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CQ VHF

Ham Radio Above 50 MHz

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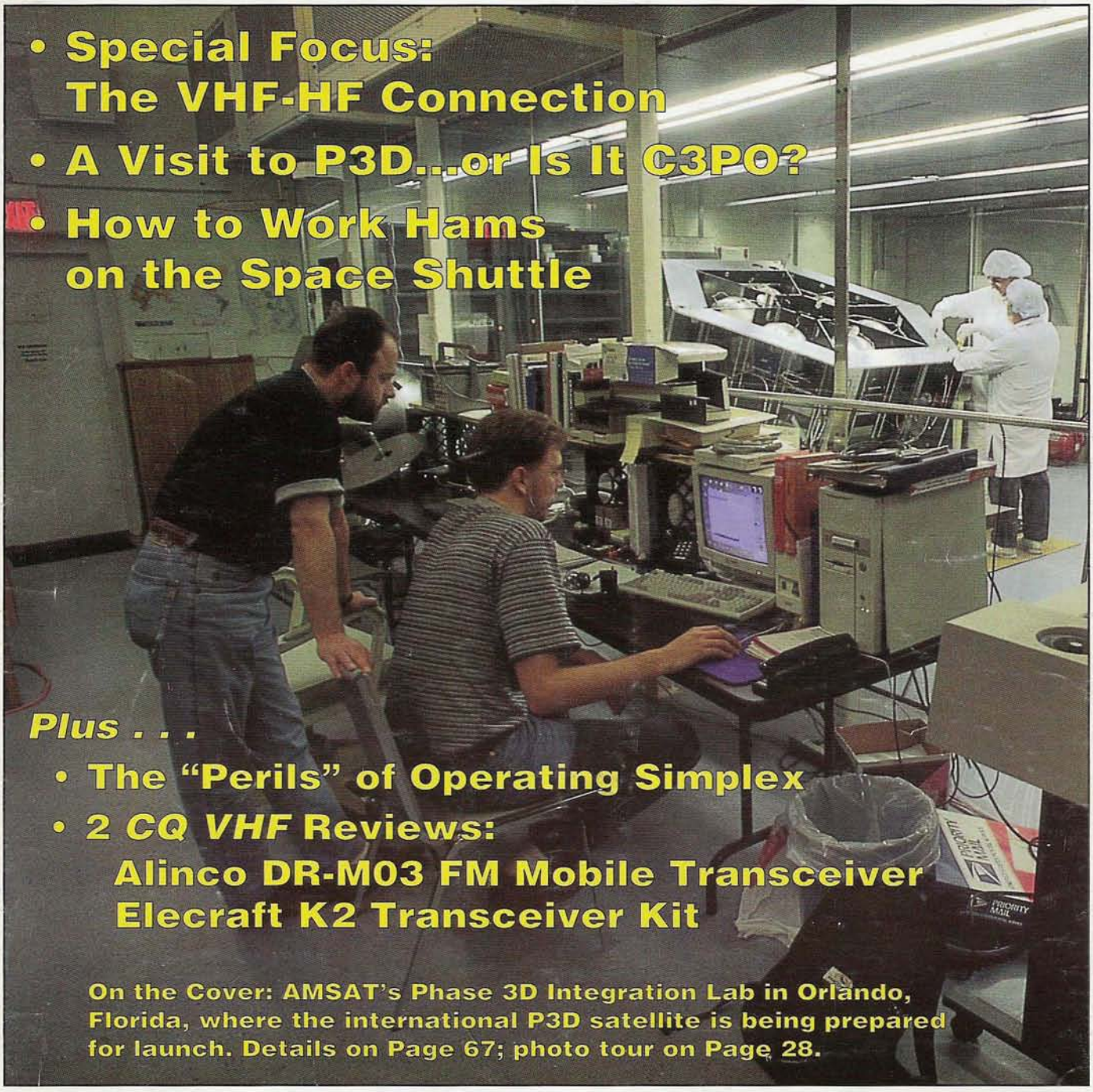
August 1999



- **Special Focus: The VHF-HF Connection**
- **A Visit to P3D...or Is It C3PO?**
- **How to Work Hams on the Space Shuttle**

Plus . . .

