaps, but it works. Sometimes, I use the PK-232 on HF with my much more ancient Heathkit SB-102, for RTTY, Morse, and even 300-baud packet.

Connections and Commands

The first step is connecting the TNC to the computer. Connect the TNC to the computer's serial (RS-232) port, commonly with a straight-thru cable from the

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Photo B: The back panel of a PacComm Tiny-2. Note the well-marked RS-232 and radio ports. This model also has a TTL (transistor-transistor logic) port, required for some computers. Just inside the TTL port opening, on the left, the white transmit audio level adjustment potentiometer can be seen.

TNS's RS-232 port (see Photos B and C). Start the terminal program and set the terminal baud rate (on the RS-232 port) to the same speed as the TNC's terminal baud rate (set inside the TNC with switches or jumpers—generally 9600 baud, even for 1200-baud TNCs). Switch on the TNC's power and you should see the TNC's power up message, which usually tells you the type of TNC, firmware version, memory size, and features, followed by what we call the "command prompt," which looks like **cmd:**. If you don't get the power-up message, fiddle with baud rate, start/stop bits and parity, as well as RS-232 cable wiring, until you get this working.

The command prompt means your TNC is waiting for you to tell it what to do (known as "Command Mode"). Let's try a few simple commands. The first, and most important, setting for your TNC is to let it know your callsign, which is sent with every transmission or packet. At the command prompt, type in the command **MYCALL** and hit enter. The TNC will respond by telling you the present setting for the **MYCALL** parameter, which is probably something like "nocall", or maybe the last owner's callsign. Type in **MYCALL** again, followed with a space and your callsign, like "MYCALL N2IRZ" (without the quotes). The TNC will confirm your command by telling you what the setting *used* to be.

Before we go any further, a word about TNC commands. All TNC commands can be abbreviated; from here on, I'll show the abbreviated part of the command in uppercase, and the rest of the name in lowercase. We'll put all commands in **bold** to set them off from the words around them. The TNC will understand the command whether you type only the abbreviation, or the whole command, and it is not sensitive to case. For example, the TNC will handle all of these commands the same: **MYcall**, **mycall**, **MY**, **my**, and **Myca**. For clarity, some commands will be shown in quotes, but these quotes should not be typed in as part of the command.

Setting your callsign with **MYcall** is the bare minimum you need to set, and it'll work for now, but you will find greatly enhanced performance if you set other parameters as well. Because of limited space, I can't explain all of them, so instead I recommend that you learn about each parameter (there are dozens; your TNC manual should have basic explanations) and set them accordingly. Ones you really need to look after are **TXDelay**, **MAXframe**, **FRack**, **Paclen**, **RESptime**, and **REtry**—more on these in a moment. Oh, yes: a common problem, where everything you type appears twice, is cured by setting **Echo** to OFF.

Now we'll verify that everything is OK by performing an "Audio Loopback Test." On the back of the TNC, use a short piece of wire or a clip lead to connect the Transmit Audio (TXA) output to the Receive Audio (RXA) input (Photo D). This allows the TNC to talk to itself, something it is usually happy to do. Then, issue a command to connect to yourself, using the Connect command. On my TNC, I would type "C N2IRZ"—you, of course, would use whatever you set MYcall to—generally your own callsign.

If everything is still OK, you'll get a message from the TNC like "*** Connected to N2IRZ". If you get that, you're set to connect up the radio. If not, first make sure your loopback wire is really connected to TXA and RXA on the back of the TNC. Then, make sure the audio output potentiometer (usually visible from the back of the TNC) is not set to zero; halfway between minimum and maximum is fine for now. If you still cannot connect, something is very wrong—re-check everything again, and then call for help.

Once you've connected for the first time (congratulations!), you can play with it for a while, typing in a message and seeing it come back. Notice how the TNC waits for either a full packet's worth of characters to be typed in (set by the **PACLen** parameter, something between 1 and 255 characters), or for you to hit the Enter key. You are now in the other

Photo C: The RS-232 connector and transmit level adjustment potentiometer (labeled AFSK Level) on the back of an AEA PK-232. Compare these with those shown in Photo B.

common mode for a TNC, known as "Converse Mode." In this mode, the TNC transmits what you type in, instead of trying to interpret it as a command (remember Command Mode?). To break the connection, you need to type in the "Disconnect" command, switch over to Command Mode with **Ctrl-C** (hold the Ctrl key and tap the letter C), then type **D** and hit enter. The TNC will confirm that you've disconnected.

On the Radio...

Now, the easy part—connecting the TNC to the radio, using the "Radio" port on the back of the unit (see Photos B and E). There are only four wires to worry about: Transmit Audio (TXA), which goes from the TNC into the radio's microphone input; Receive Audio (RXA), which comes from the radio's speaker output to the TNC; Push-To-Talk (PTT) which the TNC uses to make the radio transmit (this "ground-to-TX" signal can usually be fed into the radio on the microphone connector); and Ground (GND), which is just, well, a plain old ground from the TNC to the radio. As I mentioned last month, K4ABT's Web site at <http://www.packetradio.com> has a huge variety of TNC-to-radio connection diagrams, and most TNC manufacturers also sell pre-made connection cables for most radios.

There are two minor adjustments that need to be made before you can get out on the air: Transmit audio level and Receive audio level. The Receive level is not as critical, and a setting on the volume knob of the radio about 1/3 up should be just fine, at least to start. This setting can be optimized later.

For the Transmit level, there is a potentiometer inside the TNC (usually accessible from a hole in the back panel; see Photos B and C), and you need to set this so that the FM deviation of the packet signal is 3 kHz. If you do NOT set this level, it probably won't work. If you have a deviation meter, use that; otherwise follow the procedure in "Setting Transmit Audio."

On the Air

OK, now that everything's set well enough to get started, power up the computer, start the software, and power up the TNC, in that order.

Tune the radio to a local channel with packet activity. Set the squelch low, but high enough that it is quiet between hearing other stations. A good place to hear what packet sounds like is the national APRS (Automatic Position Reporting System) frequency of 144.39 MHz. There is also a lot of activity in most parts of the country between 144.91 and 145.09 MHz, and you're likely to find the most to see and do here. Monitor the channel for a while (you might have to turn the **Monitor** parameter to ON) and look at the callsigns (or network node names) at the beginning of each "packet." The first callsign is doing the transmitting, and the last one is the intended destination. Any callsigns in between are either network nodes or digipeater stations passing the message along. Look for a station that has an asterisk (*) next to it—that means you're hearing it directly and are likely able to connect to it. (As an alternative to setting Monitor ON, which might take some time to figure out, try the TNC command "**MHeard**," which is a list of stations recently heard).

Let's try a test connection over the air. For a brief test connect, few stations will mind a random connection. Normally, though, you would only connect to stations that are intended for user access, or someone else's home station. One thing you'll notice is that there are not many live "keyboard to keyboard" packet QSOs on VHF. So, select a station, and type in to the cmd: prompt something like **C KB2BAV** (using the correct callsign, of course!).

Your TNC should then briefly key the transmitter and, if unsuccessful, repeat that every few seconds about 10 times (the exact number is set by the **RETry** command, between 0 and 15, with 0 meaning keep trying forever). If successful, you'll receive a message on your screen like ***Connected to KB2BAV**, or perhaps something like ***KB2BAV Busy** (followed by a disconnect).

If you connect successfully, you can be sure everything is working OK. If you've selected a station that's intended for user access, you'll get some kind of brief welcome or identification screen. Typing **?** or **H** usually gets you some help on using whatever it is you've connected to. If you connected to another ham, you might try typing HELLO, which is a good way to say, um, hello, perhaps get some help, and even find out what packet stations and services are available near you. If you

Setting Transmit Audio

Correctly setting the transmit audio level is absolutely essential to ensuring that your packet station will work. The goal is to set the audio drive level from the TNC so that the transmitted signal has a deviation of 3 kHz with the higher modem tone (2200 Hz). The ideal method is to use a deviation meter or service monitor, but the "ear" method should get you close. Some TheNET X1J nodes had deviation meters connected to them; you simply connect to the node and look at the heard list (using the **MH** command to the node) and your station will be listed, with the measured deviation level. Keep tweaking the adjustment until it reads about 3 kHz consistently.

Your TNC is equipped with a **CALibrate** mode to allow you to set the transmit level accurately. Most TNCs use the command **CALibrate**, but check the manual. Once in Calibrate mode, you key the transmitter using the **K** command, and unkey using the **Q** command. Note that the watchdog timer in the TNC will automatically unkey the transmitter after a minute or so.

With a deviation meter, key the transmitter, press the space bar on the PC to get the higher tone (listen on another radio), and turn the adjustment potentiometer inside the TNC (usually accessible from the rear panel; see Photos B and C) to get 3-kHz deviation.

The "ear" method requires another radio to monitor the transmitted signal. key the transmitter, select the higher tone, and turn the adjustment potentiometer first all the way down, then up until the signal just stops getting louder as you turn. You might want to repeat this a few times until you find the right spot. This is where your signal is hitting the radio's internal deviation limiter of 5 kHz. Now, turn the level DOWN until the signal is about at half volume—this is about 3 kHz deviation. Note that it is much more desirable to have an under-deviated signal, say, 2 kHz, than an over-deviated signal of 4 kHz.

For a thorough discussion of transmit audio level and some good procedures for adjustment, look at the Web page written by John Ackermann, N8UR, located at <http://www.febo.com/layer-one/transmit.html>.

Photo D: A crude but effective audio loopback jumper, made from part of a 5-pin DIN connector. This connector is a TNC-2 standard, but other types of connectors are also used for the radio connections.

