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CQ VHF

Ham Radio Above 50 MHz

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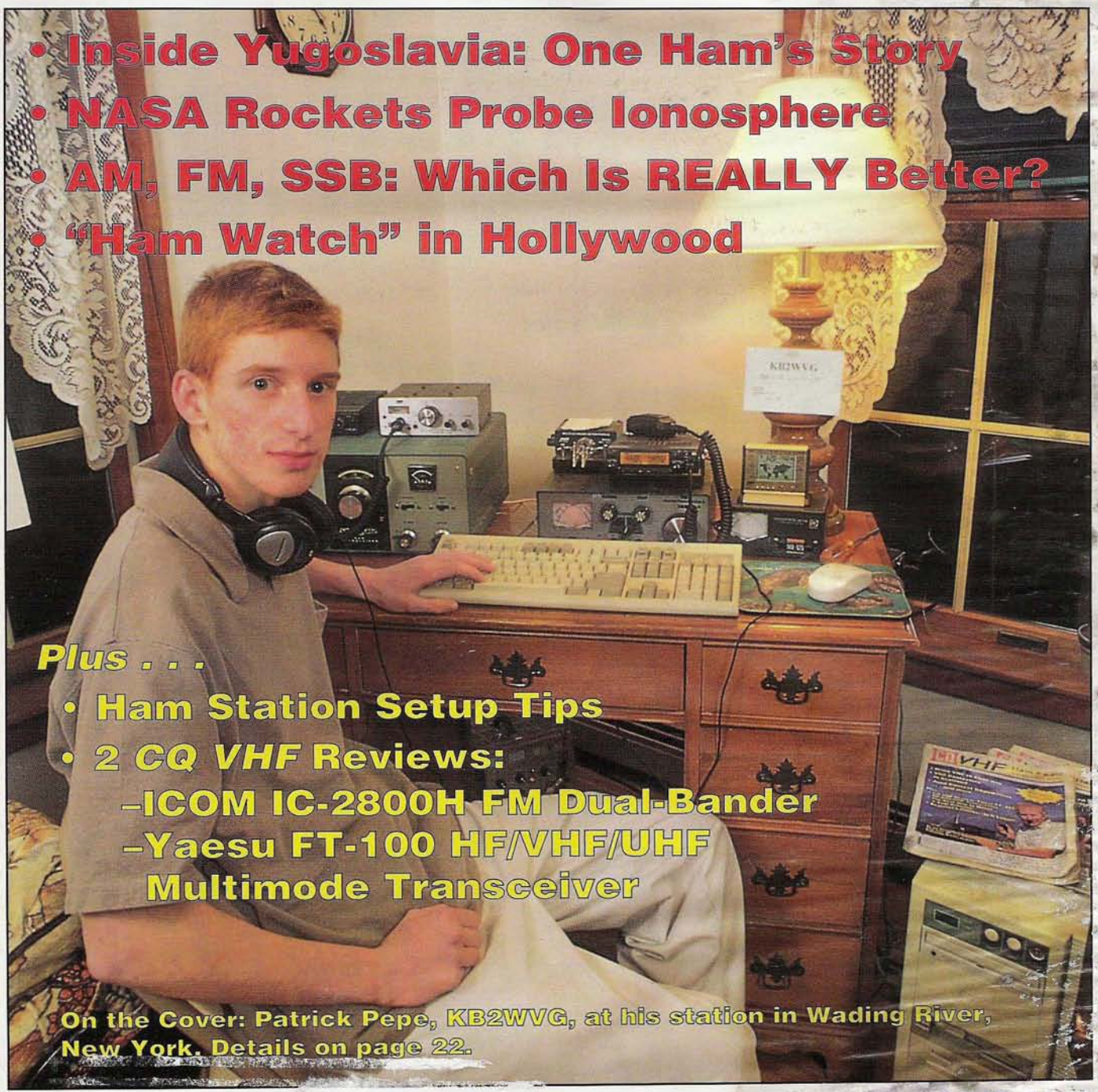
September 1999



- Inside Yugoslavia: One Ham's Story
- NASA Rockets Probe Ionosphere
- AM, FM, SSB: Which Is REALLY Better?
- "Ham Watch" in Hollywood

Plus . . .

- Ham Station Setup Tips
- 2 *CQ VHF* Reviews:
  - –ICOM IC-2800H FM Dual-Bander
  - –Yaesu FT-100 HF/VHF/UHF Multimode Transceiver

On the Cover: Patrick Pepe, KB2WVG, at his station in Wading River, New York. Details on page 22.

U.S. $3.99/ Canada $5.50

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■ Repeaters & FM ■ Packet Radio ■ VHF/UHF Weak-Signal ■ Microwaves ■ Amateur TV ■ Plus Product News, VHF Basics, and

ICOM IC-2800H

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HIGH VISIBILITY COLOR LCD
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9600 BPS PACKET CONTROL.** Packet popularity is growing. Have fun! The '2800H offers a dedicated data port on the main unit.

INDEPENDENT BAND CONTROLS. Independent controls make it easy to work dual or cross band repeat. Tuning, AF and squelch level, and four function switches are available per band.

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Accepts NTSC video signals (PAL in European model). Simple connection works with most digital camera or VCR plugs.

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Install the main body under a seat, in the trunk, or wherever it remains out of the way.

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Total control! Backlit keys, too.

6 PIN DATA PORT
*Simple packet connection.**

SPECIFICATIONS

Transmit: ..... 2 Meter, 440 MHz (70 CM)
Receive: ..... 118-174 MHz, 430-450 MHz*
*(guaranteed 144 - 148 and 440 - 450 MHz only)
Mode: ..... AM (118 - 135.9 Rx only), FM
Power: ..... 2 Meter: 50W/20W/10W/5W
440 MHz: 35W/20W/10W/5W
Power Supply Requirement: ... 13.8 V DC
Memory Channels: ..... 232 Total
Including 12 Scan Edges, 10 Log, 10 Repeater, and 2 Call
Size & Weight (approximate):
Control head: . 5.5(W) x 2.75(H) x 1.3(D) in.
140(W) x 70(H) x 34(D) mm.
10.2 oz /290 g
Main Unit: ..... 5.5(W) x 1.6(H) x 6.6(D) in.
140(W) x 40(H) x 165.8(D) mm.
2 lb, 9 oz /1.15 kg

FEATURES

- **Totally Separate Control Head**
  - Independent band controls
  - High visibility TFT color LCD monitor
  - Connection cable included
- **Independent Tuning Controls**
  - Tuning, AF and squelch level, and 4 function control switches per band
- **Tone Squelch (CTCSS Encode) with Pocket Beep and Tone Scan (CTCSS Decode) Standard**
  - 50 independently programmable tone frequencies for repeater and tone squelch use, respectively
- **On-Screen Menu "Soft Keys"**
- **Simple Band Scope**
- **9600 BPS Packet**
- **Fast Scanning**
- **Air Band Rx***
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- **Rugged ICOM Construction**
- **Mounting Brackets Included**
  - One for controller, one for main unit
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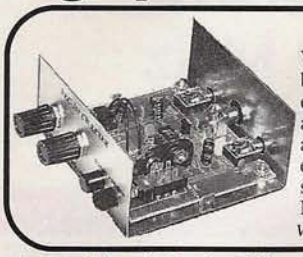

Full featured CW Keyer Kit, $24.95!

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VEC-201K shown in optional case (vinyl cover top not shown), VEC-201KC, $14.95

Aircraft Receiver Kit tunes entire voice aircraft band 118-136 MHz. Picks up air traffic 100 miles away. Track progress of incoming/outgoing traffic in your area, gain advanced weather information, and discover how the National Air Traffic System really works. Great way to learn about aviation. Use 9V battery. Drives external speaker/phones. 1¾x4x3½ in. *Intermediate skill level.* Order **VEC-131K, $29.95.**

20/30/40/80 Meter Receiver Kits give high performance! Covers entire band or tailor to cover desired portion. Copy CW/SSB/AM. NE602/ 612 mixer-oscillator, LM386 high gain audio amplifier. 1¾x4¾x 5¼ in. *Moderate skill level.* Order **VEC-1120K** (20 Meters),**VEC-1130K**(30 Meters),**VEC-1140K** (40 Meters), **VEC-1180K** (80 Meters), **$29.95 ea.**

20/30/40/80 Meter QRP CW transmitter Kits have variable crystal oscillator tuning, front panel switch selects 1 of 2 crystals. 1 crystal included. Transmit and Receive switch. Connect receiver. 1¾x4x3½ in. *Intermediate skill level.* Order **VEC-1220K** (20 Meters), **VEC-1230K** (30 Meters), **VEC-1240K** (40 Meters), **VEC-1280K** (80 Meters), **$29.95 ea.**

Tunable SSB/CW Audio Filter Kit has sharp *four* pole peak and notch filters. Zero in with frequency control & adjust bandwidth for best response. Tune frequency from 300-3000 Hz. Notch is an outstanding 50 dB. 1 Watt amplifier. Speaker/Phone jacks. 12 VDC at 300 mA. 1¾x4¾x5¼ in. *Intermediate skill level.* Order **VEC-841K, $34.95.**

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Super CW filter/amplifier Kit has powerful 1 watt audio amplifier to drive speaker. 8 poles active IC filtering uses cascaded low-Q stages. 3 bandwidths: 80,110, 180 Hz. Center frequency: 750 Hz. Up to 15 dB. Use 9-18VDC, 300 mA max. 1¾x4 x3½ in. *Simple skill level.* Order **VEC-821K, $29.95.**

Super SSB Audio Filter Kit improves readability with 8 poles, optimizes audio bandwidth, reduces SSB splatter, low, hi-pitched interference, hiss, static crashes, background noise. Use 9V battery. 1¾x4x 3½ in. *Simple skill level.* Order **VEC-830K, $19.95.**

144/220/440 MHz Low-Noise Preamp Kits soup up your antenna system. Helps pull in weak signals. Works wonders for scanner or ham-band receiver. Gives great low-noise performance and immunity from damaging electrostatic discharge. 1x1½ in. *Simple skill level.* Order **VEC-1402K** (144 MHz),**VEC-1422K** (220 MHz), **VEC-1444K** (440 MHz), **$17.95.**

CW Memory Keyer Kit stores 512 characters in four 128 character non-volatile EEPROM message memories. *Carry on entire QSOs by just pressing memory message buttons.* True sinewave sidetone with soft rise and fall time eliminates harsh keyclicks. Has all features of VEC-201K CW Keyer Kit. 1¾x 6¾x5¼ in. *Simple skill level.* Order **VEC-221K, $69.95.**

High-performance 2 Meter Preamp Kit pulls weak signals out of noise. Solves three reception problems -- boosts signals using a 1-dB noise figure microwave transistor, provides razor-sharp bandpass filtering, eliminates unwanted electrical noises with built-in balun. Uses 9-14 volts DC. Tiny 1½x3x1 in. fits in any size box. *Intermediate skill level.* Order **VEC-1402DK, $59.95.**

2/6/10 Meter FM Receiver Kits let you tune into the world of ham radio. Catch all the action! Each covers the entire FM sub-band and runs off your 9 volt battery. Plug in speaker or headphones for loud clear reception. 1¾x4x3½ in. *Intermediate skill level.* Order **VEC-1002K** (2 Meters), **VEC-1006K** (6 Meters), **VEC-1010K** (10 Meters), **$34.95 each.**

2 Meter Monitor Kit receives 144-148 MHz. Low noise, high gain RF preamp gives you excellent 0.1 uV sensitivity. Air variable tuning capacitor has 8:1 reduction. Dual conversion superhet provides selectivity and stability. Automatically eliminates squelch tails. Built-in speaker, squelch, tone, volume controls. 19¼ in. telescopic whip. 9V battery. 2x4¼x4 in. *Intermediate skill level.* Order **VEC-104K, $79.95.**

5 Watt 2 Meter FM transmitter Kit lets you transmit voice and data -- AFSK data (up to 1200 baud) and FSK data (up to 9600 baud). Jumper select reactance or direct FM modulators. Reliable Motorola NBFM transmitter IC and PA transistor. Crystal controlled (x8 frequency multiplication). -60 dBc spurs and harmonics. Use 12-14 VDC, 1.5 amps. 5-pin DIN microphone jack. 1¾x4¾x5¼ in. *Difficult skill level.* Order **VEC-1202K, $99.95.**

Ni-Cad/Ni-MH Battery Charger Kit safely quick charges expensive batteries -- no overcharging -- many in less than an hour. HTs, cell phones, camcorders, lap top computers. Handles 1 to 12 cells. Charging status LEDs. Discharge before charge function reconditions batteries. Also removes memory effect. Runs on 12-15 VDC. 1¾x4¾x5¼ inches. *Moderate skill level.* Order **VEC-412K, $49.95.**

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Shortwave Receiver Kit lets you listen to the world! Covers 75/80, 49, 40, 30, 31, 20, 25, 22, 19, 17, 16, 15 and 13 Meter bands. Explore AM, SSB, CW, WWV, RTTY and Packet signals. Vernier reduction drive, smooth regeneration control, RF stage. *Includes all metal cabinet.* 2 earphone jacks. Use 9V battery. 2½x7x6 in. *Intermediate skill level.* **VEC-102K, $59.95.**

QRP Transceiver Kits for 80/40/30/20 Meters

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Super CW Audio Filter Kit gives you three bandwidths: 80, 110, 180 Hz. Eight poles gives super steep skirts with no ringing. Pull CW QSOs out of terrible QRM! Plugs into phone jack to drive phones. QRM down 60 dB one octave from center frequency (750 Hz) for 80 Hz bandwidth. Improves S/N ratio 15 dB. Use 9V battery. 1¾x4x 3½ in. *Simple skill level.* Order **VEC-820K, $19.95.**

AM Radio Transmitter Kit lets you set up your own AM station and broadcast crystal clear programming from your studio with *you* as the disc jockey or talk show host. Play music from CD player, tape deck or other source. Choose clear frequency from 530-1750 KHz. Standard line level or microphone input. Easy CD, tape deck or mike mixers connect. Audio level adjustment. 1¾x4x3½ inches. *Simple skill level.* Order **VEC-1290K, $29.95.**

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CIRCLE 121 ON READER SERVICE CARD

CQ VHF Ham Radio Above 50 MHz

Volume 4, Number 9—September, 1999

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FEATURES

COLUMNS

BASICS

DEPARTMENTS

Next Month: "CQ VHF Review: ICOM IC-706 MkII-G HF/VHF/UHF Transceiver," by Gordon West, WB6NOA

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CIRCLE 174 ON READER SERVICE CARD

"Why Ham Radio Matters"

A recent power outage in my neighborhood reminded me of how much we take for granted...including our own hobby and its unique place in our nation's culture.

It's amazing how much we tend to take for granted: good health, electricity, living in peace and relative prosperity, ham radio. Unfortunately, we often don't appreciate these everyday blessings in our lives until they're gone.

If you're over 30, chances are pretty good that you've been through the experience, at least once, of watching illness overtake a friend or a loved one; or perhaps they've watched it happen to you. The fact that, sooner or later, virtually everyone will share a similar experience doesn't make things any easier. You still feel powerless, out of control.

Feeling Powerless

Electricity is another everyday thing we take for granted, and it's not until the lights go out that we realize how dependent we've become on it. When the power at our house went out for six hours in the middle of a 100-degree heat wave, we not only lost our lights, but our ability to stay cool, to get food from the refrigerator, to use the cordless phone (even though it's a battery-operated radio, the base unit depends on AC from the wall outlet to complete the "autopatch" to the phone lines), and to sleep comfortably on a hot, humid night. When the power went out again the next day, the computer and fax machine went with it, limiting my ability to get my work done (fortunately, it didn't take six hours to come back this time). We have become so dependent on electric power that, without it, we truly feel powerless.

It's interesting, though, as we sat on our front steps in candlelight, the one item we brought out from inside to keep us company was a battery-powered radio. Not a TV, not a laptop computer with a modem to keep us online, but a radio. Sometimes it's a broadcast radio, sometimes a ham radio. But when people feel cut off, they still turn first to radio as their link to the rest of the world...as they have for nearly a century.

Ham Radio Diplomacy

Speaking of feeling powerless, living here in the U.S. it's hard to imagine the everyday horror of being in a war zone. We can only get glimpses of it from news reports, or, thanks to the person-to-person diplomacy of ham radio, from first-person reports such as the one in this issue that Contributing Editor Bob Josuweit, WA3PZO, brings us from YT6DTM in Montenegro. He describes not only the military situation in his country, but the political situation as well. I, for one, could not imagine what it must be like to live in such a no-win situation.

In this month's "Letters" column, reader Lon Kinley, N3ZKP, takes us to task for our July report from the Balkans, and suggests that the article is "blatant[ly] anti-NATO and anti-U.S...." I'm sure he'll feel the same way about this month's report from Montenegro, but I disagree with his conclusion. Reporting the views of someone who is, in his own words, "angry and confused" about certain aspects of the NATO bombing campaign, does not mean that we agree with those views or that we are "anti-NATO and anti-U.S." Mr. Kinley's e-mail address suggests that he's a current or former military officer, and I'm sure that he's concerned about U.S. forces serving in the region. I respect and share that concern, and I hope that Mr. Kinley understands that one of the freedoms that our armed forces have so bravely fought to protect for the past 200-plus years is the right of the people to have unfettered access to a variety of views on important matters, rather than having to rely on "official" news sources—as is generally the case in places like Yugoslavia.

One of the benefits of ham radio is that we're able to communicate directly, person-to-person, with people all over the world, without the "filters" of government propaganda (on both sides) or the selective reporting of the major media outlets ("is there good video?"). N3ZKP makes a very valid point that civilians in Serbia and Montenegro share a measure of responsibility for their government's atrocities, as did German civilians during World War II, by permitting these actions to go on without protest. "The news coverage has been full of footage showing unbridled support for the Serb government," writes N3ZKP.

Yet, our ham in Montenegro is clearly anti-Milosevic and tells us that a majority of Montenegrins share his views, but "you can't talk democracy with a dictator." He also tells us something we haven't heard from the major media—that the strong anti-Milosevic views of Montenegro's civilian government nearly resulted in civil war between Serbia and Montenegro. Are we reporting a different perspective? Yes. But I don't feel that makes us anti-anything.

Listening In

My summer reading project this year is a book titled *Listening In*, by Susan Douglas*. It's a *cultural* history of radio in America. The book focuses mostly on broadcast radio, examining the art of *listening*, and looking at how radio helped

**Listening In*, by Susan Douglas, is published by Times Books, a division of Random House, and is available at most bookstores. ISBN # 0-8129-2546-7.

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

create a feeling of nationhood by bringing voices from all over the country into our homes. "Radio is arguably the most important electronic invention of the century," the author writes. "Even with the advent of television, which was supposed to make radio obsolete, radio has remained a thriving cultural and political force." And while the book is very biased against the homogenizing influence of the networks and the growing concentration of radio station ownership in fewer and fewer corporate hands, hams are clearly the author's heros.

Douglas accurately chronicles the contributions of hams to radio technology (even if she lumps in our cousins, the shortwave listeners, medium-wave DXers, and scanner monitors, with us), but focuses also on our continuing political determination to maintain space in the spectrum for everyday people. "[Amateurs] were the hackers of the early twentieth century," she writes, "pushing the technology to new levels, forming their own fraternity, and thumbing their noses at authority figures who tried to curtail their activities."

The book features an entire chapter—at the end, in the current day, in the present tense—titled "Why Ham Radio Matters." Ham radio matters, she says, because it promotes technical literacy among ordinary people.

And there is a critical relationship between the technical literacy of ordinary people and a nation's ability to compete in increasingly high-tech international markets. Ham radio played a pivotal role in producing engineers who kept American industry, not to mention the American military, at the cutting edge of the field....The hams are one of the most important yet least visible subcultures in America.

But—especially since this is a cultural history of radio—Douglas says hams' contributions go beyond the technical arena. "...hams didn't just start radio broadcasting in America," she writes, "they also have consistently offered another model for how radio might be used and for how to listen."

Hams have always insisted that listening in be an active participatory pastime and that Americans always have a portion of the spectrum reserved for *them*—everyday people. They have demanded and cultivated a commercial-free zone in the spectrum in which individuals—not just corporations and ad agencies—are allowed to transmit, to explore, and to connect with one another.

I haven't finished *Listening In* yet, but it's fascinating reading, and I recommend it to anyone for whom radio in general is more than a passing fancy, even if—as I did—you disagree with the author's views on certain matters. Just as with our report this month from Montenegro, it won't hurt you to read opinions that may differ from yours. And if it makes you think, and maybe reconsider what you thought before, well, folks, that's what the First Amendment is all about. A diversity of views. And the right to make up our own minds. Something else that's all too often taken for granted. ■

Help Wanted

If you're involved with a project or activity that you think would be of interest to your fellow *CQ VHF* readers, we'd like to hear from you. Article submissions are welcome, as are "Op-Ed" opinion pieces if you have a point of view you'd like to share about a VHF-related topic. You can contact us by mail at 25 Newbridge Rd., Hicksville, NY 11801 (send an SASE for writers' guidelines), by e-mail to <cq-vhf@cq-vhf.com>, or via our World Wide Web page, <http://www.cq-vhf.com>. We look forward to hearing from you.

VHF News

Where in the World Is P3D?

By the time you read this, AMSAT's Phase 3D (P3D) satellite may be at, or on its way to, its eventual launch site—even though, at the time we're writing this, no definite launch date has been set and the location of the launch site and identity of the launch agency have not been revealed. The *ARRL Letter* quotes AMSAT P3D Integration Lab Manager Lou McFadin, W5DID, as saying, "Even if we don't get a launch in October, we plan to ship to the launch site in August...P3D may wait for the first launch opportunity on a 'hot standby' basis—all ready to go on a few weeks' notice."

In late June, McFadin told the *Letter*, a team of experts and the builders of various P3D components converged on the Florida integration lab for a "rollout"—taking the satellite outside for on-air tests in full flight configuration (a sealed tent protected the sensitive equipment on the satellite from the hot, humid Florida environment). Those tests were passed with flying colors, as was a test-firing of the satellite's rocket motors. Next up on P3D's agenda were spin balance and vibration tests at Goddard Space Flight Center in Maryland, followed by shipment to the launch site, wherever that might be. Stay tuned.

Meanwhile, as part of the rollout tests, P3D volunteers ON4AOD and DB2OS completed what the AMSAT News Service says might have been the first-ever PSK (phase-shift keying) contacts on 24 GHz, via the transponder on P3D.

Final SAREX Mission From Shuttle

The Space Amateur Radio EXperiment (SAREX) mission on shuttle flight STS-93, scheduled to fly in late July (*as we went to press, it was still on track for a July 20 launch; see "SAREX Flies Again" in last month's issue*), is the *last* SAREX flight scheduled to take place from a U.S. space shuttle, according to SAREX Principal Investigator Matt Bordelon, KC5BTL. Quoted in the *ARRL Letter*, Bordelon says future shuttle flights will be "way too busy" for ham radio operations, and that all future SAREX activity will be from the International Space Station (ISS), on which an interim ham station is supposed to be set up by early next year. STS-93 is the 25th SAREX flight since Astronaut Owen Garriott, W5LFL, first took ham radio into space in 1983.

Bordelon also reported that the STS-93 SAREX mission will include tests—on the ham gear—of digital signal processing (DSP) equipment intended for eventual use in improving the audio on the astronauts' standard communication systems. Testing it on the SAREX ham gear, he said, is cheaper and easier.

Central States Petition Sparks Controversy

A rulemaking petition asking the FCC to designate VHF/UHF subbands for narrow-band signals (such as CW and SSB) has been given an "RM" number by the FCC, and has touched off a fair amount of controversy. The Central States VHF Society petition, approved a year ago by the society's membership but not submitted to the FCC until this past May, has been designated as RM-9673. It asks the Commission to protect traditional weak-signal band segments—50.1 to 50.3; 144.1 to 144.3; 222.0 to 222.15; and 431.8 to 432.5 MHz—from wideband signals such as FM and packet radio. The petition cites growing problems with violations of the "gentlemen's agreements" that set aside these band segments for weak-signal contacts.

A few typographical errors in the appendix to the proposal set off some hysteria among hams who decided that the petition sought to ban packet entirely on 6 and 2 meters (it does not), but philosophical objections were raised by other hams, including two leaders of TAPR (Tucson Amateur Packet Radio), Steve Dimse, K4HG, and the group's president, Greg Jones, WD5IVD. Jones notes that restrictions in the rules are difficult to change and limit future flexibility, and he says the current rules against causing interference should be sufficient.

There is a 30-day window after an RM-number is assigned during which people may file brief statements of support or opposition, followed by a 15-day reply period. The comment period on this petition ended on June 28, with only four comments being filed. Additional comments will be accepted only if the FCC decides to go ahead with a formal Notice of Proposed Rule Making.

FCC Enforcement Actions Continue

The FCC continues to crack down on ham radio abuses, and it has canceled the licenses of several amateurs who were ordered to appear for retesting, but did not show up. Several other hams were ordered to submit to re-examination. And the FCC threatened to confiscate the equipment of one person accused of operating without a license on 2 and 10 meters.

In addition, amateur enforcement chief Riley Hollingsworth, K4ZDH, sent out several letters to people who hold multiple club callsigns—including a family of five hams in California who, between them, have at least three dozen club calls—requesting justification for each of the club callsigns. In some cases, recently issued club calls were summarily canceled. Amateur Radio Newsline reported that the first ham to get hit for multiple club callsigns, Motoaki Uotome, W9BO, said that if he could keep one club callsign, W3AN, for the Washington-DC-based "DX Gang," he'd be willing to give up all the rest. So far, no public response from the FCC.

In other actions, two Houston hams accused of repeater jamming were sent official Notices of Violation by the FCC's Houston field office. And FCC inspectors tried to inspect the Maine station of Glenn Baxter, K1MAN, while it was on the air, but reportedly found no one there; Hollingsworth has asked Baxter to provide detailed information on the station's operations and control operators.

The Commission *withdrew* a two-year ban on HF operation imposed against David Castle, WA9KJI, after receiving additional information on the communications in question. "You are cautioned, however," a letter from Hollingsworth stated, "that there have been numerous allegations of malicious interference by your station at various times, and we

Compiled by the CQ VHF Staff

remind you that Amateur frequencies are shared....We will continue our review of this matter in regard to alleged past incidents of interference...."

Finally, the K7IJ repeater system in California (see "Grizzly Peak: The FCC's Line in the Sand," in our May issue) was allowed back on the air under the strict terms of an agreement worked out between the licensee and the FCC.

Vanity Callsign Fee Up $1

The FCC has increased the cost of applying for a vanity callsign from $13 to $14, effective September 10, according to the ARRL. The commission's fiscal year 1999 fee schedule shows the cost of processing a vanity application to be $1.42 per year, which works out to $14.20 for a 10-year license term and is then rounded down to $14.00.

Storm Chasers Adopt 146.55

"Newsline" reports that storm chasers and severe weather spotters who use ham radio to stay in touch with each other have agreed to use a single, nationwide, simplex frequency—146.550 MHz—during severe weather events. This does not affect ongoing severe weather nets, such as Skywarn operations, which use repeaters rather than simplex for communication. For more information, visit Steve Miller, KC5TRR's, Web site at <http://www.hamsnet.net/kc5trr>.

NIH: No Proven Cancer Threat from Power Lines

There is "little confirmable documentation" to make any valid connection between the electromagnetic fields (EMFs) around power lines and cancer, according to the National Institute of Health. According to "Newsline," the June 15 report said six years of research had failed to identify a direct link between EMFs and cancer. However, it said research is continuing, and that efforts to limit EMF exposure should continue.

Two 2-Meter Transatlantic Attempts

Groups of hams on both sides of the Atlantic were planning efforts this summer to make the first transatlantic contacts on 2 meters. The Radio Amateurs of Canada (RAC) reported that a group of Canadian hams led by Paul Piercey, VO1HE, would be operating as VO1AA from Cabot Tower, in Newfoundland, where Marconi received the first transatlantic signals on any frequency in 1901. They would be trying to contact a group of Scottish amateurs, led by Bill Ward, GMØICF, operating as 2SØICF/P, from Ardnamurchan Lighthouse, at the most westerly point on the mainland British Isles, between June 26 and July 4.

Meanwhile, a group of hams in New Jersey, led by Vince Biancomano, WB2EZG, was planning to attempt contact on June 23 with Paolo Gomes, CT1FOH, in Portugal, also on 2 meters. The announcement from WB2EZG did not indicate exactly where either station would be operating.

At stake is the Waterford crystal Brendan Trophy, offered by the Irish Radio Transmitting Society to the first two stations that make direct contact across the Atlantic on 2 meters (satellite and moonbounce contacts don't count). At press time, there were no reports of results from any of the groups. ■

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.*

Biased Reporting?

Dear *CQ VHF*:

I have just finished reading the article by Bob Josuweit entitled "Ham Radio in the Balkans," in the July issue. All after "Outside the War Zone" is a rather good report on ham radio in Slovenia. However, the section entitled "In the War Zone" leaves much to be desired.

Reports are attributed to unnamed amateurs and to unnamed Web sites that cannot be verified, yet are presented as fact. The statements about hams monitoring aircraft and command & control communication are, to me, suspect. Friends in the military and at NSA (the National Security Agency) tell me that all such communications are encrypted. I have no reason to doubt them. I am of the opinion that the supposed transmissions reported in the article are fabrications.

Of even greater concern to me is the blatant anti-NATO and anti-U.S. sentiment that pervades the article. I have always admired CQ publications for keeping a non-political perspective in articles, but this one falls far short of that standard. The article clearly ignores that the Serbian campaign of murder, rape, and pillage upon the Kosovo Albanians has proceeded with little or no protest from the "innocent" Serb civilian population. The news coverage has been full of footage showing unbridled support for the Serb government.

When a country commits acts such as the Serbs have committed with the tacit approval of the population, that civilian population places itself at risk when other nations act to end those acts. The pleas of German civilians during and after World War II that they were ignorant and innocent of Nazi atrocities fell on deaf ears. But then again, this is a new world—countries are no longer held accountable for the acts of their leaders and governments.

I sincerely hope this article is an aberration and not an indication that CQ or *CQ VHF* is taking sides in world conflicts where hams are affected.

Lon Kinley, N3ZKP
Baltimore, Maryland

WA3PZO responds:

Lon—Thanks for your comments. In response: As the article states, we chose not to report the identities of those involved, out of concern for their safety. Every piece of information can be attributed to a person or Web site. When we were suspect of the information reported on one Web site, we clearly indicated that.

The reports of Yugoslav hams monitoring NATO air communications were confirmed by the Pentagon at a daily press briefing in May. I consider this to be an official source of military information. See my August column for the exact quote. We also reported in August that some do not believe this to be the case. But I have first-hand accounts from hams in the Balkans that they *did* monitor NATO aircraft.

As for our alleged anti-NATO and anti-U.S. sentiment, we cover ham radio and activities of ham radio operators serving in the public interest, even when it may not be in *our* best interest. This is part of the story. If you want to know about other aspects of the story, there are other news sources available. The article covers amateur radio activity on both sides and provides the reader with all of the information that was available at deadline. There are only three sentences that could be considered anti-NATO. Considering that it's a direct quote, that's not much out of a four-page story.

You say that the atrocities committed by the Serbian government have "the tacit approval of the population." You apparently are not aware that not all of Yugoslavia supports the current government. In fact, one province may seek independence and was not a main target of NATO bombing.

We are not taking sides in this conflict. As I stated before, the reporting is accurate. Accurate reporting does not mean that you like what you read. As you saw in my August column, and in this month's update, I'll continue to report the news as it becomes available. It may be a different concept, but I don't see any difference between a ham reporting severe weather which may cause severe damage and a ham in a war zone reporting on bombing runs that may cause severe damage. Both are serving *their* government and *their* people in *their* public interest.

I appreciate your input and hope that you will keep an open mind to the work of the hams and possibly reflect on what we as amateurs would do in this country if *we* came under attack and had to serve during times of war. After working on this story for several months, and having played a key role in the use of ham radio with NDMS (the National Disaster Medical Service) during the Gulf War, I'm convinced that we would be doing the same thing.

See this month's "Line of Sight" for additional comments from W2VU.

Thanks for 222 Articles

Dear *CQ VHF*:

I just received my July issue of *CQ VHF* and am glad to see some articles on the 1.35-centimeter band (222 to 225 MHz). I hope you will continue to publish more in the future, plus include information on 33 centimeters, 23 centimeters, and higher bands. I think there is great potential for amateur radio on some of the higher UHF frequencies to provide high-speed data or multi-media (FSTV) capabilities. I am especially interested in the amount of activity and propagation characteristics of each band. Your most recent articles highlighted some points I wasn't aware of with 1.35 centimeters.

I was active on the 1.35-centimeter band from 1987 until 1994, when I noticed activity had really started to drop off in my area (southern New Hampshire/eastern Massachusetts). What got me involved in 1.35-centimeter FM to begin with was Novice Enhancement. When the

(Continued on page 52)

CQ VHF Ham Radio Above 50 MHz

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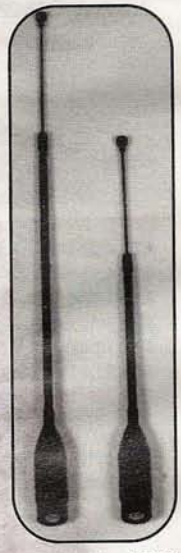
Product Update

New Antenna Products from MFJ

MFJ has introduced several new VHF/UHF antennas, ranging from extendible "rubber ducks" for HTs to high-gain base/repeater antennas. The MFJ-1816 and 1817 combine extendibility and flexibility in a single HT "duck" antenna. The 1816 extends from 6 inches to 8-1/2 inches, while the 1817 extends to 14-1/2 inches. Both antennas are designed for dual-band use on 2 meters and 70 centimeters, and the 1817 will also receive well on 900 MHz.

For repeater and base station operation, MFJ has introduced its line of six different vertical "Pulsar" antennas for FM use. Three of the six models are dual-banders, covering 2 meters and 70 centimeters. One covers 2 meters only, one adds 6 meters to the 2-meter/70-centimeter configuration, and one covers 2 meters, 70 centimeters, and 23 centimeters (1.2 GHz).



Prices range from $89.95 to $189.95. For more information or your nearest dealer, contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; Phone: (601) 323-5869; Fax: (601) 323-6551.

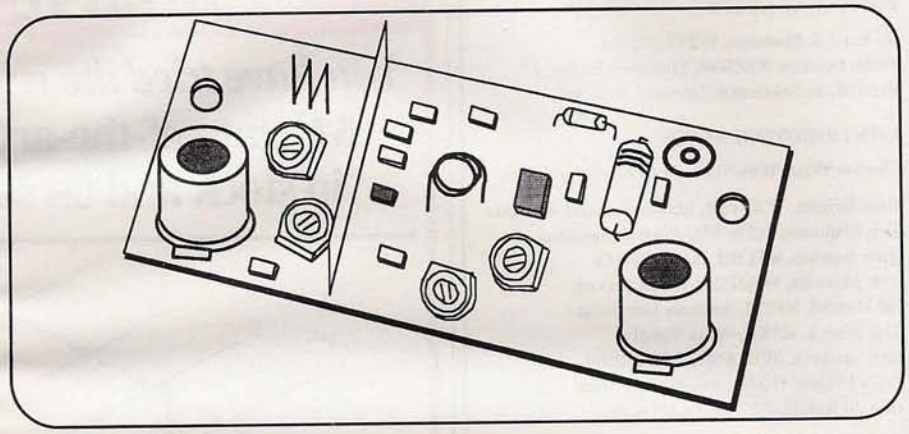
Circle 100 on reader service card

Hamtronics Low-Noise Receiver Preamps

Hamtronics has been making VHF/UHF preamplifiers for over 30 years, and its new LNY series is its latest refinement. Designed to mount inside an equipment cabinet next to a receiver board, the preamps feature a low-noise MOSFET amplifier chip with built-in diode protection and very low feedback capacitance.

LNY preamps are $29 each and are available for all popular ham bands between 28 and 470 MHz.

For more details, you can view their entire catalog at their Web site, <http://www.hamtronics.com>, or you may request a printed catalog. Write to 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.



Two New Books from K4IPV

Solid State Amplifiers provides a solid foundation in the subject of amplifiers and examines transistor-type amplifiers, including bipolar NPN/PNP, junction field effect, and MOSFET. This book emphasizes the practical end of amplifier technology, with topics such as small-signal RF amplifiers, solid-state parametric amplifiers, monolithic microwave integrated circuits (MMICs), troubleshooting solid-state amplifiers, and selecting replacement parts. By Joseph J. Carr, $29.95 (plus s/h); 352 pages; Sams# 61192; size: 7-3/8 x 9-1/4 inches.

In *RadioScience Observing, Volume 2*, Joe Carr expands on his Volume 1 with all-new material, covering techniques and methods, hardware design and construction, more RadioScience theory, and, in response to numerous questions and requests, related geo-science and planetary science activities. Discussions will be more skill-oriented and the design and construction more specific, building on the material presented in Volume 1. A CD-ROM with all new material will be included, enabling readers to actually experience the thrills of "listening to the heavens." This book features a special chapter written by Dr. Paul Shuch of the SETI League. By Joseph J. Carr, $34.95 (plus s/h); 336 pages; Sams# 61172; size: 7-3/8 x 9-1/4 inches.

For more information, contact Prompt® Publications, a division of Howard W. Sams, at (800) 428-SAMS.

Largest Amateur Radio Class Ever?

"Ham Radio 101" is a radio program being aired over WGTG shortwave and has the potential of being the largest ham radio class ever assembled! The show is hosted by Bill Lauterbach, WA8MEA of Hanover, Michigan, who owns DWM Communications, a small ham and shortwave manufacturer/retailer in Jackson, Michigan. He and station owner Dave Frantz, WA4SZE, developed this over-the-air license course for the U.S. Novice and Technician class licenses. Students will need to purchase a textbook, Gordon West's *Technician No-Code Plus*, which is available at any RadioShack store (Catalog #62-2426).

Because shortwave times and frequencies are constantly changing, it's best to keep up with the schedule of the program by visiting Bill's Web site and clicking the "Ham Radio 101" icon. The tentative schedule is Monday through Friday, from 7 to 7:30 p.m. Eastern time (2300 to 2330 UTC, summers; 0000 to 0030 UTC, winters) on 6.890 MHz, upper sideband.

The programs are pre-recorded and rotated so that people who are new listeners can "catch-up" with past programs. New programs are added to the rotation every week.

For further information about "Ham Radio 101," please visit Dave's Web site

at <http://www.erols.com/imageinn/dwm>: E-mail: <tinytenna@hotmail.com>; Phone: (517) 563-9022.

MSDSP for Windows

In response to popular demand, there is now a Windows® version of MSDSP, software for high-speed CW (HSCW) meteor scatter communications. This shareware product, "WinMSDSP 2000," has just been released by author 9A4GL who first introduced MSDSP as a DOS application in 1997. The new version of MSDSP supports speeds up to 20,000 LPM (letters per minute), although realities of modern radios may limit maximum speeds to lesser rates. The new application includes a CW-decode feature which will be of interest to amateurs not proficient in fast CW.

The application is a true 32-bit Windows application which employs the latest Microsoft DirectX technology to achieve high performance with virtually any sound card which Windows supports. WinMSDSP 2000 operates under both Windows 95 and Windows 98 and will operate under Windows NT as soon as contemporary DirectX support is available in NT.

A demo version of the program may be downloaded from the author's Web site at <http://ham2.irb.hr/9a4gl>, or from VE5UF's Web site at <http://www3.sk.sympatico.ca/freed/projects/9A4GL>. Download the file "WinMSDSP2000_160699.exe." The manual is also on-line at <http://www3..sk.sympatico.ca/freed/projects/9A4GL/manual/>.