- **The "Perils" of Operating Simplex**
- **2 *CQ VHF* Reviews:**
  Alinco DR-M03 FM Mobile Transceiver
  Elecraft K2 Transceiver Kit

On the Cover: AMSAT's Phase 3D Integration Lab in Orlando, Florida, where the international P3D satellite is being prepared for launch. Details on Page 67; photo tour on Page 28.

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Repeaters & FM ■ Packet Radio ■ VHF/UHF
Microwaves ■ Amateur
TV ■ Plus...Reviews,
VHF Basics, and much more!

ICOM IC-T81A

Add the Wide-Open Microwaves to Your Fun

JIS 4 WATER RESISTANT

YOU'VE GOT IT ALL. With four bands at your command, excellent audio, 124 memory channels, water resistant construction, and ICOM durability, get ready for the most fun ever!

SIMPLICITY, RIGHT OUT OF THE BOX. Function keys can be confusing. The 'T81A doesn't use any! It's so easy to use, many operators said they never needed to open the instruction manual.

LISTEN BEYOND THE HAM BANDS. Pick up incredibly clear, wide band* reception. Tune in a ball game (radio *or* TV broadcast), listen to air traffic control, or scan for police activity. Take your 'T81A everywhere!

AN EXTRA BAND, AND 1/2 THE SIZE *Compared to an older tri-band HT model of just a few years ago, the IC-T81A is smaller, offers more features, is water resistant, and adds 6 meters! The IC-T81A is more affordable, too.*

IC-T81A ACTUAL SIZE*

PC Ready!

ICOM options required for PC operation:
OPC-478 Cloning cable,
CS-T81 Cloning software

WORLD'S FIRST! FOUR BANDS IN ONE HAND

SPECIFICATIONS

Transmit: ..... 6M, 2M, 440 MHz, 1.2 GHz
Receive: ..... 50-54, 74-174, 400-470, and 1240-1300 MHz*
*Reception guaranteed on US ham bands only
Mode: ..... WFM and AM (Rx only), FM
Power: ..... Up to 5 Watts @ 13.5V, 1 Watt on 1.2 GHz
Memory Channels: ..... 124 total Including 100 regular, 20 scan edges, and 4 call
Size : ..... •2.3(W) x 4.2(H) x 1.1(D) in. 58(W) x 106(H) x 28.5(D) mm.
Weight : ..... 9.9 oz /280 kg

FEATURES

- **Slim, Powerful Ni-MH Battery**
  – 4.5 Watts @ 9.8V/680 mAh (4-6 hrs)
- **Rugged ICOM Construction**
  – Die-cast aluminum chassis
  – JIS-4 water resistance rating
- **CTCSS Encode/Decode (Tone Squelch)**
  – 50 tones, pocket beep
- **DTMF Encoder, 9 Memories**
- **Multi-Function "Joystick"**
  – Easy to change bands, cruise menu options, and set modes
- **Built-in Guide Function**
- **Auto Repeater**
- **Backlit Alphanumeric Display**
  – Use a PC to name channels
- **RIT and VXO for 1.2 GHz Band**
- **Battery Voltage Indicator**
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Get $40 off a new IC-T8A and also receive a free alkaline battery case. Limited time only. Contact your authorized dealer for details.

SAVE $40 ON THE IC-T8A

ICOM's original 3 bands in one hand mini HT is easy to use! 6M/2M/440MHz. Many of the same features, and a very attractive price. Pick one up today.

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MIRAGE ...160 Watts on 2 Meters!

Turn your mobile, base or handheld into 160 Watt powerhouses and talk further, longer, clearer . . . All modes: FM, SSB, CW . . . Superb GaAsFET preamp . . . Overdrive, high SWR, Over-temperature protection . . . Remote controllable . . .

B-5016-G
$299
Suggested Retail

Power Curve -- typical B-5016-G output power								
Watts Out	*130*	*135*	*140*	*145*	*150*	*155*	*160*	*165*
Watts In	*20*	*25*	*30*	*35*	*40*	*45*	*50*	*55*

The MIRAGE B-5016-G gives you 160 watts of brute power for 50 watts input on all modes -- FM, SSB or CW!

Ideal for 20 to 60 watt 2 Meter mobile or base. *Power Curve* chart shows typical output power.

Hear weak signals -- low noise GaAsFET preamp gives you excellent 0.6 dB noise figure. Select 15 or 20 dB gain.