Photo E: The radio connector as found on the back of an AEA PK232 multi-mode data controller. Although it's very different in appearance from the one shown in Photo B, it serves the same purpose.

connect, but get disconnected with a Busy or similar message, it also means that everything is working, but that the station is not accepting connections, so try another callsign.

Looking Ahead in CQ VHF Ham Radio Above 50 MHz

Here are some of the articles that we're working on for upcoming issues of *CQ VHF*:

- "Truly Portable Packet," by Ray Rischpater, KF6GPE
- "Hams and Y2K—The Real Need," by Brent Walton, KF6FGB
- "Ham Shack in the Sky," by Sam Vigil, WA6NGH

Plus...

- "Build Your Own Laser Station," by Jim Hatton, GM4RJX
- "Phase Noise and Frequency Synthesizers," by Ian Poole, G3YWX
- "Six Meters in Bermuda," by Ken Neubeck, WB2AMU/VP9
- "*CQ VHF* Review: Alinco DJ-V5T Handheld," by Harold Rubin, N2MDD

If you'd like to write for *CQ VHF*, you may download our writers' guidelines from the *CQ VHF* World Wide Web site at <http://www.cq-vhf.com> or FTP to <ftp://ftp.cq-vhf.com/cqvhf> and look for the file, "writguid.txt." Or, you may send a written request along with an SASE (self-addressed stamped envelope) to *CQ VHF* Writers' Guidelines, 25 Newbridge Road, Hicksville, NY 11801.

The worst is when nothing happens. Your TNC keys the radio a few times, and you end up with a message *****Retry count exceeded**. This means that there was no response from the other station, which could mean that your transmitter power is too low, there is noise on the channel, or that something is wrong. To troubleshoot, first listen to your transmissions with another receiver. You should hear a "Braaaaap" (about the only way to describe the sound of a packet transmission) when the TNC keys the radio. If not, check the cable (especially transmit audio) and the transmit audio level setting.

If it sounds fine (you *did* set the audio level, didn't you?), then monitor the channel while making another connect attempt. If you hear the other station responding with a brief Braaaaap (this will sound very obvious on a relatively quiet channel, less so on a busy channel), then there's a problem in the receive chain. Turn down the receive audio volume until the TNC's DCD (Data Carrier Detect) light turns off, then turn it up just a little bit past where it lights reliably when another station transmits. If the DCD never lights, then the TNC isn't hearing the incoming audio; again, check the cable.

I just don't have the space to cover every single possible problem that you might encounter and how to go about solving it, so let's do it off-line instead: If you've checked everything and you've read the user manual cover to cover and you still can't get it working, then write to me and we'll figure it out together. Be sure to tell me what kind of computer, TNC, radio, and software you're using. Nothing personal, but this time I hope I *don't* hear from you—that means you've been successful!

Explore! Experiment!

Once you're on the air, explore! Connect to stations and see what happens. While some stations you can connect to directly might offer some kind of service, a bulletin board system (BBS), for example, you're more likely to encounter a network *User Port*. This is where you connect into the local packet network, offering greatly increased range, and many more servers.

I've written about BBS systems, APRS, and surfing the packet network before, so you can either look up those columns, or order a book or video and learn more about it. Some suggestions are the CQ Video, "Getting Started in Packet Radio" (see the ad elsewhere in this issue), or the book, *Practical Packet Radio*, available from the ARRL. There are dozens of similar books, all will tell you almost everything you need to know. Also, check out the Tucson Amateur Packet Radio (TAPR) Web site at <http://www.tapr.org>.

So that's it in a nutshell. I hope that I've given you enough information to get a packet station on the air. I urge you to try it—borrow a TNC if you're still not sure—because there really is a lot that packet offers. No, it isn't the World Wide Web, but, if you're so inclined, there's no reason you can't do whatever you do on the Web on packet. After all, packet radio is only the pipe in which data flows—there is no limit to what that data is (within Part 97 boundaries, of course). And if you need any help, just write! Good luck, and 73.

—N2IRZ

An Introduction to Oscillators... and a Blast from the Past

If you've got a radio—any radio—and you want to know "how it works," then you need to start by understanding oscillators. We've got you covered—PLUS Dave's got a homebrew project for you: a 1930s-style 6-meter AM transceiver!

Our quest for electronic knowledge and pursuit of related quick-brew fun projects continues this month, and we have some very interesting info to share with you. In the spotlight this time are *self-excited oscillators*, those main "building blocks" found in communications equipment of all types. Without these frequency determining and controlling circuits, modern radio and television could not exist. We'd all be transmitting and receiving in the same general frequency range or around the same wavelength—total confusion for sure.

Also this month, we'll take a heart-warming look back in time at one of the very first homebrewable (and easy-to-duplicate) VHF transceivers; a rig from, believe it or not, 1936. That's right. Two decades before fancy transceivers appeared on the scene, hopped-up oscillator varieties were in use on VHF bands. Surprise! We have some exciting ground to cover, so let's get rolling!

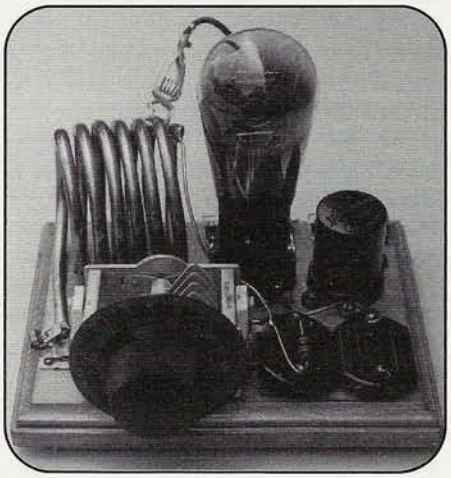

Photo A. This modern-day replica of a 1930-style transmitter uses a type 45 tube in a basic Hartley oscillator circuit and pumps out a healthy 5-watt signal on any frequency its tuned circuit covers. When powered from a well-filtered and regulated power supply, it emits a beautiful sounding signal on today's bands.

"Without these frequency determining and controlling circuits, modern radio and television could not exist. We'd all be transmitting and receiving in the same general frequency range or around the same wavelength—total confusion for sure."

Oscillators Simplified

Since we're introducing a new topic for discussion, let's begin with a quick "applicable to all" explanation of what oscillators are and what they do. We can then expand our studies into more advanced types "down the line."

Oscillators are used to generate various RF (radio frequency), IF (intermediate frequency), and AF (audio frequency) signals employed in all types of communications gear, and they can be separated into two rather broad categories: self-excited and crystal-controlled. Both types of oscillators typically produce a low level signal on a desired frequency and rely on a following amplifier or buffer stage for increasing output power.

Self-excited oscillators are the easiest to homebrew from "junkbox" parts and are the most frequency-agile (they can be assembled to tune any frequency range), but crystal-controlled types are more accurate and stable for "stay put" operation. An easily recognized example of a crystal-controlled oscillator is the local oscillator stage in a modern transceiver, or a little "barebones" QRP transmitter. A comparable example of a self-excited oscillator is the CW sidetone stage in a multimode transceiver or a 1930s-style transmitter like the one shown in Photo A.

"Swinging" Oscillators

Oscillators typically generate a frequency by using a tube or transistor (or equivalent device within an integrated circuit, or IC) to electrically activate or energize a tuned circuit. This "push," or activation, then causes the tuned circuit's coil and capacitor to exchange their acquired electrical energy back and forth at a rate, or frequency, determined by the coil's inductance and the capacitor's capacitance.

In many ways, watching a parent push a youngster in a swing is a convenient way to visualize an oscillator's action. How so? The parent briefly pushes the swing, then pauses or rests while the swing goes through a complete back-and-forth cycle. Each time the swing returns to its starting

By Dave Ingram, K4TWJ (k4twj@cq-vhf.com)

"Self-excited oscillators are the easiest to homebrew from 'junkbox' parts and are the most frequency-agile (they can be assembled to tune any frequency range), but crystal-controlled types are more accurate and stable for 'stay put' operation."

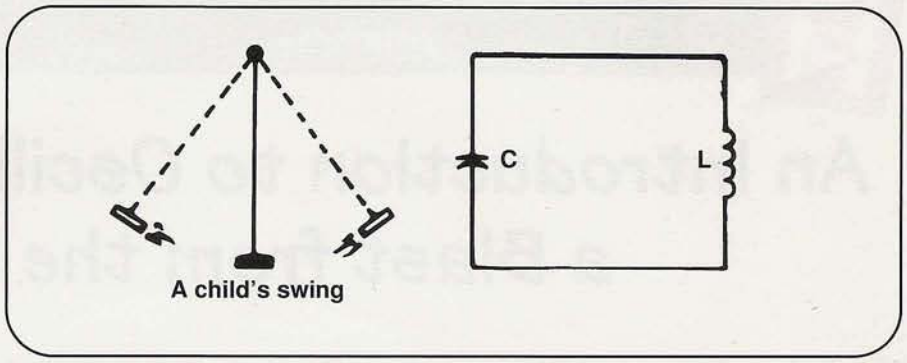

Figure 1. The back-and-forth movement of a child's swing is a good analogy for how an oscillator generates a signal on a specific frequency by exchanging energy between its tuned circuit's coil and capacitor. Discussion in text.

point, the parent gives it another brief push and the cycle repeats. Now compare one side of the swing's arc of travel to a tuned circuit's capacitance and the other side to its inductance (Figure 1). Also imagine the length of time or speed at which the swing goes through each full cycle as the tuned circuit's frequency. Notice, too, that a "balanced condition" of equal travel on each side of the swing's arc plus an accurately timed and repetitive "push" are necessary for sustained smooth action. The equal travel is akin to equal capacitive and inductive *reactances* in an oscillator's tuned circuit, and the timed "push" is comparable to using grid or base leak bias (more on this later) with the proper time constant for a selected frequency range.