Alinco DJ-V5T VHF+UHF HT with Wide Receive

Alinco USA has introduced the DJ-V5T, a compact handheld transceiver designed to operate on the 2-meter (144- to 148-MHz) and 70-centimeter (420- to 450-MHz) amateur bands. The new HT features alphanumeric display, up to 5 watts power output, 200 memories, expanded receive capability offering coverage from 76 to 999.995 MHz (cellular blocked), narrow and wide FM receive modes, and CTCSS encode and decode. The wide FM mode lets you tune in FM broadcast stations and listen with excellent fidelity. Additional features include four scan modes, five programmable scan banks, automatic internal temperature protection, cable cloning, SMA antenna connector, 13.8 VDC direct input, and input voltage display with overvoltage warning.

The manufacturer's suggested retail price for the DJ-V5T is $345 for the 5-watt output battery model (a 2-watt output model is $315). Some dealer "street" prices may be lower.

For more information, see your favorite Alinco dealer or contact Alinco, 438 Amapola Ave., Suite 130, Torrance, CA 90501; Phone: (310) 618-8616; Fax: (310) 618-8758.

Circle 102 on reader service card

ICOM Color Display IC-2800H Dual-Bander

You gotta see it to believe it...signal strength in grapes, plums, and cherries, plus a display that turns from megahertz to mega-view from any video input. It's the brand new ICOM IC-2800H 2-meter/440-MHz high-power, dual-band mobile.

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

The ICOM 2800 is a radio like many others...and, at the same time, a radio like none other.

On the surface, it's your typical high-power, dual-band FM mobile transceiver with 50 watts out on 2 meters and 35 watts on 440 MHz (Photo A). Each band will hold 99 memory channels, plus you get some additional channels on each band for scan edges, call channels, and search-find repeaters (more on that later). The 198 standard memory channels each hold regular or odd-split info, CTCSS encode and decode frequencies (you may store different transmit and receive tones), an eight-character alphanumeric memory channel name, scan-skip or hold settings, and full capabilities of all memory channels to be cloned from a personal computer with the optional cloning software and cloning cables from your local dealer.

The CTCSS split-tone feature could allow you to program in a different transmit tone and a different receive tone, with full decode squelch turned on, for certain repeaters that may offer different output tones depending on what "state" the repeater is in. For instance, a control operator could listen all night to a repeater on full decode squelch, and the only time a signal would come through on the 2800's separate receive tone is during autopatch, if that feature outputs a tone different from the input. Not many dual-band radios offer separate transmit and receive tone capabilities.

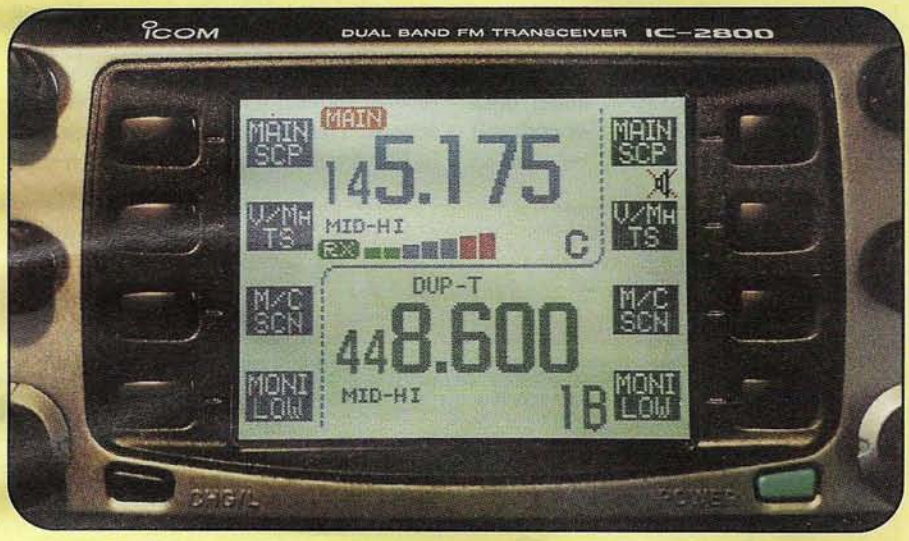


Photo A. The thin-film transistor LCD color display on the ICOM IC-2800 is clearly visible in just about any lighting condition (except direct sunlight), a major accomplishment for a color display. (WB6NOA photos)

Another squelch note: the 2800's "smart squelch" may also function as a 10-dB attenuator. When the correct menu is activated, the squelch dial will rotate into silence, and will then add in a "pad" of 0 to 10 dB as the squelch is rotated fully on. This feature, which I believe is a first in amateur FM equipment, can be quite helpful in reducing intermod in RF-rich environments.

The "search find repeaters" function scans repeater *input* frequencies (based on the scan edge frequencies you program in for repeater *inputs*), locks onto a signal, and displays both the transmit frequency and the frequency of the CTCSS tone (if any) on the signal. Press one button and the radio will switch to that repeater's output frequency, ready for

"And what a display—living color!...At first I was skeptical, but as soon as I took the radio out to the dash on my comm van, I could see that all but direct sunlight offered a good view of the screen."

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

Photo B. The "funky" display, complete with a grapes, plums, and cherries S-meter, is one of four display options you may select for the IC-2800.

you to join in on the QSO after the next break in transmission. Please note: this feature is *not* intended to be used for accessing closed repeater systems.

The 2800 is also 9600-bps packet ready. It connects directly to a packet modem from a separate rear jack. A 1200-bps TNC may also be connected to that jack or to the microphone connector.

Memory Editing

As I was beginning to program the memory channels, I found I liked the memory editing feature that allowed me to make changes without having to transfer the memory over to VFO, change things, and then re-memorize everything. This is particularly handy if you want to change memory alphanumeric names.

The mobile radio also has a band scope function that lets you look for activity 500 kHz up and down from a center frequency. The receiver mutes during the quick 1-MHz scan.

OK, so this is beginning to sound like just another neat mobile dual-band transceiver, huh? It gets better. On VHF, the receiver covers 118 MHz to 136 MHz in AM for hearing aircraft calls, and 136 MHz to 174 MHz in FM for public service, etc. On the UHF side, the receiver is capable of tuning from 320 MHz to 530 MHz, though the first production unit we had for U.S. distribution tuned only 430 MHz to 450 MHz. But my local

Photo C. Hams at the Casper, Wyoming, hamfest enjoyed looking at the IC-2800's color display, but had a variety of opinions on which display option they liked best.

"...the screen that was most fun of them all was something I've never seen before in a ham rig—the funky letters and numbers screens, including bar-graph S-meters, that come out in grapes, plums, and cherries!"

"mod" man tells me that UHF may be expanded, too, on receive only, by simply going into the radio and cutting the "W13" jumper on the main board. I tried it, and the modification expands receive coverage perfectly!

There's something else I like: separate volume, squelch, and channel-changing controls for each band, large enough and far enough apart that you can even change the settings with gloves on. No micro-controls here! There are also four buttons on each side of the display that may toggle up to eight different functions for each side, and the display tells you exactly what each button does as soon as you press it. Some you press quickly, and others you press and hold for more sub-functions.

The Main Event

And what a display—living color! That's right, a three-inch, thin-film transistor, color LCD that is indeed daylight viewable. At first I was a bit skeptical, but as soon as I took the radio out to the dash on my comm van, I could see that all but direct sunlight offered a good view of the screen.

And it gets better yet. There are four screen settings that can give you dark backgrounds and light-colored letters and numbers, or a light background with dark characters. But the screen that was most fun of them all was something I've never seen before in a ham rig—the funky letters and numbers screens, including bar-graph S-meters, that come out in grapes, plums, and cherries! (Photo B). When I did demos with the 2800 at the Casper, Wyoming, hamfest (Photo C), nearly everyone had a different idea on which of the four screens they liked best. But most amazing was how visible the screen was in a bright vehicle.

I've seen ham manufacturers try color LCD displays before, and they were so hard to see in the daylight that one manufacturer actually offered retrofit kits at

Photo D. The IC-2800 accepts a standard video input (via the yellow plug on right) to let you hook up a camera to keep watch on who's sleeping on the job or to monitor ATV images—but the unit itself does not transmit or receive video.

Photo E. This do-everything microphone is standard equipment with the IC-2800. See text for details of what you can control from the microphone (hint: nearly everything!).

no charge. But the thin-film transistor is a very bright display, and it worked fine for me on the dash.

The color LCD display can also take NTSC video input while the unit continues to work as a regular dual-band mobile (but it doesn't directly transmit or receive video). My first test of the video was with a micro-video TV camera I picked up at Dayton. I could use the camera as a back-up monitor, or run it inside the van and catch who was taking some ZZZs in the captain's chair (Photo D).

I also ran the 2800 on Field Day, using the screen to display fast-scan ATV images captured by a PC Electronics down-converter, and then switched by an MCM Electronics composite-to-separate-video box for an up-front display of what was out there on the airwaves. Later that night, I took the output from our camcorder and viewed all of the Field Day activities that I'd recorded, right on the screen of the 2800 while it was simultaneously hearing activity on 2 meters and 440 MHz. And finally, I tied in my GPS (Global Positioning System/APRS (Automatic Position Reporting System) mapping program, and this output could also display on the 2800 head in full color!

A Do-It-All Mic

It gets better yet! The microphone supplied with the 2800 is the full-function HM-98 back-lit mic with a removable button guard (Photo E). This is not an accessory mic you need to buy—it comes with the program! Features on the mic include up/down pushbuttons; push-to-talk big bar; VFO/lock switch; memory and call button; activity indicator; band toggle; function switches; function indicator; DTMF pads; squelch override; scanning; power output; duplex/simplex; volume control; memory dial; squelch level; and lock (there's probably more things I haven't discovered!).

And when you work the mic buttons, you often get an LCD readout of exactly what's happening and what percent of volume or squelch you have dialed in. The two big up-and-down mic buttons control frequency or channel changing.

"The color LCD display can also take NTSC video input while the unit continues to work as a regular dual-band mobile (but it doesn't directly transmit or receive video)."

Remote Control—NOT an Option

It continues to get better. The 2800 *is* remote-controlled. It's not an option; the head doesn't come off the radio. The head *is* off the radio, with a long remote-control cable included. ICOM has placed a ferrite core on the radio end of the cable to minimize any RF getting into the remote-control line.

And some very good news follow: I tried substituting over-the-counter 8-pin and 6-pin telephone cables for the provided 8-conductor mic extension cable and the 6-conductor remote head cable, and guess what? The phone cables work great! This allowed me to move the remote head and the "black box" (the rest of the radio) from one vehicle to another without having to change out the remote-control head and mic cables. If you're going to mount the black box transceiver in the trunk area of your vehicle (Photo F), you're going to need an extension mic cable, and the telephone cables available almost anywhere work just fine.

So where does the speaker audio come out? On the back of the remote head! And talk about loud audio—you probably won't need to run an external speaker off of the black box. Wherever you can see the head, you'll certainly hear the loud speaker within. The head comes with a mounting assembly that gives the speaker enough room to sound off coming out of the back. I temporarily used hook-and-loop fasteners to display the head, and still had plenty of audio out with the close spacing to the dashboard (Photo G).

Plus the Usual Features...

Like all modern dual-band radios, there were plenty of options for different

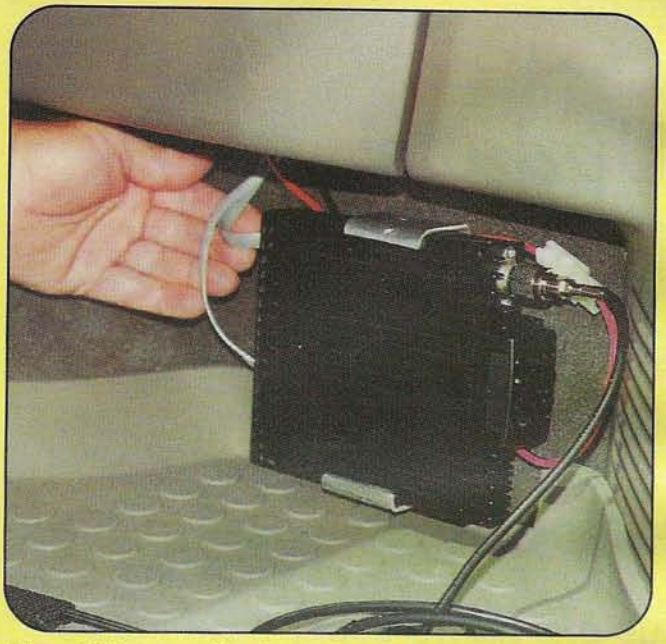


Photo F. The control head and transceiver body must be mounted separately (they don't clip together), and long control cords give you the flexibility to mount the radio "black box" in a convenient, out-of-the-way location.

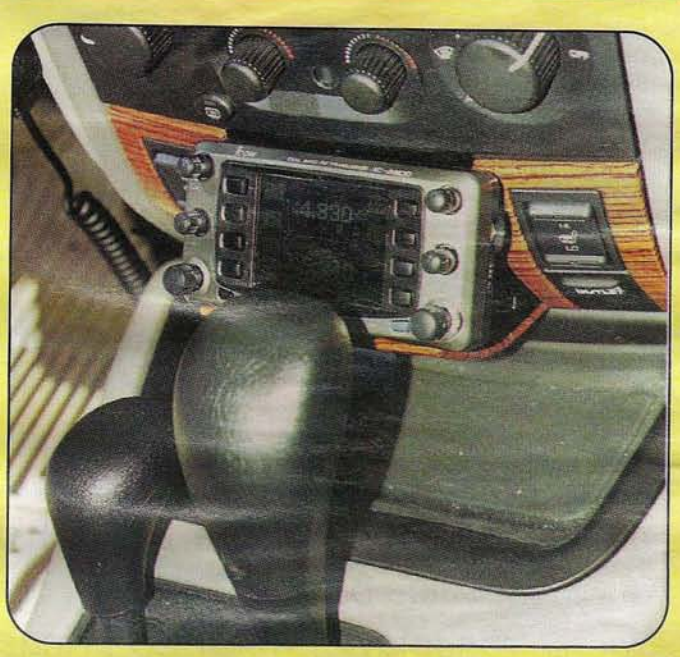


Photo G. The IC-2800's control head mounted easily to WB6NOA's dashboard with hook-and-loop fasteners, and there was no problem hearing the audio output from the speaker, which is located in the back of the control head.

scan types, scan edges, scratch pad memory, memory scan, scan skipping, and scan resume time adjustments. Oh, sure, there's also priority watch, beep on CTCSS receive, tone scan, and up to 14 DTMF number storage. And sure, you can even adjust all of the speeds for all of these different functions from additional menus that may be easily accessed by pushing and holding the display set button. There are 16 different set menus, including squelch delay, cooling fan running time, auto power off, subband mute, automatic RF attenuator, display brightness, display contrast, and even capabilities like punching in your own callsign so the radio comes up with your call on the screen when you turn it on (Photo H)!

Was it complicated to operate straight out of the box without reading the manual? Not with this radio—it was flown into the Casper hamfest, and I had it on the air about 20 minutes later with a good feel for how to run it through its paces.

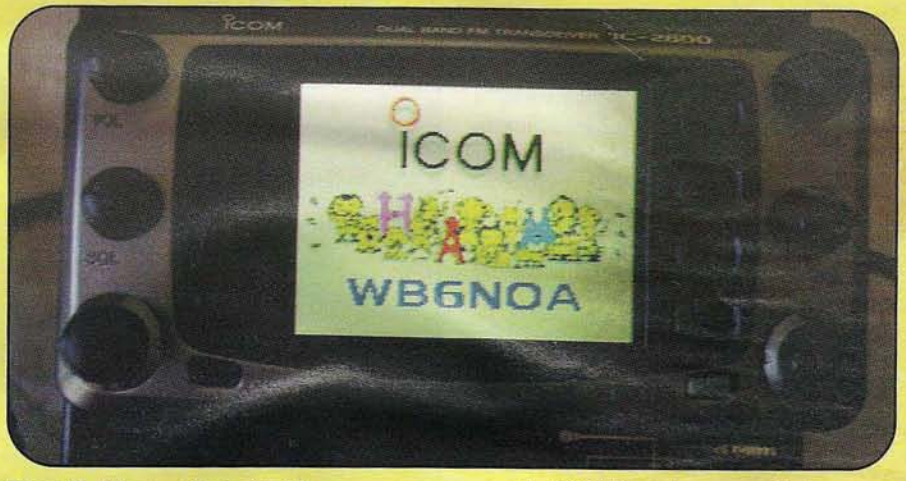


Photo H. Whose radio is this? You can even program the IC-2800 so that your callsign comes up on the screen whenever you turn on the unit! Should make it easier to identify it as yours if a question of ownership ever comes up.

You've Gotta SEE This Radio

But you gotta *see* the display to really appreciate what ICOM has done. Instead of trying to squeeze the last nit out of a common LCD display, ICOM is first with thin-film transistor (an extremely bright display that can even be seen in the sunlight). About the only thing they could have done to make the display better was to put in some sort of light sensor to automatically increase brightness during the day and to pull down the intensity at night. But with just a couple of pushbuttons, this is easily done without having to read the instruction book.

Of course, you *should* read the manual. And, like all ICOM products, the instruction book is well written, with plenty of examples and descriptive pictures, leaving nothing to be figured out on your own...other than where you're going to use it to appreciate the color thin-film transistor display, and how to tell your better half about the approximately $550-dent it's going to put in your pocketbook! But you gotta see it to believe it! ■

"It continues to get better. The 2800 is remote-controlled. It's not an option; the head doesn't come off the radio. The head is off the radio, with a long remote-control cable included."

Balkans Update: The Bombing Has Stopped... Now What?

One of ham radio's greatest values is that it lets "just plain folks" communicate one-on-one, even when their governments are at odds. As we continue our series of special reports on ham radio in and around Yugoslavia, WA3PZO brings us one ham's story from inside the war zone.

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

For the past few months, *CQ VHF* has been keeping in contact with a ham radio operator in Montenegro, one of two Yugoslav republics (the other is Serbia, which includes the province of Kosovo). Our first contact was shortly after the NATO bombing campaign in Yugoslavia began. At the time, we were told we would not be able to maintain contact with each other since our countries were at war. But he said he would be back in touch "when all this madness is over (if I survive)." Our thoughts were with a fellow ham radio operator as the war continued.

Throughout our reporting, we have kept all our contact in the Balkans confidential to prevent any harm from coming to him. Shortly after the bombing stopped in June, we reestablished contact. Now, having received permission to identify our contact and tell his story, we bring you the story of one ham radio operator living in the danger zone.

Map. Montenegro is in the southern part of Yugoslavia, on the coast of the Adriatic Sea. Squeezed between Bosnia-Herzegovina, Croatia, and Kosovo, its residents have witnessed more than their share of warfare over the past decade. (CIA map)

Introducing Montenegro

Montenegro is situated on the coast of the Adriatic Sea (see Map). Before Yugoslavia split up and engaged in a decade of civil wars, Montenegro had a population of 650,000 people. Now, there are some 30,000 refugees there from the wars in Bosnia and Croatia, as well as 100,000 Albanian refugees from Kosovo (about 20% of the population); and, in the few days since the arrival of NATO troops, a large number of Serb refugees from Kosovo arrived in Montenegro as well.

Montenegro can be divided in three geographical areas. The northern part is mainly a mountainous region with crystal clear lakes, deep woods, and high peaks. All of the big towns and factories

**Bob Josuweit, WA3PZO, is CQ VHF's public service and emergency communications editor.*

Photo A. Dejan Tusup, YT6DTM, spends time with friends in the mountains. (Photo courtesy YT6DTM)

"Some of my friends from the west can't believe me when I tell them that nobody in my country pays any attention if they hear shooting or explosions."—YT6DTM

are in the central region, as are the capital of Cetinje and the main city of Podgorica. Some 70% of the population lives here. The third region is the southern part of the country, along the Adriatic coast. It is a tourist area with beautiful beaches, caves, old towers, relics of sunken ships, clean sea, and a lot of sun. Mount Orjen—at1896 meters, the highest peak on the eastern Adriatic shore—attracts skiers from November to May, while the beaches beckon tourists from May to October.

Let's Meet Our Guest

Dejan Tusup, YT6DTM (Photo A), is 26 years old and studies economics at the University of Montenegro. He lives in Herceg Novi (Photo B), in southern Montenegro, on the Adriatic coast, along the bay of Boka Kotorska. At the moment, he is active on 2 meters, 70 centimeters, and packet radio, but hopes to be active soon on HF as well. His local radio club, YU6KOP, is active on all bands. Herceg Novi is only 20 kilometers (15 miles) from Mt. Orjen, and Dejan is also a member of mountaineering club "Subra" from Herceg Novi.

"Mountains are my big love," says Dejan, "and I try to spend as much of my free time in nature as I can. In Subra, we try to work especially with young people, because with the sea near a city like ours, it is unlikely that you want to be a climber (water polo player is more likely)."

The political situation in Montenegro is much more complex than you might gather from news reports. Here's our guest's explanation:

There are two sides. On one side there is the SNP party, Milosevic's puppets in Montenegro, supported by about 40% of the population, mostly from the northern region near the border with Serbia (a mountain region, and the people there are very poor and uneducated). SNP, together with Milosevic's SPS party from Serbia, controls the army. On the other side is the coalition of all other parties in Montenegro (Montenegrin, Serb, and Albanian), which controls civilian government in Montenegro and the police. This group is supported by some 60% of the people, mostly from the big cities in the central region and the south. The two sides disagree with each other.

Well, you can't talk about democracy with a dictator. Milosevic was prepared to use the army to break down opposition to his regime in Montenegro (about 20,000 troops). Our government, together with our President (who is a leader of the biggest party in our government, DPS), raised the number of police from about 3,000 to about 15,000. For a few days, it looked as if there would be civil war. But then a voice was raised from the frightened people, "don't do that, we are all brothers, we are all the same people." So, the situation now is calmed, but no one knows what that man from Belgrade will do next.

Angry and Confused

Dejan and his family are OK following the war. I didn't hear from Dejan immediately because he was in Podgorica, Montenegro's main city. Dejan picks up the story.

I couldn't send you an e-mail after your first message, because I was in Podgorica, main city of Montenegro, to see my friend and his family. He lives in Podgorica, but his parents live in Kosovo, and escaped from there, because KLA terrorists are murdering all non-Albanian people in Kosovo (Serbs, Montenegrins, Gypsies, Muslims, etc.), now that the Serb army is no longer there. We Montenegrins received about 100,000 Albanian refugees during this war, and now KLA terrorists (not ordinary Albanians, but KLA—Albanian nationalists) are forcing Montenegrins out of Kosovo, just because we are Orthodox Christians, like Serbs; and Gypsies and Muslims, just because they were loyal to the regime in Belgrade. Sorry about this, but I am very angry and confused, because I think that it is wrong to hate someone just because he is different.

For accepting all of the refugees into Montenegro, Dejan says, "NATO bombed us. That is what we got for being against...Milosevic and his regime in Serbia, and helping refugees of all nationalities...and trying to build democracy in our country."

A Decade of Warfare

Dejan has literally grown up in an atmosphere of nearly constant warfare—a situation so common to him that gunfire and bombing are everyday events.

When I first went to the university, back in 1992, the war in Croatia was in its second year. The border with Croatia is about 10 miles from where I live; I can see Croat territory from my balcony. Some of my friends died or got wounded in that war. Later came war in Bosnia, and the border with Bosnia is some 20 miles from my city. Now, there is war in Kosovo, on the northern part of Montenegro border with Serbia [Kosovo]. I have gotten used to the war, after 10 years of it. Some of my friends from the west can't believe me when I tell them that *nobody* in my country pays any attention if they hear shooting or explosions. They say, "you won't hear the bomb that is going to kill you," and that is true. I am lucky because I am a student and, by law, I don't have to go to the army until I graduate (now you know why I am still a student).

Did Hams Report on NATO Communications?

Over the past few months, several sources reported that ham radio operators in Yugoslavia were listening in on NATO aircraft communications during the conflict and reporting what they'd heard to their government (see July/August *CQ VHF*). I asked Dejan if this information was accurate. He replied,

It is true what that British reporter said, as I already told you, the military and government in former [Yugoslavia] for decades sponsored radio amateur clubs for the purpose of having educated people if they needed them. It is our obligation by law to give any information to army and [government] officials. It is very simple to find NATO (132.450 kHz AM, etc.) if you want to!

While in Podgorica, Dejan passed one of his college exams. He now only has three more exams to take, but he says,

Many of my friends are still in army reserve units, so it is too soon to think about our hobby,

Photo B. Dejan lives in the scenic town of Herceg-Novi, right on the Adriatic seacoast. (YT6DTM photo)

because the political situation is still very unstable. We are afraid that the regime in Belgrade will try to punish us for being against them (they control the army), and I think that my country will seek independence (the Yugoslav constitution gives us that right) if the regime in Belgrade survives. Sadly, now when the bombing is over, troubles for Montenegro are just starting.

Happier Subjects

I asked Dejan to tell us a little about ham radio in Montenegro, and he was happy to oblige.

What can I tell you about our hobby in Montenegro? Well, before all these wars, we had two main repeaters on the 2-meter band. They were R3 and R4 linked and covered 80% of the territory (*European repeater channels are labeled R0, R1, etc., on 2 meters, and RU1, etc. on 70 centimeters—ed.*). The main RU3 repeater is on the 70-centimeter band, and there were local R6, R5, and two R0 repeaters in various cities in Montenegro. On packet radio, there were two main digipeaters linked, also covering 80% of the territory and serving as a gateway between the Italian and eastern European packet networks. Every city had at least one radio club, active in all radio amateur activities. The State financed the clubs because we were useful in civilian protection and with the army (our emergency network). A lot of young people gathered in clubs (I met my girlfriend there; she even has a higher class license—KT, Morse—than I do).

No Rig, No Callsign

My girlfriend is a refugee from Croatia, so she does not have the money to buy a rig, and in my country, no rig means no callsign. So, she can only work from the club and under the club callsign. I wanted to give her one of my rigs, but she is too proud to accept something so expensive from me (she said that she does not want it, but I know the real reason). Her name is Biljana. She is half Serb (father), half Croat (mother). I am half Serb (father), half Montenegrin (mother). Before 1990, I didn't even know what nationality meant.

Now, only one main repeater—the R3—is functioning. The digipeaters were destroyed because of their possible use in espionage. The local repeaters survived, but the clubs are "dead." There is no money from the state, no new equipment, no money for the bills. Young people are interested only in surviving. Plus, a person's pay has dropped from an average of $800USD in 1990 to $10 USD in 1993 (a period of astronomic inflation) and about $150 now.

Just before the war started, we were preparing to repair one damaged main repeater and its link, and to put a TNC on the same mountain to serve as a packet node until we find money for a real node with a BBS and links to Serbian, Italian, and Croat networks (some $2,500). My club has a local repeater here in my city on the 2-meter band, and there are three more clubs in my city. Sadly, most of the members are inactive because of the wars.

Even if you have equipment, operating can be difficult. Mobile telephony is destroying work on the UHF band. Also, a lot of equipment is set up around my country (mostly in Albania) for NATO communication—radio telephones, spying, and antimilitary communication devices—making work in the radio amateur bands almost impossible because of interference. But I am optimistic, once the political situation is calmed, that radio amateurism will "rise again." My friends and I, a small group of "fanatics," must then start almost from nothing.

Dejan asked about ham radio activity in the Philadelphia area, where I live. I described repeaters on every 2-meter and 440-MHz frequency pair, and indicated that there are many clubs in the area. He replied:

It is very simple to have such a network in a rich country like the U.S. I have some $1,000 worth of equipment, and that is someone's six-month pay here. But that does not stop me! I am a chief of my club's station in my mountaineering club (callsign YU6ARS—"Amateur Radio Station"). We have a station in a local high school, too. My friend, YZ6TVM, is the president of the club.

In Yugoslavia, club stations have YU prefixes, and a personal callsign starts with YT, YZ, or 4N. Serbia is 1, Montenegro is 6, and the regions of Vojvodina and Kosovo are 7 and 8, respectively. Slovenia, Bosnia, Croatia, and Macedonia were 3, 4, 2, and 5 in the former Yugoslavia.

Dejan wants to learn more about amateur radio and clubs in the U.S. He has visited the *CQ VHF* Web site and many others. He hopes that the clubs in his country can be rebuilt.

Looking to the Future

We'll close with one more quote from YT6DTM, looking at his own future and that of his country:

I wish to you and to your great-grand children never to be in a situation like I am. I wouldn't wish it to the worst enemy. But I hope things will be better. Half of my friends from high school are now living in the West, in the U.S., Canada, U.K., Italy, or Australia. If the situation continues like this, I will go, too, at the same moment when I finish my studies. I speak Italian and English, so I will probably go to Italy; I have many friends there. This country will soon be without educated youth, if situation goes on like this.

"But I am optimistic, once the political situation is calmed, that radio amateurism will 'rise again.' My friends and I...must then start almost from nothing."—YT6DTM

We'll continue to help Dejan as best we can. Although it would seem to be very easy to send over a packet TNC or other piece of gear, postal mail could not be sent to Serbia or Montenegro at the time this was written, and President Clinton had just said that any U.S. assistance to Yugoslavia would be limited to humanitarian aid, as long as Slobodan Milosevic remains in power.

Keep watching the news and we'll do our best to keep you updated on the amateur radio situation in this war-torn part of our world. ■

"It is our obligation by law to give any information to army and [government] officials. It is very simple to find NATO (132.450 kHz AM, etc.) if you want to!"—YT6DTM

Resources

Interested in learning more about Montenegro? Dejan suggests the following Web sites:

<http://www.montenegro.com> and <http://www.montenet.org>.

If you want some information about the Internet in Montenegro, Dajan's Internet provider, <http://www.cg.yu>, is linked via satellite directly to the eastern U.S.

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☐ ARRL Handbook CD Version 1.0	~~$49.95~~	**$10.00**
☐ Gordon West Advanced Class License Manual (effective 1/1/95-6/30/99)	~~$11.95~~	**$5.95**
☐ Novice Antenna Notebook by Doug DeMaw, W1FB	~~$10.00~~	**$5.00**
☐ Gordon West's 10 to 28 wpm CW Speed Builder (6 tape set)	~~$29.95~~	**$14.95**
☐ Cynthia Wall Children's Novels	~~$5.95~~	**$3.00**

☐ Firewatch ☐ Disappearing Act ☐ Night Signals
☐ Easy Target ☐ Hostage in the Woods

☐ Low Profile Amateur Radio, by Jim Kearman, KR1S	~~$8.00~~	**$4.00**
☐ Beam Antenna Handbook, by Orr & Cowan	~~$11.95~~	**$5.95**
☐ Your Ham Antenna Companion, by Paul Danzer, N1II	~~$10.00~~	**$5.00**
☐ Getting on Track with APRS, by Stan Horzepa, WA1LOU	~~$14.95~~	**$6.95**
☐ Your HF Digital Companion, by Steve Ford, WB8IMY	~~$10.00~~	**$5.00**
☐ ARRL Antenna Compendium, Volume 1	~~$10.00~~	**$5.00**
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☐ ARRL Antenna Compendium, Volume 3	~~$14.00~~	**$7.00**
☐ ARRL Antenna Compendium, Volume 4 (with Disc)	~~$20.00~~	**$10.00**
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☐ Radio Amateur CAllbook CD-ROM 1998	~~$49.95~~	**$10.00**

☐ Personal Computers in the Ham Shack, by Paul Danzer, N1II & Richard Roznoy, K1OF	~~$15.95~~	**$7.95**
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Which Is REALLY Better? AM, FM, or SSB?

Is SSB really better than FM? And what about AM, a mode that's enjoying a resurgence in popularity? To look for answers—and do a science fair project—KCØAMO compared all three modes in a controlled setting. Some of the results may surprise you.

By Sara Witte, KCØAMO* (kc0amo@bigfoot.com) and
Bob Witte, KBØCY** (kb0cy@arrl.net)

We use many types of modulation in amateur radio communication, each with its advantages and disadvantages. Have you ever wondered why most VHF operation uses FM, but weak-signal voice work employs SSB? How much of an advantage does SSB have over FM in actual use? And what about AM? While not very common on the ham bands today, AM still gets used. How do these modulation schemes stack up? These questions resulted in a Science Fair project involving an on-the-air comparison of modulation types.[1]

Modulation Types

For this experiment, we used three of the most common types of radio signal modulation: amplitude modulation (AM), single sideband (SSB) and frequency modulation (FM). Modulation basically means change, so each type of modulation changes the carrier of the radio signal in a different way (see Table 1). We won't go into great detail here on the technical aspects of the modulation types, since other articles have done a good job in this area. The recent *CQ VHF* article by Dave Ingram[2] is a good reference that gives more technical background (also see "References" at the end of this article).

The Experiment

The basic idea of this experiment was to check the effectiveness of each type of modulation with varying signal levels under real operating conditions. The experimental method was to use two amateur radio stations on the 2-meter band, one set up as a transmitting station and the other as the receiving station. The receiving station consisted of an ICOM IC-R7100 communications receiver mounted in a vehicle with a quarter-wave magnetic mount antenna on the roof (Photo A). The transmitting station was located at our house and consisted of a Yaesu FT-847 all-mode transceiver (Photo B), hooked up to an MFJ-1740 quarter-wave antenna mounted on the front porch (Photo C).

We chose the 2-meter band for the experiment for several reasons. All-mode equipment was available for the band, antenna size was reasonable, and unusual propagation (band opening) was not likely to interfere with the test. A lightly populated frequency in the lower portion of the band (144.260 MHz) was used to minimize any interference with ongoing ham operations. With this approach, we were able to use the same transmitter, receiver, and antenna, all on the same frequency, with varying transmit power and modulation type.

Photo A. Co-author Sara Witte, KCØAMO, records the readability of the received signal during the comparison tests. The receive station consisted of an ICOM IC-R7100 communications receiver and a quarter-wave vertical antenna mounted on the roof. (Photo by Joyce Witte)

One major challenge in the experiment was to accurately control the transmit power level. The FT-847 output could be varied from 2 watts to 20 watts on all

**Sara Witte, KCØAMO, a sophomore at Lewis-Palmer High School in Monument, Colorado, has been a ham since 1997. She has participated in the regional science fair for the past three years.*

*** Bob Witte, KBØCY, has been licensed since 1977. He enjoys a variety of VHF-plus operating, is an electrical engineer, and the author of two books on electronic test equipment. And, he's Sara's father.*

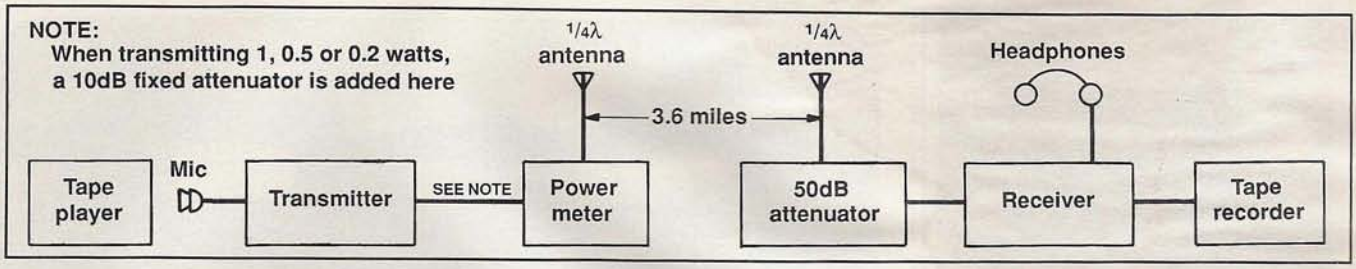

Figure 1. This block diagram shows how the transmitting and receiving stations were set up for the experiment.

modes on the 2-meter band.[3] Ideally, we'd have a wider range of output power level available to test a wider range of variation in signal strength at the receiver. To increase the range of output power available, a 10-dB fixed attenuator was inserted at the transmitter output to reduce the minimum power from 2 watts down to 0.2 watts. Ten decibels happens to correspond to a factor of 10 in power, so to get a transmit power of 0.2 watts with the attenuator installed, the transmitter was set on 2 watts output. Ultimately, seven different power levels were chosen: 20, 10, 5, 2, 1, 0.5, and 0.2 watts, with the 10-dB attenuator used to achieve the 1-watt, 0.5-watt, and 0.2-watt output levels. The output power of the transmitter was monitored using a Diamond SX-600 SWR/power meter (Photo B).

Line-of-Sight Propagation

Another challenge concerning the signal level arose as the experiment continued. With the receiving station and transmitting station within each other's line of sight, the signal levels were quite strong even when the transmit power was only 0.2 watts. This, of course, is the nature of VHF propagation—good signal levels exist when you have line of sight.

Since we wanted to test the limits of the modulation techniques, we would need much smaller signals at the receive station. One way to increase the signal loss was to simply move the receiving station beyond line of sight with the transmitting station. However, this had the potential problem of not having consistent propagation between the two sites. Any variation in the beyond-the-horizon path between the two sites could cause the test results to vary. Instead, we chose to keep the stations some distance apart while still maintaining line-of-sight propagation. To simulate a longer distance while still having a reliable propagation path, we placed an additional attenuator in series with the receiving station's antenna coax. This provided lower signal levels at the receiver without requiring a greater physical distance from the transmitter. The real world nature of the test was preserved since typical radio equipment and on-the-air transmissions were used.

The receiving station (Photo A) was positioned 3.6 miles away from the transmitting station. One station could be seen from the other with binoculars, confirming line-of-sight propagation. The attenuator at the receiver was set to 50 decibels, simulating the loss of signal associated with long distance between transmitter and receiver. We determined this attenuation setting experimentally through a series of test transmissions. We made sure the signals were easily readable on the highest transmit power level, while, at the lowest power setting, the signals were very weak at the receiver. Figure 1 shows the basic setup of the two stations in block diagram form.

Test Transmissions

To maintain consistency between transmissions, a standard 30-second test message was recorded on audio tape and was played back into the transceiver's microphone while transmitting. The message said, "*This is amateur radio station Kilo Charlie Zero Alpha Mike Oscar. This is a test message. Testing one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty. End of transmission.*"

Another major issue in designing the experiment was deciding how to measure the clarity of the received signal. Again, with the aim of having this be a "real world" analysis, the **Readability** scale from the standard RST system was used for rating the received signal quality (Table 2). The S-meter on the radio would normally have been used for measuring signal strength, but the signal levels were generally very weak in this test (1 S-unit or less), making S-meter use impractical.

The readability of the signal was judged and recorded by an amateur operator monitoring the received signal using headphones to limit any outside influence. This does introduce the element of human judgment and human error into the experiment, and, while a piece of test equipment might have been a more objective judge, the intent was to make this as "real world" as possible while maintaining scientific integrity. To min-

Table 1. Basic Differences between Common Types of Modulation

Modulation Type	Basic Characteristic
AM (Amplitude Modulation)	Modulation that changes the amplitude of a radio signal.
SSB (Single-Sideband)	A form of amplitude modulation that uses only one sideband.
FM (Frequency Modulation)	Modulation that changes the frequency of the radio signal.

Table 1. AM, FM, and SSB are the most common types of voice modulation used by hams. This table shows the basic differences between them.

On the Cover

"Everyone is equal out there, on the air, because you can't see each other. Everyone's the same." That's what 16-year-old Patrick Pepe, KB2WVG, of Wading River, New York, views as one of amateur radio's major benefits. A ham for four years, Patrick holds a Tech Plus license. He operates CW and SSB on HF with an old Heathkit "Hot Water 101" HW-101 transceiver, 6-meter single sideband with an MFJ-9406, and 2-meter and 70-centimeter FM with an ICOM IC-2350H dual-band mobile rig. He's also using an MFJ-906 antenna tuner and a Quantex 486 computer.