B-5016-G has legendary ruggedness. *We know of one that has been in constant use since 1979!*

Heavy-duty heatsink spans entire length of cabinet -- prevents overheating. Power transistors protected by MIRAGE's *Therm-O-Guard*™.

Fully protected from high SWR and excessive input power. Has warning LED.

Has smooth adjustable Transmit/Receive switching with remote external keying.

RC-1B, $45, Remote Control. On/Off, preamp On/Off, selects SSB/FM. With 18-ft cable.

Draws 17-22 amps at 13.8 VDC. 12x3x5½ in.

More 160 Watt, 2 Meter Amplifiers . . .

B-2516-G, $299. For 10 to 35 watt mobile or base stations. 160 watts out for 25 watts in.

B-1016-G, $379. MIRAGE's most popular *dual purpose* HT *or* mobile/base amplifier. 160 watts out/10 W in. For 0.2-15 watt transceivers.

B-1016-G Great for ICOM IC-706!

B-215-G, $379. MIRAGE's most popular *handheld* amp. 150 watts out/2 watts in; 160 watts out/3½ W in. For 0.25 to 5 watt handhelds.

100 Watts for 2 Meter HTs

B-310-G
$199
Suggested Retail

Power Curve -- typical B-310-G output power							
Watts Out	*25*	*50*	*75*	*95*	*100*	*100+*	*100+*
Watts In	*¼*	*½*	*1*	*2*	*4*	*6*	*8*

- ***100 Watts out with all handhelds up to 8 watts***
- ***All modes: FM, SSB, CW***
- ***Great for ICOM IC-706***
- ***15 dB low noise GaAsFET preamp***
- ***Reverse polarity protection/SWR Protection***
- ***FREE mobile bracket*** • ***Auto T/R switch***
- ***FREE handheld BNC to B-310-G cable***
- ***Ultra-compact 4¾x1¾x7¾ inches, 2½ pounds***
- ***One year MIRAGE warranty***

***Boost** your 2 Meter handheld to 100 Watts!* Ultra-compact all mode B-310-G amp is perfect for all handhelds up to 8 watts and multimode SSB/CW FM 2 Meter rigs. *Great for ICOM IC-706!*

35 Watts for 2 Meter HTs

B-34-G
$89.95
Suggested Retail

Power Curve -- typical B-34-G output power								
Watts Out	*18*	*30*	*33*	*35+*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*

- ***35 Watts Output on 2 Meters***
- ***All modes: FM, SSB, CW***
- ***18 dB GaAsFET preamp***
- ***Reverse polarity protection***
- ***Includes mobile bracket***
- ***Auto RF sense T/R switch***
- ***Custom heatsink, runs cool***
- ***Works with handhelds up to 8 watts***
- ***One year MIRAGE warranty***

MIRAGE RUGGED!

35 watts, FM only . . . $69.95

B-34, $69.95. 35 watts out for 2 watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛x1¾x4¼ inches.

MIRAGE Dual Band 144/440 MHz Amp

BD-35
$159.95
Suggested Retail

MIRAGE RUGGED!

Power Curve -- typical BD-35 output power							
Watts Out (2Meters)	*30*	*40*	*45*	*45+*	*45+*	*45+*	*45+*
Watts Out (440 MHz)	*16*	*26*	*32*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*

- ***45 Watts on 2 Meters/35W on 440 MHz***
- ***Auto Band Selection*** • ***Auto T/R switch***
- ***Full Duplex Operation*** • ***5x1¾x5 inches***
- ***FREE mobile bracket*** • ***"On Air" LEDs***
- ***Single Connector for dual band radios and antennas***
- ***Reverse polarity protection***
- ***Works with all FM handhelds to 7 watts***
- ***One year MIRAGE warranty***

Add this Mirage *dual band* amp and boost your handheld to a *powerful* mobile or base -- 45 watts on 2 Meters or 35 watts on 440 MHz! **Mirage's** exclusive *FullDuplexAmp*™ lets you talk on one band and listen on the other band at the same time -- *just like a telephone conversation.* (Requires compatible HT).

6 Meter Amplifier

FCC Type Accepted

The A-1015-G, $389, is the *world's most popular* all mode FM/SSB/CW 6 Meter amplifier. 150 watts out for 10 in. For 1 to 15 watt transceivers.