Still with me? OK, now let's "bring everything together" with an overview of how three classic oscillator circuits actually work.

Lights, Camera, Oscillation!

Heading up our discussion of self-excited oscillators in action is the ever popular *Armstrong* oscillator shown in Figure 2. A tube or a transistor could have been used as the active device in this circuit, but I chose a tube because it just seemed like a "natural" for this timeless classic. Let's step through its cycle of operation.

Like all self-excited oscillators, the Armstrong uses *grid leak bias*. As a result, no bias is present at turn-on and near-full current flows from ground, or the power supply's negative terminal, to the tube's cathode, on to its plate, and back to the power supply's positive terminal. This change from zero to near-full plate current causes "tickler" winding L2 to produce a continuously expanding electromagnetic field. Since L2 is in close proximity to L1 (usually it's comprised of insulated wire and wound on top of L1), it begins to induce voltage into L1. This voltage increases as L1's electromagnetic field expands, so the *increase* or *change* (from a fixed value of zero to a more positive voltage) "looks like" AC to the grid capacitor C2, and thus goes right through it.

This positive-going cycle of voltage is then felt on the tube's grid and further supports current flow until the tube reaches saturation and plate current becomes steady (rather than increasing to maximum). When plate current becomes a steady value, tickler winding L2 no longer produces an expanding electromagnetic field and thus stops inductively coupling voltage into L1. Simultaneously, the tube's grid (which previously was positive) begins pulling current *from* the main electron stream within the tube.

This current, in turn, charges grid leak capacitor C2 with an *opposite polarity* voltage (minus toward grid). This negative-going voltage quickly increases to the point where it cuts off current flow in the tube (because the tube's grid now feels a negative voltage on it). The tube then gets a short rest (a gasp!) while the biasing charge in grid capacitor C2 "leaks down to zero" through its shunting resistor, R1. Meanwhile, voltage induced into L1 by L2 charges C1. Ah, but immediately after C1 charges, it "realizes" there's a coil shorting its terminals and it discharges (the opposite way) back through L2. Bingo: oscillation is produced at the resonant frequency of L1 and C1. When voltage across C2 leaks down low enough, the tube again conducts. Again, this changing voltage inductively couples into L1, again C2 charges and cuts off plate current flow at saturation, and the cycle repeats. A separate pickup coil usually couples the signal out of an Armstrong oscillator.

Now would you like to see the Armstrong circuit work with a transistor

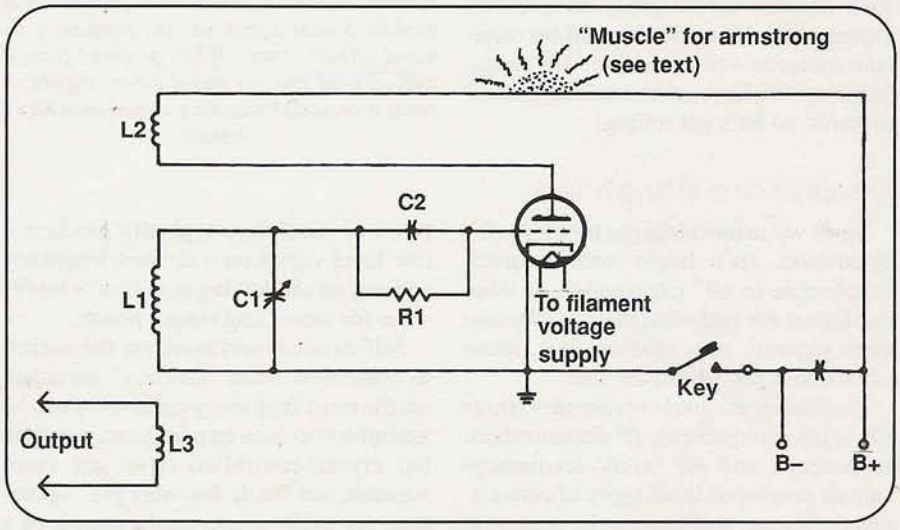

Figure 2. The circuit diagram of the ever-popular Armstrong oscillator is fairly easy to understand and thus makes a good starting point for our "How It Works" discussion in text. Note that I added a "muscle" to the circuit's associated "arm" for easy recognition.

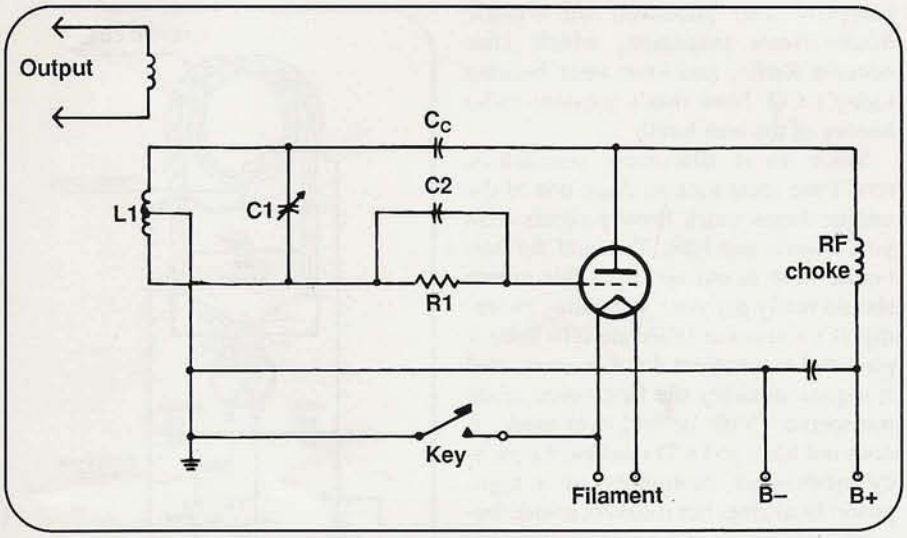

Figure 3. Circuit diagram of the famous Hartley oscillator. Operation of this circuit is similar to the Armstrong, except a tapped coil is used in lieu of separate tickler winding. Think "tapped coil, measured in Henrys, H-Henry, H-Hartley," and it's easy to remember. The circuit shown also applies to classic transmitter in Photo A.

rather than a tube? Just change the tube's symbol to an NPN transistor with the emitter in place of the cathode, the base in place of the grid, and the collector in place of the plate, and visualize using a lower voltage—or reverse polarities and use a PNP transistor. Essentially that's how an oscillator works. We could have delved into more technical complexities, phase relations, etc., but let's keep this study lighthearted rather than hard nosed.

Hartley-Davidson?

Two additional and always-popular types of self-excited oscillators are the famous *Hartley* and *Tuned Grid-Tuned Plate* versions shown in Figures 3 and 4. Both of these circuits work on the same principle of feeding back energy from their plate (or collector) to produce and sustain oscillation in their tuned circuit. How that energy is fed back, however, is what makes the two circuits different.

In the *Hartley* (Figure 3), the tap on L1 causes it to act like an autotransformer. When plate current flows, a brief pulse goes through Cc and is coupled into the above-tap section. This, in turn, induces oscillator-sustaining voltage into the below-tap section. Again, as in the Armstrong, this initial rise of positive voltage causes the tube to reach saturation, draw grid current, charge C2, and cut off plate current flow. From that point, operation of the Hartley and

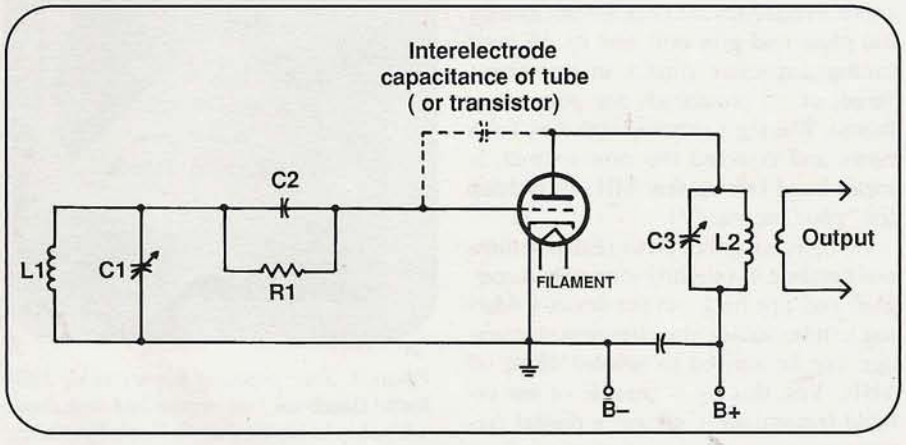

Figure .4 Circuit diagram of the tuned grid-tuned plate oscillator. This design depends on the interelectrode capacity of the tube (or transistor) plus proximity of coils for oscillator-sustaining feedback. The circuit is also a bit more stable than other self-excited types.

Operating Notes

Should you choose to operate this radio with an antenna, be sure—as noted in the text—to check with a frequency counter or well-calibrated modern transceiver to assure in-band operation (also check for harmonics and other spurious emissions). In addition, you should avoid the low end of the 6-meter phone band so you don't interfere with SSB contacts. The unofficial 6-meter AM calling frequency is 50.400 MHz, so this should be a good place to look for other AM enthusiasts once you're sure the rig is working well (do your testing off of the calling frequency). If the band opens up, you may find you have a good deal of company...and a good deal of fun!

Armstrong oscillators is basically the same. That is, voltage exchanged between L1 and C1 produces oscillations at a selected frequency and a separate pick-up coil couples the signal to a following stage or antenna.