He credits his father, John, KB2VJR, with sparking his interest in ham radio. "He got his license about a year before I did," says Patrick, "and that just made me want to get into it, too." Patrick is starting his junior year in high school this fall and is interested in working toward a career in aeronautics, preferably as a commercial pilot or an aeronautical engineer. But he's keeping his options open.

Patrick says 6 meters is fast becoming his favorite band, and that he's already worked some 75 grids. "It's just amazing," he says, "that with that radio, with just 10 watts, that you can work so many stations, so far away, when the band opens....I've worked out to the west coast with that radio."

So if you're active on 6-meter SSB, keep your ears open for KB2WVG. Bonus: He's in the relatively rare (for 6 meters) grid square of FN30. What would Patrick tell other young people considering ham radio? "Definitely get into the hobby," he says. "It's a great hobby, it's a lot of fun. You get to meet a lot of people from all over." (Cover photo by Larry Mulvehill, WB2ZPI)

Photo B. The transmitting station consisted of a Yaesu FT-847 transceiver and a power meter to monitor the output power, which was varied to simulate varying distances and band conditions. (Photos B through D by Sara Witte)

Table 2. Readability Scale

1	Unreadable
2	An occasional word readable
3	Readable with considerable difficulty
4	Readable with practically no difficulty
5	Perfectly readable

Table 2. The "R" from the standard RST (Readability, Strength, and Tone) reporting system was used to create the Readability Scale. For an explanation of the entire RST system, see the CQ Amateur Radio Almanac, The ARRL Operating Manual, *or the ARRL Web site (see "References" for exact URL).*

imize the effects of the human observer, we used the same observer for all test transmissions and the experiment was repeated three times to check for repeatability. All transmissions were recorded on audio tape so they could be rechecked later, if necessary.

Experimental Results

The results of the experiment are plotted in Figure 2. At high power levels, all of the signals could be read. Basically, this is consistent with modulation theory—at high signal levels, all modulation

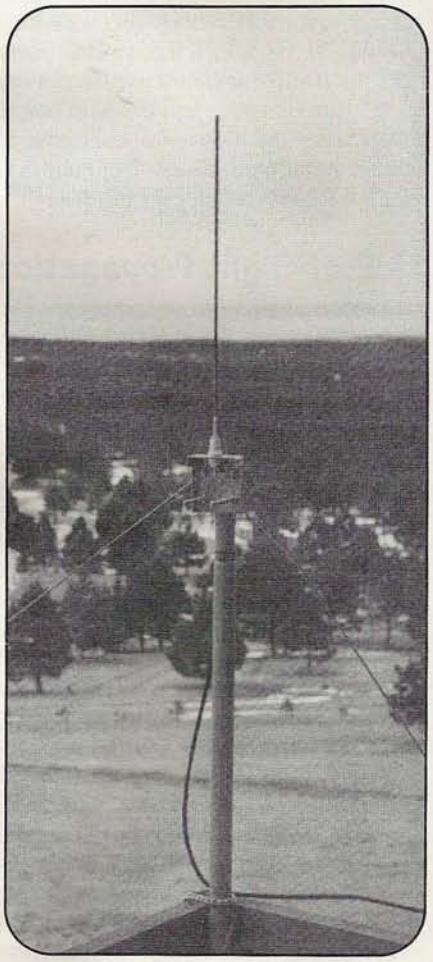

Photo C. The transmitting station used a quarter-wave ground plane antenna mounted in a fixed location. The same antenna was used for all modes and all power levels.

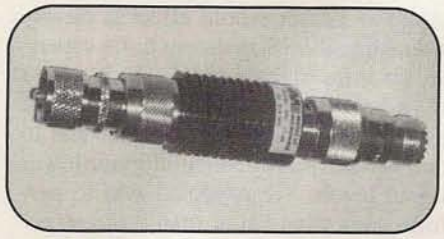

Photo D. To reduce power levels below 2 watts, a 10-dB attenuator was inserted in the transmission line.

schemes perform quite well. For most of the power levels, FM was judged to have superior readability, probably due to the high-quality nature of FM audio. AM was judged to be less readable than FM and SSB at all power levels, getting (at best) a rating of just over 3.

When the power dropped, things started to get interesting. FM retained a slight advantage over SSB until they crossed over at 0.5 watts. At the 0.2-watt level, the readability of FM dropped dramatically to 1.5, while SSB maintained an average readability of greater than 3. This abrupt drop in FM performance at small signal levels is known as the *Threshold Effect*.[4] SSB and AM have more consistent performance with varying signal levels, with SSB being the clear winner.

"The receiving station...was positioned 3.6 miles away from the transmitting station. One station could be seen from the other with binoculars, confirming line-of-sight propagation."

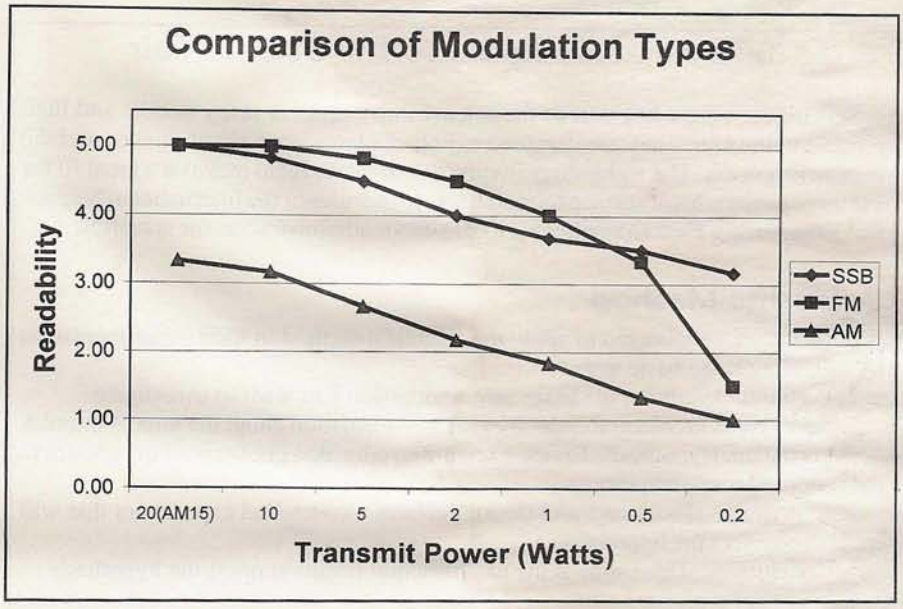

Figure 2. Comparison of readability (average of three separate tests) versus transmit power for each of the three modes tested. Note that maximum power on AM was 15 watts due to transmitter output limitation.

This information helps us understand how and why each type of radio signal modulation is used, and which one to use in certain situations. For weak-signal operation, SSB is clearly the way to go. On the other hand, for local communications where signals are usually strong, FM is the better choice from a readability perspective.

There are other considerations besides readability in choosing modulation type. Overall, FM has the clearest signal; it almost sounds like talking to someone in person. SSB, on the other hand, can have that well-known "Donald Duck" sound to it, even when it's carefully tuned in. Many proponents of AM point to the quality of the received audio as a key advantage of AM over SSB (and a primary use of AM is broadcast radio, where music is often transmitted). While AM is not as high fidelity as FM, it's arguably much better than SSB for tonal quality. FM is also less susceptible than either AM or SSB to the effects of static and other noise sources, which tend to vary more in amplitude than in frequency. We can put the tradeoffs in modulation in perspective by comparing the advantages and disadvantages of each, as shown in Table 3.

Conclusion

The experimental results agree well with the expected behavior based on the-

Table 3. Modulation Type Comparison

Modulation Type	Advantages	Disadvantages	Primary Uses
AM	Narrower bandwidth than Broadcast FM; acceptable for music, good for voice.	Wider in bandwidth and less efficient than SSB.	Broadcast radio (AM broadcast and international shortwave); aircraft.
FM	Very clear sound; best mode for music reproduction.	Poor when signals are weak. Widest bandwidth of the three modulation types.	Short distance amateur radio, broadcast radio, police, marine
SSB	Narrowest bandwidth of the three modulation types; good when signal is weak .	"Donald duck" sound; has to be tuned precisely.	Weak-signal VHF work, HF (amateur, military, marine).

Table 3. Advantages and disadvantages of each tested modulation type: AM, FM, and SSB.

Take Amateur Radio to the Science Fair

Science fairs are a key part of the science curriculum at many middle and high schools in the U.S. They are designed to help students learn about science and the scientific process. The technology involved in amateur radio makes it a great fit for a science project. Most science fairs conform to the rules of the International Science and Engineering Fair. Consult your local school administration for specifics.

Scientific Method

Students are encouraged to apply the scientific method in their experimentation by following these basic steps:

1. Purpose: Determine the basic area or question you want to investigate.
2. Analysis of Problem: Research existing information about the area of interest.
3. Formulate Hypothesis: Create a scientific, educated guess about the answer to the proposed research problem.
4. Experiment (Procedure and Data): Perform a controlled experiment that will support or reject the hypothesis.
5. Conclusions: Determine if the experimental results support the hypothesis.

ory. The FM threshold effect is clearly evident, and SSB is shown to be superior when the signals are weak. It would have been interesting to have reduced power/signal levels even further and to check SSB performance at even lower signal levels. We expected AM to perform somewhat better than it did, especially at stronger signal levels. However, this is largely a weak-signal experiment since the S-meter readings were S1 or lower, and AM is not known for its weak-signal performance.

It was fun to combine amateur radio and schoolwork in a positive way, and to apply science to ham radio, consistent with the experimental spirit and tradition of our hobby.

Any other VHF ham-related science projects out there? We'd like to hear from you!—ed. ■

Notes:

1. This article in based on a science fair project entered in the 1999 Pikes Peak Regional Science Fair in Colorado Springs, Colorado, by Sara Witte, KCØAMO, representing Lewis-Palmer High School.
2. "Understanding Signal Levels, Frequencies, and Modes—Part 3" by Dave Ingram, K4TWJ, *CQ VHF*, March, 1999.
3. The FT-847 output on 2 meters is rated at 50 watts on SSB and FM, but only at 12.5 watts on AM. However, the measured transmit power for this particular radio was found to be 15 watts on AM, so the maximum AM power used was actually 15 watts.
4. For more information on the Threshold Effect, see "A Close Look at Frequency Modulation," by Robert A. Witte, KBØCY, *QST*, September 1985.

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CQ VHF Ham Radio Above 50 MHz

Reader Survey—September, 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, This month, we'd like to ask about your involvement in emergency and public service communications:*

1. Please indicate whether you have *ever* been a participant in:	**Circle Reader Service #**
Emergency communications	1
Disaster communications	2
Severe weather net	3
Public service event/activity (e.g., bikathon)	4
Emergency/disaster drill	5
Emergency training net	6
Message-handling (traffic) net	7
Other public service communications/activities	8

2. Please indicate whether you *regularly* participate in:	
Emergency communications	9
Disaster communications	10
Severe weather nets	11
Public service events/activities (e.g., bikathon)	12
Emergency/disaster drills	13
Emergency training nets	14
Message-handling (traffic) nets	15
Other public service communications/activities	16

3. Please indicate which, if any, of the following groups you belong to (circle all that apply):	
ARES (Amateur Radio Emergency Service)	17
CAP (Civil Air Patrol)	18
MARS (Military Affiliate Radio Service)	19
Public-service-oriented radio club	20
RACES (Radio Amateur Civil Emergency Service)	21
REACT (Radio Emergency Associated Citizens Teams)	22
SAR (Search and Rescue) Group	23
Skywarn (Severe weather spotter)	24
Other emergency/public service group	25

4. Please indicate whether you feel you'd be prepared to respond and provide needed communications if a major emergency or disaster occurred in your community.	
Yes	26
No	27
Not sure	28
Not interested	29

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

What You Told Us

Our June survey asked about what you like to read in *CQ VHF*, why you decided to buy the issue if you got it on the newsstand, and—if you're a subscriber—whether you're likely to renew when your subscription expires.

It looks like most of you like to read most everything. Feature articles are the most popular, read regularly by 92% of you; followed by monthly columns at 90%, product news at 84%, news/opinion/letters at 81%, the Basics section at 80%, and advertisements, at 74%. When asked whether you prefer reading articles about topics already of interest to you, or about new areas of ham activity, 93% of you said you read a mix of both, with only 4% sticking with their areas of interest, and 3% reading only about new stuff.

Among the respondents who bought the issue on the newsstand, there was a three-way tie for the factor that most influenced your buying decision—between the topic (Ham Radio Above 50 MHz); a combination of factors; and none of the factors listed, each getting a 21% response. Next, at 14%, was "enjoyed previous issues," followed by another tie, at 7% each, between "the title," "cover info about the articles," and "a specific article."

Finally, nearly all of you who currently subscribe say you're likely to renew, with 63% saying definitely, and 29% saying probably, as opposed to 6% who are undecided, 2% who say probably not, and 0% who say definitely not.

This month's winner of a free one-year subscription is Jim Murphy of Waukesha, WI. As always, thank you for your responses.

Yaesu FT-100 Field Commander HF/VHF/UHF Multimode Transceiver

Imagine a radio that gives you all modes on 160 meters through 70 centimeters—in a box only slightly larger than a typical FM mobile rig—and you've got Yaesu's new FT-100 Field Commander. We put it to the test in mobile and portable operation...

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

One of the most eagerly anticipated radios to hit the ham radio market this year is the Yaesu FT-100 Field Commander HF/VHF/UHF all mode transceiver, both because of what it offers and because of the nine-month delay between its announcement and its appearance on dealers' shelves. The radio was originally unveiled at the 1998 Dayton Hamvention and ham ads were showing it as early as the fall of 1998, but it didn't hit the ham radio streets until February, 1999. So, now that it's here (Photo A), does the FT-100 meet its advance expectations?

Ken Neubeck, WB2AMU, is "Magic Band" Editor of CQ VHF.

A Field Review

While a few reviews on this radio have already appeared in other ham radio magazines, it's important to point out that those earlier reviews were primarily HF- and/or lab-oriented, as there was no opportunity to check out the radio operationally on the VHF bands during periods of high activity, such as the summer sporadic-*E* season on 6 and 2 meters or during the major VHF contests. While lab tests can tell how well the radio meets FCC signal quality requirements and claimed performance specifications, the real proof of a radio is its reliability during field operation.

The focus of our review, then, is primarily on the radio's *operational* capability and performance, both as a base station and as a mobile/portable radio. This review was conducted over a two-month period in the late spring of 1999, providing the opportunity to work sporadic-*E* openings on 6 meters and to give the radio a thorough workout during the ARRL June VHF QSO Party.

Basic Features

The first thing that hits you about the FT-100 is its size. How did Yaesu get all

The FT-100 versus the IC-706 MkII-G

Yaesu's FT-100 is in head-to-head competition with ICOM's new, and very similar, IC-706 MkII-G. Some comparisons will be made in this review, but the bulk of them will be covered in upcoming issues of *CQ VHF*. We plan to run a review of the new 706-G, by Gordon West, WB6NOA, in next month's issue, followed by a special comparison article, also written by Gordon, in the November issue.

Photo A. The Yaesu FT-100 Field Commander operates on all ham bands between 160 meters and 70 centimeters (except 222 MHz), with 100 watts out on HF and 6 meters, 50 watts on 2 meters, and 20 watts on 70 centimeters. Features include all-mode operation and 349 memory channels. (WB6NOA photo)

of that stuff into such a small package? Portable operation is a snap since the small size (6.3 by 2.2 by 8 inches) allows the radio to be easily carried in an attaché case or small container (Photo B).

The FT-100 has many nice features, including a pleasing blue display with adjustable back-lighting; adjustable power output, noise blanker, and speech processing; DSP (digital signal processing) features for the receiver; DTMF (push-button) microphone with back-lighting; and various warning and alert icons.

The radio's main tuning knob has a good feel to it, along with a small indentation for your fingertip to spin the dial. The FT-100 displays the frequency in large numbers, along with the mode and the currently selected VFO (A or B) and/or memory channel. The radio has 349 memory channels that can be programmed as follows:

- 300 standard memory channels (001 through 300)
- Five "Quick Memory Bank" channels for prime operating frequencies (QMB 001 through QMB 005)
- 20 Split Frequency memory channels for repeater operation (DUP 001 through DUP 020)
- Four "Home" channels with one frequency from each of the major band groups: HF, 50 MHz, 144 MHz, and 430 MHz (HOM 001 through HOM 004)
- 20 band-edge memory channels for setting scanning limits (PGM 001 through PGM 020)

Each memory stores the operating frequency, along with additional data, such as operating mode and receiver settings.

The FT-100 puts out a maximum power output of 100 watts on HF and 6 meters, 50 watts on 2 meters, and 20 watts on 70 centimeters. The radio is rated at drawing a maximum of 22 amps, but this appears to be the worst-case situation for certain setups, as nominal current draw for most HF and VHF applications is around 17 amps (confirmed by Yaesu). This means that, in most instances, you can use a 20-amp power supply for base station applications and stay within the range of typical current draw from car batteries.

What's really great about the FT-100 is that you can adjust the power output by using a simple menu function (see more on menu functions below), which displays a numerical value representing percentage of maximum power output for any of four frequency groups (HF, 6 meters, 2 meters, or 70 centimeters). For example, if you wish to use only 10 watts out on 2 meters, just bring up the menu function for 2-meter power output and then dial up the number 20 on the display (representing 20% of the maximum power of 50 watts available on 2 meters). This feature is good for QRP work as well as for driving a VHF linear amplifier which needs only 10 watts of input power.

You can also set the power output based on the current capacity of the power supply that you have available. For example, I have a 16-amp power supply, so I can adjust the HF output to the range of 50 to 70 watts, as the rig requires more current to put out its full 100 watts than my supply can provide. I did a spot check with an external power meter on some of the frequencies and saw that the power output that you dial in was pretty much what was going out.

The FT-100 also offers the option of computer control, allowing you to make all adjustments with simple mouse clicks, or to use another software package, such as contest logging software, to communicate with the radio. The idea of interactive radios with personal computer control is taking hold in the hobby,

Photo B. Mobile or portable operation is a snap with the FT-100, and, at only 6 1/2 inches wide and weighing only 5 pounds—including the microphone—it's easily carried in one hand or an attaché case. (WB2AMU photo)

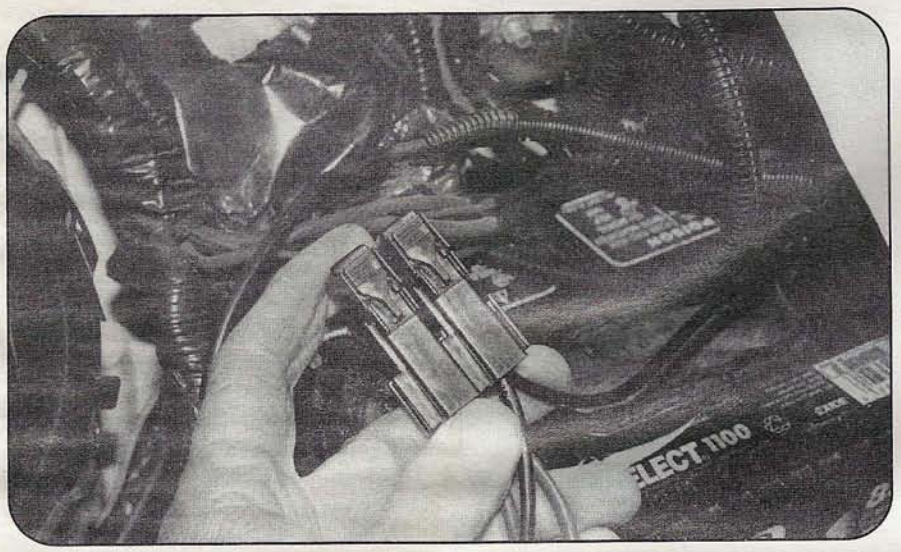


Photo C. The large blade-type fuse-holder used in the FT-100 power cable makes it a challenge to pass the cord through the firewall between the passenger and engine compartments. It is important, though, to wire the radio directly to the battery because of the high power output. Many newer cars have a large grommet through which the cable and fuse-holder will pass. Your challenge is to find it! (WB6NOA photo)

and the manual provides hookup details along with the data protocol required to do the programming.

The Manual and the Menus

When you first get the FT-100, you'll need to keep the manual handy until you're comfortable with the radio's various options. If you install the radio in your car, it's a good idea to keep the manual in your glove compartment in case you need to look up something.

You'll definitely need the manual—at least to get started—for navigating the radio's *two* different menu systems: one that handles basic front panel controls and switches and another that handles less commonly changed functions (power output, noise blanker level, etc.). The first menu is accessed by quickly pressing the **FUNCTION** key and then scrolling through by hitting the function key until the desired item is reached. The second menu is activated by holding the **FUNCTION** key longer. Each function is listed numerically and scrolled through by rotating the left selector switch on the panel (see bottom left of Photo A). It will take a little bit of getting used to, and of referring the manual, until you're comfortable finding and changing the radio's various settings.

Yaesu has written a very good manual, by the way; however, there are some minor loose ends. The process for activating CW is a little bit unclear. What it comes down to is that, in order to get power out in the CW mode, the **BK** icon that indicates *break-in* has to be **bold.** This button can only be pressed for a split second. If you hold it in too long; you enter into another menu listing for semi- or full-break-in options. (By the way, you'll need a stereo mini-plug or adapter to plug in a code key.)

The manual could also give more tips on wiring the FT-100 into your car, along with some tips on how to feed the wiring through the car's firewall (more on that in a minute).

Finally, there's no explanation of the specific meaning of the various icons that appear on the display. For example, there's a high SWR icon and an icon that indicates when you're within range of a repeater. But at what SWR level does the high SWR icon light up? The manual doesn't say. Likewise, there's no explanation of the repeater icon, which, it turns out, lets you know when a repeater shift (for example, -600 kHz) is active.

On the other hand, the manual does a good job of describing a modification you might need to make in order to use headphones with the FT-100. This radio has only one audio output jack—with a mini (^{1}/8-inch) plug input—for both headphones and an external speaker. Since it has enough volume to drive a speaker, you may need to build an attenuator to use headphones, and Yaesu provides a description of a simple circuit in the manual. Building the attenuator requires the purchase of a small box, a ^{1}/8-inch plug, a female connector for your headphone plug, and two resistors (any electronic companies looking for a simple new product line to make for owners of the FT-100?). You can probably get away without this circuit, but the manual recommends it so the volume in the headphones isn't too high.

Mobile Installation

From the effort expended by Yaesu to make the radio as small as possible, the Field Commander appears to be primar-

Photo D. Once he found the 3-inch grommet through his car's firewall to run the power cable to the battery, WB2AMU was able to conveniently mount the FT-100 to his car's center console. (WB2AMU photo)

ily designed for mobile and portable use. The manual shows very basic guidelines for hooking up the FT-100 in your car, and it recommends direct wiring to the car's battery rather than hooking up the power by way of the cigarette lighter on the dashboard. The manual cites noise and voltage drop as two reasons for not using the cigarette lighter approach. This concern is justified, particularly if a non-fused lighter plug is used.

As noted briefly above, the manual does not completely address how to install the wire harness in the car, particularly how to get past the firewall separating the battery from the passenger compartment. This is a problem because of the large fuse-holders used on the FT-100's power cable (Photo C). I found out something new when I brought up this concern to Yaesu. Apparently, many newer cars have a large grommet in the firewall where the dashboard wire harness is fed through from the car's fuse box. In my 1998 Chevy Cavalier, this grommet is three inches in diameter and can easily be moved to pass the connector of the FT-100 through into the passenger compartment. Some hams may face a different situation with older cars where either a hole has to be drilled in the firewall or the wire harness has to be cut, passed through the hole, and then soldered back together. If you have to cut the wires, there's a small consolation in that this allows you to trim the harness to the desired length to fit in the car without excess wire.

Once I installed the FT-100 in my car, I found that I was able to situate it temporarily underneath the dashboard and above the middle compartment of my Chevy Cavalier (Photo D). The blue display is easy to read and is a pleasure to look at. Yaesu provides a mounting bracket with the radio, and also offers a detachable control head if you'd rather mount the radio in one place and the head in another. The front panel of the FT-100 removes very easily for remote front panel mounting. However, as opposed to the single harnesses used by some other radios with detachable front panels, the setup for the FT-100 involves three separate wires: one long control line, a long microphone extension line, and one long speaker line. This setup is actually preferred by some hams who like to have the microphone going into the radio rather than the front panel and so they can mount the speaker away from the control head. If the radio is located under the driver's seat, you may even be able to get away without the microphone line extension.

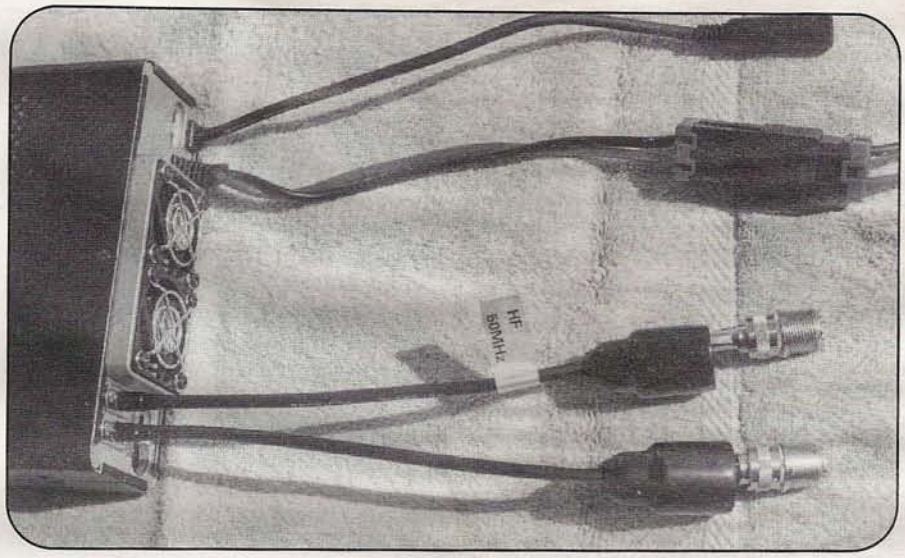


Photo E. The rear panel of the FT-100 is a busy place. The two fans take up a lot of real estate, so the antenna feedlines must be routed through pigtails (bottom). One connector is for HF and 6 meters, the other is for 2 meters and 70 centimeters. Above the fans are the power cord and the data line for computer control. (WB2AMU photo)

Pigtail Connectors

One concern among new owners of the FT-100 is the use of two coaxial pigtails on the back of the radio for connecting antennas: one for HF/6 meters and the other for 2 meters/70 centimeters (Photo E). This is not a new concept, as several small VHF radios use this method. It is, however, a relatively new idea for HF radios. Both pigtails in the FT-100 are 10-inch sections of RG-58 coax with SO-239 connectors on the end. It's apparent that space restrictions on the rear of the panel prevented the connectors from being built directly into the panel; this space restriction was made worse by the location of *two* cooling fans on the rear panel.

During portable operation, I was a little bit concerned when I connected 1/2-inch RG-8/U coax to the pigtail connectors of the FT-100, which are only a 1/4 inch in diameter. Attaching or removing the heavier RG-8/U coax could flex the smaller-diameter cable from the rigs in the area at the base of the connector and where the cables goes into the rig. Although there is stress relief where the pigtails exit the radio, they will be a reliability concern if the radio is disconnected frequently from the car or base station. This could eventually cause problems if one does a lot of portable work in which the equipment is set up and taken down from scratch (such as a rover operation during a contest).

A number of FT-100 owners have addressed this by tying the pigtails together with the power cord. One operator, Steve Gurley, KJ7WK, has found the pigtails to be an advantage when installing the radio in tight spaces in the mobile. However, in the long run, based on both amateur radio experience and professional electronic equipment work experience, I doubt this would be durable for the long haul. Perhaps this will be improved in future models of this radio.

Base and Mobile Operation

During most of April, as the VHF bands were quiet, I used the radio in a base station setup and made a few dozen contacts on the HF bands, using both CW and SSB, and running about 50 watts output. The radio worked well and comments were favorable with regard to both the signal and audio quality.

I found the receiver and the many filter-type options to be very good. The DSP (digital signal processing) is particularly nice to have, particularly in a radio of this size. It's kind of neat to experiment with different noise blanker levels to see what will work best in the environment you're working in, especially in a mobile application where there's a lot of ignition noise and the like.

ATAS-100 Automatic Antenna

Senior Contributing Editor Gordon West, WB6NOA, had the opportunity to examine the ATAS-100 Automatic Tuning Antenna System and has provided the following mini-review.

With two HF/VHF/UHF transceivers on the market (the FT-100 and the FT-847), Yaesu saw a real need for a single mobile antenna that could work all frequencies from 7 MHz through 450 MHz. No stopping the car to change band taps. No extra "stingers" sticking out from the sides. Just one heavy-duty, automatic-tuning antenna for most of the HF bands (no 160 or 75 meters), all of 6 meters, all of 2 meters, and all of 70 centimeters. Yaesu calls it the ATAS-100, for "Automatic Tuning Antenna System," and this motorized antenna gets its automatic tuning commands from either the FT-100 or the FT-847.

Setup and Use

The ATAS-100 is a variable-length vertical antenna that's driven by voltage carried by the same coax that feeds the antenna. After installing the antenna on your vehicle (Photo F), the first step toward using it is enabling a menu item on the radio to select either HF-only operation, or combined HF/VHF/UHF operation (with a required duplexer). Next, just dial in the band and frequency of choice on the FT-100, select the **TUNE** function, and press and hold for a second to engage the automatic tune-up operation. The radio goes to low power constant carrier transmission and drives the antenna up or down within the rubber boot until it's in resonance; then automatically drops the radio back to receive with an antenna tune indicator. You wouldn't know anything was happening if it weren't for the tuning indicator on the LCD screen and the very quiet hum as the antenna goes up and down to find resonance with minimum SWR on your chosen frequency. The whole process might take five or 10 seconds.

For VHF and UHF operation, the Yaesu FT-100 commands the antenna into a nested position. This is a preset tuning command, so stay patient as the FT-100 takes around 60 seconds to complete the VHF/UHF tune cycle. On 2 meters, the antenna acts as a quarter-wave radiator; on the 440 band, it is a three-quarter wavelength radiator. Besides the internal loading coil, there are fixed-value capacitors that will provide optimum matching for each ham band. On the HF bands, I'd let the antenna go into its automatic match mode, and then electronically "touch up" the setting for lowest SWR. You do this by simply nudging a single button to "fine tune" the ATAS-100 antenna system. On 2 meters and 70 centimeters, the SWR was just about flat!

The antenna base hooks up well on almost any type of hatch-mount, lip-mount or, heaven forbid, through-the-body mount. Note that the antenna does not terminate $^3/_8$ by 24 threads, but rather with a common PL-259 base that screws into an SO-239 antenna mount.

An Important Note

There is an important caution! When you take the rig out of your vehicle and off of the ATAS100, be sure to disable the automatic tune function. If you were to hook up the rig to your base station antenna and by habit push the tune button, you would be sending a small amount of voltage up your base station antenna line that your home antenna system does not "expect." The radio would quickly recognize this and shut down with "antenna error" on the display. If you had a linear amplifier in between your home antenna and the FT-100, the linear would not appreciate DC voltage coming into its input.

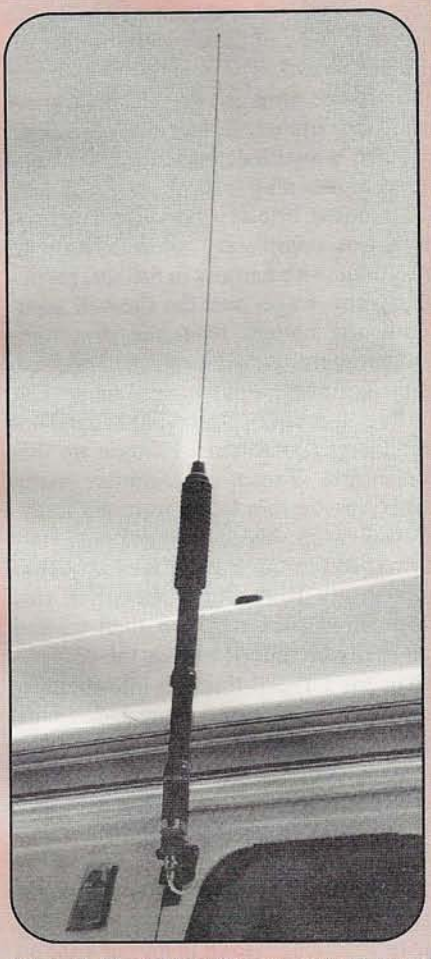


Photo F. The ATAS-100 automatically tuned antenna system attaches to most standard vehicle mounts. Voltage fed up the coax feedline carries instructions for raising or lowering the antenna to achieve a match on the selected frequency. (WB6NOA photo)

I was extremely impressed with the performance of the ATAS-100, even when I did a field test of the antenna last year in Nome, Alaska, on some very rough back roads. If you're planning to use the FT-100 for mobile operation, you should take a good look at the ATAS-100 antenna option.

One of the more interesting QSOs I had was on 10 meters with Steve, KJ7WK, who also has an FT-100. Steve told me that he used to have the original ICOM 706, and that it was extremely difficult to program repeater frequency pairs into that unit. By contrast, he found the FT-100 much easier, as it took him only 20 minutes to program 20 repeater frequencies. The process was made easier still with the optional CTCSS (subaudible tone) decoder unit, because you don't have to dial in the tone frequency.

I received similar comments from others, such as Mario Karcich, K2ZD, who also points out the improvements of the FT-100 over the *original* ICOM 706 (but it should be noted that the new ICOM 706 Mark II-G has been improved in this area, so this comment may no longer be as critical). Steve also mentioned the DSP microphone equalization menu, which allows you to tailor the mic's audio output to match your personal voice charac-

"I caught a major sporadic-E opening on 6 meters and had the opportunity to work several stations from Georgia and Tennessee while going mobile. I boosted the power up a bit—to 40 watts output—to compensate for the simple magnet-mount vertical antenna on the car."

teristics, using selectable cut-off settings for high, low, and medium audio frequencies. Steve found, as I did, that although there are over 60 menu settings for different features, and they may at first seem overwhelming, they are all easy to set and are very well explained in the manual.

When using the radio in the mobile setup, I concentrated primarily on the 6-meter band while using a magnet-mount vertical antenna on the car. I was able to tap into a couple of good band openings and received good reports. I found the adjustable power output feature extremely useful during one sporadic-*E* opening in early June, where I set my power output at 30 watts. This seemed to be just the right amount of power to work into the Georgia/North Carolina area from my car in a parking lot on Long Island. This was a nice boost over the 10 watts that I normally used in my other mobile rig, the FT-690. And, of course, I could go to even higher power if I needed it.

VHF Contest Performance

I used the FT-100 and portable Yagi antennas for 6 and 2 meters and 70 centimeters during the 1999 June ARRL VHF contest, which I entered in the QRP (low power) portable category, operating from a hilltop near my home QTH in Long Island, New York (Grid FN30). I've found that running in the QRP portable category during a VHF contest is a very good way to test the rig, antenna, and feedline. The first thing I found was that using just one radio to cover these three bands was a real blessing, compared to previous operations in which I used a separate radio for each band. This simplified setup means less equipment to haul around and less setup time. I connected the coax for the 6-meter antenna to the HF+six pigtail, and the coax for the 2-meter and 70-centimeter antennas to the other pigtail, and I didn't have to disconnect the coax until breaking down the setup.

The radio worked very well during the contest. I found the power output and SWR meters to be particularly useful, and the signal strength meter (S-meter) was very helpful in determining which stations I'd be able to work with QRP. For example, if a station had his beam pointed away from me, there generally would be a minimal reading on the S-meter. But as soon as that station starting pointing the antenna toward me, I would see the number of bars on the meter increase and know I had a good chance to work that station.

I also found that it was easier to conduct a number of cross-mode contacts with stations in the fringe areas of line-of-sight coverage where I needed to use CW for them to pick me out. For exam-

Update

In last month's "Reader Feedback," reader Dick Warren, W7TIO, wrote about the difficulty of finding surplus Motorola commercial gear (from the land mobile and public safety services) at two-way shops. Dick recently forwarded to us several Web sites full of ham conversion info, if you do manage to get your hands on either surplus Motorola or GE/Ericsson gear:

Motorola:
<http://www.cdi2.com/build_it/motstuff.htm>
<http://www.condor-connection.org/mods/mods.html>

G.E./Ericsson:
<http://www.nhrc.net/mastr2/index.html>
<http://www.cdi2.com/build_it/ge_stuff>

Table.

Frequency (MHz)	Line-of-Sight Contacts QSOs	Grids	Sporadic-*E* Contacts QSOs	Grids
50	59	15	5	5
144	32	10	0	0
432	7	3	0	0
Total	98	28	5	5

Table. Summary of WB2AMU's QRP operation during the June, 1999, ARRL VHF QSO Party, using the Yaesu FT-100, operating 10 watts output on all bands, with three-element Yagis on 6 and 2 meters, and a homemade six-element Yagi on 432.

ple, I was able to work K8GP in grid FM08 on Spruce Knob mountain in West Virginia, over 350 miles from me, with CW, but not on SSB.

I made just over 100 QSOs altogether on three bands (see Table) and was able to make a number of contacts into some of the fringe area grids via line-of-sight. My area had only two brief and narrow sporadic-*E* openings on 6 meters during the contest, so 2 meters was a pretty busy band. In any event, I was able to work just about all the stations I could hear on both bands—in fact, when there was a short sporadic-*E* opening into Mississippi on 6 meters Sunday evening, after I had taken down the beam antennas, I was able to get through and pick up a new grid (EM53) with just a magnet-mount vertical antenna. I also made a few contacts on 432 MHz—my first time operating on 432 SSB. The FT-100 also performed quite well on this band.

Overall, I found that the radio grew on me during VHF contest operation, and I would recommend it for this kind of use. It ran like a champ!

A few days after the June contest, I caught a major sporadic-*E* opening on 6 meters and had the opportunity to work several stations from Georgia and Tennessee while going mobile. I boosted the power up a bit—to 40 watts output—to compensate for the simple magnet-mount vertical antenna on the car. I found that the receiver's noise blanker worked well enough to reduce most of the ignition noise while the car was running. The display just as easy to read, and the various button controls just as user-friendly, while I was driving on the highways.

I think that this radio is an ideal VHF radio for mobile applications on the three VHF bands as quarter-wave antennas can be used, whereas the HF bands would require a loaded whip of sorts. (Yaesu offers an automatic HF antenna for mobile use with the FT-100, called the ATAS-100; Gordon West, WB6NOA, tested that out and reports briefly on it elsewhere in this review.)

Early Production Bugs

Many hams will advise you to wait a few months after a brand new radio is introduced before buying it, in order to give the manufacturer time to work out early-production bugs. This advice is appropriate with the FT-100. I was using the Field Commander in my car on 6 meters, transmitting into a mag-mount vertical, when at some point I noticed I was not getting any power output indication on the radio. I eventually found that the radio was not transmitting at all in the HF and 6-meter mode, but still worked on 2 meters and 70 centimeters. I sent the radio back to Yaesu, where it got a factory realignment and a configuration update of about 20 parts.

WB6NOA encountered the same problem while operating mobile during his comparison review of the FT-100 and the ICOM 706 MkII-G, and I heard of several other cases as well. This particular failure—no output on HF or 6 meters—was traced by Yaesu to an incorrect voltage setting for the pre-driver transistor. By the time you read this review, newly-shipped FT-100s should not have this problem, and early units will be updated when sent in for warranty repair.

It's understandable that such problems may be encountered with a new radio, particularly with a new product line that's breaking new ground with a lot built into a small package. The highly competitive situation between Yaesu and ICOM has accelerated the engineering and technical learning curves, in both the design and production phases. I should note that, with all of the fixes incorporated, the radio worked quite well during extensive use in the VHF contest and during some major sporadic-*E* openings on 6 meters.