70cm Amplifiers (420-450 MHz)

D-3010-N, $365, -- 100 W out/30 in. For 5 to 45 watt *mobile/base*. **D-1010-N, $395**, 100 W out/10 in. *Dual purpose* -- for handhelds or mobile/base. **D-26-N, $269**, 60 W out/2 in, for *handhelds*.

Amateur TV Amps

Industry standard ATV amps -- **D-1010-ATVN, $414**, 82 watts PEP out / 10 in. **D-100-ATVN, $414**, 82 watts PEP out/2 in. (without sync compression).

Remote Control Head for Amps

RC-1, $45, remote controls most MIRAGE amps. Power On/Off, preamp On/Off, switch for SSB/FM. 18 foot cable (longer available). 1¾x3¾x2½ inches.

Repeater Amps

11 models -- continuous duty all modeFM/SSB/CW repeater amps for 6, 2, 1 1/4 Meters, 70cm, 450 MHz ATV.

Low noise GaAsFET preamps

KP-1

KP-2

High gain *ultra low noise* GaAsFET preamps for receiving weak signals. Selectable gain prevents receiver intermod. 15 to 22 dB gain. Less than 0.8 dB noise figure. Automatic RF switching up to 160 Watts. **Choose** In-*Shack* model or *Mast-Mount* (includes remote control) model to reduce loss. Rugged die-cast enclosure.

Frequency (MHz)	*In Shack $139*	*Mast Mount $195*
28-30	KP-1/10M	KP-2/10M
50-54	KP-1/6M	KP-2/6M
144-148	KP-1/2M	KP-2/2M
220-225	KP-1/220	KP-2/220
430-450	KP-1/440	KP-2/440

1¼ Meter Amps (223-225 MHz)

Choose from 10 models -- 20 to 220 watts out for 2 to 50 watts in, $129 to $655.

Commercial Amps ($199 to $395)

FCC Type Accepted

Commercial amps for 150 - 174, 450-470 MHz and VHF marine bands, 70 -130 watts out.

Accurate SWR/Wattmeters

Read SWR directly andForward/ Reverse, Peak/Average power. Remote Coupler. 1.8-30, 50-200, 420-450, 1260-1300 MHz band models.

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MIRAGE . . . the world's most rugged VHF/UHF amplifiers

CIRCLE 135 ON READER SERVICE CARD

CQ VHF Ham Radio Above 50 MHz

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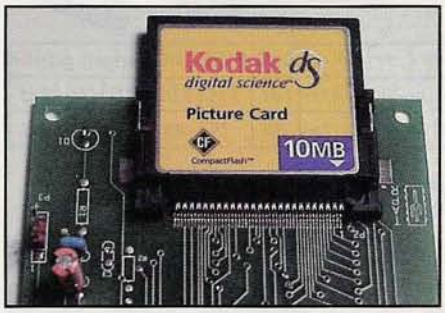

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Next Month: "CQ VHF Review: Yaesu FT-100 HF/VHF/UHF Transceiver," by Ken Neubeck, WB2AMU

ALINCO 2000

Alinco is ready for the new year with exciting new products and proven performers. High quality and affordable prices make us Amateur Radio's Value Leader!SM

NEW!

DJ-V5TH 2m/440 HT*

NEW! Extended Rx from 76 ~ 999 MHz†, alphanumeric display, 200 Memories, CTCSS encode+decode, 6 watts output, compact size, 4 scan modes, 5 scan banks, cross-band operation, auto-dialer, 13.8 VDC direct input and more!

NEW!

DJ-195T 2m HT

NEW! Alphanumeric display, 40 memories, CTCSS encode+decode, DCS, auto-dialer, burglar alarm, 13.8 VDC direct input. Comes with 5W battery!

DJ-180TH (144 MHz)*, DJ-280TH (222 MHz)*, DJ-480T (440 MHz)

Solid performers at a low Alinco price. 10 memories expandable to 50 or 200, illuminated display.

DJ-C5T 2m/440 "Credit Card" HT

Amazing "Credit Card" size, internal speaker, 50 memories, CTCSS encode+decode, AM airband RX, 300 mw output, soft case, lithium-ion battery, desk charger included!