One final note bears mentioning. The Hartley diagram shown in Figure 3 corresponds to my 1930s replica transmitter shown in Photo A, which employs a directly heated tube like the type we discussed last month. Do you remember the difference between indirectly and directly heated tubes? I occasionally use this little rig on the air today, and it is a treat.

In the *tuned grid-tuned plate* circuit (Figure 4), the grid coil receives its oscillation-sustaining "kicks" or voltage pulses through capacity coupling from the plate to the grid *within* the tube. In many TGTP circuits, the grid and plate coils are also positioned near each other to enhance feedback and ensure stable oscillator.

That's enough theory for this time. Now let's focus on a fun oscillator-related project!

A Blast from the Past

A few months ago, Paul Messer, KB4TTT, gave me a 1936 edition of the famous Frank C. Jones *Radio Handbook* (Photo B), and I've had a ball homebrewing some classic rigs from this legendary publication. I say "legendary" because the book was written by a "biggie" of the time and published by the Pacific Radio Publishing Company. This company also published the *Pacific Radio News* magazine, which later became *Radio*, and even later became today's *CQ*. Now that's amateur radio history of the best kind!

Since we're discussing oscillators, now's the ideal time to share one of the unique Jones quick-brew projects with you, friends and fans. Yes, and the particular item in our spotlight this month should really get your adrenaline pumping. It's a genuine 1936 one-tube battery powered transceiver for 6 meters, and it's quite possibly the first voice mode transceiver (VHF or HF) ever made. It does not have an LCD readout, frequency synthesizer, memories, or a high-power final amp, but it covers a wide frequency range (on receive and transmit!), plus it works AM (and even FM when battery juice is low!).

In other words, it's a "wild child" by modern standards and requires some conscientious and careful handling if you use it with an outdoor antenna today. Alternately, you can just assemble it as an historical display item or use it without an external antenna for around-the-shack demos. Or you might build a pair of them for fun use within a two or three block area (without antennas). Hopefully, I'm not creating a monster here, and you understand this little tyke is about as crude as they come. A pile of notes must now be squeezed into a couple of paragraphs, so read close and digest the info as we continue.

The circuit diagram and physical details of this mini-transceiver are shown in Figures 5, 6, and 7. It uses a genuine 1936 type 19 tube, which functions as a grid bias-modulated tuned grid-tuned plate oscillator on transmit and doubles as a super-regenerative circuit on receive. Frequency range is determined by the plate and grid coil and its 15 mmf tuning capacitor (that's micro-microfarad, or 15 picofarads for you newer hams). The rig's original coil was 1-5/6 turns and covered the now-extinct 5-meter band (with a few MHz of overlap for "good measure"!).

By increasing the coil to a full two turns and bending its (slightly longer than original) end tips back out for direct-soldering to tube socket pins, frequency coverage can be shifted to around 48 to 60 MHz. Yes, this rig is capable of out-of-band transmission, so use a digital frequency counter or a modern transceiver to initially check/set the rig to an in-band frequency—and recheck it regularly. Frequency stability, such as is possible

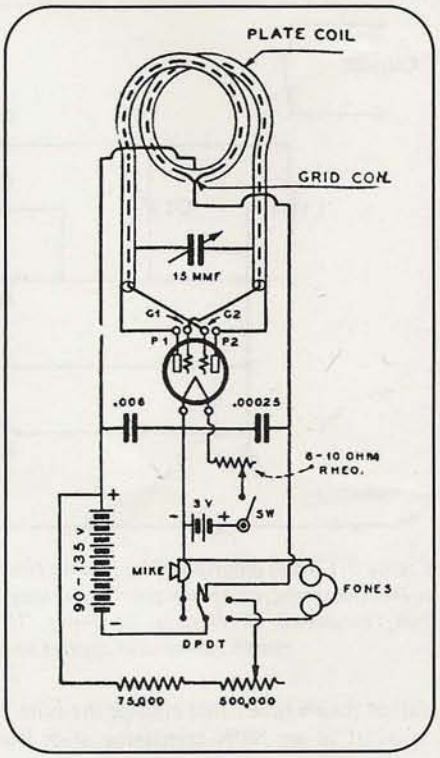

Figure 5. Circuit diagram of the one-tube 1936 transceiver. The little rig was used and proven by Allied Radio Corporation in its original "Knight" transceiver built by youngsters nationwide, then revised slightly by Jones and featured in his Handbook. Quickly—what type oscillator is this, friends?

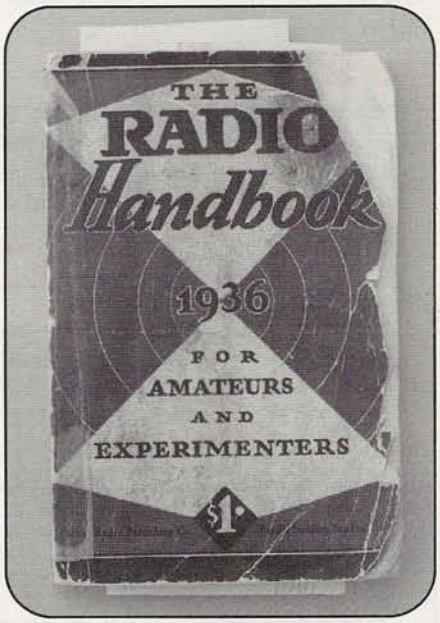

Photo B. True pages of history! This 1936 Radio Handbook *was written by Frank Jones and published by the Pacific Radio Publishing Company, which was a forerunner of today's* CQ *and* CQ VHF. *One of its featured projects was the one-tube, battery-powered transceiver revisited in this month's column.*

"...the particular item in our spotlight this month should really get your adrenaline pumping. It's a genuine 1936 one-tube battery powered transceiver for 6 meters, and it's quite possibly the first voice mode transceiver (VHF or HF) ever made."

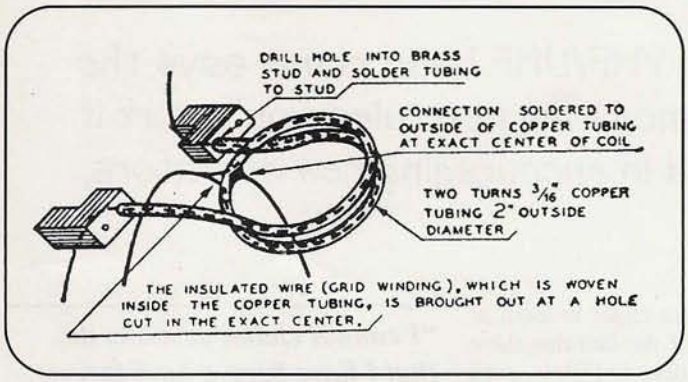

Figure 6. Assembly details of the plate coil with the grid coil inside it. Details in text.

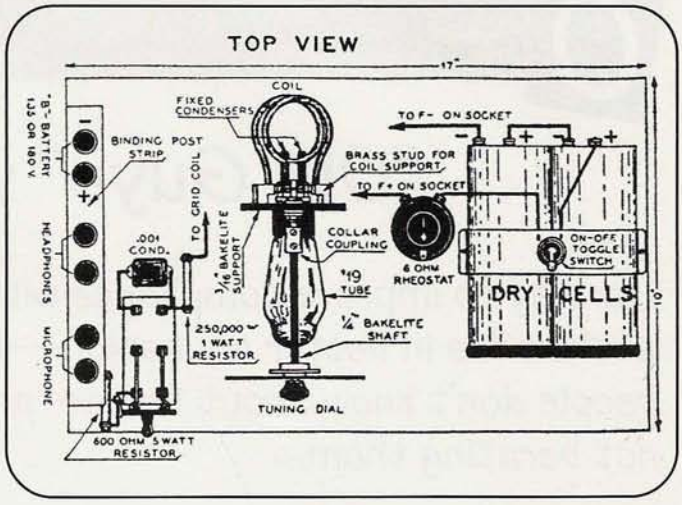

Figure 7. Layout of the 1936 transceiver as sketched in Jones's Handbook. *Although originally built open-air style on a 10- by 17-inch pine board, this little gem could be condensed to fit into a file box with the tube extending out the side or top. Don't look too closely or you'll notice Jones's habit of substituting off-the-wall values in components. Whew!*

for a 1936 self-excited rig, is achieved by "unity coupling." That is, the grid coil is placed—are you ready for this—*inside* the plate coil (see Figure 5 and detail in Figure 6). Big time radio for sure! Whew! Here are the amazing details:

The plate coil consists of 3/16- or 1/4-inch soft copper tubing wound two full turns with an O.D. (outside diameter) of 2 inches. Leave approximately 1-1/2 inch leads on each end of the coil for direct connection to the tube socket's pins or brass mounting studs screwed to socket pins (you make 'em). Cut a 1/2-inch wide slot in the lower area of the tubing at the coil's center and thread a well-insulated length of rubber- or plastic-coated wire through each side of the tubing. Allow their ends to extend about an inch out of the copper coil's ends for trimming, stripping, and connecting to the tube socket's grid pins. Connect the middle sections together to produce a center tap. Solder a separate wire directly to the copper coil's center for connection of plate voltage (in upper area, opposite the slot for grid coil wires, as shown in Figure 6).

Check your assembled coil with an ohmmeter to ensure grid and plate windings are insulated from each other. When installing the coil, cross its grid leads over to opposite terminals on the tube socket. This helps keep coil taps clear of other socket pins. Mount the tuning condenser (what they called capacitors in the 1930s) near the tube socket so its leads are also 1 inch to 1-1/2 inches long. Add an insulated shaft extension for minimizing hand capacity when adjusting this (frequency-setting) condenser. The tube is mounted horizontally for minimum lead length.