Summary of Performance

The FT-100 has some very good features and, overall, it appears best-suited for both mobile and portable use. Some particularly nice features include a graphic high-SWR warning, adjustable power output, large memory, and adjustable noise blanker level.

Yaesu committed itself early to the very small overall dimensions of the FT-100 case, and then tried to put a very complex radio inside. I wonder whether an extra half-inch or so of width would have allowed the dual coax connectors to be mounted directly into the back of the radio as opposed to using pigtails. I'm not a big fan of pigtail connectors in general and have seen connectors wear out, with the center conductor breaking over time from the effects of cycling (removing and reconnecting the antenna several times). In addition, you need to be careful when disconnecting the plastic power connector during portable and mobile use.

This radio will require some training for efficient use, even by a veteran ham radio operator. Keep that manual nearby! In fact, this rig may not be a good first radio for a newcomer to ham radio because of the significant learning curve required. Take the time to learn the radio before you use it for a contest or expedition, and then you'll really appreciate the features that are included in it.

The FT-100 Field Commander is a hot radio! Yaesu is offering a lot of radio for not a lot of money—it's reasonably priced under $1,500. Consider how many different radios you'd have needed—and what they would have cost you—just five to 10 years ago to cover the range of frequencies offered in the FT-100. How can you beat having all of this in just one radio for the price offered?

I wish to thank Gordon West, WB6NOA, Steve Gurley, KJ7WK, and Mario Karcich, K2ZD, for their input to this review, along with the many signal reports that I received from those whom I worked on the air. Thanks also to Chip Margelli, K7JA, of Yaesu for working with me in getting the FT-100 ready in time for the VHF contest! ■

U-Gotz Any Rain?

WB5YYX takes us back to the "good old days" of VHF contesting... before solid-state rigs...before multiband VHF rigs...before computer logging...when only one thing could get between his contest group and a great score.

By Bob Scupp, WB5YYX*
(bobscupp@worldnet.att.net)

It was a sunny, hot, humid Saturday morning in September, 1974, as we finished setting up our contest stations from 6 meters through 432 MHz. Some of our club members had camped out the previous night, getting an early start assembling the master (disaster?) contest array for the K2DEL, Knight Raiders VHF Club, ARRL September VHF QSO Party setup.

"Single- and double-hop sporadic-E mode was in full swing, with most signals on SSB 56 to 59+ in all directions....We exchanged contest information with amateurs in the 1, 2, 3, 4, 5, 8, 9, and 0 callsign districts, with no end in sight!"

The Knight Raiders VHF Club, K2DEL, contest crew "cutting through the QRM" sometime in the 1970s. From left, Bill Raue, K5KKO; Israel Mayo (not licensed at the time, now N2GCM); Jack Wilk, K2DKQ, later N2DXP (SK); Jack Mandelberger, WA2CRF; Bob Meece, WB2BCA; and two more people whose names Bob can't remember.

Starting with a Bang

We tested our 6-meter station, complete with Jack, K2KDQ's, Drake TR-6, 20-foot telescoping mast, rotator and three-element beam, then we were out the gate like anxious race horses. Since the only signals we heard on the band during setup and testing were the usual local contesting big guns and no one else, we "assumed" (remember what that means?) that propagation was just average. We were stunned and pleasantly shocked when the floodgates opened at starting time that Saturday afternoon. Single- and double-hop sporadic-*E* mode was in full swing, with most signals on SSB 56 to 59+ in all directions, and most signals were clear, without much fading, flutter, or fuzziness. We exchanged contest information with amateurs in the 1, 2, 3, 4, 5, 8, 9, and 0 callsign districts, with no end in sight! Our contest multipliers were accumulating better than a pair of rabbits during mating season.

The 2-meter station was buzzing with sporadic-*E* and tropospheric ducting paths covering Maine through Virginia, and as far west as Illinois. The latter was accomplished via 2-meter CW with a 559 signal report, using our new "homebrew" amplifier with an Ameco TX-62 transmitter and a W2AZL receiving converter from 2 meters down to an intermediate frequency of 14 MHz using a military surplus BC-342 receiver. The antennas were stacked Yagi arrays for greater vertical gain. I remember occasionally hearing 20-meter SSB stations "bleeding" in, confusing some operators (including yours truly!) as to which band and contest we were competing in!

Our 220-MHz and 432-MHz contest stations were also gathering a generous

**Bob Scupp, WB5YYX, has been a VHF contester for over 20 years, starting out with the Knight Raiders VHF Club in northern New Jersey. He currently lives in Albuquerque, New Mexico, and is a former ARRL Vice Director.*

"We were able to take advantage of excellent troposheric ducting on both [220 and 432 MHz], contacting amateurs from Maine through Maryland and west to Ohio."

portion of contacts and multipliers. We were able to take advantage of excellent tropospheric ducting on both bands, contacting amateurs from Maine through Maryland and west to Ohio. Signal reports both ways were excellent, with regular 56 to 59+ reports! Having stacked Yagi arrays for both bands, as was the case on 2 meters, gave us the advantage of having increased receiver and transmitter gain. During previous VHF contests, we used only single Yagi antennas on 50 to 432 MHz.

Our overall contest score, through early Saturday evening, was far beyond anything we had accomplished during any preceding VHF contest operation. If we continued at this pace, we could conceivably be among the top contenders in the ARRL Northern New Jersey Section and Hudson Division. This thought alone was a great incentive to "push the limits" of our stamina in addition to our usual "contest fever."

"Stormzilla" Approaches

Fortunately, the contest stations were in tents to protect the operators from the heat and weather. We usually had two operators at the 6-meter station, one working the band and the other manually logging contest QSOs (computer logging wasn't even a dream in 1974!).

As Saturday evening twilight came upon us, I was trading places with K2KDQ when I glanced toward the West and noticed an ominous front of very dark clouds. I gave this no thought whatsoever until Jack and I began hearing faint static crashes in the background. They rapidly increased in amplitude as the tall, solid black clouds advanced toward us. The static crashes became so intense that I nervously asked Jack if we should shut down all contest operations and disconnect the antenna feedlines from our equipment. Jack, in a loud, authoritative tone, barked, "Keep your pants on, not now!" I was crushed by this blow since the static crashes were so audible that hard rock concerts seemed extremely tranquil in comparison.

As the storm finally came upon us, it grew very windy. The treetops began bouncing back and forth like a tennis ball during a great match. I had since moved to our 2-meter station some distance away, leaving Jack operating the 6-meter station alone. Without warning, an ex tremely large bolt of lightning shot overhead with a loud thunderclap at the same time! The next thing I heard was a murderous, bloodcurdling scream, "Disconnect the @!&%$# $#@!# antennas!" Guess whose voice it was? Right...Jack.

As the storm grew more threatening, it began to rain. I was convinced it would end within a short period of time. But after a half-hour, the rain turned into a torrential downpour—not in buckets, but in bathtubs! Since the gas generators were unprotected from the elements, they were shut down. We all made a mad dash for the nearest available tent.

"Water Resistant" Is NOT "Waterproof"

Bob Wetzel, WB2VLC, and I were "protected" at the 2-meter station. As this now "Stormzilla" continued, I looked up and saw water accumulating in the top of the tent. I then received a devastating comment from Bob that our "waterproof" tents were in fact "*water resistant*!" Despite our efforts at holding up the tent, the water weight was too much for it, and the tent began to collapse. We barely escaped being forever encapsulated within its mucky confines. All of the other tents suffered a similar fate.

Our only remaining refuge was stuffing ourselves into our cars. And I do mean *stuffing*—at 6 foot 2 inches, being in the back seat of a 1964 Plymouth Valiant sedan was like being in a trash compactor! Not receiving a normal sleep cycle added new dimensions to an otherwise colorless evening. It was extremely depressing to view all of our mountaintop contest stations being literally flushed through a never-ending vortex into a bottomless sink hole.

"The rain receded to a drizzle and the winds calmed down...until the next cycle of squall lines repeated high winds, raining bathtubs, and an extreme lightning display with thunderboomers galore! It would put any Fourth of July fireworks display to shame."

Matters naturally went from bad to worse as Stormzilla's pattern emerged during the remainder of the night. Intense squall lines attacked us one after another. The rain receded to a drizzle and the winds calmed down...until the next cycle of squall lines repeated high winds, raining bathtubs, and an extreme lightning display with thunderboomers galore! It would put any Fourth of July fireworks display to shame. As I attempted to sleep, but only counted squall lines and thunderclaps, I wondered if this monster storm would ever end. Finally, shortly after sunrise Sunday morning, Stormzilla left the rain-flooded area now known as *Lake* Garrett Mountain. We all emerged from our cars and viewed lakes of mud and water everywhere.

Enter the U-Gotz

Our first duty was to assess the damage done and determine whether it was worth continuing our contesting. It was unanimous to pack everything up and leave after breakfast. We heard a local radio station announce that nearly six inches of rain had fallen. Jack, K2KDQ, prepared our "last meal," the sustenance we needed to give us the strength to finish "tearing down" (Stormzilla took care of most of the effort for us).

I walked over to our kitchen area and watched Jack busily manufacturing some form of unknown concoction. It was a large kettle filled with a foreign brew which I didn't recognize. I noticed him adding every ingredient we brought with us and asked him, "What is it?"

Jack replied, "U-Gotz!"

I pondered his answer for a while and dared to ask him, "What's U-Gotz?"

Jack bluntly answered that, "What you see is what U-Gotz, so you better eat so we can pack up and get the &^%$#@! out of here!"

We all ate the U-Gotz and actually liked it.

After packing everything into our cars, we drove off very disappointed that our efforts had been drowned out. But we'd made the right choice. About a half-hour after I arrived home, "Son of Stormzilla" appeared in all its fury. U-Gotz any rain?

ARRL September VHF QSO Party

Summertime sporadic-E and tropo are just about gone...but this fall may offer worldwide F_2 openings to those lucky enough to be on the air when they happen. The ARRL's September VHF contest helps pump up activity to make sure there are active stations on both ends of any openings.

Here are the complete rules for the ARRL September VHF QSO Party, courtesy of the ARRL Contest Branch:

1. Object: To work as many amateur stations in as many different 2 degrees X 1 degree grid squares as possible using authorized frequencies above 50 MHz. Foreign stations work W/VE amateurs only.

2. Date and Contest Period: The second full weekend of September. Begins 1800 UTC Saturday, ends 0300 UTC Monday (September 11–13, 1999).

3. Entry Categories:

3.1. Single Operator

3.2. Single Operator, QRP Portable

3.3. Rover

3.4. Multioperator

3.5. Limited Multioperator

4. Exchange: Grid-square locator (see April 1994 *QST*, p 86).

4.1. Exchange of signal report optional.

5. Scoring:

5.1. QSO points:

5.1.1. Count one point for each complete 50- or 144-MHz QSO.

5.1.2. Count two points for each 222- or 432-MHz QSO.

5.1.3. Count three points for each 902- or 1296-MHz QSO.

5.1.4. Count four points for each 2.3-GHz-or-higher QSO.

5.2. Multiplier: The total number of different grid squares worked per band. Each 2 degrees X 1 degree grid square counts as one multiplier on each band it is worked.

5.3. Final score: Multiply the total number of QSO points from all bands operated by the total number of multipliers for final score.

5.4. Rovers only: The final score consists of the total number of QSO points from all bands times the sum of unique multipliers (grid squares) worked per band (regardless of which grid square they were made in) plus one additional multiplier for every grid square activated (made a contact from).

5.4.1. Rovers are listed in the contest score listings under the Division from which the most QSOs were made.

6. Miscellaneous:

6.1. Stations may be worked for credit only once per band from any given grid square, regardless of mode. This does not prohibit working a station from more than one grid square with the same callsign (such as a Rover).

6.2. Only one signal per band (6, 2, 1 1/4, etc.) at any given time is permitted, regardless of mode.

6.3. Multioperator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station (transmitter, receiver, and antenna) must exist for each QSO made under these conditions.

7. Awards:

7.1. Certificates will be awarded in the following categories.

7.1.1. Top single operator in each ARRL/RAC Section.

7.1.2. Top single operator on each band (50, 144, 222, 432, 902, 1296, and 2304-and-up categories) in each ARRL/RAC Section where significant effort or competition is evident. (Note: Since the highest score per band will be the award winner for that band, an entrant may win a certificate with additional single-band endorsements.) For example, if WBØTEM has the highest single-operator all-band score in the Iowa Section and his 50- and 222-MHz scores are higher than any other Iowa single operator's, he will earn a certificate for being the single-operator Section leader and endorsements for 50 and 222 MHz.

7.1.3. Top single-operator, QRP portable in each ARRL/RAC Section where significant effort or competition is evident. (Single-operator, QRP portable entries are not eligible for single-band awards.)

7.1.4. Top rover in each ARRL Division and Canada where significant effort or competition is evident. (Rover entries are not eligible for single-band awards.)

7.1.5. Top multioperator score in each ARRL/RAC Section where significant effort or competition is evident. (Multioperator entries are not eligible for single-band awards.)

7.1.6. Top limited multioperator in each ARRL/RAC Section where significant effort or competition is evident. (Limited multioperator entries are not eligible for single-band awards.)

7.2. Participation Pins

7.2.1. Available, while supply lasts, to all who make at least 25 contacts (any combination of bands and modes) during the contest.

7.2.1.1. This includes all operators of qualifying multioperator efforts.

7.2.2. Send order to: ARRL Contest Branch, 225 Main St, Newington, CT 06111. 7.2.2.1.Price is $5 for each pin.

7.2.2.2. Make check or money order payable to the ARRL (no cash please).

7.2.2.3. Include a return mailing label (preferably a self-adhesive type).

8. Other: See General Rules for All ARRL Contests and for VHF Contests.

Hollywood Ham Watch

"This is the city...Los Angeles, California. Behind the bright lights, there's a whole other world—sometimes not a pleasant world—and you never know who might be watching from the shadows. My name's Tracy. Bill Tracy, KE6EQJ...I carry a radio."

By Bill Tracy, KE6EQJ*

We will see you walking along Hollywood Boulevard, but you won't see us...as we watch over visitors in our fair city, thanks to Hollywood Division Ham Watch, overseen by Los Angeles Police Department Detective Dave Moye. He's a veteran of leading Ham Watch teams in other parts of Los Angeles. Ours is a new group, small but growing. From our perches around the city, we watch for those who would rob and hurt average citizens and visitors. It's fun, exciting, and a big change from my day job working in an office.

What Is Ham Watch?

Ham Watch is a group of concerned amateur radio volunteers helping the police reduce crime through surveillance. We provide extra eyes and ears for the police and report any observations to the detective working with us, usually over our ham radios. We do not apprehend criminals ourselves; in fact, we're prohibited from doing so. Instead, we let the police do that work, which is just fine with me.

Our prime operating word is *safety*. When the detectives or officers move in on a suspect, we continue to report any changes in the scene. We do not carry weapons of any kind: no guns, nightsticks, not even pepper spray. We're protected by concealment, wits, and our radios. Oh, and by the fact the police are just a shout away. But stripping away everything else, this is about hunting other humans and that's a very interesting challenge.

**Bill Tracy, KE6EQJ, has been a ham for five years. And if you visit Hollywood, he might be watching...you!*

In practice, we may spend several nights without seeing a crime. But it's time well-invested, practicing the skill of observing and accurate reporting. Detective Dave chooses a location based on information the police department has developed on recurring crimes and the Modus Operandi (method of operation) those criminals use. While waiting for a crime to occur, we see a lot of other things: drunks having trouble negotiating a corner, people running errands or out for a night on the town, prostitutes cruising for customers, and a surprising number of pets prowling around the neighborhood. And once, at 3 a.m., I saw a man wearing two swords as he walked down a Hollywood street. It turns out it's legal to carry a sword in Los Angeles, as long as it isn't concealed!

What Do We Look for?

Criminals hit fast and try to get away even faster. We need to keep alert, looking not only for potential criminals, but also potential victims. We watch for people who are not where they should be,

"We need to keep alert, looking not only for potential criminals, but also potential victims."

slow-moving vehicles that are looking for a target. The rule of thumb is that car thieves travel in pairs. Car *strippers* travel in fours.

We're extra vigilant when one of our team announces over the radio that he or she has spotted someone who is "capering," behavior that indicates a crime is likely to be committed.

Where Do We Work?

Sometimes we're on rooftops, other times we're in our own cars, staking out a neighborhood. On occasion, we might be staked out in the back of a store.

Rooftops pose the greatest inherent danger. Since the roofs were not primarily designed for us to watch out for suspects, we must adapt to the obstacles we find up there. There's heating and air-conditioning equipment around which we have to move in the dark, along with antennas with almost invisible guy wires, and cans and buckets that "go a-clatter" when kicked.

On arrival, we first check out the layout of the roof for dangerous surprises. One apartment building we use has no railings along the irregular roof edges that define the apartment's inner courtyard, and it would be very easy to step off in the dark. In addition, the same roof has at the outer edge a rickety old "Apartments For Rent" sign—four feet high and 16 feet long—that's attached to a rotting wooden frame by one Vise Grip and maybe some chewing gum. It leans precariously towards the edge. We don't touch it. On top of that, the sign supports stick out onto the roof and really get in the way when we need to keep a suspect in sight.

We have to walk softly and carefully because we're often standing above someone who's trying to sleep, and who may call the police if disturbed. We must try not to damage the roof so the building owner will continue to let us up there. One of the big rules, of course, is *never* to drop anything off of a building.

Some rooftops are extremely noisy because of the air-conditioning equipment. Occasionally, we get whiffs of noxious odors from standpipes and exhaust from furnaces wafting in our direction. That reminds us that people are living right below us and we had better be quiet. We also find that birds leave their calling cards on places we would otherwise like to rest our arms to steady our binoculars.

We often bring a folding chair, a favorite beverage (nonalcoholic), and a snack, so we can sit back and relax while we hunt for bad guys.

What to Wear? (Some Surveillance Fashion Tips)

Generally, we wear dark clothes, but the important thing is to dress to blend into the background. We're hunting humans and must blend in since we humans are reputed to have pretty good eyesight. When on a rooftop, we check to see if we're silhouetted against the sky or a higher part of the building. On a clear night, black or indigo blue clothes work well, but if it's cloudy and the streetlights illuminate the bottoms of the clouds, we may find a charcoal gray or even a medium gray will hide better.

We also have to be aware of incidental light shining on us. It can be light spilling from a street lamp, a security lamp on a building, even a light from a window in another building. It can be light shining on a wall behind us that silhouettes us. We have to be very careful not to smoke where someone below can see the dull red glow of the cigarette, as it's easy to see and is a dead giveaway to our presence.

We also carry a roll of black electrical tape in case we need to cover a light source on our equipment. One night, I wanted an opinion of how well my new indigo blue down jacket concealed me. I asked Marc, the other person on the roof, what he thought. He said the jacket was fine, but suggested I turn off the light on my microphone clipped to my collar. Out came the electrical tape.

Do I really need a down jacket in southern California? Yes. It gets colder than you would expect, especially because we're standing or sitting in one place for long periods. Dark knit caps and gloves are handy for warmth as well as stealth, and long underwear is wonderful, even in mild-weathered Hollywood. On the other hand, full facemasks—the ones the bank robbers wear—are effective at darkening and warming one's face, but they also scare the daylights out of everyone and can get one in more trouble than they're

"It's to our benefit to follow the FCC rule for ham radio to limit power to the minimum needed. This is a clandestine operation and the fewer people who know the better."

worth, especially if you're seen by a citizen from a nearby building who may call the police.

More Concealment Tips

Up on the roof, we keep as far from the edge as possible and never look directly over the edge because then we'd really stand out visually. Sudden movements catch the eye of a criminal or even an innocent bystander who could inadvertently point us out to the bad guy. If we see someone looking up in our direction, we back off from the edge or crouch to reduce or eliminate what can be seen. We may have to lose visual contact with a suspect to keep from having our cover blown. But we may be able to hand off a suspect to another observer via radio.

Mobile Surveillance

We want to be undercover when we're mobile, too, so we limit antennas to the smallest and least noticeable. A car bristling with antennas stands out way too much. I have a simple glass-mounted antenna on my car that looks like an extra-long cellular telephone antenna, and, since it's black, it's unnoticeable at night. Dave the detective uses a small black magnet mount antenna with a "Hershey Kiss" sized magnet that works well on his police car.

What Do We Need to Know?

We have to know surrounding street names, including the street we're on, and be able to give concise descriptions of suspects, vehicles, and street addresses. We drive around the area before being deployed there to learn the streets better, but as carefully as I look, I still wish I knew the area better after getting in place on the roof.

It's also helpful to know the police phonetic alphabet (Adam Boy Charles David). Not only can I report license numbers in a more professional manner, but I'm getting to understand more quickly what is said over the police radio. (*Different police departments use different phonetic and number codes. The important thing here is to get to know the lingo of the department with which you're working.—ed.*)

We also learn to use our binoculars only when absolutely necessary and only for short periods. While we watch one possible suspect, we could miss a crime going down just out of view of the binoculars because the trade-off for seeing better close-up is a narrower visual field and virtually no peripheral vision. As far as magnification goes, 10 power is marginally good, but 12 power is better. Higher-power binoculars prove too hard to hold steady without a tripod and are very expensive, something to keep in mind when one receives no money for the job.

Communication

We generally operate with handheld radios and I've found that a headset with a boom mic works very well. We keep the PTT button in hand, or even temporarily clip it to the binocular strap, so it's easy to transmit while observing. There are two reasons we use an earplug or headset: 1) we're often in a noisy environment; and 2) we don't want to alarm people who occupy the building or tip off the "bozos" (suspects) to our presence.

We operate on simplex with a CTCSS (PL) tone. We commonly use 2 meters, depending on the radios the volunteers have with them, but Detective Dave says he has used every band from 2 meters up, including 1.2 gigahertz. It's to our benefit to follow the FCC rule for ham radio to limit power to the minimum needed. This is a clandestine operation and the fewer people who know the better.

On the air, since we have quite a few people on a single frequency, we have a net control who coordinates radio communication. We usually conduct a roll call every half-hour, and team members are expected to report when they move to a new location, or have to leave their post for any reason. We also practice handing off suspects to another Ham Watch person. For this, we need a description of the suspect and sometimes write it down in case we're asked later to confirm what the suspect looked like.

But the idle chitchat instantly ceases whenever we hear two words that really get our hearts pumping: "Stand By." That means something is happening or "going down." We pay full attention because this is what we're out here for: helping the police to apprehend a criminal.

When reporting a possible crime, the adrenaline really starts flowing and the temptation is to transmit for a minute or two to relay all of the information we know, plus all updates. But we must remember to un-key every 15 seconds and leave a short break so someone else can communicate. They may add crucial information. Or there may be another, more important incident going down. Also, there may be a problem with our transmission. Perhaps it is unreadable due to location, depleted battery, or improper mic technique.

Who Can Be a Ham Watch Volunteer?

Obviously, each police department will set its own eligibility rules. In L.A., a person must first be a ham with at least a Technician class license, and must not have a criminal record. The Police Department will check your record right away. In Hollywood, we're issued ID cards that indicate we're LAPD volunteers. These allow us to move around the police station unescorted, and if we talk nicely to a building manager or owner, that card often gets us onto the roof. But they won't get us out of a ticket or get us a discount on a meal.

We're sworn to obey the law and not to reveal any privileged information to which we may be exposed. Basically, the department is protecting itself. We're not police officers and don't pretend to be, but participating in Ham Watch allows us to see a unique side of where we live, and to help make it a better place. ■

How Do I Start Ham Watch in My Area?

Los Angeles Police Department Detective Dave Moye is an enthusiastic supporter of the Ham Watch concept and is willing to talk with police departments in other parts of the country to help get the program going. If you're interested in starting a Ham Watch program in your community, why not show this article to the officer responsible for police auxiliary or other volunteer help in your local police department, and suggest that he or she contact Detective Moye. He can be reached at the Hollywood Division Police Station in Los Angeles.

"Wireless" Education— "Neil's Boss" Responds

"We are on the same side," writes Steve Hardman, Director of Junior Engineering State, responding to June's "Line of Sight" editorial. And if we can help him find the money, he'd love to add a ham radio module to his program.

Editor's Note: In June's "Line of Sight" editorial, I noted that author Neil Dabb, KC7GCL, worked for a program that brings hands-on science and technology to elementary schools throughout the intermountain west, but that the program did not include a ham radio module. "I'm still working on convincing our director that we need one," Neil noted, "not to mention finding funding for such a module." I wrote an open letter "to Neil's boss," explaining why an introduction to radio—with amateur radio as the ultimate "hands on" radio experience—is a necessity in today's wireless world. The following is the response from "Neil's boss," Junior Engineering State Director Steve Hardman.

I thank you for your editorial in your June, 1999, magazine. Please understand that we are on the same side of the fence. I am a big supporter of hands-on science activities for wireless or radio subjects.

You hit the nail right on the head as you were discussing funding opportunities. As director of a program that will deliver over 33 different science and technology modules to over 200 elementary schools next year, I am swamped with details in just keeping our program on the road, let alone finding funding for new opportunities. With a limited staff and a very limited budget, I am constantly looking for new and exciting ideas that I can easily develop into new learning modules for today's elementary children.

My research has found that at least elementary schools have very limited budgets and almost no technology budget for bringing into their schools wonderful hands-on activities that will stimulate young minds to investigate the possible careers available in electronics or other wireless communications. It is my belief, as we create interest in very young minds about technology, that that interest will sustain them through those trying years of junior high, when their minds are on anything *but* education.

Would I Like a Ham Radio Module?

Would I like a ham radio module (or other wireless module) in our delivery program? The answer is a big YES!!! Do I have the manpower or monies available at this point to develop one? The unfortunate answer to this question is NO. Am I willing to sacrifice and develop some type of module? You bet. Just give me some funding from a technology business that wants to have its name in over 200 elementary schools, with the option of going national in a couple of years, and I will create the time or hire someone with the qualifications who can create a module.

Rich, I guess what I am saying is that, with some financial backing, our program would be thrilled to develop something that over 250,000 elementary school students could experience, and through which they could learn first-hand how "wireless" radios work. Do you have any suggestions or possible people that I could talk to? Believe me, if there is a chance for funding, I am willing to look into what needs to be done. Just point me in the right direction. ■

W2VU here again, folks. The ball is back in our court. Do you work for a telecommunications company that's willing to invest in its own future? Do you know of any potential funding sources and whom to contact for more information? We need to hear from you. If you e-mail Steve directly, please cc: me as well. Steve's e-mail address is <steveh@cc.usu.edu> and mine is <w2vu@cq-vhf.com>.

**Steve Hardman is Director of Junior Engineering State, a Utah State University program which brings hands-on science and technology programs to over 200 elementary schools throughout the intermountain west.*

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.*

By Steve Hardman* (steveh@cc.usu.edu)

When the Shaking Starts, It's Too Late to Plan

We have all seen stories about our fellow hams "saving the day" in a disaster or communications emergency. It's a good feeling to know that you're a ham and that you could do it, too. Or could you? Guest columnist KØOV shares his emergency preparedness checklist.

This month, we're pleased to have Joe Moell, KØOV, contributing as our guest columnist (so Bob could work on the Balkans update, found elsewhere in this issue). Joe is an electronic engineer and has been an active ham since age 11. He serves as Assistant Emergency Coordinator of the Hospital Disaster Support Communication System (HDSCS), an organization founded by his wife April, WA6OPS. He is also the ARRL ARDF (Amateur Radio Direction Finding) Coordinator and coordinates the CQ VHF *National Foxhunting Weekend.—W2VU*

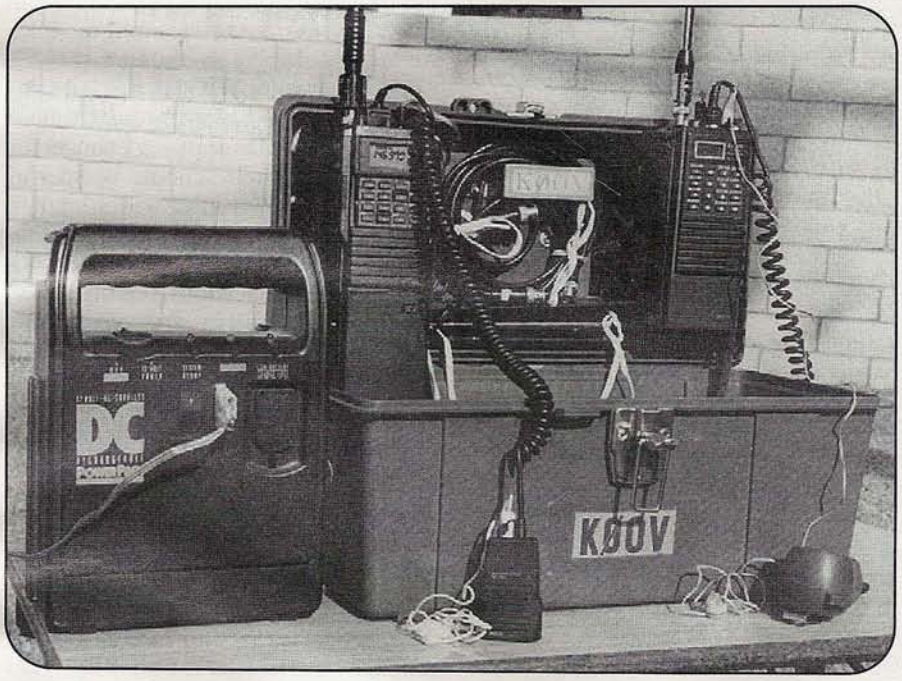


Photo A. An inexpensive durable plastic tool case makes an excellent radio console for rapid setup in an emergency. Simple modifications hold radios and accessories in place. See text for details. (Photos by the author).

If disaster struck your home town right now, would you know what to do? If an inattentive backhoe operator cut the telephone trunk lines to your local hospital, could you be of service? In either case, you wouldn't be of much help from your home. You and other hams would have to go to the places where communications were needed, and you'd probably need to bring your own radio gear.

Is all the equipment that you would need ready to go right now? Are your batteries charged? Could you get on the air quickly and effectively from a disaster site or a damaged facility? What agencies and institutions would you be able to help? What would they expect of you? With whom would these agencies want to communicate? What radio paths would you use to contact or send messages to the people whom they need to reach?

Simply put, if you haven't put some very serious thought and effort into answering questions like these in advance, you're not yet ready to be an emergency communicator. You might become one of the scores of hams who'll get on the air to talk to each other about the disaster, but you won't provide any real support to the citizens of your community. You won't be a vital resource, you'll be a wasted resource.

Orange County's Plan Works

Since 1980, I've been privileged to be a member of Hospital Disaster Support Communication System (HDSCS), a spe-

By Joe Moell KØOV* (hdscs@homingin.com)

Joe and April's Personal Preparedness Plan

Earthquakes are the primary disaster concern in southern California, so Joe and April's personal preparedness plan is focused on responding after a quake. If you live in an area prone to other sorts of disasters, such as tornadoes or hurricanes, adapt this list as necessary to meet your own needs.

After the shaking stops:

1. Check condition of family members and pets, attend to any injuries.
2. Tune radios to HDSCS net frequencies, check in and continue to monitor.
3. Inspect home and prepare to depart.
   - -Check for fire hazards, gas appliances, and broken/cracked pipes
   - -Check electrical equipment in house and HV power lines behind house
   - -Check for hazardous spills, such as chemicals, fuel, medicines
   - -Check foundation for cracks, also chimney, water heater, etc.
   - -Move all vehicles out of garage and secure house for aftershocks
   - -Cover/secure broken windows and any other structural damage
   - -Verify that vehicle is stocked and prepared
4. Depart for pre-assigned hospital
   - -Check with net control en route for possible redirection
   - -If no net control, establish the net

cial ARES (Amateur Radio Emergency Service) group dedicated to the emergency communications needs of hospitals and health care facilities in Orange County, California. In that time, HDSCS has responded to over 65 actual communications failures. Some of them were the result of widespread disasters such as earthquakes, floods, and wildfires. The majority have been sudden telephone system outages due to computer crashes and construction accidents, such as the backhoe example above.

No matter what the cause, any interruption of normal communications at a hospital puts patients' lives at risk. When there isn't instant contact between internal units, or when staff members cannot rapidly reach outside doctors, blood banks, and suppliers, it's a disaster to them. In our area, hospitals know how to get hams to help in these situations "stat." Can they do so in your town?

HDSCS supports 33 medical facilities with almost 7,000 patient beds in a county of over 2.6 million souls. Almost every time, our emergencies have begun with no advance warning. Nevertheless, our typical response time after an emergency alert is about 30 minutes to the first ham's arrival at the hospital. It's not unusual to have a full contingent of a half dozen or more hams in place for department-to-department communications in 45 to 60 minutes.

Many of our hospitals have installed rooftop multiband VHF ham antennas (usually discones) and a few have even installed complete VHF-FM stations. But this pre-installed equipment is often not accessible, especially in the wee hours. HDSCS hams always bring along their own gear to provide floor-to-floor communications. They usually use their own rigs for hospital-to-hospital and other external links, too. Typically, outside links are on 2 meters, and the 125- or 70-centimeter bands are used between units within a facility.

"To achieve rapid response time, our personal ham equipment must be organized and ready, 24 hours a day."

A "Bug-Out" Box

To achieve rapid response time, our personal ham equipment must be organized and ready, 24 hours a day. In the early years, I kept a "bug-out bag" with me at all times, containing handi-talkies, batteries, cables, and small tools. This got me through a few activations, but it left a lot to be desired. The radios tended to bang around and get scuffed up in the floppy cloth bag. Cables got tangled and knotted. Telescoping whips got bent and broken. Usually, everything was in there when I needed it, but if something wasn't, I couldn't tell it at a glance before heading out. I had to either dig around by hand or dump out all the contents to check.

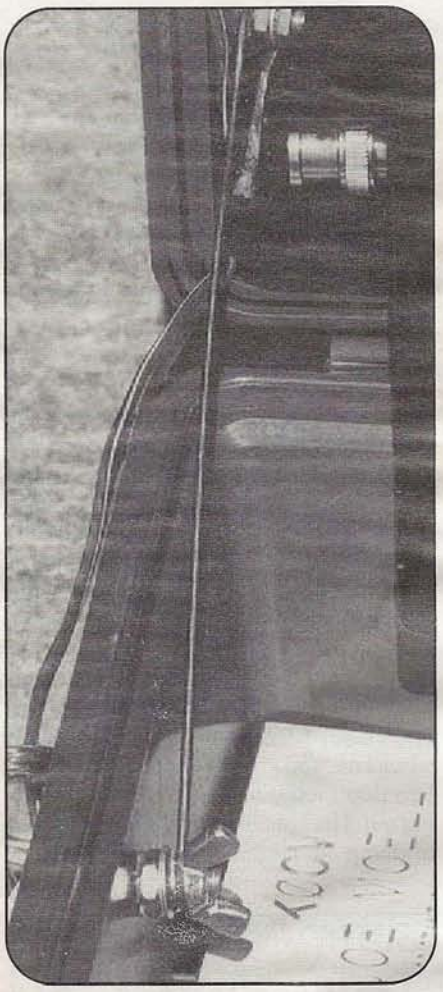


Photo B. A short rod secured by bolts and wing nuts keeps the lid and its attached handi-talkies vertical during operation. The +12-VDC power input line goes in here, too.

Handi-talkies are designed to hang on a belt or be held in front of your face, but not to stand on a table. HDSCS members learned early on not to wear HTs on belts when on a hospital unit because the antenna's proximity to the body blocked incoming signals—too many calls were being missed. When I stood my HTs on a table, they would fall over whenever I picked up my speaker-mic. So I needed a better system.

About this time, HDSCS member Jack Haddon, WA6LWF, showed off his new equipment box, with the lid modified to be a radio holder. I knew right away that his idea would be the basis of my readiness solution. A couple of weeks later, I had finished a similar setup, with a few improvements (Photo A).

The heavy plastic tool box cost only about $8 at a discount store. I cut up a coat hanger to make a rod that holds the lid vertical when operating (Photo B). The two radio holders bolted onto the lid are U-shaped pieces of steel from my junkbox. Hanging an HT's belt clip on one of these brackets keeps it firmly in an upright position against the lid. The whip antenna stays vertical and in the clear. I have two radio positions on the lid, one for the UHF internal net and one for the VHF external net. There's room in between to mount my scanner, if needed.

Power Options

An average HDSCS activation lasts three to four hours, but some have continued for 24 hours or more. The HT's battery packs will not last through a long activation, so I wired the box with 13.8-VDC connections to each radio location. The little 2-ampere, 13.8-VDC supply that I carry along will power the setup when AC power is available. If not, a 6 ampere-hour sealed lead-acid battery pack will do it.

My emergency kit also includes coax jumpers and adapters, so I can utilize any external antenna that may be available at a hospital. There's room in the box for 5/8-wavelength telescoping whips, a small bag of tools, flashlight, micro-cassette recorder, HDSCS rosters and county-wide frequency lists. Cables and whips are secured to the lid with shoelaces. That's much better than tape, which gets gummy, or wire ties, which break and get lost. It's easy to see at a glance that everything is in place and ready to go.

My "bug-out box" has stayed close to me for five years and has served me well. From the Emergency Department of a major hospital, I placed autopatch calls to patients' families and to physicians during a five-hour phone system failure. From the Command Post of another hospital, I directed a network of internal unit hams while communicating with a countywide net on another band.

Those are just two examples; the box has been used many other times. In between emergencies and drills, it's ideal for fast station setup at public service event locations, such as parade announce stands and marathon mileposts. Most other HDSCS members now have their own quick-setup kits, using a variety of soft and hard enclosures in accordance with their personal preferences.

Plan for Yourself, Too

A "bug-out box" will keep you on the air during a communications emergency, but it's not the total solution for personal preparedness. What if a widespread disaster leaves you stranded, away from home? You'll need enough provisions to keep you functional so that you don't become part of the problem instead of part of the solution.

Many ARES and RACES (Radio Amateur Civil Emergency Service) groups provide training in personal preparedness, with lists of suggestions for items that the comfort kit in your vehicle should include. I collected lists from several sources and used them to create my own personalized list, which includes personal medication, first aid supplies, gloves, dust mask, hard hat, change of clothes, and spare glasses. It's all in a big tub that I keep in my vehicle at all times. Make your own list, tailored to your own circumstances, and be sure that the most important items are always close by.

But that's still not the end of good personal preparedness. HDSCS's ability to respond to hospitals within minutes after a disaster requires us to secure our homes quickly. Imagine that you are at home and a disaster has just struck. What steps would you take before departing to serve an agency? In what order?

My own Personal Preparedness Plan appears elsewhere in this article. This example assumes a damaging earthquake, because that's the most likely major disaster here in southern California. With a little modification, it would serve for a tornado or hurricane emergency. The idea is to attend to your personal post-disaster situation with the right priorities, and without forgetting anything important. Give some thought to your own circumstances and create your own list.

Preplanning your reaction to a sudden disaster not only adds to your efficiency and makes you a faster responder to the agencies that depend on you, it also helps reduce your level of stress. Instead of flailing around wondering what to do next, you'll be taking positive steps to control the situation.

Are you really ready? Remember, when the disaster strikes, it's too late to start planning. ■

Resources

For more information on HDSCS and ham radio support to hospitals, see the HDSCS Web site: <http://members.aol.com/emcom4hosp/>.

Q & A

Q: I recently leased a new Ford Windstar minivan and only have a clearance of 10 1/2 inches between the roof and the bottom of the garage door. I have a dual-band mobile radio and am looking for any info on an antenna that can be used in this situation. I have a 1/4-wave Diamond antenna (21 inches in total height, antenna plus magnet mount) that can be folded, but it would be somewhat inconvenient to have to fold/unfold every time I entered the garage, not taking into account the wear and tear on the antenna. A few people have recommended the through-the-glass type of antenna, but then say that the type of tint in the glass could affect the performance. Others have told me that this type of antenna is not a very good performer.