DJ-S11T (144 MHz), DJ-S41T (440 MHz) HT

The "affordable radio" sensations for every ham! "Pager size", 21 memories, easy to operate and program, great TX and RX audio, self-storing pivot antenna, uses AA batteries, 340 mw output, fits in pocket or purse.

DJ-G5TH 2m+440 HT*

A durable favorite with solid reviews. Up to 5 watts output, Channel Scope™ display, 100 memories/band, CTCSS encode+decode, AM airband RX, programmable second PTT, full duplex and crossband repeater capabilities, 13.8 VDC direct input, illuminated keys and display, RF attenuator and more!

DJ-191TH 2m HT*

Versatile performer with 40 memories, huge illuminated display, easy to program, 13.8 VDC direct input, auto-dialer, direct frequency entry, CTCSS encode, decode optional.

CIRCLE 122 ON READER SERVICE CARD

***Optional 2 watt batteries available.**

DR-M03SX (10m/10 watts), DR-M06TH(6m/20 watts) FM Mobile/Base

Enjoy local and DX FM communications. Great for simplex or repeater operations, includes CTCSS encode (decode optional), 100 memories and many functions in a compact design.

DR-140T, DR-140TQ (CTCSS decode) DR-140TPKT (for Packet) 2m FM Mobile/Base

Affordable fun! Alphanumeric display, CTCSS, easy operation, cable cloning, 50 watts output, 51 memories, AM airband RX.

DR-150T, DR-150TQ (CTCSS decode) 2m FM Mobile/Base

50 watts, 100 memories, airband + 440 ~ 450 MHz RX, Channel Scope™ display, 2 VFOs, auto-dialer, 9600 packet port, CTCSS.

DR-605T, DR-605TQ (CTCSS decode) 2m/440 Mobile/Base

Value Leader! 50 watts VHF/35 watts UHF, 51 memories/band, 430 ~ 4449.995 MHz range allows for satellite work, internal duplexer, 9600 packet port.

DR-610T, DR-610TQ (CTCSS decode) 2m/440 Mobile/Base

Channel Scope™ Display, 50 watts VHF/ 35 watts UHF, 120 memories, detachable face, 2 VFOs, AM airband RX, V/U, V/V, U/U, U/V operation, RF attenuator, CTCSS, more!

DX-70T (100w HF, 10w 6m), DX-70TH (100w) HF+6m Mobile/Base/Portable

160 ~ 6m Amateur band TX in all modes, general coverage RX from 150 KHz ~ 30 MHz and 50 ~ 54 MHz. 2 VFOs, 100 memories, removable face, speech compressor, SSB, CW and AM narrow filters, full, semi or automatic break-in, multi-function control, and MUCH more! Ask about optional EDX-1 or EDX-2 antenna tuners.

DX-77T HF Base/Portable

160 ~ 10m Amateur band TX in all modes. 500 KHz ~ 30 MHz general coverage RX, 2 VFOs, internal keyer (6 ~ 50 wpm), CW crystal filter, 13.8 VDC input, speech compressor, front-mounted speaker, 100 memories, RIT, easy split operation, compatible with EDX-1 or EDX-2 antenna tuners. **Clean, crisp RF modulation!**

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The VHF-HF Connection

Like it or not, there's an indestructible link between the worlds of VHF and HF ham radio. In fact, they're not worlds apart at all, and in today's ham radio, not only is each one important, but each one's important TO the other.

If you've taken a look at this month's table of contents, you might think we've been out in the hot summer sun for too long. Why on earth would a magazine dedicated to "Ham Radio Above 50 MHz" feature four articles (five, including this editorial) about Ham Radio Below 30 MHz? Have we been compromised by "the enemy"? Are we "showing our true colors" as "closet HFers" whose only goal is to get you onto the low bands and, in doing so, get you to spend a lot of money on HF equipment? What *could* we be thinking?

"Have we been compromised by 'the enemy'? Are we 'showing our true colors' as 'closet HFers' whose only goal is to get you onto the low bands and, in doing so, get you to spend a lot of money on HF equipment? What could we be thinking?"

What we're thinking is this: The "battle" between HF and VHF—a battle which never should have started—is ending. And this is good because, like it or not, the 30-MHz "dividing line" is an artificial one. There shouldn't be "HF hams" and "VHF hams," just "hams." And, thanks to the convergence of a variety of events, the line between "us" and "them" is beginning to blur.