This rig's microphone uses a single button carbon-type element—just like those used in regular (wired) telephones. The earphone is a high impedance type (also as used in telephones). Don't cannibalize your home phone for these items, however; substitutes are plentiful at hamfest fleamarkets or from such suppliers as Antique Electronic Supply (6221 S. Maple Avenue, Tempe, AZ 85283; phone: 602-820-5411).

We're now overflowing space, so here are some quick closing notes. Two "C" cell batteries work fine for the tube's filament supply. Ten to 15 series-connected 9-volt batteries will make a handy plate supply. You might even cover them with a homemade Burgess battery wrapper for authenticity.

Testing and Operation

When operating properly, the rig will draw 5 or 6 milliamps (mA), and its earphone will emit a light hiss on receive. Plate current will increase to 30 to 50 mA without an antenna connected or 15 to 20 mA with an antenna on transmit. A 3- or 6-volt flashlight bulb connected to a two-turn pickup coil placed beside (or inside) the plate coil should illuminate well on transmit—just like old times. A single 4-1/2-foot wire, alligator clip-lead-connected to the copper coil near its center tap, makes a good antenna. Experiment with that tap point. When correct, the receiver will still hiss over its full tuning range.

Have fun dinking with this experimental rig (but not on local repeaters and not on the SSB calling frequency!) and stay tuned for more theory 'n practice fun next month. 73, —Dave, K4TWJ

A Note on Mail for Dave

Questions and comments for Dave Ingram, K4TWJ, are welcome and appreciated. Due to the large volume of correspondence Dave receives, most e-mail will be answered, on a space-available basis, in his column. This way, everyone benefits from shared knowledge. If you prefer a more personal reply, send a brief letter (with space provided for replies/answers), along with a self-addressed stamped envelope (SASE), to Dave Ingram, K4TWJ, 4941 Scenic View Dr., Birmingham, AL 35210. Or, if you're active on HF as well as VHF, listen for Dave on Sundays between 2200 and 2230 UTC around 14.200 MHz (±QRM), or weeknights on 30 meters.

"Old Guys" vs. "Newbies"

The way to improve compliance with VHF/UHF band plans, says the author, lies in better education—since even new rules won't work if people don't know about them—and in encouraging new operators, not berating them.

Editor's Note: This was originally posted to the W6YX VHF Reflector on the Internet and is reprinted here with the author's permission.

I have been following with a fair amount of interest the current discussions regarding the proposed legislation of the band plans and licensing restructuring. It seems to be the consensus that all the problems that exist in ham radio today are directly related to the current lack of legislation and testing of new operators.

I cannot claim, as many do, that I have been a ham forever, nor do I profess to have a great amount of electronic knowledge. You see, I am one of those dreaded "No-Code Techs" whom everyone seems to hate so much. I do, however, take great pride in operating my station within the subband portion of the spectrum allocated to weak-signal SSB. And hopefully, someday, in the CW portion as well; as I have a learning disability that makes copying code very difficult. I will master it eventually, but at least the No-Code Tech entry level allowed me to be a part of a hobby that I have been interested in since high school.

I know from reading many comments on this reflector that every No-Code Tech seems to be lumped into the category of bumbling fool and general incompetent, but I don't think that is a fair analysis. Just because I chose to start at this level does not make me any less eager to learn or any less cognizant of the fact that there are rules and regulations to follow, even if they are by "gentlemen's agreement." How do I learn what are proper operating procedures and acceptable operating etiquette? Obviously not by gleaning any knowledge from the current discussions on this reflector.

An Excellent "Elmer"

I was fortunate to have an excellent "Elmer" to help me get started. Not everyone is that fortunate, I guess. Especially the way the "Newbies" get blasted from the "Old Guys." I guess they don't remember that they were also Newbies at one time. My Elmer helped me make decisions on equipment and instructed me in the proper procedures and regulations in the areas in which I was interested in operating. He monitored me to make sure my operating procedures were in compliance with accepted parameters and corrected me when they weren't. He directed me on literature to read and know, and he continues to help me toward my General. The point here being that, if you don't like the way I operate, then provide me with some means of learning the proper way.

One excellent way to instruct is through club participation and club nets. A technical round-table net is an excellent place for the new guys to listen in and be able to ask questions, *if* the old guys don't shut them out completely. Don't make it so technical that the new guy is afraid to step up to the mic and ask a question that might very well make him a better operator and not the point of many of the flames we see on the reflectors.

"I cannot claim, as many do, that I have been a ham forever, nor do I profess to have a great amount of electronic knowledge. You see, I am one of those dreaded 'No-Code Techs' whom everyone seems to hate so much."

I belong to the Western States Weak Signal Society and, through their meetings and informal get-togethers, I have been able to make new friends who care about ham radio, and to get a lot of information about how to approach weak-signal work. They also have a technical round-table net once a week where you can ask questions without feeling like an idiot and generally get excellent information from the Old Guys.

Educating Purchasers

Sure, the band plans are published in the handbooks and study guides, but how about asking the equipment manufacturers to voluntarily put a nice, easy to read band plan in the package with the radio when you buy it? That would certainly put the information directly in the hands of the new equipment purchaser. Several manufacturers have nice band plan handouts, but if you never go to a hamfest or to a formal equipment display, you'll probably never see one. If the voluntary band plan gets promulgated enough times to new operators in every form available, maybe everyone would start to accept that that's the way it is supposed to be. No

By Howard L. "Mick" Mosley, Jr., KF6JBB* (mickdraw@ix.netcom.com)

*"Mick" Mosley, KF6JBB, has been a ham since 1997. He lives in San Diego, California (Grid DM12), and is active on SSB on 6 meters, 2 meters, and 70 centimeters. And he knows not to operate FM on 2 meters below 144.300 MHz.

amount of legislation will change things without getting the information directly to the people operating the equipment. (*Packaging band-plan information inside the radio carton would be impractical on a manufacturer's level, as their radios are packaged for sale all over the world and band plans vary from place to place. It* would *be practical, however, for the manufacturers to provide their dealers with those band plan charts and ask them to include one with each radio sold.—ed.*)

Guidance, Not Alienation

No, I haven't come up with any earth-shaking solutions to the problems that exist, but I do resent being designated a No-Code Tech as a derogatory label. My license says "Technician" and I operate within the designated areas assigned as "privileges" to that license. I will eventually be able to upgrade to a higher license, but that will not necessarily make me a better operator. That will only come through guidance supplied from the operators who care enough about the hobby to continue to educate the new guys and not alienate them just because they are new.

I am 56 years old and have had my Technician license since February, 1997. I am active on VHF and UHF SSB and enjoy contesting. I have been the Single Op Leader in the San Diego region in every ARRL UHF and VHF contest since 1997. I want to upgrade to General if I can ever master the code (and I *will*). I participate in nets in the area and work tropo and *E*-skip whenever possible. I have worked over 150 grids on 6 meters and have worked three grids via Tropo to Hawaii on 2 meters and 432. And I QSL 100% to every card I get (SASE or not), which is a lot more than I get going the other way.

Help keep the ham radio hobby alive—support and instruct the "New Guys" so that when we become the "Old Guys," we will be able to pass on the legacy to the next generation of "New Guys." ■

The opinions expressed in this column are those of the author and do not necessarily reflect the views of CQ VHF *or its publisher, CQ Communications, Inc.*

If you have an opinion on this issue or another matter of importance to the VHF ham community, we'd like to hear from you. Well-reasoned, well-written commentaries will be considered for our Op-Ed page. If we publish your Op-Ed article, we'll give you a complimentary one-year subscription (or extension of your current subscription) to CQ VHF. *Submissions not accepted for the Op-Ed page may also be considered for Letters to the Editor.* CQ VHF *reserves the right to edit all submissions for length and style.*

Cross-Banding the IC-2800H

ICOM's new IC-2800H will operate as a crossband repeater—but figuring out how is a big-time challenge. N9XGZ found the answer and shares it with us.

By Norris Klesman, N9XGZ
(retro@bresnanlink.net)

Editor's Note: N9XGZ first left a note on the "Q&A" page of the CQ VHF *Web site, asking for details on using the new ICOM IC-2800H as a crossband repeater, as the manual had no information on it—even though the promotional literature lists crossband repeating as a feature. We were unable to come up with any details, so N9XGZ then did some digging on his own and shares what he learned with us here.*

I would like to give you some information on crossband repeating that I was able to track down on this unit. My question came up because ICOM listed cross-banding in both its Web site and in its color brochure on the unit, and several members of my local club (Arrowhead Amateur Radio Club) asked me about cross-banding. Under "Other outstanding features" in the brochure, the fourth feature listed is "Crossband full duplex operation capability." But there's no mention of it in the manual.

I called ICOM for more information on this capability. I received a fax from a technician name Oren with instructions on how to go crossband. Quoting the fax:

2800H cross band repeater mod is as follows:
—Press and hold **CHG/L** button while holding both VHF and UHF **MAIN** buttons.
The key lock indicator will blink, and will be ready to operate.
—Set **hang time** to 0 on cross band repeat mode, press and hold **CHG/L** button while holding **UHF MAIN** and bottom key at VHF side. The key lock indicator will blink, and will ready to operate. End of translation"

The above is a direct copy of the faxed instructions. Releasing the crossband mode is by again holding the VHF and UHF **MAIN** button while pressing the **CHG/L** button.

I tried the above and found the unit does, indeed, work in crossband. When I asked Oren why this was mentioned in the promotional materials but not the manual, he said, "ICOM prints a worldwide manual and cross band is illegal in some areas. People who want to use this function contact us, and we tell them how to use it, if it is legal in their area."

While this does keep the radio legal in all areas, there's no mention in the manual that you should contact the company for how to do it, if you legally can. (I think this is a poor way to promote the radio).

Thank you, Norris, for sharing this information with us.