Of course, all these problems could be avoided if I left the van in the driveway, but this is not something I wish to do. Has anyone else had this problem and found a solution? Is there an antenna on the market that would solve the problem? Any info would be appreciated.

Peter Kruys, VE3JWP
Russell, Ontario

WA5VJB responds:

A: I have a minivan, with just about as much clearance, and I use a 6-meter 1/4-wave antenna on top. I just have a good flexible spring, a thin whip, and don't mind listening to the noises as I drive in! It's been working fine for a year now. If that solution won't do it for you, a really thin 1/4-wave 2-meter antenna will work pretty well on 450, and you can save the big one for vacations.

Q: I enjoy your magazine very much, and I'm glad to see a VHF and above specialty magazine. I would like to know if you are aware of a resource (hopefully a Web site, so it would be available to everyone) that describes (government/military) surplus equipment. From time to time, one can run across surplus at swap meets, or (here in Southern California) at the local surplus dealer; but the sellers are not always knowledgeable about such specs as frequency, etc.

For example, I have run across such items as RT-178/ARC 27, or RT349/ARC55, and I know both are transmitting units using 4CX250 or similar tubes; but, without information, I don't know if they can be modified for use on a ham band, or if they would have to be completely stripped and re-built from scratch.

Any information you may be able to provide will be greatly appreciated; you may even want to consider publishing the information in *CQ VHF*, as I'm sure there are many others out there who would welcome the information. Thanks.

Larry J. Rolewic, WA9SVD
Long Beach, California

A: This is going to be one of those questions that I'll bet the readers will be better able to answer than I can. I don't know of any specific Web sites or other resources to which you can turn for general info on surplus gear. I'd suggest a Web search on "radio+surplus" to see what you can turn up; also, you might see if there's a surplus e-mail reflector on qsl.net or elsewhere on the Internet. Readers? Anything more specific?

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*:

- *CQ VHF* Reviews:
  - "ICOM IC-706 MkII-G HF/VHF/UHF Transceiver," by Gordon West, WB6NOA
  - "Head to Head: The FT-100 and IC-706-G" by Gordon West, WB6NOA
- "Solid State Guy Lines," by Mike Baker, W8CM
- "Meteor Scatter via APRS," by Ev Tupis, W2EV

Plus...

- "The RF Attenuator," by Peter Ostapchuk, N9SFX
- "Communicating with Your Computer," by Lew Ozimek, N2OZ
- "Truly Portable Packet," by Ray Rischpater, KF6GPE

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' Guide-lines, 25 Newbridge Road, Hicksville, NY 11801.

Link Up with TAPR "SIG"s

If you want to learn more—from fellow users and experts alike—about a specific aspect of amateur radio digital communications, such as APRS or the 6-meter "PropNet," then Tucson Amateur Packet Radio's "Special Interest Groups" are the place to look.

This month, we'll take a look at what is probably the most comprehensive resource of information, knowledge, and talent in the world of amateur packet. No, not the back issues of *CQ VHF*, but the *Special Interest Groups* (*SIG*s) sponsored by Tucson Amateur Packet Radio (TAPR). If you can't find the answer in one of the SIGs, it doesn't exist...yet.

Before we even get started, I want to urge you to join TAPR. It's only through members' support that any of these resources are offered, even though you don't have to be a member to use them. One of the greatest benefits is a subscription to the *Packet Status Register*, still one of the best newsletters out there. Membership in North America is only $20 a year, and $25 elsewhere. They even take MasterCard and Visa! Their contact information is at the end of this month's column.

I also want to take a moment to thank everyone who writes in with their comments and ideas. Letters from readers are always the highlight of my day, so keep 'em coming!

The TAPR Web site

If you've never visited TAPR's Web site at <http://www.tapr.org>, your first visit might be a bit overwhelming (see Figure 1). Gee, I visit quite often, and when I decided to really look into all the corners of the site, even *I* was overwhelmed. There is *so* much information there, and all of it is very useful. The site was reorganized early this year, and the new look is a considerable improvement—everything is easier to find now.

There's information about all of the TAPR projects for the past few years,

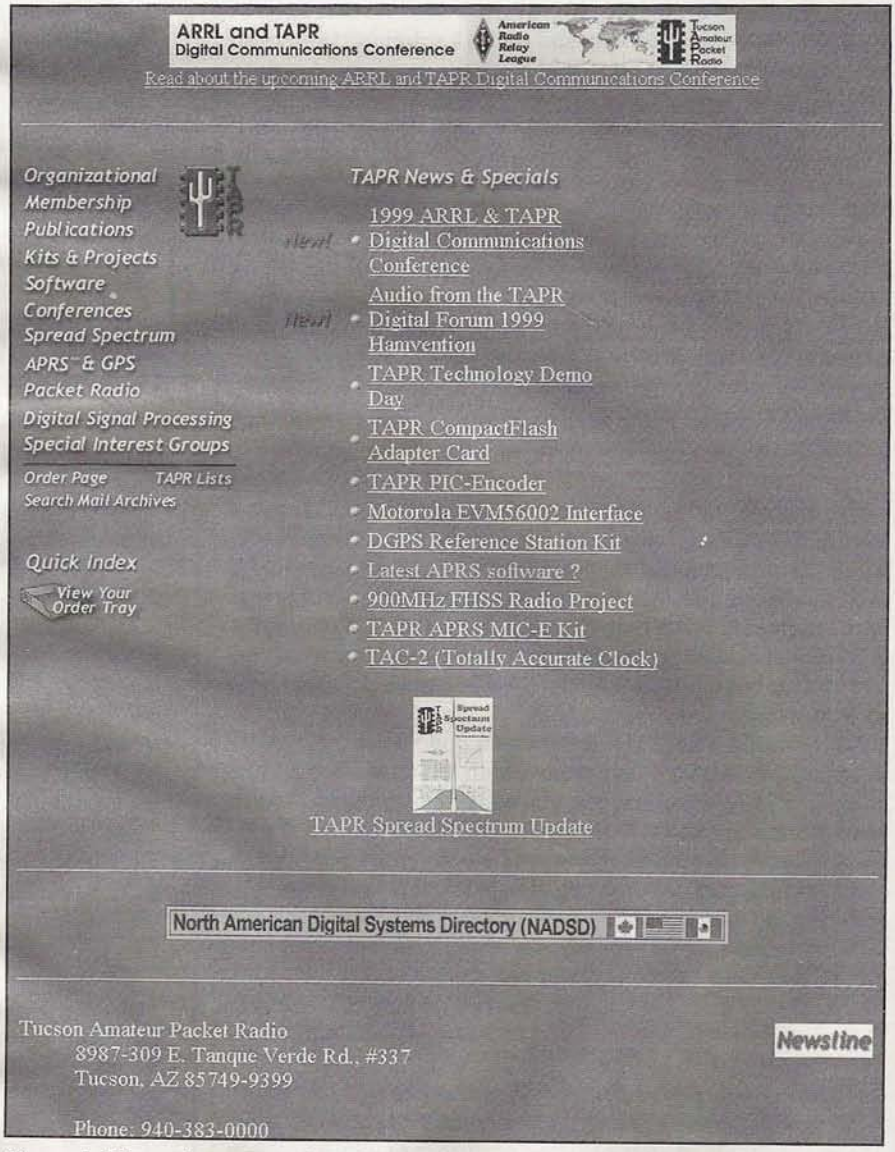


Figure 1. The main screen of the Tucson Amateur Packet Radio (TAPR) Web site at <http://www.tapr.org>. This is your doorway to a tremendous amount of information about all sorts of amateur radio digital communications, including the Special Interest Groups, or SIGs, that are the subject of this month's column.

By Don Rotolo, N2IRZ (n2irz@cq-vhf.com)

including updates on the latest ones. Their FTP site contains nearly every packet-related software program there ever was: APRS, AX.25, BBS programs, networking programs, Linux stuff, and much, much more. There's also information on how to modify radios for 9600 baud, modem designs, basic and advanced packet radio, the *North American Digital Systems Directory* (a listing of nearly every packet network node on the continent), and...well, you get the idea. *LOTS* of stuff. Overwhelming.

One area that's often overlooked is the Special Interest Group (SIG) areas. These are primarily *list servers* on a specific topic; you send an e-mail message to the server, and it bounces a copy out to everyone who has "subscribed" to the SIG. These SIGs are a fast way to tap into the combined knowledge of nearly all the packet gurus out there. Send a message to the APRS (Automatic Position Reporting System) list, for example, and it isn't unusual to see the authors of one of the various flavors of APRS respond. In addition, every message processed by the server is archived monthly, so between the live SIG itself and the archived messages, the answer to almost every question ever asked is in there, somewhere.

Digging into the SIGs

Here's an alphabetical listing of a few of the more popular SIGs, and a brief description of what they're about. I have to emphasize that these are only *some* of the SIGs!

APRS SIG—There are a number of SIGs devoted to APRS, including general discussions, hardware issues, software issues, and AO-16 operations. The purpose of these SIGs is to provide a meeting place where experts and novices alike can help each other and share up-to-the-minute information.

Digital HF SIG—The HF SIG serves as a forum for those involved in developing and experimenting with digital applications for HF. The low bands offer unique challenges and rewarding opportunities for amateur radio. Modern technology applications, such as modulation schemes, DSP (Digital Signal Processing), and error-correcting protocols, are sparking a dramatic resurgence in HF digital operations.

DSP SIG—The purpose of the DSP SIG is to serve as a forum for those involved in developing and experimenting with DSP-based applications and techniques. TAPR is seeking talents representing a wide range of topics, such as mathematics (coding theory, signals, and transforms), software engineering (algorithm development, real-time OS, low-level I/O, host OS), electrical engineering (analog, digital, and RF), and DSP (theoretical, hardware, and software). However, there's a similar need for technical writers, beta testers, and project management.

FCC Regulations—The fccreg list provides a forum for folks interested in discussing FCC topics related to amateur radio digital communications.

Linux SIG—The purpose of this list is to discuss Linux activities related to amateur radio operations and various TAPR projects. For the uninitiated, Linux is a computer operating system.

Mic-E SIG—The TAPR *Mic-E* (Mic Encoder) installs between your radio mic and radio and allows your GPS unit to transmit APRS AX.25 frames at designated intervals without needing a TNC!

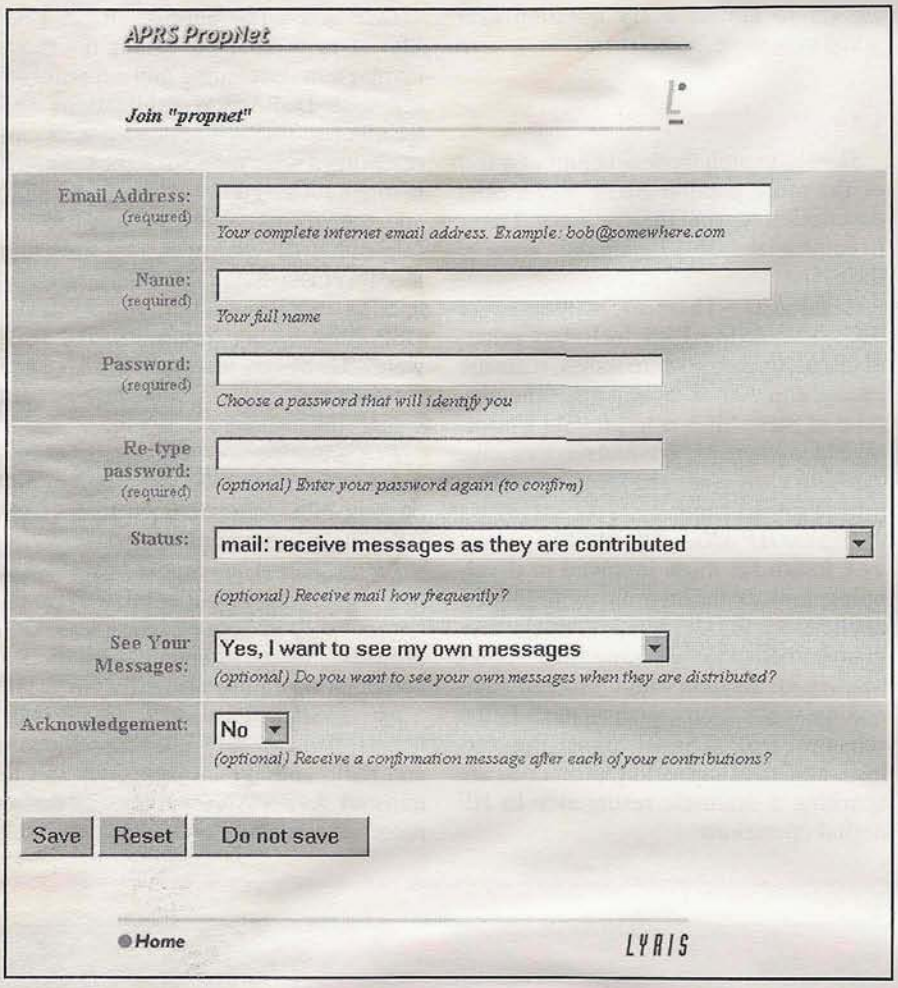


Figure 2. Joining a TAPR SIG is as easy as filling in the blanks on an interactive Web site form, then responding to an e-mail message to confirm your "subscription." It's also possible, but not as easy, to join via e-mail, if you don't have Web access (see text for details).

(See the review I wrote in the October, 1997, issue of *CQ VHF*.) The Mic-E can be very useful in many settings. This group is all about providing support to Mic-E kit builders and users.

Networking SIG—The TAPR NET-SIG is one of my favorites, intended for the discussion of all aspects of packet networking, such as helping people implement or repair networks, regional network interconnections, and the role of Internet gateways.

Packet BBS SIG—The BBSSIG is for discussions of concern to BBS operators, including software selections, message addressing, user education, network interactions, and operating or troubleshooting a BBS. Perhaps you have a question—likely someone on the SIG knows the answer. There are also discussions concerning sysop guidelines for more efficient BBS operations. This SIG is moderated by Barry Buelow, WAØRJT (in a *moderated* listserve, all messages are screened by a specific person—the moderator—before being retransmitted, to assure that they're on-topic and are not abusive to other list members).

PIC SIG—The purpose of this list is to discuss PIC (Peripheral Interface Controller chip) development and technical topics related to amateur radio operations and various TAPR projects. Also, support for TAPR's *PIC-E* kit is handled on this SIG.

Regional Freq—Issues related to Regional Frequency coordination, the 219-MHz band, and the *North American Digital Systems Directory* are discussed on this list.

Spread Spectrum SIG—This mailing list is for the discussion of topics related to the application of spread-spectrum communications technology to amateur packet radio networking. The emphasis of this SIG is on the technology of spread spectrum rather than regulatory or political issues.

TAC-2 and GPS Technical Issues SIG—The purpose of the tacgps list is to provide a forum for folks interested in discussing technical issues related to TAC-2 (second generation of the Totally Accurate Clock) and GPS (Global Positioning System).

TAPR-TNC SIG—This SIG is intended to be a low volume, high signal-to-noise place (meaning lots of useful information) to discuss issues related to use of the TAPR (and clone) TNCs. Topics such as hardware, firmware, problems, mods, and interface issues are welcome.

How to Join a SIG

To join any of these SIGs, simply log on to the TAPR Web site and follow the links to Special Interest Groups, and then look down the menu on the left-hand column for a "Join" button. You'll be presented with a form (Figure 2) on which you simply fill in your name, e-mail address, and select your preferences. You'll then receive a confirming message, to which you need to reply (this keeps other people from signing you up for a SIG without your permission). Preferences include receiving every message as it's posted, or having them all strung together into a single daily message, known as digest mode.

Although the majority of *CQ VHF* readers have regular access to the Internet and World Wide Web, there are some with only e-mail access, through such generous providers as juno.com, which offers it for free. While it's much more convenient to subscribe to a SIG on the Web, it *can* be done via e-mail. Any time you want the list server to do something for you, simply send an e-mail message to <listserv@tapr.org> with the subject line "Request" (without the quotes) and type the desired command as the body of the message, again without quotes. Some common commands are:

- "list"—Returns a list of all SIGs on tapr.org
- "information *listname*"—Returns details on the SIG specified by *listname*.
- "Subscribe *listname yourname*"—Subscribes you to a specific list (specified by *listname*). Please use both your first and last names for *yourname*. For example, "subscribe netsig Don Rotolo" would subscribe me to the packet networking SIG.
- "Unsubscribe *listname*"—Unsubscribes you from the list.

• "Digest *listname*"—Sets your account into digest mode.

The Lyris server (which maintains the lists and moves the mail) is quite intelligent; not only does it confirm every command by e-mail, it will even tell you if it did not understand a command. If you need help, there's a comprehensive (and sometimes confusing) user manual at the Lyris Web site, <http://www.lyris.com>. As a last resort, you can send an e-mail message to tapr@tapr.org, which is read by a real human being, but I doubt it will come to that.

The bottom line on e-mail commands is that it's a *lot* easier to use the Web site than to e-mail for these things.

A Worldwide Resource

TAPR offers a valuable resource to the worldwide amateur community, not only in its comprehensive Web site, but with these special interest groups, which provide a virtual meeting space for all kinds of discussions. Just "listening" to the traffic on some of these lists is an education in itself. Of course, without the support of members, this would all just disappear, so I again urge you to support TAPR by becoming a member.

Now that we've had a brief look at some of the information available in the TAPR SIGs, where no question is too basic, we're going to continue in a similar direction next month. If you've been reading this column for a little while and want to get involved in digital communications, but haven't had a clue as to how to get started, next month is just what you'll need. We'll go from zero to packet in three pages or less, with TNC selections, connections, problems you might face, and more. Until then, 73.

—N2IRZ

Resources

Tucson Amateur Packet Radio (TAPR), 8987-309 E. Tanque Verde Rd. #337, Tucson AZ 85749-2544. Phone: (940) 383-0000; Fax: (940) 566-2544; E-mail: <tapr@tapr.org>; Web: <http://www.tapr.org>.

"QSL.net" is another large listserver, which uses the popular "majordomo" server software and offers e-mail lists on virtually every ham radio interest. Visit them at <http://www.qsl.net>.

Reader FEEDBACK

"Cheap Yagi" Questions

The following letters were received by "Antennas, etc." columnist Kent Britain, WA5VJB, regarding his ongoing series on "Cheap Yagi" antennas.

Hi Kent,

I have been following your series on "cheap and easy" antennas in *CQ VHF* magazine. I have tried getting the materials here in the Utah desert, but the lumber people tell me that $^1/_2 \times {}^3/_4$-inch isn't an "industry standard" size! They do offer to sell me outsized wood, then to cut it up for me and charge extra for the cutting. I have a saber saw, but can't saw a straight line with it! This size factor might be why you are receiving the various comments or questions about booms.

I'm on a temporary assignment here, so I need simple and cheap portable antennas for both 2 meters and 440. I plan to building a 2-antenna "stacked" array for 440, and a couple for 2 meters, aimed in opposite directions, and will see what happens.

Dick Warren, W7TIO

WA5VJB replies:

Hello Dick,

Just about anything smaller than a 2 × 4 can be used. Around here, $^1/_2 \times {}^3/_4$ is commonly available, but 1 × 1 can also be used. The only time we have ever had any trouble was when a chap in Houston built a 1296-MHz version using 1 × 1 wood. With about $^1/_3$ of the element inside the wood, there were some detuning affects.

73, Kent, WA5VJB

Kent,

I'm currently putting together one of your Cheap Yagi antenna designs for the 2-meter band. I plan on using it for local T-hunting here in southern California. However, I can't find any wire that I like. I'm using $^1/_2$-inch PVC for the boom, since the PVC is lighter and easier to carry around, and since I won't be leaving the antenna out in the weather.

Your design calls for 10-gauge wire for the driven element. Personally, I'd like to use 10-gauge wire for all of the elements. However, all the wire that I have been able to find, even at the local electronics parts store, is stranded and far too flexible to be used as a Yagi element. Any idea where a guy could find some solid, or at least more rigid, wire?

Ken Collier, KO6UX

WA5VJB replies:

Hello Ken,

Most anything about that diameter can be used. I find silicon bronze welding rod works pretty well, as will elements off an old 2-meter antenna. Just try and find something about the same diameter. I've also used the brass tubing you find at hobby shops. I have also stripped the insulation off #10 house wire. It works well on the smaller antennas, but would be a bit "floppy" for 2-meter antennas.

73, Kent, WA5VJB

Hi Kent,

I am going to build one of your 2-meter FM "Cheap Yagis" (the three-element version). Should I make the driven element out of #10 copper wire and the other two out of $^1/_8$ aluminum ground wire (like the 440 version)? 73,

Carl Johnson, KF4WXK
Cary, North Carolina

WA5VJB replies:

Hello Carl—I used $^3/_{16}$-inch in the article because I think it's a little stronger. As long as you protect it, it should work fine. Many of my cheap Yagis are mounted in my attic.

73, Kent, WA5VJB

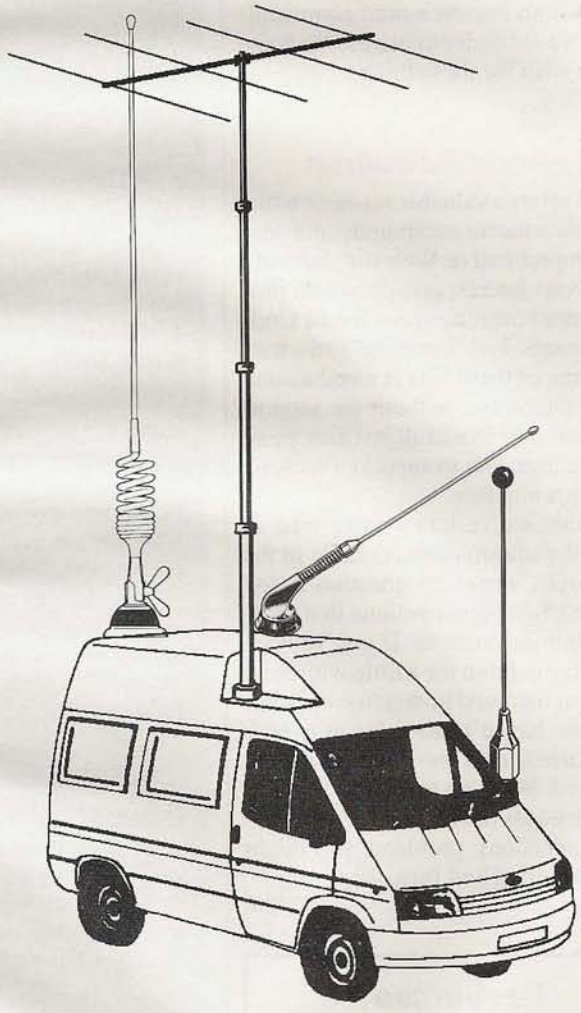
Your First Mobile Installation

Putting a ham radio in your car is a tradition almost as old as ham radio itself. Here are some tips for the first-timer to make the installation smooth and easy.

Social critics often comment on the love affair that Americans have with their automobiles. Hams are no exception, and, to the average ham, the car often becomes a rolling ham station. If you have a commute that lasts more than 15 minutes, the time you spend behind the wheel starts to be a significant block of time on a weekly or monthly basis. Why not use that time for something more worthwhile than chuckling at Howard's seventh-grade humor?

Most new hams start out with a handheld—period. If you're more than a few miles from the repeater while driving, the limitations quickly become apparent. Sure, it can be less expensive to buy an outboard amp and antenna to boost your handheld's effectiveness. But you may not be satisfied with the ergonomics of operation or the need to constantly hook up and unhook the handheld. And if you have to make a sudden stop, the handheld is probably going to become a UFO—Unrestrained Flying Object—that you have to duck (*and in a collision, a flying HT can be downright dangerous—ed.*). Besides, it's not good for the radio. So, unless you live in a high-crime area, a permanently installed mobile rig sooner or later shows up in most hams' cars.

This month, we'll cover the basics of a sound mobile installation, starting at the top—literally—with the antenna.



Antennas

Mobile antennas come in all sorts of shapes and sizes. For simplicity's sake, let's limit this discussion to FM operation and FM antennas. Still, we're left with a myriad of choices. My experience has been that the type of antenna used is usually less important than its placement. In general, from the perspective of signal coverage, the best place for the antenna is the center of the roof of the automobile. The second best location, for a passenger car, is the trunk lip in the center of the car. The Figure shows some "typical" radiation patterns for identical antennas that are mounted at different spots on an automobile body. Of course, this is only true for car bodies made of metals; fiberglass bodies present a whole other set of problems, which we'll take a closer look at in an upcoming column.

I've never understood it, but there are some people who don't want to drill a hole or two in their new car. In a former life, I worked for a Motorola Service Station (repair shop). We installed most of the Motorola two-way radios sold in the area. That was fun! Almost every company owner or president wanted a radio in his car to keep in touch with the employees. In those days, they mostly drove big Cadillacs or Lincolns, and it was a thrill to take a brand new luxury car with the sticker still in the window and drill a $^{7}/_{8}$-inch hole in the roof! It felt like something that belonged in *The Blues Brothers*. These guys wanted to squeeze the last drop of performance out of their radio systems. And that meant putting the hole in the roof.

When you're installing an antenna this way, you'll have to loosen the head liner (*car-speak for the ceiling panel—ed.*) and route the antenna feedline between the inside roof and headlin-

By Peter O'Dell, WB2D (wb2d@cq-vhf.com)

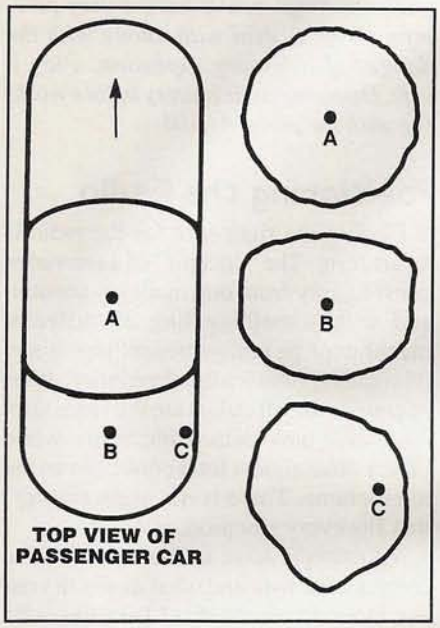


Figure. Comparison of typical radiation patterns from mobile antennas mounted in the center of your car's roof (A), centered on the trunk lip (B), and on the side of the trunk lip (C). Note that this applies only to vehicles with metal bodies.

er to the edge of the roof. From there, channel the feedline through one of the vertical columns or behind some trim so that it comes down the front/side of the car near the radio.

RG-58-size coax is lossy at all VHF/UHF frequencies, so you'll want to keep the coaxial cable as short as possible. Route the cable to the radio location, make sure that you have enough cable to easily connect to the radio, give yourself another six to eight inches and then cut off the rest of the cable. When you put on the PL-259 (why do we still use UHF connectors? They should be banned!), make sure that you've done a great job soldering the center pin and all four of the holes in the barrel. UHF connectors are bad at best, but a poorly installed one becomes a nightmare—especially in a car with vibration, heat, humidity, and all the other naturally occurring phenomena of this environment.

Most antenna manufacturers offer several different mounts. The NMO style has been my favorite for years. When I worked for Motorola, I seldom saw those mounts go bad with leaks, rusting, etc. Not so with the other style connectors. Mechanically and electrically, it's one of the best-style mounts on the market. The one drawback is that it does require a 7/8-inch hole, which is a little bigger than some of the others. But it is solid.

Finally, there's the question of which particular antenna to use. My first choice would be a simple 1/4-wave antenna. They're inexpensive, durable, unobtrusive, and the performance factor is good when mounted in the center of the roof. Also, if you're dealing with a vehicle other than a passenger car (a minivan, SUV, truck, etc.), antenna height can be a problem on a vehicle. When I had a 5/8-wave on the top of my car, I "took out" several fluorescent bulbs in a parking garage. Not a good idea.

If you're not willing to drill a hole (coward!), then I'd suggest either a magnetic mount in the center of the roof or a trunk-lip mount near the center of the trunk lid. In either of these cases, I'd be more inclined to go with a 5/8-wave antenna than a 1/4-wave. In these instances, the gain antenna may make up for some of the deficiencies in the mount, and height is less of a problem with a trunk-lid mount (but watch out on roof-mounts). If you choose to go with a magnetic mount, make sure it's a strong one. You're dealing with some powerful forces—at 70 miles per hour, your antenna starts to function more like a sail than a toothpick.

Power Cables

Getting power from the battery to the radio safely and noise free can be one of the most difficult steps in a good mobile installation. In most cases, the battery is located in the engine compartment (however, if you're lucky enough to own a 1959 VW Beetle, you'll find the battery under the back seat!). And there's a firewall between the engine compartment and the passenger compartment of the car. My theory (*and general wisdom—ed.*) is that you should tap the positive line as close to the battery as possible. That means that your power line must come through the firewall.

How do you do that? Since the firewall is made of metal and insulation, it can be somewhat tricky to route the power cable. Incidentally, the car/truck chassis usually provides a very good ground, so there generally is no need to run a negative lead all the way to the battery. Just find a good metal brace or the firewall itself. Find a large bolt or drill a hole and use a large sheet metal screw. Either way, a large star washer helps to lock the tap in place and provide solid contact. However, I've known of a case or two where some really strange problems disappeared by routing the negative lead directly to the battery.

Look closely at the way the automobile manufacturer gets wiring through the firewall. You'll probably find the wires grouped together and molded into a rubber plug that fits exactly into a hole in the firewall. And you may notice a few isolated wires passing through other rubber plugs. Since you probably don't have the manufacturer's resources at your disposal, a custom rubber plug is out of the question. But an ordinary rubber grommet runs a close second! And if you're lucky, you may find some pre-existing holes with rubber plugs in them. Pop out a plug and replace it with an appropriately sized grommet.

Why the need for the grommet? The sharp edge of the metal might cut through the insulation of the power wire over time, creating a short-circuit. This brings up another issue: You *must* have a fuse in the line *between the firewall and the battery*—otherwise you run a real risk of starting a fire in your car if something goes wrong!

How do you actually get the wire through the firewall? You have pretty tight quarters under the dashboards of most cars. The easiest way that I know of is to start with a short piece of stiff wire, such as a coat hanger or the whip of a discarded antenna. Once you have the stiff wire through the firewall, form a small hook at the end where the power cord is starting out. Hook the end of the power feed to the stiff wire and tightly tape the two together. Then pull the stiff wire through the firewall with the power feed trailing behind.

The size of the wire to use depends on the number of amps your radio will draw. But I come from the "brick outhouse" school of engineering, so I would run number 8 or 10 stranded copper wire to the battery tap. Overkill? Probably. But then I seldom get complaints of whine on my signal. Also, if I should want to run two rigs in the car someday—it could happen—I already have sufficient power in the passenger compartment.

Since most cars have the fuse box somewhere inside the passenger compartment, you might ask, "why not just tap power from the fuse box?" You could, but you may find yourself receiving complaints of "alternator whine" or "windshield wiper whine." In the early days of digital control of automobile engines and

accessories, it was not uncommon for people to complain about all sorts of strange "behavior" associated with keying the transmitter. It's less likely today, but it's still possible that your radio could interfere with the operation of your car. So, my advice stands: make your connection as close to the battery (inside the engine compartment) as possible, and make sure both positive and negative lines are fused before the wire passes through the firewall.

What's the best way to attach a power feed to positive near the battery? If you have a battery with the posts on top, it's pretty simple to unscrew the nut from the battery terminal and attach your wire there with a spade lug. However, many newer cars have side-terminal style batteries. Electrical supply stores sell copper compression fittings that make for a very secure tap. You just need to disconnect the positive lead to the battery and scrape about an inch of insulation off at least six to eight inches from the terminal. Put the fitting onto the wire and add the end of the radio power feed. Use a screw driver to tighten the fitting as tight as you can make it. Then use a lot of electrical tape to make sure the tap is well insulated. Failure to adequately insulate the tap could result in a short—in that case a destroyed battery would probably be the good news.

Another safety note: *Be sure to disconnect the positive lead from the battery before trying to attach anything. If you, or a tool, accidentally create a short-circuit to ground, you'll have a very powerful shock to deal with, along with the danger of a battery explosion. Play it safe. Disconnect the battery before working with the power leads!*

Positioning the Radio

Finding the right spot for the radio is an art form. The "cockpit" of a car varies considerably from one model to another, and with something like 25 different manufacturing companies selling cars in this country, that's a lot of variation. Plus, of course, not all radios are the same size. And some have detachable heads, while others offer almost total control from the microphone. There is no "right answer" that fits every situation.

You simply have to find what you're comfortable with and what works in your car. How do you do that? Take the radio with you and sit in your driveway while pretending that you're operating. Have a friend sit in the car with you to see what it's like when you have a passenger along. While sitting there for a few minutes, close your eyes and imagine you're in heavy traffic and you want to grab the mic for a minute. Can you find it easily without taking your eyes off the road. Can you read the frequency/memory channel information with only a quick glance. Think through all the things that you'll be doing and choose your mounting position accordingly. Also, the old carpenter's adage, "measure twice and cut once," applies.

Finally, one of the best additions that you can make to a mobile installation is an external speaker. Without it, your receive audio will probably be blasting into the floor of the car. "You can't work 'em if you can't hear 'em" is as true on FM as it is on the low bands.

Time Management

Allow yourself enough time to do the job. When I worked for Motorola, it took about two hours to install one of the trunk-mounted radios with a remote head. It was something I did several times each week, I had all the tools I needed, and I had a parts box with deep drawers. Granted, your installation may not be as complicated as one of those, but still, allow a whole afternoon. And do it before the weather turns cold.

With a few hours of preparation and work, you can have a mobile installation that will last as long as you keep the car. It's well worth the investment. ■

Letters

(from page 8)

FCC reallocated the lower 2 MHz of the band to the Land Mobile service, it scared a lot of hams away. There were a lot of repeaters on the air in the late '80s that were linked, allowing someone to work stations in several states with just 1 watt. I used to take my Kenwood TH-31BT mountain-climbing all the time and work hams all over the place. Plus, I would take it mobile for the commute into Massachusetts each day. After a while, I started to realize that the grass was probably greener on 2 meters and sold my 220-MHz gear and bought 2-meter gear instead.

In hindsight, I wish I had held onto the 220-MHz radio. I just checked on e-Bay [an Internet Web site] and found the exact model radio I had sold years ago listed for $1.00. There are some bargains out there to be had for 222-MHz FM gear. If more folks get on the band, we may find manufacturers beginning to introduce more gear at lower prices to accommodate this band for North American hams.

Bryan King, K1SNH
Via e-mail

Bryan—I certainly hope you scooped up that $1 special on e-Bay! I'm sure the manufacturers will be watching to see how well ADI/Premier does with its new AR-247 1.35-centimeter FM mobile rig. If it's successful, others will certainly follow suit. Speaking of manufacturers, we left out one from our listing: Azden had a 222-MHz rig in its line of single-band FM transceivers. And while Azden is no longer in the ham market, some dealers may still have one or two of these in stock, or you may find them on the used market.

Really Cheap Yagis

The following letter was addressed to Antennas, etc. columnist Kent Britain, WA5VJB:

Kent—For Field Day, I got saddled with making a satellite QSO for our group. So I undertook to build one of your Really Cheap Yagis per your articles in *CQ VHF*. I got a stick and some wire and built a six-element 432 Yagi. Sure was tough to build...in about 10 minutes.

Fired it up on AO-10, and I discovered that I had a *huge* signal through the transponder. I ended up with 25 satellite QSOs, most of them through AO-10 at a range of up to 39,000 kilometers. The best part was seeing all the raised eyebrows and skepticism from people who didn't believe it would work. Tee hee.

Thanks for a great series of articles. I'm working on the long one for 432 now, and I am going to work Hawaii on it during the next opening. And maybe next year's project for FD will be a 2-meter EME array (for OSCAR-0!). 73,

Chip Margelli, K7JA
Garden Grove, California

WA5VJB replies:

Always glad to have a happy user. It don't have to be hard!

Getting Started in ATV—Part 2

Most ham TV activity is in the 420-MHz band, but it's growing on higher frequencies as well. This month, N5EM continues his tour of ATV equipment and activities, moving into the microwave ham bands above 1.2 GHz.

Welcome back to "In Focus." First, an apology for all who expected my Dayton report. Thursday night while at Dayton, I got word that my Dad was to undergo cardiac bypass surgery on Friday morning and I had to completely change my plans and return to Houston. So, I missed all the great ATV activities this year. But my Dad is doing great and that's what's important. There is always next year—and you can bet I'm planning to be there.

Last column, we discussed ATV frequency usage up to and including the 1.2-GHz band. This month, we finish that discussion with the bands above 1.2 GHz. There's a lot of room in our microwave bands. That's good, because ATV *takes* a lot of room. The disadvantages are that range is diminished as we go higher and higher in frequency and power gets harder to generate and becomes increasingly more expensive.

Photo. The Wavecom Jr., a commercial product designed for sending signals from a VCR or cable box to a TV in a different room, uses the 2.4-GHz band as an unlicensed Part 15 device. Hams share this band, and the availability of these low-cost transmitters and receivers has given a significant boost to ATV activity on 2.4 GHz.

The 2.4-GHz Band

The next band up in our survey of ATV bands is the 2.4-GHz band. This band originally came to the interest of the ATVer as a result of the nearby use of 2.2 to 2.5 GHz for educational television distribution. For quite a while, there have been services ranging from public school TV links to commercial single channel broadcasting to multi-channel "wireless cable" services using frequencies near our 2.4-GHz band. Amateurs have had access to inexpensive antenna mounted down-converters for these bands for quite a while. HF Technologies made a 2.4-GHz FM ATV transmitter for a long time, providing one of the only commercial transmitters for the band. Slowly, surplus equipment from these commercial television services began to make its way into the amateur service and 2.4-GHz ATV began to emerge. Today, you'll find both AM and FM television in this band, depending on the local preference and availability of equipment.

The recent introduction of commercial 2.4-GHz FM ATV equipment intended for the residential consumer market (see Photo) has given a boost to ATV in this band. I've recently discussed these devices (see December, 1998, "In Focus") and won't rehash this information, but you can find plenty on converting these devices to real, usable amateur television gear. Already, P.C. Electronics has created a kit that provides add-on functionality to increase the utility and capabilities of these little transmitters and receivers.

The traditional "channel-Z" (as the early commercial broadcast services were known in Texas) down-converter was a very simple device. These services thought that since 2.4 GHz was "microwave," they could transmit open broadcasts and that interception of these sig-

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

Reader FEEDBACK

Elitist Paranoia

Reader Tom O'Hara, W6ORG, takes issue with N5EM's comment in July that he doesn't feel comfortable recommending ATV operation on 434.000 MHz, because of the potential for interference to weak-signal operations at 432 MHz:

Ed—

I must comment on a few things in your recent "Getting Started in ATV" column in the July issue of *CQ VHF*.

You have 426.25 and 427.25 reversed as far as reference to cable channel 58; 427.25 corresponds exactly to cable channel 58 and 426.25 is the one that is close enough that the TV's AFC can usually lock up on. Plus, 434.0 does not correspond to cable channel 59 (433.25 MHz) but is close enough to lock up on.

I was sorry to see you propagate the technically unfounded elitist paranoia of a few satellite and weak-signal hams that 434.0 can trash the input of a satellite in the 435- to 438-MHz segment and yet at the same time where you mention 439.25 LSB, you do not mention this frequency as doing the same thing. If all the ATVers at home transmitting on 434.0 or 439.25 DSB, as most all ATVers in the country do, were actually interfering with satellite reception or retransmission, there would be a lot of complaints—there just aren't any except for the normal overload with close-by neighbors. The sideband energy in the satellite and 432 weak-signal segments is more than 40 dB down and random from the average ATV transmitter operating DSB on 434.0 or 439.25 MHz. See figure 12.61 on page 12.48 in the *ARRL Handbook*.