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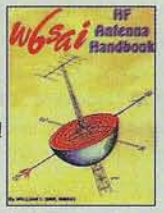

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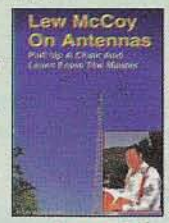

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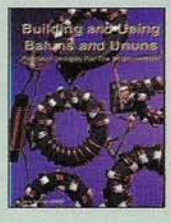

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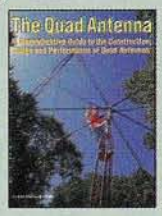

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Basics

Packet Bulletin Boards—Ham Radio's "General Store"

Today's digital communications networks—including ham radio packet networks—fall under the buzz phrase of the "information highway."

The reason you get onto a highway, any sort of highway, is to go somewhere. Usually, on a real highway, we have a specific destination in mind before we ever leave home. It's not much different on packet. Most of us turn on our packet stations to make contact with another specific station. In many cases, that station is our local *PBBS*, or *Packet Bulletin Board System.*

Since we're using a travel analogy, let's think of our PBBS as a small-town general store. In many towns, the general store is a combination post office, newsstand, and gossip center. If you want to find out what's happening, you stop by the general store.

On the ham bands, you can "stop by" your PBBS to pick up your mail, send off a note to a friend across the country or across the ocean, find out the latest ham radio news, and see if anybody knows where you can find that elusive piece of gear you're looking for. See the similarities?

In many ways, ham radio's general store is better than a real one. It's open 24 hours a day, seven days a week, you don't have to leave home to get there, and all the local stores are hooked together in a global network that automatically forwards messages and bulletins around the corner or around the world.

Using a PBBS

Let's take a look at how you connect to a packet bulletin board and what you can expect to find there. Like other specialized packet stations, most bulletin boards are either identified by a ham radio callsign followed by a dash and one or two numbers, or by an *alias* that generally includes the letters BBS (for example, the WA2SNA BBS in northern New Jersey uses the alias "BBSNNJ").

There are several different types of bulletin board software and each one is a little different. But they all have some features in common. When you log on for the first time (by typing "C," a space, the callsign or alias of the BBS, and pressing "enter"), you'll get a "new user" screen that asks a few questions, such as your name, location, and "home" BBS.

That last one's important. Your "home" BBS is where you want to receive your packet mail. Generally, it's the board you check into most frequently. If you check into a different board sometime, don't worry—you won't insult it by telling it you "live" someplace else. But you will let that system do two things: First, on some systems, any messages you send out from the board you're "visiting" will direct the receiving station to reply to your "home" BBS. And second, if a message coming to you without a full address happens to reach this bulletin board, it will automatically forward it to your correct "home address." *Please*...have just one "home" BBS.

Once a bulletin board "knows" who you are, it'll let you see what's there. The basic command for "listing" messages is "L." Just press "L" and "Return" or "Enter." The board will send you a list of all bulletins plus personal messages to or from you that have been posted since your last check-in. If this is your first, prepare for a long list. If you only want to see your mail, type "LM." It means "List Mine."

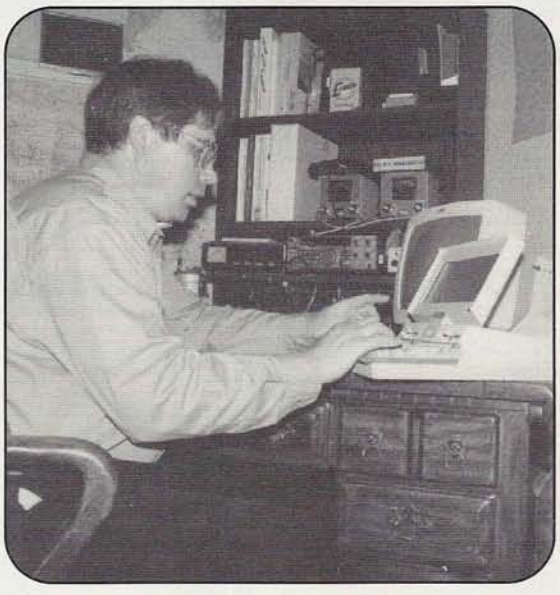
What Does It Mean?

On a typical listing of messages, each line represents one message. The information you'll see includes the message number, the type of message (is it "P" for personal or "B" for bulletin?), and a status code ("Y" or "N" to indicate whether it's been read), its size in bytes, the message address, including callsign and destination, plus the return address, the date and time the message arrived on this BBS, and a brief description of what it's about.

To read a message, type "R," space, and the message number. You can string together several numbers to read a group of messages with just one request. After you've read a message addressed to you, it's a good idea to delete it by typing "K" for kill, followed by the message number and a "return."

Sending a Message

To send a message, the basic command is "S." For a personal message to another ham, type "SP," space,



Checking into your local packet bulletin board will let you send and receive mail, get the latest ham news, see what other hams want to buy and sell, and even download files and computer programs. This is Tom Klimala, KM4LB, of Raleigh, North Carolina, at his packet terminal.

that ham's callsign, and, if he or she is at a different bulletin board, the "@" sign, followed by the call of the destination BBS. Don't include the dash and SSID number, but it is good practice to provide routing information—basically a two-letter state abbreviation, the country and the continent, each separated by a period. A typical address would be <W2VU@WA2SNA.#FN21.NJ.US.NA>. This would tell any forwarding station that the message is heading—in reverse order—to North America, the United States, New Jersey, Grid Square FN21 (different systems use different regional identifiers), and finally, the WA2SNA bulletin board. WA2SNA will hold the message for W2VU until he checks in, and then will list it as a waiting message.

After you tell the BBS you want to send a message and who you want to send it to, it will ask you for a short description, then tell you to type the message. When you're finished, type "CONTROL-Z" or "/EX" on a separate line. Your message will now be automatically forwarded by the BBS to its destination.

Sending a Bulletin

Sending a bulletin is pretty much the same, except that you type "SB" instead of "SP" and the address generally isn't a callsign. It's either "All" or some descriptive name, such as "Info." "Info @ USBBS" will send your information request to all packet bulletin boards in the U.S.

Please think carefully before you distribute a message widely; for instance, do you *really* need to send this to the whole country? And try to avoid "ALL@ALLBBS," or "ALL@WW," worldwide, unless it's truly important for hams everywhere to see your message. If it isn't, then your message just becomes clutter on the airwaves.

Files and Programs

Most bulletin boards also include file sections which contain either computer programs or long text files which you may download. One example is a file which will give you schedules and beam headings for working amateur satellites. You may also be able to download a public-domain program for tracking those satellites. Procedures vary on different systems, so check the help screen of your BBS or ask the *sysop* (system operator) how to access and download files on your system.

Handling Traffic

You can't travel on any sort of highway without seeing other traffic. In ham radio, the term *traffic* usually refers to radiogram messages sent via the American Radio Relay League's "National Traffic System." Many BBSs forward ARRL message traffic (generally addressed to "XXXXX@NTSzz," where the Xs are a Zip Code and the "z"s are a state abbreviation. A radiogram going to Hicksville, New York, for example, would be addressed to <11801@NTSNY>. There's a whole separate procedure for handling ARRL messages. We won't cover them here except to say that, if you see a message for someone local to you, feel free to pick it up (read it) and deliver it (generally by phone). If you do, be sure to then "kill" the message (using the procedure outlined above) so it's not picked up and delivered a second time by a second ham. To find out about traffic-handling, check into a local VHF voice net on a repeater, or contact your ARRL Section Manager.

Exit Ramp

When you've gotten your mail, checked the latest news, and maybe picked up a new program for your computer, it's time to leave "Ham Radio's General Store." That's the easiest command of all. Simply type "B" or "Bye" and press "return." The BBS and your TNC will do the rest. ■

CTCSS Tone Frequencies

The following is a listing of the 42 standard CTCSS (Continuous Tone-Coded Squelch System) tone frequencies, along with the Motorola PL® designators often used to describe them. Many repeaters require that you transmit a CTCSS tone along with your signal in order to have your signal retransmitted by the repeater. CTCSS is usually used to minimize interference to and from other repeaters, not to restrict access.

Frequency (Hz)	"P/L" Designator	Frequency (Hz)	"P/L" Designator
67.0	XZ	136.5	4Z
69.3	WZ	141.3	4A
71.9	XA	146.2	4B
74.4	WA	151.4	5Z
77.0	XB	156.7	5A
79.7	WB	162.2	5B
82.5	YZ	167.9	6Z
85.4	YA	173.8	6A
88.5	YB	179.9	6B
91.5	ZZ	186.2	7Z
94.8	ZA	192.8	7A
97.4	ZB	203.5	M1
100.0	1Z	206.5	8Z
103.5	1A	210.7	M2
107.2	1B	218.1	M3
110.9	2Z	225.7	M4
114.8	2A	229.1	9Z
118.8	2B	233.6	M5
123.0	3Z	241.8	M6
127.3	3A	250.3	M7
131.8	3B	254.1	ØZ

Basics

Calling Frequencies

It's common practice on VHF/UHF weak-signal modes (SSB and CW) to look for contacts on a nationwide *calling frequency* on each band, then to move off frequency to complete your contact. There are even specialized calling frequencies on some bands for EME (Earth-Moon-Earth) contacts.

Plus, each band has a designated *national simplex frequency* for non-repeater FM contacts, generally based on the ARRL's national bandplan for each band. These frequencies are set aside by "gentleman's agreements" and, while there's no rule establishing them, it's considered poor amateur practice to tie up the calling frequencies with long-winded QSOs—and *that* is against the rules. So please respect the calling frequencies by moving off once you've established contact.

Keep this in mind, too: just because there's a calling frequency doesn't mean it's the *only* place where you can call CQ. Spread out, especially when the band is getting crowded.

Here's a list, by band, of designated calling frequencies and national simplex FM frequencies:

Band	Frequency	Notes
6 meters	50.110 MHz	DX Calling Freqency
(50–54 MHz)	50.125 MHz	SSB (Domestic) Calling Freqency
	50.200 MHz	Proposed New (Domestic) SSB Calling Frequency
	50.400 MHz	AM (Domestic) Calling Freqency
	52.525 MHz	FM National Simplex Frequency
	(28.885 MHz)	(10-meter frequency used to report 6-meter band openings)
2 meters	144.010 MHz	EME (random; see below for scheduling frequency)
(144–148 MHz)	144.100 MHz	CW
	144.110 MHz	CW Alternate
	144.200 MHz	SSB
	146.520 MHz	FM National Simplex Frequency
	(3.818 MHz)	(Meteor scatter scheduling, unofficial)
	(14.345 MHz)	(EME scheduling—nets every weekend)
1.25 meters	222.100 MHz	CW/SSB
(222–225 MHz)	223.500 MHz	FM National Simplex Frequency
70 centimeters	432.010 MHz	EME (random; see below for scheduling frequency)
(420–450 MHz)	432.100 MHz	CW/SSB
	446.000 MHz	FM National Simplex Frequency
	(14.345 MHz)	(EME scheduling—nets every weekend)
33 centimeters	902.100 MHz	CW/SSB (some areas)—check locally
(902–928 MHz)	903.100 MHz	CW/SSB (other areas)—check locally
	906.500 MHz	FM National Simplex Frequency
23 centimeters	1294.500 MHz	FM National Simplex Frequency
(1,240–1,300 MHz)	1296.100 MHz	CW/SSB
13 centimeters	2304.100 MHz	CW/SSB
(2,300–2,310 MHz/ 2,390–2,450 MHz)	2305.200 MHz	FM National Simplex Frequency
9 centimeters	3456.100 MHz	CW/SSB
(3,300–3,350 MHz)		
5 centimeters	5760.100 MHz	CW/SSB
(5,650–5,925 MHz)		
3 centimeters	10,368.100 MHz	CW/SSB
(10,000–10,500 MHz)		

CQ VHF Hamlink

CQ VHF "Hamlink" offers *free listings* of clubs, licensing classes, and exam sessions for up to four months at a time! *Plus*, for $1/month or $10/year, we also offer listings of **ham-related** *personal* Web sites (*commercial* **ham-related** Web listings are $5/month or $50/year).

Web site listings must be accompanied by payment in full in check or money order in U.S. dollars and mailed to *CQ VHF "Weblink,"* Attn: Bernadette Schimmel, 25 Newbridge Road, Hicksville, NY 11801. Credit card orders are accepted by mail, phone (516) 681-2922, or fax (516) 681-2926. Club, class, and exam listings may be submitted to *CQ VHF* "Clublink," or via the Web at <hamlink@cq-vhf.com>. Be sure to say what it is in the subject line (e.g., Club Listing).

Club Listings

CA, Catalina Amateur Repeater Association: Meets 2nd Saturday of even-numbered months, 8 a.m. at Country Harvest Buffet, 6731 Westminster Ave., Westminster, CA. Visitors welcome. Club repeater (AA6DP) located on Catalina Island serves Southern California from Santa Barbara to the Mexican border: 147.090(+), no PL and 224.420(-) PL 110.9. Two-meter net every Monday, 7:30 p.m. followed by Swap Net, 8:15 p.m. Young People's (age 19 and under) 2-meter net every Wednesday 7 p.m. (3rd party traffic welcome). Trivia net Thursdays 8 p.m., as announced. For more information, send SASE to CARA, P.O. Box 425, Garden Grove, CA 92842-0425 or visit: <www.cara.nu>.

CA, El Cajon, Amateur Radio Club: Meets 2nd Thursday of each month at 7 p.m., La Mesa Church of Christ, 5150 Jackson Dr., La Mesa, CA. Visitors welcome. Repeater 147.420(output), 146.474 (input) 107.2 PL. Nets: WAMO/YL/Young Persons (<16). For further information, visit: <www.qsl.net/wa6bgs> or e-mail: <kf6ila@arrl.net>.

CA, San Clemente, Beach Cities Wireless Society: Meets 2nd Thursday of each month at 7 p.m. Ole Hanson Beach Club at beach end of Ave Pico and PCH, San Clemente, CA. Visitors welcome. Open repeater 146.025(+) PL 110.9), net Wed. eves. 8 p.m. For more info, visit club Web site at <http:// www.qsl.net/bcws> or contact Tom at (949) 661-4307, e-mail: <prmercury@earthlink.net>, or write to BCWS, P.O. Box 4016, San Clemente, CA 92674-4016.

CA, Santa Barbara Amateur Radio Club: Meets 3rd Friday of month September–May at 7:30 p.m., County Schools Auditorium, 4400 Cathedral Oaks Rd., Santa Barbara. For more info, see <http://www. sbarc.org>, or call (805) 569-5700.

CO, Bicycle Mobile Hams of America: National non-profit club of bicyclists who use VHF radios for emergencies, lost riders, route information, chatting, etc. 450 members in 46 states, 6 countries. Annual Forum at HamVention. Net: 14.253, 1st & 3rd Sundays, 2000 UTC. E-mail: <hartleyal@aol.com>. For info, sample newsletter, send SASE to BMHA, Box 4009-CV, Boulder, CO 80306-4009.

CO, Rocky Mountain VHF+ Contest Group (RMVHF+): Contests, information and exchange of ideas related to VHF+ weak signal operations, design and construction. Members and participants in Colorado and the surrounding states. Monthly newsletter. Weekly net on 144.220 USB, Mondays at 20:00 Mountain Time. Membership info: Wayne, NØPOH, e-mail: <Nrclog@aol.com>; Fax: (707) 220-1820. Info also available via our Web site: <http://www.qsl.net/rmvhf>; Web Site info: Phil, K6LS, e-mail: <rmvhf@qsl.net>; E-mail: <k6ls@amsat.org>.

FL, Clearwater Amateur Radio Society: Meets 7:30 p.m. 2nd Thursday of every month, Clearwater Red Cross, 624 Court Street. Linked repeaters on 146.970 (103.5), 224.940, 444.15 (103.5) and 444.575 (131.8) with weekly club net on Wednesday at 8 p.m. Web: <wwwfgcarc.org/cars>. For more information contact Paul Toth, K2SEC (club Secretary) at (727) 415-1657 or <k2sec@arrl.net>.

FL, Highlands County Amateur Radio Club: Meetings held 3rd Monday of each month, 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Visitors are welcome. Repeaters at 147.045 +.6, 442.350 +5.0, with packet on 144.970. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio@strato.net>.

FL, St. Lucie Repeater Association: Meetings held the 1st Tuesday of all months except July and August, 7:30 p.m. at Lakewood Park Branch Library, 7605 Santa Barbara Dr., Ft. Pierce, FL. Visitors are welcome. Repeater at 146.775. Area-wide repeater serving the Treasure Coast. Auto-patch and NWS severe WX alert. Ragchew and trader's Net, Sunday at 8 p.m. Also YL Net Sunday at 6:30 p.m. and Weather net at 9 p.m. Sunday. SKYWARN severe weather nets as situation requires. E-mail: <KD4SPW@arrl.net>.

MA, Franklin County Amateur Radio Club: Meets second Monday of every month at Greenfield High School small auditorium, Silver Street in Greenfield, MA at 7:15 p.m. Repeaters 146.985 - PL 136.5 and 448.875-PL 136.5. For information, e-mail Richard, KD1XP, at <kd1xp@arrl.net>

MB, Canada, Winnipeg Amateur Radio Emergency Service (WARES): Callsigns VE4YWG (Public Service Communications), VE4EOC (City Emergency Operations Centre). Meetings 3rd Tuesday of month, 1930h at Sir Wm. Stephenson Library, 765 Keewatin St. Membership open to all licensed amateurs at least 18 years of age and living in or near Winnipeg and interested in emergency amateur communications. E-mail Jeff Dovyak, VE4MBQ, Emergency Coordinator at: <ve4mbq@ve4umr.ampr.org>; Web: <http://www.geocities.com/CapeCanaveral/Hanger/1632/wares.html>.

MI, South East Michigan Amateur Radio Association (SEMARA): Meets the 1st Friday of the month. September through June at 7:30 p.m., at Grosse Pointe North High School, in Grosse Pointe Woods, MI. Repeater 146.740-. For further information, contact <n8fgk@amsat.org>.

MO, St. Louis, Gateway to Ham Radio Club (KBØUAB): A youth-focused club, meetings are held each month on Saturdays. Get on our new repeater at 443.225 (146.2 pl). For more information, visit our Web site at <http://www.iidbs.com/gateway/>.

OH, Cleveland Area, Cuyahoga Amateur Radio Society: Meets 3rd Wednesday of every month except December at 8 p.m. at Busch Funeral Home community room, 7501 Ridge Rd., Parma, OH. June, July, and August, "Picnic Meetings" are held at the Cuyahoga County Metropolitan Park. Repeaters on 146.82(-), 443.825 & 444.75 (+), 53.83 & 53.01 (+), plus digipeater 145.07, club simplex frequency of 146.475 MHz. For more info, contact club president, Tom Wayne, WB8N, at (440) 232-4193 or at <wb8n@en.com>.