We use 434.0 quite a bit in Southern California and it is part of our local band plan. This was not an arbitrary selection, but arrived at technically, backed up with demonstrations and tests with satellite and weak-signal users. If it were arbitrary, one would have expected 433.25, but that would have put the sound subcarrier below 438 MHz in the satellite segment. In the Los Angeles basin, we have ATVers who also enjoy operating the satellite and weak-signal modes and vice versa. Rather than polarizing people with technically unfounded hysteria, 434.0 was chosen and agreed to by all mode users—and based on good engineering practice—as the ATV frequency least likely to give interference to satellite and weak-signal users or FM voice repeaters in our high communications density area.

It is bad enough that you blast 434.0 in your text, but worse as a bold sidebar. This will only stir up the malcontents looking for a cause and polarize the unknowing against ATVers using the 70-centimeter band.

Tom O'Hara, W6ORG
SCRRBA Technical Committee Member
ARRL Technical Advisor for Spectrum Management and ATV

N5EM responds:

Tom—

You present some good information in his criticism of my column. As I pointed out, many parts of the country use these 70-centimeter ATV frequencies on a local option basis. It is important that you contact local ATV enthusiasts and determine what is in use before making any equipment decisions.

The subject of interference between different modes is a more difficult one. Again, many ATVers are using 434 MHz and 439.25 MHz in many different parts of the country. Each ham is responsible for his own transmission. That includes technical issues as well as good neighbor issues. As long as we practice ATV with those concepts in mind, everyone will have fun—and that's what its really about.

nals would be too difficult for the experimenter. You can stop laughing now. These down-converters consisted of nothing more than a pre-amp, followed by a simple mixer and a voltage-tuned oscillator. They weren't particularly stable but they worked. The early ones converted a range of frequencies in the 2.2- to 2.5-GHz band down to channel 3 or 4 reception on a conventional TV. These same down-converters can be fed into an FM receiver/IF that operates at 70 MHz (satellite receivers) and can be used for FM ATV.

When considering using these down-converters, it's important to know that there's a later version that differs in function. While the early versions converted directly to TV channel 3, the later versions were designed to convert a series of channels to UHF television channels. These can still be used for AM television as they were originally intended, but they cannot normally be used for FM television, as you would not have an FM receiver that would tune the frequencies used by the output of the down-converter.

One of these systems was deployed at the Johnson Space Center in Clear Lake, Texas. It transmitted several television signals out into the surrounding community where the small down-converters allowed reception on a conventional UHF television set. As with any piece of surplus equipment, make sure you know what you have before you commit to obtaining it—unless, of course, it's free!

A number of ATV groups have added a 2.4-GHz AM ATV output to their repeater systems, employing these simple down-converters for reception. In addition to making use of inexpensive surplus equipment (always a worthy goal of the amateur), the addition of an output in a different band allows full-duplex operation on the ATV repeater system where only in-band operation may have been used before. I've mentioned before the advantages of full-duplex operation.

Up to 3.3 and 5.7 GHz

Our next amateur band is 3.3 to 3.5 GHz. This band has not been commonly used for ATV because of the limited equipment available. I do know of one system using this frequency. Our HATS (Houston Amateur Television Society) system in Houston is a split-site repeater with most of the receiving equipment on

one building separated from the transmitting equipment on a different building several hundred yards away. The FM ATV link between these buildings uses this band. Our technical guru, Rick Pense, WD5BQN, took an old Scientific Atlanta satellite receiver and converted it into a low power transmitter. Using another for the receiver provided a perfect way to link the two buildings. The only cost was the purchase of a pair of commercial 3.3-GHz loop Yagi antennas.

Likewise, the 5.65- to 5.925-GHz band is ripe for use by ATV. Small dishes on both these bands provide excellent gain, making low-power equipment very useful. The problem continues to be one of limited equipment. This is the same problem faced by small signal and satellite operators. For years, SSB and CW operators struggled to get equipment for these bands built and working.

Today, the scene is changing. First of all, the availability of down converters from such companies as Down East Microwave has enabled the interested microwave experimenter to purchase equipment in the form of a kit or a fully assembled module. These kits provide a very high probability of success. Second, the building of AMSAT's Phase 3D satellite with operating capability on all these microwave bands has spurred interest in the small signal community in getting equipment up and running for these bands. While the Phase 3D satellite still awaits launch, renewed discussions with those parties who have the launchers have been very encouraging. The successful launch of Phase 3D will result in a new batch of equipment for microwave use that will also provide a source of equipment to ATV users of these bands.

And, Finally, 10 GHz

This brings us to the 10-GHz band. Here there's no scarcity of equipment. Gunn diode oscillators have been around for a long time, providing equipment for experimenters to use for a variety of purposes, including ATV. A number of systems around the country have experimented with 10-GHz links. P.C. Electronics has a modulator in its catalog for your 10-GHz or 24-GHz oscillator (see <http://www.hamtv.com/pdf.files/Catalogpg8.pdf>). This would be a good starting point for the interested microwave ATVer.

Microwaves do have their own unique problems. Rain and fog increase the loss in a path, requiring you to have some extra power or gain to spare (fade margin). Also, it's difficult to find a non-directional antenna for these frequencies. Fortunately, a non-directional antenna is often not required; many repeaters are located so that the majority of their users are in a single area that could be served by a gain antenna (even a low-gain one for broad coverage). A good example is the Salt Lake City, Utah, ATV system, which is located on a mountain. Most of its users are located either north of south of the repeater and directional antennas can be used to good effect. It might be very interesting to plot all your ATV users on a map and actually see where they live. Perhaps you could use a microwave link on your system.

Find a Spot and Get On the Air!

As you can see, there's quite a lot of ATV activity on a variety of frequency bands. But since this activity is generally local, it's best to seek out ATV-active hams in your own area (*the new links page on the* CQ VHF *Web site, <www.cq-vhf.com>, is a good place to start looking—ed.*), find out what frequencies they're using, whether you're in range of an ATV repeater, etc., before you go out and purchase any equipment. And if there's currently no ATV activity in your area, why not get together with some friends and start some of your own? It's not as hard as you might think and the rewards are tremendous. ■

Resources

For more information on the products mentioned in this column, contact:

Down East Microwave, 954 Rt. 519, Frenchtown, NJ 08825; Phone: (908) 996-3584; Fax: (908) 996-3702; Web: <http://www.downeastmicrowave.com>.

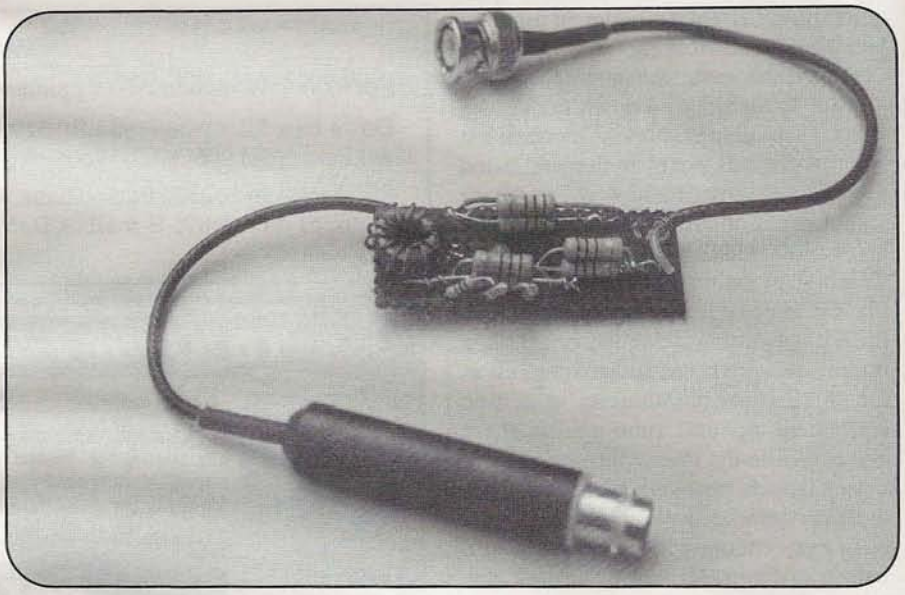
P.C. Electronics, 2522 Paxson Lane, Arcadia, CA 91007; Phone: (626) 447-4565; Fax: (626) 447-0489; E-mail: <TOM@HAMTV.COM>; Web: <http://www.hamtv.com>.

A Mini Study of Voltage, Current, and Resistance—Part 2

Before moving into vacuum tubes and transistors, Dave decided to cover a bit more ground on the basics of series and parallel circuits—and he shows you how to build a unique SWR checker.

During a quick review of last month's column, I realized some additional aspects of AC, DC, series, and parallel circuits warranted further discussion before continuing on to tubes and transistors. So I'm interjecting Part 2 with some vital, yet often-overlooked, information hams are assumed to know simply because they're licensed (we may be sharp, but we're not *that* sharp!). It doesn't explain all the fine points of analyzing circuits, etc. (that's not possible in three, four, or even five columns!), but it is an "expandable" start in the right direction.

Let's pick up from the close of last month's column and continue with a quick study of combination series and parallel circuits. We'll then trace current paths in some often-used circuits, clarify some of the "why and how" logic in circuit operations, and wrap up with an experimental four-resistor SWR bridge that can be adapted to fit your needs. Sound interesting? Let's get started!



My homebrewed Wheatstone bridge SWR checker. The little critter works on the principle of measuring resistance rather than reactance. That is, a 50-ohm antenna exhibits a 1:1 SWR, a 75- or 37-ohm antenna exhibits a 1.5:1 SWR, and a 100- or 25-ohm antenna exhibits a 2:1 SWR. This follows the circuit in Figure 6, so it has an LED (barely visible in the photo) instead of a meter.

Combination Series and Parallel Circuits

Studying basic series and parallel circuits is a superb exercise in understanding how more complex circuits in electronic equipment work. In fact, the more we compare on-paper circuits with in-cabinet rigs, the more we realize they're one and the same. This is vividly illustrated in Figure 1. At first glance, it just looks like a license exam test question with no obvious connections to the "real world." Looking closer, however, we see that it represents the DC equivalent to circuitry in a mobile or handheld transceiver. How so? Resistor R1 is electrically equivalent to the transmitter's final power amplifier stage. It has the battery's full 13 volts applied to it and, because it's wired in parallel with other circuitry, can draw its required current without affecting other stages (the fact that current divides in parallel and voltage divides in series, incidentally, was discussed in last month's column).

Resistors R2 and R3 represent other stages in the transceiver, possibly its receiver's RF amplifier and local oscillator. Where are the other stages? They might also be combined and represented with R2 and R3, omitted for simplicity of discussion, or they might be connected as additional and unshown circuits. Finally, R4 represents a voltage regulator that drops the voltage to the RF amplifier (R2) for wide dynamic range, while minimizing voltage variations felt by the local oscillator (R3), thus ensuring good frequency stability. Resistors/stages R2 and R3 draw the same amount of current, so they can be wired in parallel and the combination connected in series with voltage

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

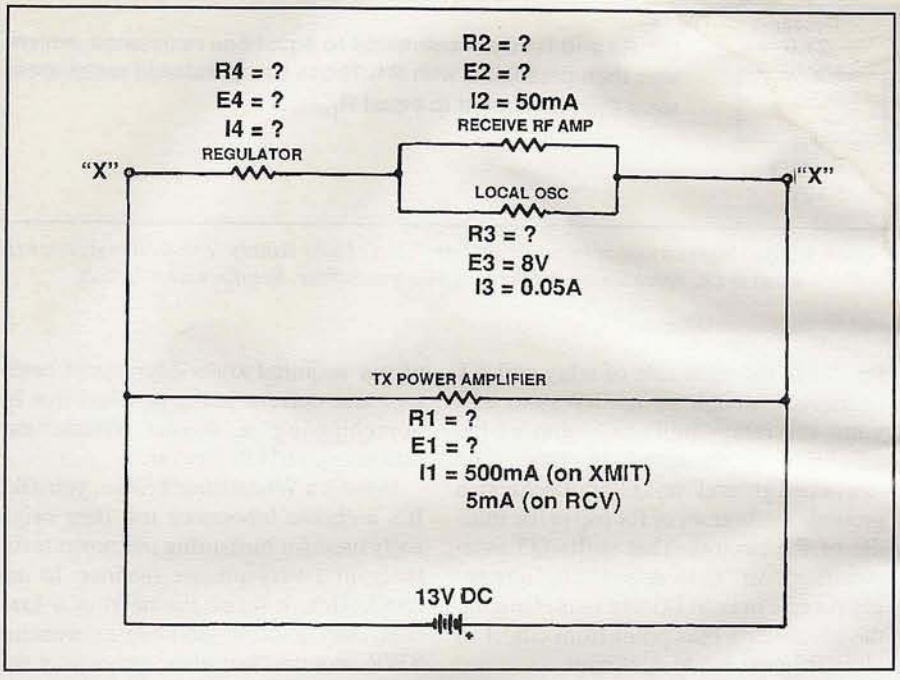


Figure 1. Combination series-parallel circuit representing various stages of a transceiver, as discussed in text. Try your skill at calculating the unknown values (it's possible!). Just start at R3 and work your way through the circuit. Then compare your answers with the text.

regulator (R4). That's assuming, naturally, that R4 can safely pass the current required for both R2 and R3.

Wow—there was a wealth of good practical electronics information in those last few sentences. Read them again to get their full impact.

Now let's calculate some missing values and watch the circuit in (electrical) action. During transmit, R1 draws 500 milliamps (mA). Applying Ohm's Law, we see that R = E (13 volts)/I(.5 amp) and yields an equivalent resistance of 26 ohms. On receive, R1 draws only 5 mA (13 volts/.005 amps) to yield an equivalent resistance of 2600 ohms. As we learned last month, the lower a circuit's resistance, the more current it will pass or use (and vice-versa).

Now look at R2 and R3. Since they're in parallel, the voltage across each is 8 volts. Since they're in series with R4, the voltage across R4 must be 13 minus 8, or 5 volts. Following? Now, since R2 and R3 each draw 50 mA, their individual resistances must be 8 volts/.05 amp, or 160 ohms. R2 and R3 are parallel and of equal value, so their combined resistance is half of 160, or 80 ohms. Let's quickly check to determine if this is correct. R2 and R3 have now been simplified to a single resistor of 80 ohms with 8 volts dropped across it, so 8/80 = .1 amp (which coincides with .05 amp for each resistor). It's right!

Can you now calculate the resistance and voltage across R4? Here's the technique: since R2 and/or R3 drop 8 volts, 5 volts remain to be dropped across R4. Since current is the same in (branches of) a series circuit, 100 mA (the total for both R2 and R3) must pass through R4. So, 5 volts/.1 amp = 50 ohms. Let's double check our calculations from another angle (between points "X" and "X"). Total current is 13 volts/50 ohms plus 80 ohms. That equals 13 volts/130 ohms, which equals .1 amp. It's right.

Next, let's redraw the same circuit in a slightly different manner (Figure 2). But this can't be the same as Figure 1, you say; the battery is in the middle, part of its current goes left, part of its current goes right, and those two parallel resistors are only on the right leg. Look again, friends. There were two current paths in Figure 1 and the two parallel resistors were only in one leg—the one with R4, the "regulator." Current flows the same whether a circuit is drawn horizontally or vertically (though it sure looks different!).

Finally, let's simplify Figure 1 (or Figure 2) to a single resistance, as "seen" by its battery or power source (Figure 3). As stated earlier, R1's resistance is 26 ohms during transmit, and the combined total of R2, R3, and R4 is 130 ohms. Using the (long) formula

$$\frac{1}{\frac{1}{R1} + \frac{1}{R2}}$$

we enter 1/26 = .0384615 + 1/130 = 7.692307692^{-3}. Add together the two long decimals (you should get .04615380769231), and then take the reciprocal of that sum (1 divided by the total above) and the answer is 21.66 ohms. Double checking, 13 volts /.6 amps also equals 21.6 ohms. This single resistance is what the battery "sees" on transmit. Now check your technical expertise by calculating the single resistance equivalent for receive and look near the end of this column to check your answer.

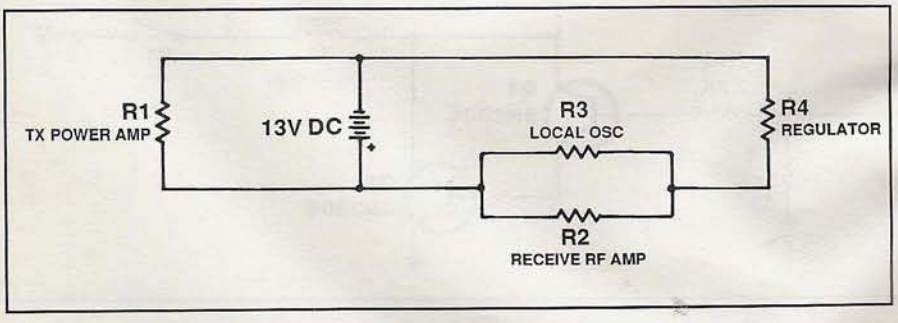


Figure 2. Here, we redrew the circuit of Figure 1 in a slightly different manner to illustrate how actual wiring in a rig can seem different from its paper diagram.

The Fine Art of Tracing Circuits

Once you acquire a "knack" for studying schematic diagrams and tracing circuits, visualizing how a rig, or a circuit within a rig, works becomes a quite informative and eye-opening pursuit. Not all schematics and circuits are easy to follow and understand, however, but a few "brain teasers" along the way just keep us on our toes will help.

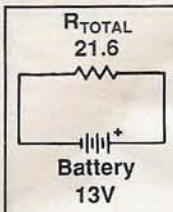
Consider, for example, the partial circuit diagram of a small linear amplifier shown in Figure 4. Let's focus on the amplifier's T/R switching arrangement (mainly because we've only covered ground-floor theory so far; we'll discuss actual amplifier circuitry in more detail later). Looking at this unit's manual, its theory of operation is described in the following paragraph:

An input signal appearing at J2 is voltage-doubled by C7, C8 and C9, then applied to the Darlington pair of Q1 and Q2. These transistors, in turn, activate K1 which switches the amplifier circuit in line during transmit. When Q2 enables K1, it also activates Q3. This shifts the amplifier's bias from cutoff to linear mode operation.

OK gang, now let's go back and fill in some blanks in that story.

One alternation of an incoming (AC) signal charges capacitor C7. Diode D3 completes that current path. The next alternation charges C9 and C8. D2, C7, and resistor R15 complete that current path. After a few alternations, the combined voltage in C9 and C7 charge C8 to twice the voltage in either capacitor. This voltage passes through R16, causing transistor Q1 to saturate and turn on Q2. When Q2 switches on, the ground on its emitter becomes connected to its collector. Since the right side of relay coil K1 connects (through switch SW1) to +13 volts, the relay "pulls in"—that is, the amplifier is switched in line. The "switched ground" on Q2's collector also grounds the bottom of R4 (up in the middle of the circuit). That shifts Q3 from switched "off" to switched "on," removing reverse bias on D5 and thus changing the amplifier's bias point from cutoff to class B/linear mode operation.

Don't fret if those last few steps sounded confusing. We'll discuss amps, biasing, and transistor theory in more detail later and it will make more sense.



NOTE:
R2, R3 and R4 were combined to equal one resistance, which was then paralleled with R1. Those two paralleled resistances were then combined to equal R_{TOTAL}.

Figure 3. Equivalent circuit of Figure 1 or 2 as "seen" by its battery. The total resistance (R total) is DC representation of a complete transceiver. See discussion in text.

A Unique SWR Checker

If you're still with us technically, you're doing great. Now let's put some of our acquired knowledge about resistors and current paths to good use by homebrewing a unique Wheatstone bridge-type SWR checker.

What's a Wheatstone bridge, you ask? It's a classic laboratory test item originally used for measuring unknown resistance in a very precise manner. In our application, it forms the heart of a low-cost, easy-to-build, and self-referencing SWR monitor that also serves as a fail safe dummy load to prevent the SWR "seen" by your transmitter from ever rising above 100 ohms or 2:1. Those are the little tyke's good points. On the down side, the bridge absorbs RF power and must be disconnected from the antenna line after you're done testing, it's only suitable for low-power applications, and, since I've only had time to build one for

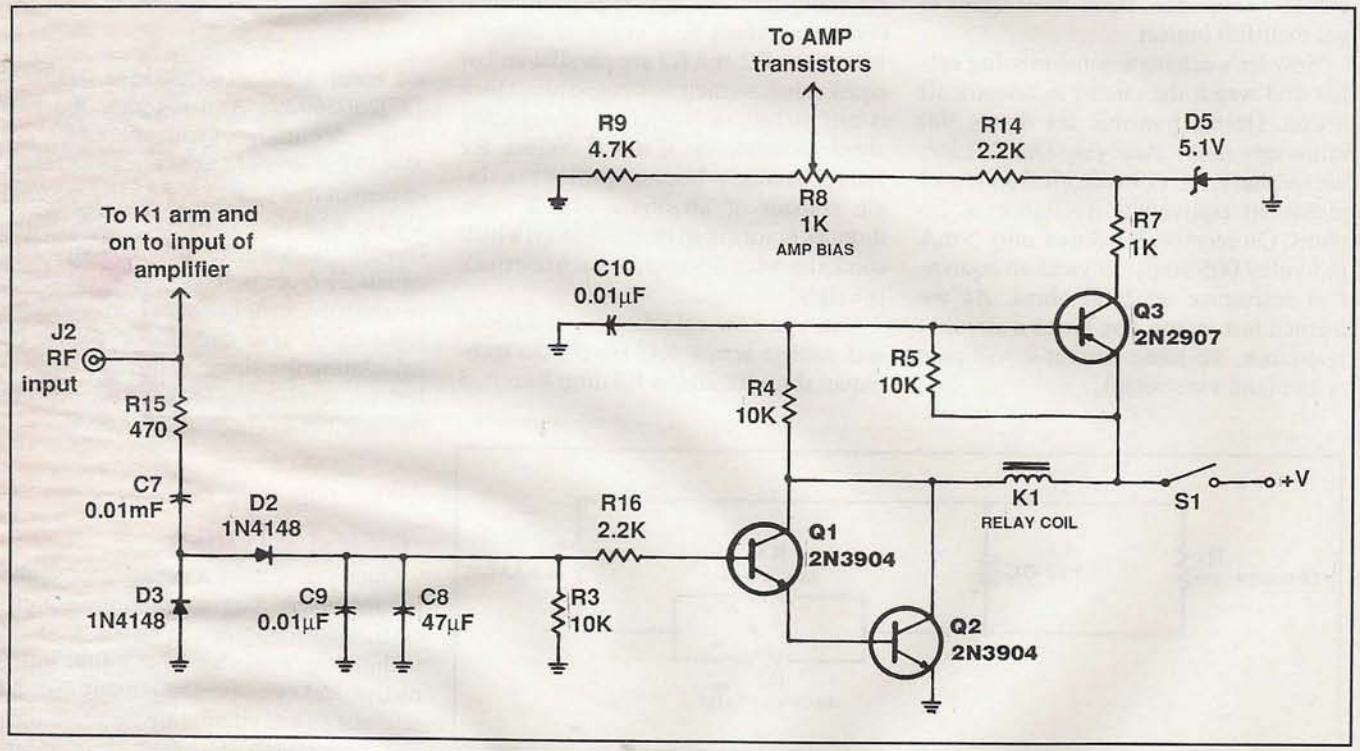


Figure 4. This RF-sensing and automatic T/R switching circuit was sampled from a small solid-state power amplifier. A complete "how it works" discussion is in the text.

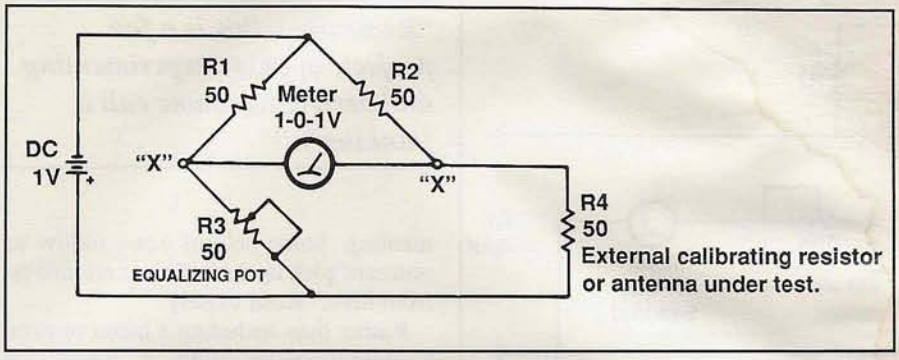


Figure 5. Circuit diagram of an original Wheatstone bridge. The principle of operation is that the meter will read zero when the potentiometer, R3, is adjusted to the same resistance as R4, resistor or antenna under test.

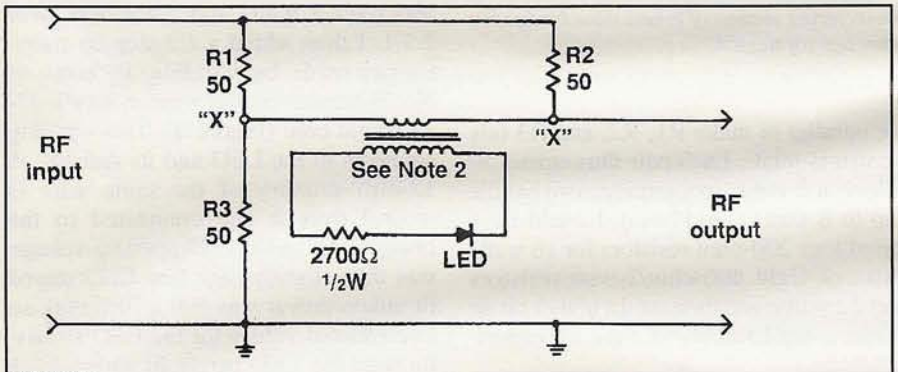


Figure 6. Circuit diagram of Wheatstone bridge adapted for use as an SWR indicator, as discussed in text. This item is ideal for impromptu use with pocket-sized transceivers and portable antennas. Note that this version uses an LED instead of a meter as the readout device.

HF use, you get the honor of perfecting it for 6- or 2-meter use.

How does a Wheatstone bridge work? Refer to Figure 5 and I'll zip through its basic concept of operation. First, let's assume that R1, R2, R3, and R4 are all equal values. Since we're talking about antennas, 50 ohms is a good value to visualize. Next, notice that R1 and R3 are wired in series and connected in parallel with R2 and R4 (which are also wired in series). A meter capable of reading voltage difference or current flow in either direction (in other words, a center-resting meter similar to an FM discriminator meter) is wired between left and right side resistors. A low amount of DC voltage is then applied to the bridge. If all four resistor values are equal, the bridge is balanced.

In this case, there will be no voltage difference or current flow between the two points "X," and the meter will read zero. If R4 (which will be our external calibrating resistor or an antenna under test) is more or less than 50 ohms, the meter will indicate that difference. We can recalibrate the meter's scale in ohms and read antenna resistance directly, or we can add a scale calibrated in ohms beneath a pointer knob attached to R3 and read antenna resistance on that scale. How's that? Suppose R4/the antenna is 25 or 100 ohms (a 2:1 SWR). Current will flow through the meter until R3 is readjusted to also equal 25 or 100 ohms. Suppose R4/the antenna is 37 or 75 ohms (a 1.5:1 SWR). Again R3 must be reset to an equal value for the meter to read zero difference. Neat, eh?

Space is now very short, so let's jump right to fine points of this bridge and how we'll use it for our needs.

First, R1, R2, R3, and R4 must be carbon composition-type resistors, not wirewound or metal film type (they exhibit

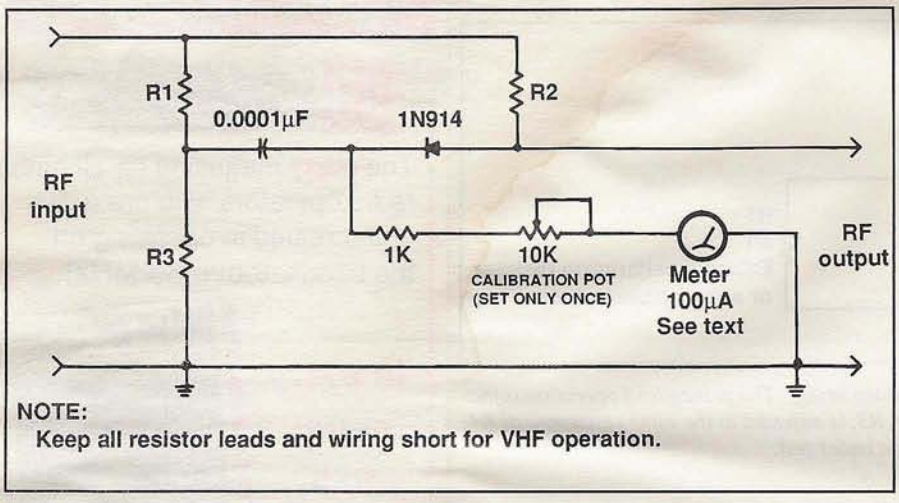


Figure 7. An alternate idea applicable to the SWR metering section of Wheatstone bridge for use on 6 and 2 meters. See text for details.

inductance and are unsuitable for RF applications). Each resistor must also be capable of handling half of your rig's output power. This rating can be "pushed" to near double if transmit/test time is held to only a few seconds, but be quick and careful to avoid burning out the resistors. I use two 100-ohm, 1-watt resistors wired in parallel to make R1, R2, and R3 (six resistors total). Each pair thus equals 50 ohms at 2 watts, so my bridge can handle up to 8 watts (see Photo). I could have used four 200-ohm resistors for 16 watts max or eight 400-ohm/1-watt resistors for 32 watts (and then used a higher range meter), but I ran out of time for experimenting. Some helpful notes follow so you can "pick up the ball and continue on from here." Read closely!

"Remember, this is a fun project, so enjoy experimenting and perfecting (some call it 'dinking')."

Rather than including a meter or even a potentiometer with a homebrew "ohms" scale, I went "po-boy style" by connecting an LED and a 27-ohm resistor between the two points "X." The idea worked, but only when transmit power was over 5 watts and SWR was over 2.5:1. I then added a 1:3 step-up transformer made by winding 36 turns of No.28 enamel-coated wire on an FT-37-43 toroid core (Figure 6). This winding connects to the LED and its resistor. A 12-turn primary of the same wire is wound over it and connected to the bridge's "X" points. Stepped up voltage was then slightly high (the LED stayed lit unless power was 500 milliwatts), so I substituted values for the LED's resistor until the LED barely lit with a 1.2:1 SWR and increased to full brightness at 1.4:1 (at 5 watts). The tweaked resistance value was 2700 ohms.

My 1:3 step-up transformer works great on HF, but not on VHF. Apparently an FT-37-43 has too much lumped inductance at 144 MHz. Amidon may have a suitable answer; alternately, I suggest direct-rectifying current difference and reading it on a 100- or 200-microamp meter (recalibrated in ohms) as shown in Figure 7. For reference, I also suggest initially checking out the bridge with a known-accurate SWR meter and an antenna tuner (plus antenna!). That way, you can vary SWR (via the tuner) and set the meter's 10-K calibration pot to work with your average SWR and power level. Remember, this is a fun project, so enjoy experimenting and perfecting (some call it "dinking").

Till Next Time

Stay tuned for more good theory 'n practice and another mini project next month. Oh yes, the answer to receive resistance for Figure 1, 2, and 3 is 123.8 ohms. Hearty congratulations if you calculated it right. You're a sharp Tech! The question was sort of tough! 73,

—Dave, K4TWJ

Analyzing Keplerian Elements—Part 2

In this follow-up to last month's introduction, N2WWD expands our exploration of Keplerian Elements to see how they're used to predict actual coverage range for satellites in elliptical orbits.

Last month, we saw how you could learn some key characteristics about an orbit by doing some relatively simple calculations with the Keplerian elements. This article extends these calculations, giving you a better idea of an elliptical orbit's actual ground coverage.

Introduction

The calculations we did in Part 1 determined the basic characteristics of an orbit from its Keplerian elements. The article included the equations needed to do the calculations, which are also coded in a Microsoft Excel® spreadsheet that you can download from the Keplerian Elements page of my Web site at <http://www.mindspring.com/~n2wwd>. The information in Part 1 was great for a circular orbit, but didn't tell the whole story for elliptical orbits.

There was uncertainty for elliptical orbits because we only set up latitudes ranging from "guaranteed" line-of-sight coverage to maximum line-of-sight coverage. The "guaranteed coverage" tells you that stations between the equator and the computed latitude will *definitely* have some line-of-sight pass opportunities. The "guaranteed coverage" latitude is pessimistic since it presumes the orbit's perigee (lowest altitude) is at the *least* favorable location on the orbit. Likewise, the "maximum coverage" in Part 1 is overly optimistic since it tells you the highest latitude that could *possibly* contact the satellite if the orbit's apogee (highest altitude) were in the *most* favorable location on the orbit.

No doubt you're really interested in the orbit's *actual* coverage rather than having a range of latitudes for which you can only say "maybe and maybe not" to line-of-sight pass opportunities. This article, therefore, extends the calculations from Part 1 so you can determine the *actual* range of latitudes with pass opportunities. Naturally, the Excel spreadsheet on my Web site has been updated with the extended calculations.

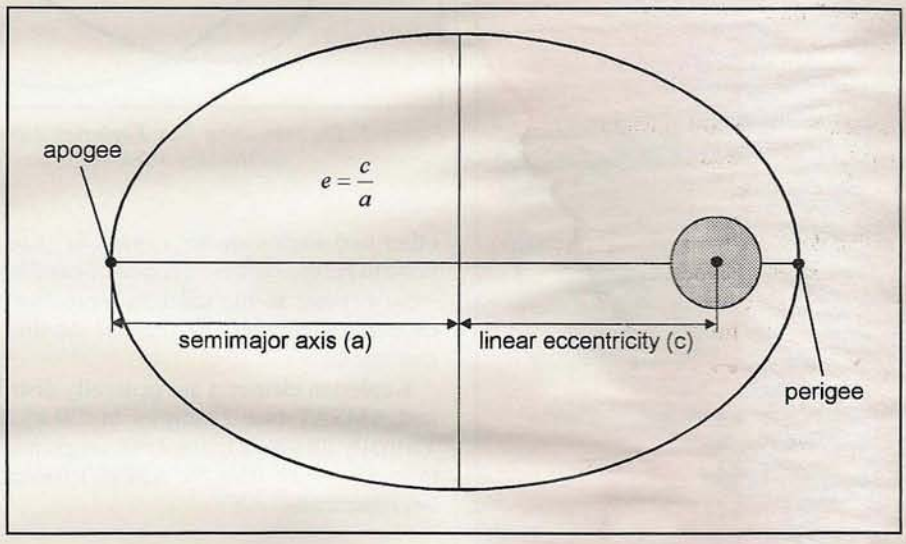


Figure 1. Kepler's First Law says satellites orbit in elliptical paths, with the Earth at one focus, or special off-center point, of the ellipse. The first two Keplerian elements—the semimajor axis and the linear eccentricity—describe the size and shape of the ellipse.

What Are Keplerian Elements?

We discussed Keplerian elements in some detail last month and in the August, 1998, "Orbital Elements" column, so we'll just review them briefly this month. As we do, you might want to refer to Figures 1 and 2, which can give you a better visual understanding of the terms involved. Figure 1 shows two important parts of an orbit: the *semimajor axis (a)*, which is half the longest dimension of the ellipse, and the *eccentricity (e)*, which is the shape of the orbit, described as the distance of the Earth from the center of the ellipse (linear eccentricity) divided by the semimajor axis. A circular orbit would have a zero eccentricity; the eccentricity of a very elongated orbit can almost reach one.

Figure 2 shows the remaining four elements—all angles that orient the orbital ellipse relative to the Earth, starting with the *inclination (i)*, or angle between the ellipse's plane and the equator; and the *right ascension of the ascending node (Ω)*, or *RAAN*, which is the angle measured eastward from a fixed direction in space called the *Vernal Equinox* to the satellite's south-to-north equatorial crossing (called the *ascending node*). The

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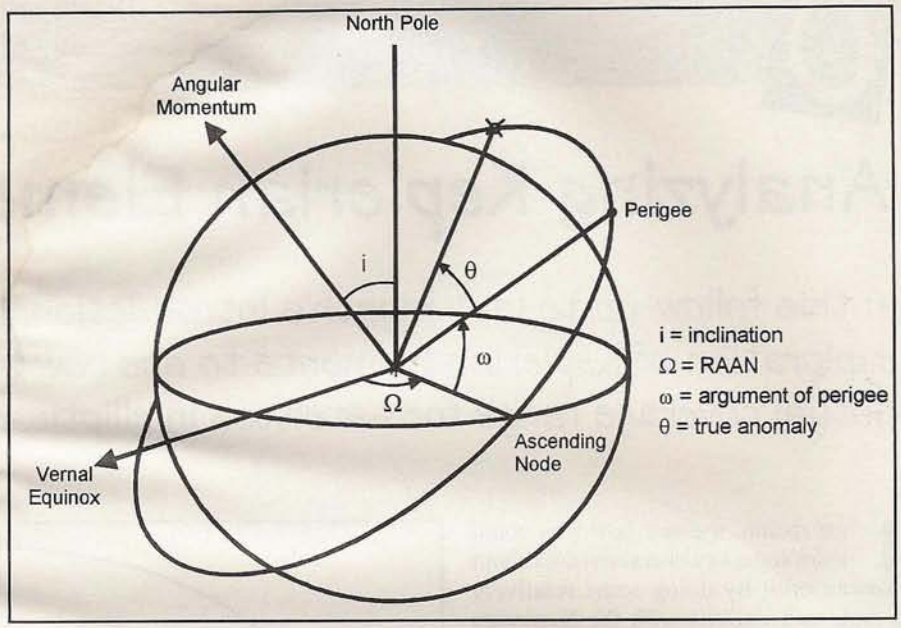


Figure 2. The remaining four Keplerian elements (beyond the two shown in Figure 3) are angles that orient the orbital ellipse relative to the Earth.

other two angles are the *argument of perigee* (ω), or the angle from the ascending node to perigee in the direction of satellite motion, and the *true anomaly* (θ), the angle from perigee to the satellite's position at the *epoch time* listed in the Keplerian elements (note that, for amateur satellite, *mean* anomaly figures are used instead of *true* anomaly).

Keplerian elements are generally distributed in either or both of two formats, TLE and AMSAT (see examples in "Worksheet for Analyzing Keplerian Elements"). Virtually all satellite tracking programs will use one or the other. Manual calculations are easier using the AMSAT format, which explains which element each number represents.

High and Low: Apogee and Perigee

Following up on last month's look at determining coverage for circular orbits and approximations of coverage for elliptical orbits, we'll now extend the calculations to get more exact in our examinations of elliptical orbits.

The first thing we need to do when extending the coverage calculations for elliptical orbits is to locate the apogee and perigee. The argument of perigee (ω) specifies the orbit's apogee-perigee line orientation. We compute the perigee latitude using the inclination and the argument of perigee as follows:

$$perigee\_latitude = \sin^{-1}[\sin(inclination) \bullet \sin(argument\_of\_perigee)]$$

Very conveniently, the apogee latitude is just the negative of the perigee latitude. Note that positive latitude is in the Northern Hemisphere and negative latitude is in the Southern Hemisphere.

Now that we know the apogee latitude, we can determine the northernmost and southernmost latitudes that have a line of sight to apogee. The northernmost and southernmost apogee visibilities are computed by:

$$northern\_apogee\_visibility = apogee\_latitude + \sin^{-1}\left[\frac{6371}{semimajor\_axis \bullet (1 + eccentricity)}\right]$$

$$southern\_apogee\_visibility =$$

$$apogee\_latitude - \sin^{-1}\left[\frac{6371}{semimajor\_axis \bullet (1 + eccentricity)}\right]$$

When northernmost visibility latitude exceeds 90 degrees, apogee is visible at some latitudes while looking over the pole. While this is an excellent feature for an orbit to have, we'll limit the description of the northernmost apogee visibility to +90 degrees latitude for clarity. Likewise we limit the southernmost apogee latitude to -90 degrees.