OH, Triple States Radio Amateur Club: Operates over a wide area with members in 50 states & 3 foreign countries. Meets 2nd Saturday of the month at 1 p.m. at Citizens Saving Bank, Colerain, OH, on Rte 250. Features Web page: http://www.qsl.net/tsrac>, major Wheeling/Martins Ferry Hamfest Aug. 8; all-mode SSB/FM/AM/CW 6-m net Wed. 9 p.m. EST/EDST on 50.150/50.151; very popular club bulletin; send for sample copy; ARRL/VEC exam sessions, meeting room, last Monday of the month at 6 p.m. at club's meeting room, phone notice required (740) 546-3930; E-mail: <k8an@aol.com>; Fax: (740) 546-3685.

PA, Lambda Amateur Radio Club (LARC), Philadelphia: Since 1975, the only open and visible public service-oriented ham club for gay and lesbian hams. Monthly newsletter, HF skeds, Internet listserv and IRC, hamfest meetings, chapters, DX-peditions. Lambda Amateur Radio Club (ALRC), P.O. Box 56069, Philadelphia, PA 19130-6069; E-mail: lambda-arc@geocities.com.

TX, Hurst Amateur Radio Club (HARC): Meets 3rd Monday of every month (except Dec.), 7:30 p.m., Hurst Public Library, 901 Precinct Line Rd., Hurst, TX. Visitors are encouraged and welcome. HARC is a family-oriented club, active in community service. All levels of ARRL and W5YI exams given; see Web site for schedule. Repeaters: 147.100+ (110.9 pl) W5KXC and 442.850+ K5KKS. Net every Sunday evening at 7:30 p.m. local on 147.100+, everyone welcome. Web: <http://www.geocities.com/area51/Orion/5663/index.html>.

UT, Rocky Mountain Radio Association (RMRA): Offers Utah, Wasatch Front, unique UHF to 6, UHF to 2, and UHF to HF remote gateways. Net Thursday at 9 p.m. on 447.900 PL 114.8 UHF/6-meter gateway open 24 hours on 448.700 PL 114.8. Visit Web site at <www.inconnect.com/~rmra>; or e-mail: <rmra@inconnect.com> for more info.

UT, West Desert Amateur Radio Club: Meets the 1st Tuesday of each month (except July & August) 7 pm. The Tooele County Courthouse, 47 S. Main

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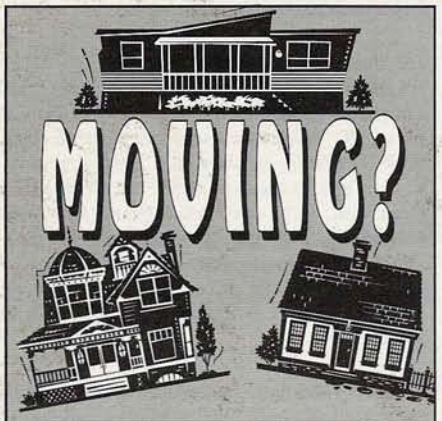

St. 84074. Meeting room is in Tooele County Emergency Management Conference Room, in the basement of the Courthouse. Access via the Public Safety Entrance at the Sheriffs Department off Vine St. next to Clairís Auto Repair, 64 E Vine St. A net is conducted on the 3rd Tuesday of each month at 7 p.m. on the 146.980/145.390 linked repeater system. WDARC supports four repeaters: 146.980/145.390 linked system (Delle; I-80 & Vernon, UT Rt. 36); 147.300 Tooele City PL 100.0 Hz; and Wendover Peak, Wendover, UT. 147.200. Contact person is Gene May, KC7MBF (Public Relations), (435) 882-1222, or David Haag, KC7PVD Secretary at P.O. Box 208 Tooele, UT 84074-0208.

VA, Alexandria, Mt. Vernon ARC (K4US, MVARC): Meets the 2nd Thursday of every month (except Dec.), 7:30 p.m. at Mt. Vernon Governmental Center, 2511 Parkers Ln., Alexandria, VA. Repeater frequency is 146.655. If interested, write to P.O. Box 7234, Alexandria, VA 22307, or contact Bob, KT4KS, at (703) 765-2313.

WV, Charleston, Kanawha Amateur Radio Club (KARC): Meetings held 1st Friday of each month at 7 p.m. at the South Charleston City Hall Annex, 4th Avenue and D Street in South Charleston. Weekly Sunday net at 8:30 p.m. local on 145.35 W8GK club repeater. Mail to KARC, P.O. Box 1694, Charleston, WV 25326. For more information, contact N8TMW, Jim Damron, Publicity Director, at: <n8tmw@arrl.net>.

WV, Oak Hill, Plateau Amateur Radio Association (PARA): Meetings held 1st Tuesday of every month, 7:30 p.m. New River Pawn Shop basement, 328 Main Street, Oak Hill, WV. Mailing address: PARA, P.O. Box 96, Fayetteville, WV 25840. Repeaters are 146.790-; 147.075- and 443.300+. For more info, contact Juddie Burgess, KC8CON, Secretary, at <kc8con@usa.net>.

Exam Sessions

CA, Santa Ana: FCC Amateur Radio Testing every Wed. of each month at Orange County Chapter of the American Red Cross. Open to the public (walk-in). All levels of testing. Begins at 6:30 p.m. upstairs in the Blood Center, Room 206. Address: 601 North Golden Circle Drive, Santa Ana, CA. Call (714) 835-5381, ext. 140, and ask for Amateur Radio Testing information.

FL, Casselberry, Lake Monroe Amateur Radio Society (Greater Orlando): 4th Saturday of every odd month at Casselberry Public Library on Oxford Rd., Casselberry, FL. For information, contact Al LaPetrer, W2IL, at (407) 671-1056.

FL, Clearwater: Exams held 2nd Monday of each month (except December) at the Clearwater Salvation Army, 1625 North Belcher Road at 7 p.m. For more information, contact John Townsely, AE4GB at (727) 376-6705 or e-mail <ae4gb@arrl.net> or Mike Branda, K4HN, at <k4hn@amsat.org>.

FL, Highlands County: Exams held 4th Tuesday of each month at 7 p.m. Agri-Civic Center Conference Room 3, South US 27, Sebring, FL. Walk-ins are welcome. Web page: <http://www.strato.net/~hamradio>; E-mail: <hamradio @strato.net>.

IN, Evansville: Exams held once a month on a Saturday morning starting at 9 a.m., local time at Evansville Red Cross, 111 Diamond Ave., Evansville, IN. No pre-registration for sessions. For more info, call Terry Brooks, AA9MM, at (812) 421-9135. (Exam dates: 9/25 (ARRL Nat'l Exam Day), 10/30, and 12/04).

PA, Monessen Amateur Radio Club: Test session 1st Sat. of even months (Feb, Apr, Jun, etc.) 10 a.m. at New Eagle Boro Bldg. Main St., New Eagle, PA. Walk-ins welcome but pre-registration preferred. For more info, contact Allan, N3UML, at (724) 852-6449, P.O. Box 26, Sycamore, PA 15364.

PA, Philadelphia: The Philmont Mobile Radio Club sponsors exams on 1st non-holiday Thursday of each month at Franklin Institute, 20th and Ben Franklin Pkwy, Philadelphia, PA. Walk-ins welcome. Exams start at 6:30 p.m. For more info, contact, Dusty Rhoades, ND3Q, at (215) 879-0505.

Personal Web Site Listings

"The Radio Picture Archive," URL: <http://www.e-etc.com/rpa> (corrected). Speciality collection of pictures of radios.

"Telegraph Key/Museum/Collector's Guide" URL: <http://w1tp.com>. Collector of telegraph keys, old radios, microphones & apparatus history, appraisals, buying, trading.

Commercial Web Site Listings

ABTRONIX: Ride the airwaves with ALFA & ZULU *cartoon* Novice/Technician license manual ($14.95), 304 pages, 100% illustrated, easy lessons, for ages 8 to 80. Web site: <http://home.earthlink.net/~abtronix>. Contact: <abtronix@earthlink.net> for quantity discounts. John Abbott, K6YB.

Byers Chassis Kits: Aluminum chassis and cabinets kits, VHF & UHF antennas and parts. Catalog: Callbook address. E-mail: <k3iwk@herd.net>; <http://herd.net/byerschassiskits>.

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HamMall.Com: Largest Web site dedicated to the sale of all types of amateur radio equipment. Check out the QSL Manager's Listing, add your call to the Call Wall, or get technical assistance. Find us at: <www.hammall.com>.

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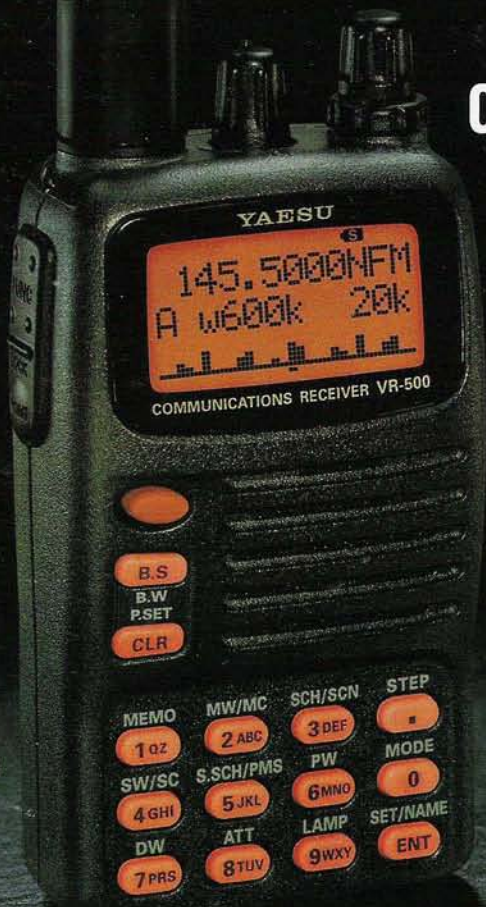

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