North and South

The orbit's coverage range in north and south latitude is usually determined by the satellite's altitude at its northernmost and southernmost points, called the *antinodes*. The satellite's altitude at the northern and southern antinodes are computed as follows:

$$north\_antinode\_altitude = \frac{semimajor\_axis \bullet (1 - eccentricity^2)}{1 + eccentricity \bullet sin(argument\_of\_perigee)} - 6371$$

$$south\_antinode\_altitude = \frac{semimajor\_axis \bullet (1 - eccentricity^2)}{1 - eccentricity \bullet sin(argument\_of\_perigee)} - 6371$$

Using these altitudes, we then re-compute the coverage latitudes using the same procedure from Part 1 of this article:

$$north\_latitude\_coverage = inclination + \cos^{-1}\left[\frac{6371}{north\_antinode\_altitude + 6371}\right]$$

$$south\_latitude\_coverage = -inclination - \cos^{-1}\left[\frac{6371}{south\_antinode\_altitude + 6371}\right]$$

Once again, we limit the north and south coverage latitudes to +90 and -90 degrees, respectively.

While this appears to work for all practical examples, I cannot guarantee that it will work for 100% of the cases. If you find a case where apogee visibility is better than the corresponding north or south latitude coverage, use it instead.

Just to Summarize

This article extended the orbital characteristics calculations from Part 1, giving a better idea of the north and south coverage range for elliptical orbits. You should be able to do the math with a scientific calculator. However, I have also updated the Excel spreadsheet on my Web page with the new calculations for those of you who have a computer and Internet access. In addition, I've done sample calculations in a "Worksheet for Analyzing Keplerian Elements" that appears on the following pages.

Happy number-crunching, and I hope this gives you a greater appreciation for the work your computer tracking program is doing! ■

Staff Notes

As we went to press, Satellite Editor Ken Ernandes, N2WWD, informed us that increased pressures at his "real" job will make it impossible for him to continue writing the "Orbital Elements" column. So this month's column will be his final one. Thank you, Ken, for your many contributions to *CQ VHF*, and for demystifying the art of satellite communication. We'll miss you. *CQ VHF* will continue its commitment to covering amateur satellites, even while we look for a successor to fill Ken's shoes on a monthly basis.

Worksheet for Analyzing Keplerian Elements

Here's an example of using all the formulas described in this month's column and last month's column to calculate orbital information about AMSAT-OSCAR-10 (AO-10) using actual Keplerian elements.

NOTE: These computations were performed at full precision, so you might get minor differences due to roundoff error.

Input Keplerian Elements
NORAD (TLE) Format:
AO-10
1 14129U 83058B 99020.76950000 .00000000 00000-0 55553-5 0 54
2 14129 26.9297 46.9808 6011222 284.2856 119.1380 2.05869872117355

AMSAT Format:
Satellite: AO-10
Catalog number: 14129
Epoch time: 99020.76950000
Element set: 5
Inclination: 26.9297 deg
RA of node: 46.9808 deg
Eccentricity: 0.6011222
Arg of perigee: 284.2856 deg
Mean anomaly: 119.1380 deg
Mean motion: 2.05869872 rev/day
Decay rate: 0.00000e+00 rev/day^2
Epoch rev: 11735
Checksum: 279

Calculations:
1. Compute period and semimajor axis from mean motion:

$$period = \frac{1440}{2.05869872} = 669.5 \text{ minutes}$$

$$semimajor\_axis = \sqrt[3]{\frac{7.537122734 \times 10^{13}}{2.05869872^2}} = 26102 \text{ kilometers}$$

2. Compute apogee and perigee altitudes:

$$apogee\_altitude = 26102 \cdot (1 + 0.6011222) - 6371 = 35421 \text{ kilometers}$$

$$perigee\_altitude = 26102 \cdot (1 - 0.6011222) - 6371 = 4040 \text{ kilometers}$$

3. Compute Earth surface coverage (%) at apogee and perigee:

$$apogee\_coverage = 50 \cdot \left[\frac{35421}{35421 + 6371}\right] = 42.4\%$$

$$perigee\_coverage = 50 \cdot \left[\frac{4040}{4040 + 6371}\right] = 19.4\%$$

4. Compute apogee and perigee latitudes:

$$perigee\_latitude = \sin^{-1}[\sin(26.9297) \bullet \sin(284.2856)] = -26.0 \text{ degrees}$$

$$apogee\_latitude = -(-26.0) = 26.0 \text{ degrees}$$

5. Compute apogee and perigee northernmost and southernmost visibility latitudes:

$$northern\_apogee\_visibility = 26.0 + \sin^{-1}\left[\frac{6371}{26102 \bullet (1 + 0.6011222)}\right] = 34.8 \text{ degrees}$$

$$southern\_apogee\_visibility = 26.0 - \sin^{-1}\left[\frac{6371}{26102 \bullet (1 + 0.6011222)}\right] = 17.3 \text{ degrees}$$

Note: + latitudes are Northern Hemisphere; - Latitudes are Southern Hemisphere.

6. Compute the satellite altitude at the northern and southern antinode:

$$north\_antinode\_altitude = \frac{26102 \bullet (1 - 0.6011222^2)}{1 + 0.6011222 \bullet \sin(284.2856)} - 6371 = 33561 \text{ kilometers}$$

$$south\_antinode\_altitude = \frac{26102 \bullet (1 - 0.6011222^2)}{1 - 0.6011222 \bullet \sin(284.2856)} - 6371 = 4163 \text{ kilometers}$$

7. Compute maximum communications distance:

$$\max\_range = 2 \bullet 6371 \bullet \frac{\pi}{180} \bullet \cos^{-1}\left[\frac{6371}{35421 + 6371}\right] = 18065 \text{ kilometers}$$

8. Compute maximum (most polar) satellite latitude coverage for the northern and southern antinodes:

$$north\_latitude\_coverage = 26.9297 + \cos^{-1}\left[\frac{6371}{33561 + 6371}\right] = 107.7 \text{ degrees}$$

Since the northern latitude coverage exceeds 90 degrees, coverage goes over the pole and the maximum latitude is at the pole (90 degrees).

$$south\_latitude\_coverage = -26.9297 - \cos^{-1}\left[\frac{6371}{4163 + 6371}\right] = -79.7 \text{ degrees}$$

Hamfest Calendar

The following hamfests are scheduled for September, 1999:

Sept. 4 (Labor Day Weekend), 3rd Annual Hamfest, Carp Agricultural Fairgrounds, **Carp, Ontario**. Talk-in: on VE2CRA, 146.94-. For information, contact Jim Cummings, VE3XJ; Phone: (613) 446-1225 (H); E-mail: <fleamarket@oarc.net>; Web: <http://oarc.net/fleamarket>.

Sept. 4, Hamfest, Otero County Fairgrounds, **Alamogordo, NM**. For information, contact Larry Moore, WA5UNO, 1830 Corte Del Ranchero, Alamogordo, NM 88310, or call (505) 437-0145, day or night. **(exams)**

Sept. 4, 50th Annual Gabfest, Club Grounds, Old Pittsburgh Rd., **Uniontown, PA**. Talk-in 147.045+ and 147.255+. For information, contact Carl (WA3HQK) or Joyce (KA3CUT) Chuprinko, 84 Heaven Hill Rd., Morgantown, WV 26508; Phone: (304) 594-3779.

Sept. 10–11, 30th Annual Hamfest, Queen Wilhelmia State Park, **Mena, AR**. Talk-in: 145.27 MHz, 100 Hz. For information, contact Charlotte, KC5DOR, at <blee@ipa.net>, or Ray, at <raysoft@intrastar.net>. **(exams)**

Sept. 11, 14th Annual Hamfest, Saratoga County Fairgrounds, **Ballston Spa, NY**. Talk-in 146.40/147.00 and 147.84/147.24. For information, contact Darlene Lake, N2XQG, 314 Louden Road, Box #84, Saratoga Springs, NY 12866; Phone: (518) 587-2385; Packet: <n2xqg@wa2umx>; E-mail <lake@capital.net> **(exams)**

Sept. 11, Erie Hamfest '99, Franklin Twp. Firehall, **Erie, PA**. Talk-in 146.01/61. For information, contact Dr. Tom McClain, N3HPR, 3954 Solar Dr., Erie, PA 16506; Phone: (814) 833-1640; E-mail <tem@erie.net>. **(exams) Handicapped accessible**

Sept. 11, Hamfest, Good Time Country Facility, **Columbia, MO**. Talk-in 147.760. For information, contact Bruce Olde, KØZY, 3315 Berrywood, Ste. 101, Columbia, MO 65201; Phone: (573) 875-5246; E-mail: <bruceo@odle-associates.com>. **(exams)**

Sept. 11, Hamfest, Rush City High School, **Rush City, MN**. For information, contact Larry Jilek, KAØMEN, at (320) 358-4205.

Sept. 11–12, The Greater Louisville Hamfest/ARRL KY State Convention, Bullitt County Fairgrounds, **Louisville, KY**. For information, call (502) 935-7197 or (606) 284-9090; Web: <http//www.thepoint.net/~glha/>.

Sept. 12, 57th Annual Findlay Hamfest '99, Hancock County Fairgrounds, **Findlay, OH**. Talk-in 147.15+, 444.15. For information, contact Dave Hoxworth, AA8KJ, 443 Starlet Oak Drive, Findlay, OH 45840; Phone: (419) 423-3402.

Sept. 12, Hamfest '99, Inwood Recreation Center, **Joliet, IL**. For information, mail reservation (with SASE) to Marti, KA9ZJJ, 345 Gehrig Circle, Bolingbrook, IL 60440, or call (815) 436-0559. **(exams)**

Sept. 18, 27th Annual Hamfest, L'Anse Creuse High School, **Mt. Clemens, MI**. Talk-in 146.420 and 147.080(+). For information, contact Betty McGinn, N8SIH, at (810) 791-4484, or send SASE to P.O. Box 180072, Utica, MI 48318-0072; E-mail <Boops@juno.com>; Web: <www.flash.net/~lcare>. **(exams)**

Sept. 18, Swapfest '99, Wester Civic Center, **Webster, TX**. For information, contact Bob Biekert, KA5GLX, CLARC Secretary/Treasurer, at P.O. Box 57714, Webster, TX 77598; E-mail: <ka5glx@clarc.org>.

Sept. 18, South Eastern Massachusetts FleaMarket, Marshfield Fairgrounds, **Plymouth, MA**. Talk-in: 146.685 Plymouth, 447.075 Kingston 88.5. For information, contact Lou Vanderstreet, N1WNT, at (781) 837-6651: E-mail: <n1wnt@mediaone.net>, Genesis ARC, P.O. Box 1234, Plymouth, MA 02362. **(exams)**

Sept. 18, Southern Kentucky Hamfest, Cave City Convention Center, **Cave City, KY**. For information, contact Larry Brumett, KN4V, 108 Withers Dr., Glasgow, KY 42141; Phone: (502) 651-2363; E-mail: <lbrumett@glasgow-ky.com>; Web: <http://www.geocities.com/CapitolHill/5421>. **(exams)**

Sept. 18, Buffalo Hamfest/ARRL Western NY Section Convention, Erie County Fairgrounds, **Hamburg, NY (near Buffalo)**. For information, contact Harold Smith, K2HC, at Buffalo Hamfest, 300 White Spruce Blvd., Rochester, NY 14623; Phone: (716) 424-7184; Web site: <http://www.buffalohamfest.org>; E-mail: <info@buffalohamfest.org>.

Sept. 18, Annual Super-Swap, Caledonia High School, **Grand Rapids, MI**. For information, contact Ed Novakowski, N8UXN, at (616) 458-9029, or e-mail: <barbv@voyager.net>.

Sept. 18, 7th Hamfest, Ella Burr School, **Lincoln, ME**. For information, contact Hamfest Committee Chairman Max Soucia at (207) 564-8943. **(exams)**

Sept. 19, Tailgate Electronics, Computer and Amateur Radio Fleamarket, Albany & Main St., **Cambridge, MA**. Talk-in: 146.52 & 449.725/444.725 - pl2A - W1XM/R. For information, contact W1GSL, P.O. Box 397082 MIT BR., Cambridge, MA 02139-7082. **Handicapped accessible**

Sept. 19, 27th Annual Hamfest & Computer Show, Lenawee County Fairgrounds, **Adrian, MI**. For information, contact Brian J. Sarkisian, KG8CO, at (517) 265-1537; E-mail: <kg8co@lni.net>; Web: <http://www.LNI.net/w8tqe>. **(exams)**

Operating Notes

For September, 1999:

4–5	IARU Region 1 (Europe/Africa) VHF Contest (2 meters)
11–12	ARRL September VHF QSO Party (see Rules, this issue)
18–19	ARRL 10-GHz And Up Cumulative Contest, 2nd Weekend (see Rules, last month's issue)
26	Good EME conditions
30	Alpha Aurigids meteor shower peak

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

Sept. 19, FallFest '99 Hamfest, Tall Cedars of Lebanon Picnic Grove, Sawmill Rd., **Hamilton Twp, NJ**. Talk-in: 146.67. For information, contact FallFest '99, DVRA, P.O. Box 7024, West Trenton, NJ 08628; Phone: (609) 882-2240; Web: <www.slac.com/w2zq>, or

Sept. 19, Communications Expo '99 Hamfest & Electronics Show, Kolping Center, **Cincinnati, OH**. For information, contact James E. Weaver, K8JE, at 5065 Bethany Rd., Mason, OH 45040; Phone: (513) 459-0142; E-mail: <k8je@arrl.net>. **(exams)**

Sept. 19, Hamfest, Edmond Town Hall, **Newtown, CT**. Talk-in: 146.67 MHz. For information, contact Jeff Cantor, WB3DLG, P.O. Box 3441, Danbury, CT 06813-3441; Phone: (203) 857-7050, (203) 798-2871, (203) 798-6860; Web: <http://www.danbury.lib.ct.us/org/cara/>. **Handicapped accessible**

Sept. 22, Hamfest '99, Blanchette Park, **St. Charles, MO**. Talk-in: 146.67. For information, contact Ken Fieser at (314) 428-4383; E-mail: <kfieser@aol.com>; Web: <http://www.qth.com/wbøhsi/>.

Sept. 25, Michigan ARRL Ham Radio State Convention, University of Michigan Flint Campus, **Flint, MI**. For information, contact Debbie Kirkbride, KA8YKK, 1315 Center Ave., #1, Bay City, MI 48708; Phone: (517) 892-1212 eves, (517) 892-5501, days (Mon–Fri., 9–5); E-mail <ka8ykk@concentric.net>.

Sept. 25, 24th Annual Elmira International Hamfest/ Computerfest, Chemung County Fairgrounds, **Horseheads, NY**. Talk-in: ARAST, Repeater 147.96/36, 444.20. For information, mail SASE to Dave Lewis, Elmira Hamfest, 465 CR 13, Van Etten, NY 14889; Phone: (607) 589-7495; Web: <http://www.arast.org>; E-mail: <info@arast.org>, <hamfest@arast.org>, <winterfest@arast.org>. **(exams)**

Sept. 24–26, Lancaster Super Moose Festival Hamfest/ Computer Flea Market, Lancaster Fairgrounds, **Lancaster, NH**. For information, contact: UW of Northern NH, P.O. Box 614, Berlin, NH 03570; Phone: (603) 752-3343; E-mail: <unitdway@ncia.net>, .

Sept. 25–26, Anchorage Amateur Radio Club, ARRL Designated Alaska State Convention, 28th Hamfest, Regal Alaskan Hotel, **Anchorage, AK**. For information, contact Rick (KL7YF) and Lillian (NL7DL) Marvin, Hamvention Coordinators, 1030 Denali, Anchorage, Alaska 99501; Phone: (907) 277-6741; E-mail: <rlment@alaska.net>.

Sept. 26, Giant Electronic Flea Market, Lincoln High School, **Yonkers, NY**. Talk-in: 440.425 MHz PL 156.7, 223.760 MHz PL 67.0, 146.910 MHz, 443.350 MHz PL 156.7. For information, contact Otto Supliski, WB2SLQ, at (914) 969-1053. **(exams)**

VHF Conferences

Sept. 24–26 ARRL/TAPR Digital Communications Conference, Phoenix Arizona. See complete announcement in the August issue, page 69. For more information, contact Tucson Amateur Packet Radio, 8987-309 E. Tanque Verde Road #337, Tucson, AZ 85749-9399; Phone 940-383-0000; Fax 940-566-2544; E-mail: <tapr@tapr.org>; Web: <http://www.tapr.org/dcc>.

Sept. 18–19, Weinheim (Germany) VHF Conference. The 44th annual Weinheim VHF Conference, the world's largest VHF conference, will be held on September 18–19 at the **Mannheimer Maimarkthalle (Mannheim May Fair Centre) near Weinheim**. This is a new location for the event. Lectures may be given in either German or English. For additional information, please visit the Weinheim VHF Conference Web site at <http://www.hamradio.de/weinheim>.

Cellular Surplus

Surplus cellphones aren't easily converted to ham use, but equipment from cellular relay sites can be a gold mine for hams. And tons of it is showing up on the surplus market.

This month, I'm going to talk some more about using some of the tons and tons of 900-MHz surplus hitting the market (see July's "Final Frontier" column for the initial discussion). We'll look at a variety of filters, antenna systems, and power supplies, and at how hams can retune them for use on the amateur bands. Plus, we'll take a look at something called "dB return loss" and activity news from the microwave bands.

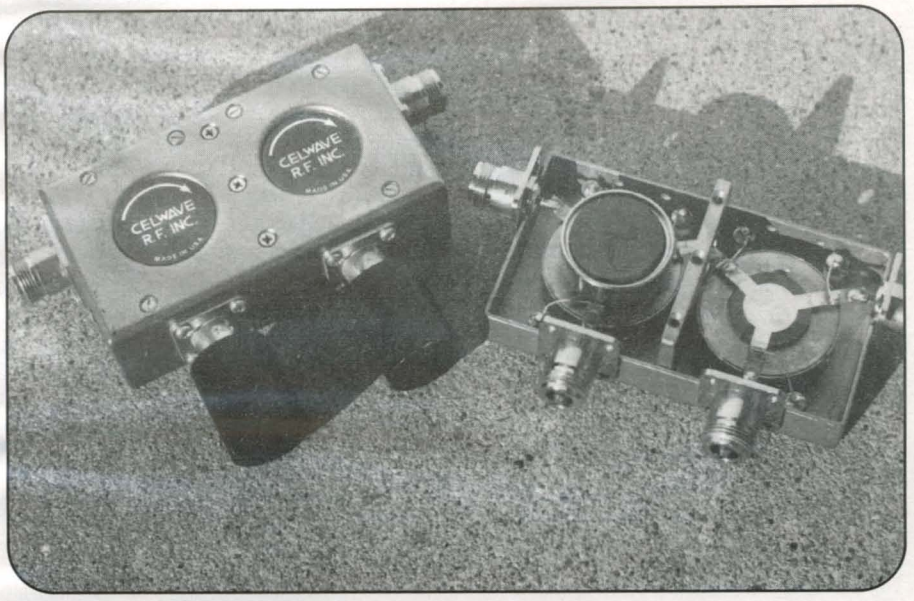


Photo A. Typical cell site circulators. These special filters are used to prevent interference when multiple transmitters and receivers operate in close proximity to each other. See "Microwave Mini-Glossary" for a more detailed explanation.

Filters

With all the thousands and thousands of cellphone sites out there, any good location for your 902- to 928-MHz ATV system, repeater, or SSB station is probably going to be near a cell site. If you don't block out all those strong 880-MHz transmitters, you're not going to hear any weak 900-MHz signals. What you'll need is a bandpass filter to allow only 900- to 910-MHz signals to pass through into your receiver. Many surplus cell site filters will do the job nicely.

In general, bandpass filters tune down farther in frequency than they tune up, and there is quite a variety of filters that can be retuned into our 902- to 928-MHz ham band. Part of this is engineering. If I want a low-loss 900-MHz interdigital filter (see Microwave Mini-Glossary), then I would design it for 905 or 910 MHz. The guys stamping them out wouldn't make all the filters exactly alike, but they'd be close enough; and with a tiny bit of capacitance, the filter could be tuned down to 900 MHz. If I designed it for 950 MHz and pulled the filter down to 900 MHz, the filter would have more loss. So the designer naturally wants to cut it pretty thin.

All the cell site bandpass filters I've worked with retuned to the low edge of our 902- to 928-MHz ham band; about half would retune to 915 MHz, a favorite spot for ATV (amateur television). Cell site filters are a good find.

PCS Band Stuff

I've built up quite a collection of filters for the 1800-MHz PCS band (Personal Communication System, the digital cellphone networks at 1.8 GHz, identifiable by ads telling you they're not cellular). But I've never gotten one to tune up to 2304 MHz or down to 1296 MHz, even with some pretty radical surgery! So the best I can say for the 1800-MHz PCS filters is to salvage them for the hardware and coax connectors.

While on the subject of 1800-MHz PCS systems, I've also collected several different PCS power amplifiers and preamps. Again, I've never worked out a modification to move the amps either up to 2304 MHz or down to 1296 MHz. The power transistors use a variety of internal matching techniques with the bond wires to optimize them for 1800 MHz. The transistors work great on 1800 MHz, but quit above 2000 MHz or below 1500 MHz. Mats Bengtsson, SM6IKY/W5, has had some success using 1800-MHz PCS transistors on 1296 MHz with some careful-

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

Microwave Mini-Glossary

For those of you who (*like your editor*) aren't familiar with some of the terms used in this article, here's a brief "mini-glossary" to help you understand better...

Bond wires—Small wires thinner than a human hair used to make connections inside transistor and IC (integrated circuit) packages.

Circulator—A three-port ferro-magnetic device that only allows radio waves to travel between certain ports (see also *Isolator*). Isolators and circulators will be the primary topic of an upcoming "Final Frontier" column.

Interdigital filter—A filter containing a series of 1/4-wavelength elements designed to pass a range of frequencies. Due to the size of the elements, interdigital filters are rarely used below 500 MHz.

Intermodulation (intermod)—When two or more signals combine to interfere in a receiver. As an example, TV channel 2 and TV Channel 11 are 144 MHz apart. These strong signals mix in my 2-meter moonbounce receiver and create an intermod signal at 144.000 MHz.

Isolator—A two-port ferro-magnetic device that allows radio waves to travel though in only one direction. Much like a "check valve" in hydraulics.

Patch antenna—A small, usually square, patch of printed circuit board mounted above a ground plane. Patch antennas will be the primary topic of an upcoming "Antennas, etc." column.

TWT (traveling wave tube)—A special vacuum tube used to amplify microwave signals. TWTs usually have very high gain (40 dB or more), taking small microwave transmitters to the 10-watt or even 100-watt level. When combined into a complete system of power supplies, switching, and so forth, they are known as TWTAs, or traveling wave tube amplifiers.

ly designed pc boards, but, in general, the 1800-MHz PCS power amps and receiver preamps are good only for parts.

Isolators and Circulators

Isolators and circulators are special filters designed to allow multiple transmitters and receivers to operate from the same physical location (such as a cell site) without interfering with each other (see "Microwave Mini-Glossary" and Photo A). I will be devoting a future column just to circulator tricks, but, for now, I can say I've never seen a cellphone circulator that didn't either already work on 900 MHz or easily retune to 900 MHz. For the most part, hams have stayed away from these "ferrite devices" (isolators and circulators). I guess it's because most don't understand what they do, and that's a shame because "ferrite devices" are very handy!

A ferrite isolator is the RF equivalent of a diode. RF goes in, but it doesn't come back out. Let's say you put a 146-MHz isolator on your 2-meter rig. Because RF cannot travel backwards through the isolator, the 2-meter rig sees a 1:1 SWR (standing wave ratio), even if the antenna falls off! Of course, with this hookup, received signals can't get back to the 2-meter rig, either, but we can have separate isolators looking in different directions after the antenna switch.

Isolators tuned to 900 MHz are great for high-linearity ATV transmitters or 900 MHz repeaters. When using an isolator in ATV systems, the transmitter is always looking into a constant impedance load. Plus, in repeater service, the isolator keeps nearby signals from other services from getting back into the transmitter and causing intermod.

Intermod in the transmitter? Yep! We had a good example of this in our area some years ago. The 222-MHz repeater was located a few feet from an FM broadcast station. Several watts of the broadcaster's 90-MHz signal were going back down into the final transistor of the repeater and generating all kinds of mixing products. While this problem was eventually solved with band pass and notch filters, it would have been the perfect spot for a 222-MHz circulator.

Cell Site Antennas

If you have ever taken apart an antenna from a cell site, you've no doubt been quite impressed. The typical 800- or 1800-MHz cell site antenna these days is an *Aperture Coupled Patch* antenna. A small square patch antenna is excited by one of two slots etched into a circuit board underneath the patch. This way, the patch can be used on two polarizations at the same time. Phasing lines and power splitters are typically etched into the same printed circuit board on which the patches are etched. An exquisitely engineered phased array antenna is a fascinating thing to look at, but useless on the amateur bands. On the other hand, the antenna hardware, coax cable, and other parts can all be quite useful.

Power Supplies

Every cell site needs amps and amps of 24-volt DC power. The extremely rugged power supplies that produce this are designed to function reliably for years and years. You'll be needing a 24-VDC supply anyway if you're going to be playing around with cell site equipment, and the 24 VDC usually runs 28-VDC military surplus equipment just fine. Look around, the power supplies usually have controls for voltage and current limiting.

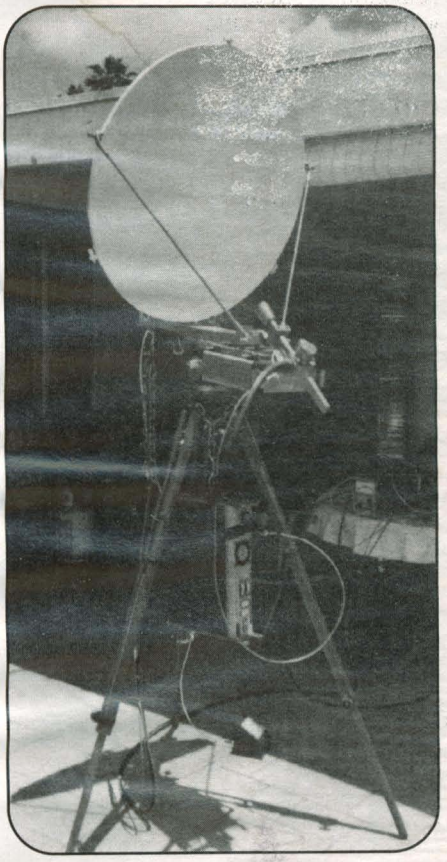


Photo B. Have tripod, will travel. Peter Bauer, W6DXJ, of El Cajon, California, is ready anytime, anyplace, to put a 10-GHz signal on the air with his tripod-mounted 30-inch offset feed dish and 15-watt TWT amplifier. (W6DXJ photo)

"German, French, Belgian, Czech, and Dutch stations were working each other on 10 GHz over a 500-mile-square area."

A few can even be cranked down to 13.8 VDC. So don't pass up those power supplies too quickly if you see some down at the surplus yard.

Activity Reports

We have word of an excellent rain scatter event over most of northwestern Europe on June 2. German, French, Belgian, Czech, and Dutch stations were working each other on 10 GHz over a 500-mile-square area. Raindrops scatter 10-GHz signals like a snowstorm scatters a bright light that shines into it. If both stations can see the tops of the thunderstorm clouds, they can work each other on 10 GHz. Now, bouncing your signal off billions of tiny dielectric dipoles swirling around in different directions does weird things to the signal. And the human voice comes out as short broadband bursts of noise. So all of these QSOs were on CW. At least one more reason for knowing enough code to recognize your call—and the other guy's!

Events

I would like to invite everyone to Microwave Update 99. This is a world-renowned conference on microwave equipment, theory, and operating that Al Ward, W5LUA, and I will be hosting at the Harvey House Hotel in Plano, Texas, this October 21 to 23. We expect 150 or so attendees from as many as eight countries. For more information, you can contact me through *CQ VHF* or Al at <W5LUA@CSVHFS.ORG>.

Finally, Photo B shows the portable 10-GHz station of Peter Bauer, W6DXJ. A note to Pete: I see that Hughes 1177 TWT (traveling wave tube) amplifier hanging from the center of your tripod. I've personally used a Hughes 1177 on 10-GHz EME and G3WDG is currently using a 1177 on 10-GHz EME. All you need is a bigger dish!

Until next time, have fun and let's see some more action on ham radio's microwave bands! ■

"dB Return Loss" and VSWR

For about the first 50 years of radio, antenna performance was measured by walking along the open-wire feed line with a voltmeter. Sometimes the meter was slid along the line, sometimes people just made a measurement every few feet. If the highest voltage measurement was 100 volts and the lowest measurement was 50 volts, then the VSWR (voltage standing wave ratio) was 100/50 or 2 to 1 (2:1). If the reading was a nearly constant 100 volts, then the line was said to be "flat." It was certainly a useful measurement method for the equipment of the 1920s, but as coaxial cable was introduced, this measurement method lost favor. Yes, you could drill holes in the coax every few feet and measure the voltage between the center conductor and the shield, but this is hardly a popular way to test antennas.

Next came the SWR meters we typically use today. These meters measure the current in the coax cable. With "directional couplers," the current going out and the current reflected back are independently measured and the antenna SWR is calculated. But that reading of 2.5:1 or 1.2:1 really doesn't tell us much about what's going on in the antenna.

I don't know exactly when the idea of *decibel return loss*, or *dBrl*, was introduced, but it seems to have come out of the telephone company in the 1940s (*back when there was only one telephone company—ed.*). The term dBrl expresses the difference, in decibels (dB), between how much power goes out and how much power is reflected back. If half the power is reflected, then the system has a 3 dBrl (3 dB representing either a doubling or halving of power). If $^1/_{10}$ of the power is reflected, then the system has a 10 dBrl (you guessed it, 10 dB loss represents $^1/_{10}$ of the original power; and 10 dB gain represents 10 times more power*). If $^1/_{100}$ of the power comes back, then you have a 20 dBrl.

You've probably noticed by now that the higher the dBrl number is, the lower your SWR is. This is particularly useful when the reflected powers are very, very low. If I reduce the reflected power from 40 dBrl to 50 dBrl, I've reduced reflected power by 10 dB. You'll have to sharpen your pencil several times to calculate the difference between 1.020 and 1.006 SWRs which represent the same change in reflected power. See the Table for additional examples.

*For an excellent introduction to decibels, see "You Don't Have to be Einstein...to Understand Decibels," by Ron Hranac, NØIVN, in the December, 1997, *CQ VHF*.

Table.

Decibels Return Loss (dBrl)	Equivalent SWR
3 dBrl	5.8:1
6 dBrl	3.0:1
10 dBrl	1.9:1
20 dBrl	1.22:1
30 dBrl	1.07:1

Table. Comparison of reflected power measurements expressed in dBrl (decibels of return loss) and SWR (standing wave ratio). The smaller the return loss, and lower the SWR, the easier it is to work with dBrl, which increases as the return loss decreases. See text for additional details.

NASA Rockets to Probe E-Layer

NASA planned to light up the summer sky along the east coast with a series of rocket launches in July to learn more about the E-layer of the ionosphere...especially about its effects on radio communication.

It's another team effort this month, with W2VU writing about the NASA E-layer experiment, and WB2AMU providing activity reports, along with those received via the Internet.—W2VU

If you've been active for any length of time on 6 meters, 10 meters, and even 2 meters, particularly on single sideband, and if you're interested in how radio signals travel from here to there, then you're probably familiar with "sporadic-*E* (*Es*)" propagation. *Es* is one of the main sources of long-distance QSOs, especially on 6 meters and especially in the summertime. And you may even be familiar with the mechanics of *E*-skip—ionized particles in the *E* region of the ionosphere occasionally clump together with enough density to form a "cloud" that's capable of refracting radio waves, or bending them back to Earth hundreds of miles from their source.

But even if you understand the *how* of *Es*, it's doubtful that you understand the *why*; in fact, scientists really don't know what causes those ionized particles to start clumping together, or why the "clouds" last only a short time before dissipating. There are plenty of theories (several of which have been discussed in these pages in the past), but no hard proof. Of course, the *E*-layer is important for more than just ham radio communications. And while some *E*-layer events improve communication range, others can be disruptive, affecting a wide variety of radio, TV, and satellite communication systems.

A Greater Understanding

Understanding more about what actually goes on in the ionosphere is key to improving the reliability of communication systems that are affected by changes in those upper layers of our atmosphere. And that's the reason why NASA was planning a series of rocket launches in July to probe the normally invisible secrets of the ionosphere.

Some of the rockets were to release a chemical called trimethylaluminum that would form large glowing clouds in space (see Photo). The clouds were supposed to be visible to the naked eye for several hundred miles from the Wallops Island, Virginia, launch site, an area encompassing most of the U.S. east coast.

According to NASA (see "Text of NASA News Release on *E*-Layer Experiment"), the primary goal of the experiment was to study the interaction of the solar wind and the sun's magnetic field with the Earth's magnetic field and atmosphere—all three come together in our ionosphere—and to determine how these interactions create disturbances that affect communication on Earth.

Photo. A trimethylaluminum (TMA) cloud over the Poker Flat Research Range in Alaska, following release from a NASA sounding rocket in 1978. Similar TMA releases were planned for July over the U.S. east coast. (NASA photo)

The experiment period was just beginning as we went to press with this issue, and it will probably be many months before any

By Rich Moseson, W2VU, and Ken Neubeck, WB2AMU (w2vu@cq-vhf.com and wb2amu@cq-vhf.com)

Text of NASA News Release on E-Layer Experiment

Following is the full text of NASA's news release on its plan to release luminescent chemicals into the *E*-layer of the ionosphere in an effort to better understand the interactions between metallic ion layers (the "clouds" that cause *E*-skip) and upper-level winds and how they create large electric fields and turbulence.

Scientific "Fireworks Display"

NASA will set off its own Independence Day fireworks during a series of nighttime rocket launches from July 2 to 20, 1999. Designed to study "space weather"—the interaction of the solar wind with the Earth's magnetic field and atmosphere—the experiments will focus on improving our understanding of electrically charged atoms at the edge of space.

During the 19-day period, two suborbital rockets will be launched on each of two nights between 9:30 p.m. and 4:00 a.m. EST from the NASA Goddard Space Flight Center's Wallops Flight Facility, Wallops Island, VA.

Two of the experiment packages will release a chemical that will form large glowing clouds in space. These luminescent, milky-white clouds should be visible to the naked eye for several hundred miles from the launch site, encompassing the mid-Atlantic region and portions of the northeastern and southeastern U.S. The clouds should be visible for 10 to 20 minutes to the southeast of the launch site at about 70 degrees elevation (approximately three-quarters of the way between the horizon and the point of the sky that appears to be directly above an observer).

The chemical, trimethylaluminum, will be released in the ionosphere between 43 and 96 miles (69 to 154 kilometers) altitude. The harmless by-products will disperse across thousands of miles as they diffuse into the upper atmosphere.

The experiments will take place in a region above the Earth that at first appears to be empty and very quiet. In fact, the Earth's upper atmosphere is bustling with activity. Here the solar wind (a fast-moving stream of particles emanating from the Sun), the Sun's magnetic field, and the Earth's magnetic field and atmosphere come together. Their interactions can create disturbances just above Earth's lower atmosphere. These disturbances can affect radio, television, and satellite communications. By better understanding these interactions in the ionosphere, scientists hope to gain information that will ultimately help improve the reliability of radio and satellite communications.

The specific aim of these experiments is to explore metallic ion layers (regions of electrically charged particles) that exist about 60 miles (100 kilometers) above the Earth and to understand how their interactions with wind in the upper atmosphere create large electric fields and turbulence. The metallic ion layers are formed by material from meteors that have collided with the Earth's upper atmosphere.

Each mission will consist of a one-stage Black Brant V rocket and a two-stage Taurus-Orion rocket. The Black Brant V, which will carry instruments only, will be launched first. The Taurus-Orion, carrying the chemical package, will be launched approximately three minutes later.

The status of the launches can be found by calling the Wallops Flight Facility launch status line at (757) 824-2050 or on the Wallops Web page at <http://www.wff.nasa.gov>.

results are made public. Meanwhile, updates are available on NASA's Wallops Island Web site at <http://www.wff.nasa.gov>.—W2VU

On the Bands

Hot Times on 6 Meters

WB2AMU provides the following information, along with selected reports from the Internet:

Es activity during the first half of June was moderate at best, including the ARRL VHF Contest on June 12 and 13. However, beginning on June 17, the 6-meter band saw daily *Es* activity for the next several days, up through the 24th. Some of these openings were quite long and strong, allowing low power to be used. Mixed in with the single-hop activity were extensive double-hop openings, resulting in transcontinental and transatlantic contacts (see Internet reports).

Some of the stronger openings I observed from FN30 were on June 17, when the band was open from noon until late at night into Georgia, Tennessee, Florida, and other southern U.S. states. Another good day of activity was June 20, when the band was open for extended periods in the morning to the south and in the evening to the Midwest. I'd hear some western U.S. states come in briefly on CW via double-hop skip during this time, but no prolonged activity. This changed on June 22, when, at 7:30 p.m. (2330 Z), some very strong signals were heard from the west. Using 10 watts CW, I worked KØYW (DM67) from Colorado at 2334 Z, and a few minutes later W7RV (DM43) from Arizona. Signals were strong at times, reaching 5 by 7.

On June 23, at 2100 Z, there were many W9 stations working into Italy and Austria. The European signals could not be heard here in New York at that time. However, we would get some very good double-hop activity into the west again, and I worked the following on CW: WØLD (DM78) at 2339 Z (6/23); KØGU (DN70) at 0023 Z and K8FV (CM87) at 0042 Z (6/24). On the morning of June 24, I took a break at work and listened to six from my car in the parking lot. I heard both the VO1ZA (Newfoundland) and FP5XAB (St. Pierre and Miquelon Islands) beacons coming in. Then I heard EH7KW (IM67, Spain) coming in on 50.135 MHz. I was able to work him at 1318 Z on CW using 70 watts into a magnetic mount vertical on the car!

A Most Amazing Day

I received the following report from Jay Buscemi, K2OVS, also on Long Island (FN30):

A most amazing day on Friday, 6/25/99. Worked the following stations on 6 meters, all CW: MMØAMW, GIØKOW, VP2E/K5AND, DK2EA, YU1EU (good luck getting a card!), GI7REP, VY0O, DL8HCW, W1CBI/VE1, DL5CC, DL9MS, DF1AN, SP5EWY, PAØOOZ, DK1CO, DL4IB, OE2UKL, all in two hours (1830 Z–2030 Z). Sounded like an afternoon on 20 meters. Best guess is it was multiple-hop sporadic-*E*, not F_2 layer, as the sunspot number was just not high enough. Up to 69 countries now on six, hope to find a few more in the coming weeks.

Another Great Field Day

You may remember last year's incredible 6-meter openings during Field Day. Well, my (WB2AMU's) 1999 Field Day

"This is great; first real opening to Europe for me—seven new countries today; signals from 4/3 to 5/9."—Kevin Bishop, WB8XX

excitement started as I drove to the W2AMC, Peconic ARC, Field Day site 40 miles away from my home QTH. Along the way, I worked a number of stations while mobile on 6 meters, including working the DXpedition VYØO (FO03) from two different grids (FN30 and FN31). At the Field Day site at Horton's Point Lighthouse in FN31 on the shore of Long Island Sound, we set up a 150-watt station with a three-element Yagi. Periodic listening on the band prior to the start of Field Day revealed that the band was open, with many beacons being heard from the midwest.

Once the event started, 6 meters was a massive wall of signals! The *Es* opening was of short-distance, letting us work stations as close as Western Pennsylvania and Ohio. In the first 20 minutes, we also worked KØGU from DN70 in Colorado via double-hop *Es*. We completed about 55 QSOs during the first hour and the band cooled down a little. During the evening, stations from the Midwest and the south were worked, but signals were not as strong as the first hour.

At the crack of dawn at 5:00 a.m., we listened on six to work a few stations via line of sight and were surprised to hear VE1VAS from GN06 in Nova Scotia come in via a short-duration *Es* opening at 5:45 a.m.! It seems that during the summer, the band can be open at any hour. At 8:00 a.m., the band opened in force into Missouri and Minnesota, then faded by 11:00 a.m., and the remaining three hours were spent working a few locals. In all, we worked 200 QSOs on 6 meters, with about 150 of them made via *Es*. This was a little bit less than our effort last year, but just as much fun!

Internet Reports

And with this, we switch over to Internet reports...and you know that the bands are hot when reports of transcontinental double-hop *E*-skip get pushed aside by transatlantic and transpacific openings on six, and big-time *Es* reaching 2 meters as well.

To briefly cover the "mundane" stuff, Rick Phillips,KB3PD, reported working California from Delaware on 6 meters at 0000 UTC on June 18, the same day that Brian Allen, NØVSB, in Colorado, reported "Magic Band" contacts with stations in Tennessee, Georgia, Ohio, Illinois, Florida, Arkansas, and Arizona. The beginning of July was good, too, with Dave Booth, KC6WFS, reporting transcontinental 6-meter *E*-skip from California on the first (*up here in New Jersey, I could only hear single-hop stuff; probably poor timing—W2VU*).

But the biggest news was the reports of openings to Europe and Japan, and from the center of the U.S. as well as the coasts. Let's start with some highlights of European openings, then swing over to Japan, tune in some reports from DX stations, and finish up with the 2-meter *Es* openings.

Virtual Visits to Europe

From Mike Smith, VE9AA:

6/23—What a day ! At something past 1900 Z I was hearing N6CA calling CQ (from California) on 110 CW....A short while later I was greeted by VE8BY/B beacon in the Northwest Territories....Putting the antenna a little farther north on a hunch, I called CQ on 50.110 CW. Almost immediately I was called by two equally loud SP9 stations, both in JO90nh (Poland). After working SP9HWY@ 1951 Z, I QSYd to .095 and stayed there for most of the next 2 hours....From 1951 Z–2112 Z I worked (all on CW) SP, DL (Germany), YO (Romania—new!), GM, GD (Isle of Man), IK1 (Italy), and S5 (Slovenia) (hrd XE2/b from Mexico).

From Kevin Bishop, WB8XX, EM79xk Ohio:

6/23—I had a great opening here into Europe today starting about 1800 Z, first hearing EH7KW but didn't work, then EH8BPX 5/3 QSB a little later he was 55 solid copy. CT3FT was also worked at 1853 Z....Then the Magic Band came to life at 2001 Z, worked EH1TA in Spain. Up until 2135 Z I heard or worked GM0, EI (Ireland), SP, IK, YO, S5, DL,GI, & OK (Czech Republic). This is great; first real opening to Europe for me—seven new countries today; signals from 4/3 to 5/9.

From George Dowell, KØFF:

6/24—Today's opening started out early in the morning for us here in Missouri. The afternoon session was even more energetic, and CT1EEB actually hit S9, and he gave me an honest S9 report also....Even though we heard and worked several different prefixes, i.e. CT1-CT4-EH7-, the geography covered was quite small. Looking at the grids worked, being IN50, IN51, IN60, IM67, and IN87,

"My CQ on 50.110 was answered by a weak CW station (NL7Z?), but that was interrupted by an SSB call from JA4MBM, whose report was 33 here...XYL NØQJM, Holly, worked JH6NKZ at 0008 Z and JA4MBM at 0015 Z."—Arliss Thompson, W7XU

most of the stations were within a 100-mile circle, and all but one fell within a 200-mile circle. Yesterday's opening was far wider, and for us covered all the way from Northern Ireland thru S5, OK, EH, and down to EH8. Lots of gaps in there though, and I missed new ones.

From Clint Walker, W1LP:

6/25—Very widespread opening to Eu. I missed lots of it due to other commitments but still managed to work EH8, G (England), GM, OZ (Denmark), GI, DL, SM (Sweden), and right in the middle also VP2E/W6JKV-K5AND (Anguilla). At least 15 other countries were heard and worked in W1 as far as SV (Greece).

From Tony Emanuele, WA8RJF EN91:

6/26—Band opened Eu about 1230. EH7AH, EH7KW, EH7GTF, CT1DMK to EN91 (Ohio) very strong. EH7KW looking for QSOs on 50.115 now; lots of good backscatter from as far west as W7. Fun day....W8ZH just worked EH7KW on CW on 50099 with RST of 559. It could be an interesting day, as it is only 5 a.m. local!

Pacific Openings

Surprisingly, the first reported U.S.-Japan contact of the summer on 6 meters wasn't from the West Coast, but from *South Dakota*. Arliss Thompson, W7XU, and his wife, Holly, NØQJM, shared the honors, as Arliss reports:

6/19—I was able to get on 6 meters this evening at 2330 Z and heard strong signals from VE7 and VE6. At 2340 Z I copied the KL7FZ beacon (Alaska, BP51) 549 on 50.090. My CQ on 50.110 was answered by a weak CW station (NL7Z?), but that was interrupted by an SSB call from JA4MBM, whose report was 33 here. We completed at 2348 Z.

I subsequently heard bursts of signal from Japan (including JH6VXP?), but the only other station I worked there was JH6NKZ at 0005 Z (signal report for him 43). I lost one or two QSOs due to stateside stations calling me over the top of JAs (in the DX window). The antenna was pointed on the great circle path to Japan for these QSOs.

XYL NØQJM, Holly, worked JH6NKZ at 0008 Z and JA4MBM at 0015 Z. JA4MBM at that time was 5 by 4—the strongest at any point during the opening. He was also the last JA signal heard here.

I presume this was multi-hop *Es*. Although I've worked Europe before on multi-hop *Es*, this was the first time I've heard or worked Japan via *Es*. The JA path is about 6,000 miles, or roughly 1,500 to 2,000 miles longer than the path to Europe from here. I never did work a KL7 during the opening.

From Jon Jones, NØJK:

6/19—Congrats on the 6-meter JA QSOs Arliss and Holly! What a deal....

Most likely was multi-hop *Es* on 6 meters at this time of year and with a solar flux of around 150. Very early in the evening for *Es* to JA, most *Es* contacts between the U.S. and Japan tend to peak much later, usually around 0500–0600 UTC. During the last solar cycle peak, the W0 to JA 6-meter F_2 QSOs occurred around the same time frame you made your contacts—but in October and November. The only time I worked JA on 6-meter *Es* (on June 14, 1992), the band was also wide open to KL7 and VE8.

Six meters never did open to Alaska that night from South Dakota, but there definitely *was* a path to KL7 from California and Colorado:

From Dave Booth, KC6WFS DM04rk:

6/20—Just worked NL7OW, Tom, in Clam Gulch, Alaska on 50.120. He was 5/3 in and out and is still in there—better, 5/5 5/9—now. Time is June 20 03:00 Z. Man I love 6 meters!

From Dave Clingerman, W6OAL, DM79, Colorado:

Well, finally made a 6-meter QSO with Alaska last night with Brent, AL7R, at 0500 Z Sunday evening (06/20/99). Brent was at work in BQ50 running 100 watts to a five- or six-element Yagi at 35 feet. I was running a couple hundred watts to a four-element quad at 40 feet. I figure the distance to be about 2,600 miles (BQ50 to DM79ql). Brent peaked about an S-3. After that, we (Brian, NØVSB, and I) experienced some really strong backscatter into PA and OH.

From Brian Allen, NØVSB:

I Finally worked KL7NO in BP54 de NØVSB DM79 (55 SSB/50.125) 06:09 UTC on 6/20/99. Also hearing NL7Z, but not worked yet.

E-Skip Reaches 2 Meters

If you think *Es* provides great DX only on 6 meters, think again. When the *E* layer gets charged-up enough, the MUF (maximum usable frequency) sometimes climbs all the way to 144 MHz. And here's what can happen when it does...

From Russ Pillsbury, K2TXB, FM29, New Jersey:

6/17—Working stations in south and west Louisiana on 2 meters via *E*-skip....First heard W5QEP mobile in EM30 calling CQ, about S5, and worked him at 1901 Z, with my driver stage—60 watts. Then warmed up the amp and worked him again a few minutes later to pass name and exact location. Then worked W5VUY in EM40. At that time, I was the only station hearing the DX. K2SMN, 40 miles north of me, was not hearing it. Shortly, stations farther north started working them, including K2SMN, W1COT in Connecticut, and WV2C on Long Island.

From Mike King, KMØT, Iowa:

6/18—I worked the following stations from my grid of EN13 this early evening, on 144.200 MHz SSB: 2328 AA7A DM43; 2328 W7RV DM43; 2335 WA7JTM DM33; 2344 K6DV DM13; 2345 N8EWU/6 DM13. My first ever *Es* on 2 meters, it was a learning experience and, boy, was it ever exciting to hear 7 and 6 calls come through the noise on 144.2 and then be 40 over for about 10 seconds! Before I knew it, it was all over....

From Bob Dodson, WB5APD EM84ak, Georgia:

6/26—Just worked VE1RG FN65 from EM84 in North GA on 144.200....Hearing DM and DNs into EM84 S9+50. CO and KS to GA on 2 meters now...

From Jay Kesterson, KØGU, DN70mq, Colorado:

6/27—Great 2-meter *Es* opening here 6/26 (6/27 UTC). The band was wide open when I got on at 0039 Z. Last contact was 0145. Many S9++ signals and extra activity from Field Day stations. Longest QSO was 1491 miles to EM90cd, a grid it took me several years to work on 6 meters. Also worked FM02, which I have yet to work on 6 meters.

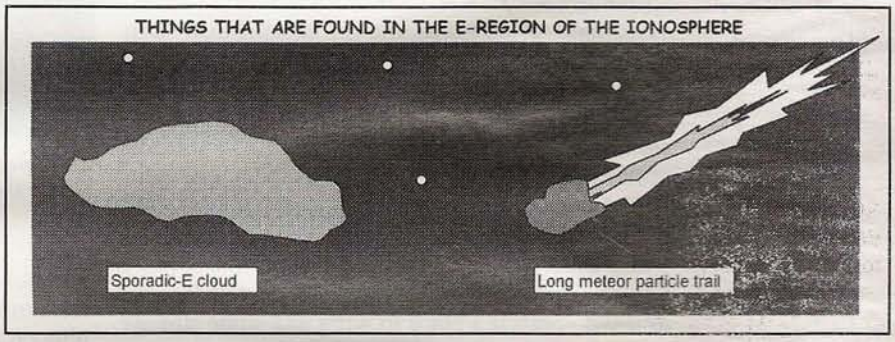
Looking Ahead—F_2 This Fall?

This fall should offer the first opportunity of the current sunspot cycle for F_2 propagation on 6 meters. When it happens, openings to Europe and Asia (like the double-hop *Es* openings described above) should be longer and more frequent, and could even produce contacts between North America and Australia/New Zealand. And with more hams than ever on "the magic band," it might be hard to tell 6 meters from 20 meters when the band is open. Don't miss this once-every-11-years opportunity! ■

Is It Es or MS?

You hear a distant signal on 6 meters. If you're quick enough, you work the station...and then it's gone. Was it a very brief sporadic-E contact? Or a meteor scatter QSO? Not even the propagation experts know for sure!

Six meters has often been called the *borderland band*—and with good reason. It seems that, for many types of propagation, such as sporadic-*E* (*Es*) and F_2, the maximum usable frequency (MUF) often seems to top out right around 50 MHz. When the MUF is dancing around this frequency range, the effect you hear is rapidly fading signals, often with only part of a transmission being copied. Unfortunately, this also describes what you'll hear on meteor scatter (MS). When this happens, trying to identify what propagation mode is being heard becomes like scientific detective work.



*Is it a short sporadic-*E *opening or a long meteor trail? Sometimes, it's hard to tell, because both* E*-skip and meteor scatter occur in the* E *region of the ionosphere, and both support communication over similar distances. A weak sporadic-*E *opening can sound like meteor scatter.*

Muddling Meteor Showers

Several times over the past few years, I have worked stations that had rapid fading on their signals that were heard for a total time of less than 30 seconds. This can conceivably happen with a signal that rides along with a long meteor trail burn in the ionosphere, or with an unstable *Es* opening when the MUF fluctuates due to the non-uniformity of the particle density of the *E* cloud. The two phenomena have the common feature of taking place in the *E*-region of the ionosphere. The answer to "which mode was it?" becomes even more muddled when something like this occurs around the time of the major meteor showers, such as the Perseids in August or the Geminids in December.

One approach to answering this question is to simultaneously listen to the 10-meter band while these things are happening. If 10 meters is quiet, then it's harder to figure out; but if there are strong signals coming in on 10 via short skip (less than 500 miles), chances are it's a *Es* opening with an MUF almost reaching 50 MHz. Likewise, if rapid signal fading and short transmissions are heard on the 10-meter band, then MS is a likely candidate.

Another confusing factor: the two meteor showers mentioned above happen to occur during the prime time of *Es* activity; and, when a strong *Es* opening occurs during a meteor shower, only a trained ear can separate the *Es* from the MS. Over the past eight years or so, I've made four or five contacts on 6 meters with stations in the southeastern U.S. and Canada, and I'm still not totally sure whether they were the result of a short *Es* opening or a long meteor trail burn.

This is just one reason why we call 6 meters the Magic Band. There is no exact science to identifying with 100% certainty all of the modes of propagation that we hear on this band. Perhaps this is one of the beauties of this particular frequency range: that there is no clear-cut answer for everything that we hear. Perhaps we still need some mysteries in life to produce a little bit in awe in us. ■

"Perhaps this is one of the beauties of this particular frequency range: that there is no clear-cut answer for everything that we hear."

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)

Basics

Setting Up Your Ham Shack

No matter where you put your station, here's some advice on keeping it comfortable, convenient, and safe.

There are two main ingredients in any ham radio station: radio equipment and a place to put it. We hams call that place, wherever it may be, our "shack." A ham shack can be found anywhere there's available space, from the corner of a bedroom to an attic or basement...even your garage or the front seat of a van.

Where you put yours depends, of course, on how much—or how little—space you have. Your most important consideration is finding a spot that's convenient and comfortable. Chances are you'll be spending a lot of time there.

An attic shack gives you the benefit of a short cable run to your antenna, while a basement shack makes it easier to hook up a good RF ground (more about this later). Whatever room you choose, try to set up your equipment on a large, sturdy surface, such as an office desk. Many hams today use computer hutches and other desktop shelf units to hold their gear. Arrange your station so the equipment you use most often is within easy reach and close to any other gear to which it may be connected. Be sure to leave yourself a place to write and some storage for logbooks and other items. Again, think comfort and convenience.

Keep this in mind, too: Every now and then, you're going to want to rearrange or rewire something. That means getting behind your gear. So if you have the room, leave enough space in back so you can walk behind and work on all those wires and cables that hook everything together. If you can't do that, make sure there's enough slack on your cables to let you pull out each piece of gear and work behind it. And remember to provide some access from your shack to the outside so you can run antenna cables, called feedlines, from your radio to your antenna.

Getting Down to Earth

Earlier in this article, we said that a basement shack makes it easy to hook up a good RF ground. So just what is that? And why is it important? The purpose of an RF ground is to provide a low-impedance path to earth for any stray RF energy that may be floating around your shack. A poor RF ground is often the cause of many interference problems, not to mention strange behavior by your equipment and little RF "bites," or shocks, whenever you touch a piece of gear or get a little too close to the microphone while you're transmitting.

What makes a good RF ground? Your best bet—if you have the room and if your house has metal water pipes—is to locate your shack as close as you can to the point where your main water pipe enters the house. Connect all of your gear to a common point and run a short, heavy-gauge ground wire to the water pipe on the street side of the meter. Next best is to connect that single ground wire to a cold water pipe.

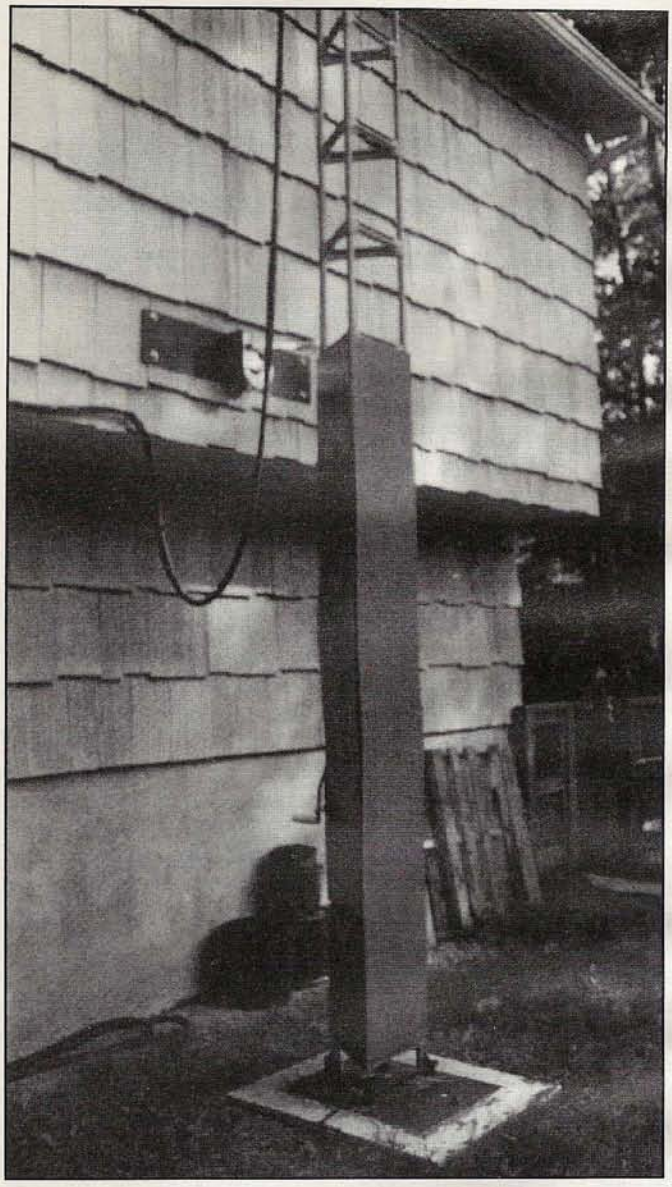
On Top of It All—Jim Stanley, KB8FCQ, has his ham shack in the attic of his Cuyahoga Falls, Ohio, home.

Many people say it's best to connect your ground wire to a copper "ground rod," at least eight feet long, that you hammer directly into the ground. But the effectiveness of a ground rod depends on the "ground conductivity" of your soil. In other words, if you have moist, well-packed soil that conducts electricity well, a ground rod will work fine. But if you have dry, sandy soil, or lots of rocks that break up the soil, it will be less efficient. On the other hand, water pipes tend to be *at least* eight feet deep, and they also present a much greater surface against the ground than does a ground rod. Just make sure you have copper pipes coming into your house (for health reasons, they shouldn't be lead; and PVC plastic is an insulator, not a conductor). Your water company should be able to tell you.

If you can't get a good RF ground directly, you should consider a counterpoise or artificial ground. You can buy one commercially or make it yourself. This isn't as effective as a true RF ground, but it does provide significant dissipation of the energy that needs to go to ground.

What Shouldn't You Use for an RF Ground?

1. NEVER USE A NATURAL GAS PIPE! Little sparks of RF energy can cause BIG booms if they come in contact with natural gas.



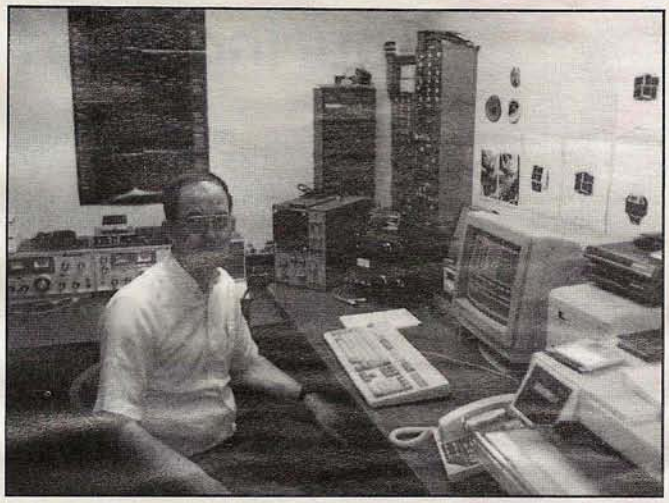
Mike Mardit, WA2VQW, of Yorktown Heights, New York, built this plywood anti-climbing shield to keep his kids off of his tower. It's padlocked on and can be removed when Mike needs to climb the tower.

2. Don't use a hot water pipe—the water heater may insulate it from ground.

3. Don't rely on your electrical ground, the center screw on an outlet cover or the third wire in your electric cords. A ground wire that's more than a quarter-wavelength long at any frequency on which you're transmitting acts just like an antenna. Your electrical wires run all over your house and straight into your TV and your stereo—maybe your neighbor's, too.

ZAP!

There's one more type of ground to worry about: lightning ground. The last thing you want is for a bolt of lightning—or the induced current from a nearby strike—to zip into your antenna, down your feedline and into your radio. If that happens, you'll end up with a fried radio. And if you're operating at the time, add a course of baked ham. That's no joke—you can be seriously injured, or even killed! So NEVER operate during an electrical storm.



Down Under—Rich Burgan, WC8J, operates a satellite station from the basement of his home in Akron, Ohio. A basement shack requires longer runs of feedline than an attic station, but, on the other hand, it's more convenient for installing a good RF ground (see text).

When the storm is *approaching*, unplug your antennas from your rigs and ground them if you can. A lightning arrestor, or static discharge eliminator, in each feedline is also useful. Use the "gas discharge" type. Despite the name, a "lightning arrestor" will not stop a direct lightning strike from damaging or destroying your radios. What these devices really do is keep static charges from building up on your antenna, making the antenna less inviting to lightning. But there's no substitute for disconnecting and grounding the feedline.

Plus, if you have a tower or vertical antenna, it should always be grounded at its base, and the tower ground should NEVER come into your shack. Connect it straight to one or more ground rods, buried six to eight feet in the ground.

Speaking of tower safety, consider an anti-climbing shield, especially if you have children. Mike Mardit, WA2VQW, protects his kids and tower from each other with a simple plywood shield that locks into place (see photo).

ZOT!

Lightning isn't the only type of electricity that deserves respect. The 110 volts in your wall sockets probably kill more people each year than lightning does. And many ham rigs operate with much higher voltages inside. For safety, always turn off and unplug a piece of gear before you work on it. If you must work with the power on, wear rubber-soled shoes and keep one hand in your pocket. This helps keep you from becoming the shortest path to ground for a hundred or a thousand volts.

RF energy deserves respect, too, especially if you're operating at UHF or above. The shielding inside most ham rigs is there for a reason. Operating with an open cover on HF can cause interference problems; at UHF and above, it can be downright dangerous. (UHF frequencies include microwaves. Think about what they do to food in a microwave oven.) If you're not sure what you're doing, ask a more experienced ham for help. And remember the motto that hams have lived by for nearly a century: SAFETY FIRST. ■

Basics

Touring Traffic Nets

Ham radio "traffic" nets are a good introduction to both net operations and public service. Here's an overview of what they're all about and some information on how you can join in.

Unless you live *really* way out in the sticks, there's a very good chance that, on some repeater near you, there's an "NTS traffic net" that meets there on a regular basis. But exactly what *is* an "NTS traffic net"? Let's work backwards to explain it.

Just What Is a Traffic Net, Anyway?

First of all, a *net* refers simply to any gathering of hams on a specific frequency at a specific time for a specific purpose. Most non-emergency nets are scheduled ahead of time, and many meet daily, weekly, or monthly.

A *traffic net*, specifically, is a net whose purpose is to *pass traffic*. You'll never get a speeding ticket by passing this kind of traffic. In amateur radio, *traffic* refers to *messages*. A message being relayed from point A to point B is called *traffic*. And a net that meets to relay this traffic is, appropriately enough, called a *traffic net*. (The hams who regularly pass traffic are known as *traffic-handlers*.)

An *NTS traffic net* is a traffic net that's part of the American Radio Relay League (ARRL) *National Traffic System*. NTS is a nationwide chain of nets, operating at the local, state, regional, and "area" levels, designed to smooth the flow of ham radio messages being passed along from any one part of the U.S. to any other.

Think Globally, Act Locally

Using NTS's network of nets, messages can be directed to virtually any point in the U.S. or Canada. Most messages are originated and/or reach their final destination on VHF "local" nets. These are also the nets on which most newcomers to traffic-handling start out.

When you first tune into a traffic net, you're likely to be rather confused by some of the jargon being bandied about and by the set order of doing things. So here's a basic guide to the structure and operation of an NTS local net. While there may be some variations from net to net, they all pretty much follow the same basic procedure:

• At the scheduled net time, the Net Control Station, or NCS, will "call" the net, announcing that the net is beginning, briefly explaining its purpose, and inviting everyone using the frequency to "join," or check into, the net (or to stand by or change frequency for the duration of the net). *The NCS is in charge of the net and all participants must follow his or her instructions during the net.*

• The NCS will then ask for check-ins, usually starting with anyone holding "emergency" or "priority" traffic (the two top priority classifications in the standard ARRL message format), followed by "liaison" stations representing other nets, stations "with traffic" (holding messages to be sent), and, finally, stations "with or without traffic." Be sure to go only in the correct category. If there's a specific check-in procedure, the NCS should announce it. If not, general practice is to say the NCS's call, unkey your mic to make sure you're not "doubling" with another station, then announce your callsign and say whether or not you have "traffic" to send (Example: "W2VU"/unkey and listen/"This is N2BFG, no traffic" or "This is N2BFG, with traffic"/unkey and listen).

• After taking a certain number of check-ins, the NCS will acknowledge those stations that have checked in and ask for any additional information he or she may need (such as where your messages are going or, if your callsign isn't familiar, your name and location). The NCS will then continue taking check-ins until everyone waiting has been checked in. (Exception: if there's emergency or priority traffic, it will be handled immediately).

• Once the check-ins are complete, the NCS will begin routing traffic. If there's a message for your town, you may be asked to take it. (All that's involved here is writing down the message as it's read to you, then phoning the person to whom it's addressed and reading it over the phone.) If other frequencies are available, you may be asked to QSY (change frequency) and meet the other station to pass your traffic. Otherwise, all the messages will be handled right on the net frequency. This is slower, but it'll give you a better opportunity to get familiar with formats and procedures.

• If you're on the receiving end of a message, you should always ask for a repeat ("fill") of any words that you're not sure of (*don't ever guess!*) and count the words to make sure that they agree with the "check," or word count, that's given to you as part of the opening information. When you're certain that you've copied the message correctly, say "Roger

Traffic-Handling on MARS

If you decide that you enjoy traffic-handling and want to be a part of a worldwide message-forwarding network, you might consider joining *MARS*, which stands for the *Military Affiliate Radio System*. Operating just outside of the ham bands, MARS members relay messages for members of the U.S. Armed Forces all over the world. You can be the link to home for a serviceman or woman at some remote outpost. There are three divisions of MARS: Army, Air Force, and Navy-Marine Corps.

Army MARS has a World Wide Web site at <http://members.aol.com/ aat6fv/>. Check with local hams for more info on Navy-Marine Corps and Air Force MARS.

number xxx (with xxx being the message number), (yourcall) back to net."

• Don't leave the net until it ends or you are "excused" by the NCS. Even if there's no traffic listed for you at the beginning of the net, someone may check in later with something you can take. If you're not there when NCS calls, you'll be wasting everyone's time. Besides, it's just common courtesy. If you need to leave before the net ends, just drop in your call at a break in the action (such as when a message is finished and both parties go "back to net"). The NCS will recognize you (although maybe not immediately) and you may then ask to check out.

• When all the traffic has been passed, the NCS will ask for last-minute check-ins, then "close" the net, repeating much of the same information from the opening. Once the net is closed, normal QSOs may resume.

Questions? Just Ask

In the very likely event that there's something you still don't understand after listening a few times, or even after checking in and making yourself available to receive messages, don't hesitate to ask the NCS, or a regular participant, to explain it to you. And if you don't understand the explanation, ask for a translation into English! But don't ask *during* the net, unless the NCS has opened up the net to questions and comments (this sometimes happens when there's very little traffic to pass). As a rule, though, you should wait until the net is closed and then call the NCS or another station to ask your question. You'll find most long-time traffic-handlers are more than welcoming of interested newcomers. ■

Resources

For more information on the National Traffic System, we recommend the following ARRL publications:

The ARRL Operating Manual; the *Public Service Communications Manual*; and the *ARES Field Resources Manual*.

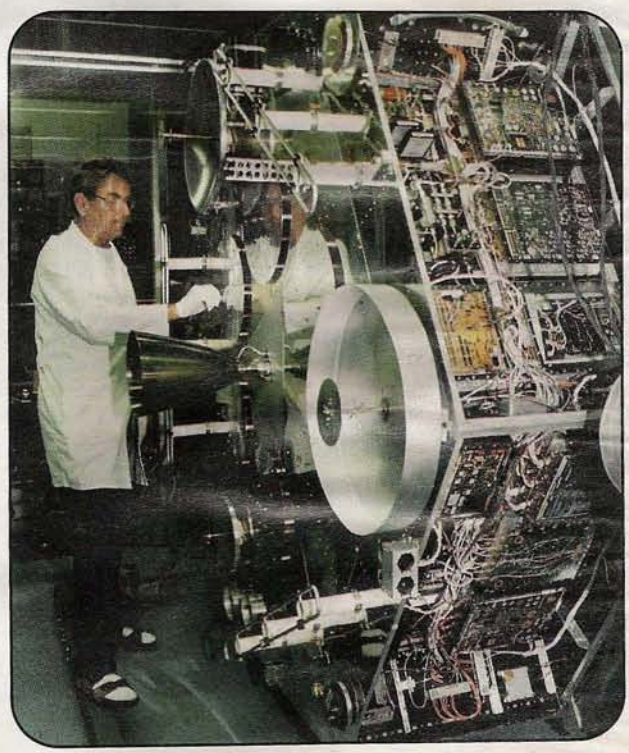
All are available from the ARRL, 225 Main St., Newington, CT 06111; Phone: (860) 594-0200; Fax: (860) 594-0259; Internet: <http://www.arrl.org>

Picture This!

"Phun Photos"

CQ P3D, CQ P3D

There's been a significant amount of progress on the AMSAT Phase 3-D (P3D) satellite since the photos published in last month's issue were taken. In addition to a variety of pre-launch tests that the satellite and its systems have passed with flying colors, the antennas that P3D Integration Lab Manager Lou McFadin, W5DID, was holding up for the camera in last month's issue have now been mounted to the satellite body in preparation for launch...possibly as early as this fall. In this photo, Horst Wagner, DB2ZB, a member of the AMSAT-DL (Germany) P3D team, works on the satellite during a visit to the P3D lab in Orlando, Florida. (AMSAT-DL photo by Wilfried Gladisch, courtesy AMSAT-NA)



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!

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, Fremont, South Bay Amateur Radio Association (SBARA): Meets 3rd Wednesday of every month (except June and December) at 7:30 pm., Freemont Community Center, 40204 Paseo Parkway, Fremont, CA. For information about SBARA, see our club Web page: <www.qsl.net/sbara>; E-mail: <sbara@qsl.net).

CA, Sacramento Amateur Radio Club: Meets 2nd Wednesday of every month at 7 p.m., Sacramento Blood Bank, 1625 Stockton Blvd., Sacramento. Visitors welcome. Repeater W6AK 146.91- PL100. Info at P.O. Box 161903, Sacramento, CA 95816-1903 or Tom, KQ6EO, at (916) 722-9358; E-mail: <ke6eo@jps.net>; Web: <http://home.sprynet.com/sprynet/w6ak>.

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.

DE, Penn-Del Amateur Radio Club: An ARRL Special Service Club meets 7:30 p.m. on the 4th Wednesday of all odd numbered months at Maximillians Restaurant on Naamans Creek Rd. in Boothwyn, PA. Visitors are encouraged and welcomed, membership is open to all. Club repeater KA3TWG/R, on 224.220, wide area coverage from atop the Delaware Memorial Bridge in New Castle, DE. Club activities include public service events, Skywarn nets and spotter training, and a hamfest in April each year. Net every Thursday at 8 p.m. on club repeater featuring R.A.I.N. the Radio Amateur Information Network programming. Club Web site & e-mail: <www.magpage.com/penndel>.

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>.

MA, Falmouth ARA: Meets last Thursday of every month at 7:30 at Falmouth Town Hall. All levels of exams given at 9 a.m. 2nd Saturday of every month at Falmouth Town Hall. Repeater 1446.655/70cm. 444.250pl141.3/. Boston link, 445.175pl.141.3. For more information, see our Web site: <http://www.falara.org>. Membership available on the Web.

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>.

MD, Baltimore Radio Amateur Television Society: Meets 3 p.m. 1st Saturday of the month at the Pikesville Public Library, 1301 Reisterstown Rd., Pikesville, MD. BRATS sponsored FM repeaters are 147.030/224.960/447.325 MHz linked system (main), 145.130, 224.800, and 443.350 MHz. Also sponsors second oldest ATV repeater in the country, the W3WCQ repeater, input 426.250/1253.250-output 439.250/911.250. Holds nets in the 147.03 system, Sunday at 8 p.m. Listening Post, Monday 7:30 p.m. Horsetraders, 9 p.m. Traffic and information, Wednesday at 8 p.m. Newsline, Thursday 9 p.m. ATV, Saturday 1 p.m. News Bulletin, 1:20 p.m. Answer Men. Club activities include public service events, field day, hamfests, ATV repeater linking, amateur classes. Membership open to all. For more info, write, BRATS, P.O. Box 5915, Baltimore, MD 21282-5915, call (410) 461-0086; E-mail: <brats@smart.net>; Web: <www.smart.net/~brats>.

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/>.

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>.

NC, Onslow Amateur Radio Club, WD4FVO: The Onslow Amateur Radio Club (OARC) is a non-profit organization dedicated to the advancement and growth of the Amateur Radio Service. We provide services to our community and a forum for hams to meet other hams. OARC operates the 147.000 (-) repeater in Jacksonville, NC. OARC meets the 1st Tuesday of every month at 7 p.m. in the banquet room of the Fishermens Wharf restaurant, located on Hwy. 17 on the bank of the New River in the heart of Jacksonville, NC. For more info, contact Ed Napoleon, KC4JKW, at <kc4jkw@gibralter.net> or Juan Lopez, AC6ZM, at < lopezfam@coastainet.com>, or visit our Web site at <http://www.qsl.net/wd4fvo>.

NC, Stanly County Amateur Radio Club: Meetings held every 4th Thursday at Stanly Community College. Two-meter nets are held at 9 p.m. (local), Wednesday (146.985), and Friday (147.390). Six-meter rag chew each Tuesday at 8:30 p.m. (50.135). For more info, visit Web site: <www.qsl. net/scarc>.

NJ, Garden State Amateur Radio Association: Meetings held 1st and 3rd Wednesdays at 8 p.m., Bicentennial Hall, Cedar Ave., Fair Haven, NJ., 1 block off River Rd. Contact info: <gsara@monmouth.com>, <http://www.monmouth.com/~gsara>, 145.485 -600 pl 151.4. Or call Bob, N2XR, at (732) 495-3437 for more information.

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, Hocking Valley ARC: Meets 1st Tuesday of every month at 7:30 p.m. in EMA building at 56 S. Market St., Logan, OH. Packet Node LOGAN: AA8BJ-2 on 145.53 MHz, club net Wednesdays at 9 p.m. on 147.345+. E-mail: <aa8bj@hotmail.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 visi-

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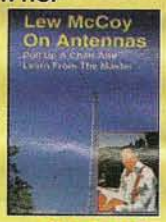

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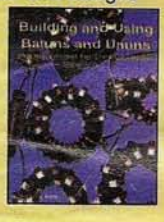

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ble public service-oriented ham club for gay and lesbian hams. Monthly newsletter, HF skeds, Internet listserv and IRC, hamfest meetings, chapters, DX-peditions. Lambda Amateur Radio Club (ALRC), P.O. Box 56069, Philadelphia, PA 19130-6069; E-mail: lambda-arc@geocities.com.

TX, Greater Houston Area, Brazos Valley ARC: Meets 1st Thursday of each month at 7:30 p.m. at Sugar Land Community Center, 226, Matlage Way, Sugar Land, TX (across street from the Main Post Office). Talk in frequencies are 145.46 - (PL 123) and 444.55 + (PL 103). For info, contact B-VARC, Box 1630, Missouri City, TX 77459-1630; Irv Smith, KK5QQ, (281) 437-4803; Web: <http://hal-pc.org/~bvarc>; E-mail: <bvarc@hal-pc.org>.

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 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 2nd Thursday of every month (except Dec.), 7:30 pm. 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, 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: 4/24 (ARRL Nat'l Exam Day), 6/19, 7/31, 8/28, 9/25 (ARRL Nat'l Exam Day), 10/30, and 12/04).

NC, Onslow Amateur Radio Club: Exams are held the last Tuesday of every month at 7 p.m. in the Onslow County Agricultural Building on College St. Call for more information. Contact Ed Napoleon, KC4JKW <kc4jkw@gibralter.net> or Juan Lopez, AC6ZM <lopezfam@coastalnet.com>, or visit our Web site at: <http://www.qsl.net/wd4fvo>.

NJ, The Garden State Association: Exams are on the 2nd Wednesday of every month at the MARS station, Fort Monmouth, NJ. Testing starts at 6 p.m. Take the Garden State Parkway to exit 105 and follow Rt. 36 to Rt. 35 North about 2 miles. Fort Monmouth is on the right, opposite Rt. 537. Contact <gsara@monmouth.com>.

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.

TX, Houston: Meets 2nd Tuesday of each month, 6:30 p.m. Strake Jesuit High School. Bellair @ S. Gessner (SW Houston). Pre-registration requested, walk-ins accepted. Sponsored by Brazos Valley ARC (B-VARC). Call Cass Germany, KG5IT, at (713) 682-6897; E-mail: <cassg@hal-pc.org>.

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 quality 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>.

Communications Specialists, Inc.: Manufacturers of Tone Signaling Equipment including CTCSS encoders and decoders, Morse Station IDers, Repeater Tone Panels and much more. Please see our ad in this issue: <http://www.com-spec.com>.

KMA Antennas: VHF, UHF, HF log periodics, Yagis, and unique 6-meter antennas. Custom designs for commercial and private use also available. Please mention *CQ VHF* when you visit <www.qsl. net/w4kma>.

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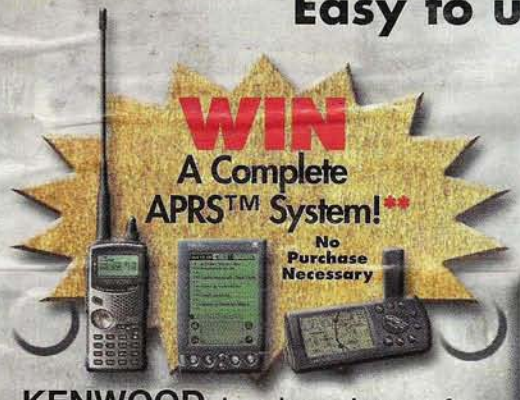

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