Convergence Factors

What are these events that are converging to change the landscape of ham radio? First and foremost is the recognition that HF and VHF are interdependent. Neither one can keep ham radio healthy and growing by itself. Yes, back in "olden times," *real* ham radio was HF ham radio, and VHF was experimenters' territory. But those days are long gone, for a good 25 years now. And it was another convergence back in the '70s that set this change in motion.

The convergence of FM repeaters retired from commercial service and the arrival of solid-state technology that let you put an entire ham shack in the palm of your hand changed 2 meters from a ham radio backwater to the hobby's most popular and most populated band. At the same time, the growth of repeaters added a new dimension to the psychology of ham radio—local utility communications became as important a part of the hobby as traditional HF DXing. The ranks of locally focused, public-service oriented hams grew through the '70s and '80s, until it was nearly equal in strength to the more established HF DXers.

Problem was that neither group could really understand the mindset of the other, and, with haggling over code requirements tossed in to fan the flames, what started out in the '70s as "different strokes for different folks" grew by the '90s into nearly a full-scale war between HFers and VHFers, "coders" and "no-coders." And the absence of the FCC from the enforcement picture only made it worse, since there were no cops around to keep order when things got out of hand on the air. But now, the winds are shifting.

Shifting Winds

The shift began quite slowly, almost imperceptibly, in the early part of this decade. First, DX clusters on 2-meter packet changed the face of HF DXing, and no serious DXer could afford to be without a VHF rig, even if it was used exclusively for DX spotting. No matter. They had to "cross the line" and become VHF operators in order to support their HF activities.

Next, a couple of manufacturers began including 6 meters on their HF radios. Midway through the decade, two big blips appeared on the ham radio radar. One was ICOM's introduction at the end of 1995 of the IC-706, the first radio to offer multimode HF, 6 meters, and 2 meters in a single box. "This rig will set the pace for small transceivers for years to come," we wrote in our review. Looking back, we were wrong. It did more. It revolutionized HF rig design, but more on that in a minute. The other "blip" was the introduction of this magazine at the beginning of 1996. We don't like to blow our own horn, but the existence of *CQ VHF*—and its eager acceptance by the VHF community—forced the other ham magazines to react, and their coverage of VHF activities and radios increased markedly.

Back to radios...it's an inescapable fact that HF radio sales drive the ham industry. The manufacturers simply can't turn a reasonable profit selling HTs for under $100, and the market for big-ticket VHF/UHF rigs has never been big enough to let them survive and prosper on those sales alone. Next fact: the IC-706 breathed new life into a moribund

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

ham radio economy. Yaesu and ICOM are now battling it out in the marketplace to see who can offer more bands and more features in a single radio; and there are now three radios on the market, all under $2,000, that let you operate from 160 meters to 70 centimeters. Kenwood has chosen to blaze its own path, introducing innovative radios with 9600-baud packet and APRS (Automatic Position Reporting System) capability built in, plus a tiny video camera that's breathing new life into slow-scan TV, not only on HF, but on VHF as well. There we go, crossing that line again.

Today, if you want to buy a multimode VHF/UHF radio, you have more choices than ever, and you generally get the HF bands tossed in as a bonus. All those extra bands, just a button-push away, can be pretty enticing, especially when the VHF bands are quiet. Enticing enough, perhaps, to motivate hams with only VHF privileges to upgrade and get access to all their radio offers.

Equally important, though, is that this is a two-way street. If you want to buy a new HF rig today, you can get one to three VHF bands in the same package for roughly the same price as an HF-only rig. Pretty tempting. And if you've got the bands, well, they shouldn't just sit there unused. The net result here has been that 6 meters, in particular, has seen an influx of new operators unlike anything in the past 40 years. And as many new operators are coming up from HF as are coming down from the higher VHF bands. The line is getting blurred.

The FCC has two parts in this equation. First and foremost is its license restructuring plan. As this is written in early June, no decision has been announced, but it's widely expected to come this summer, perhaps by the time you read this. And it's widely expected to result in a General class license with a code requirement under 10 words-per-minute, perhaps even as low as 5 wpm. This will make it much easier, and much more enticing, for all those VHF-only hams with HF/VHF radios to qualify for a broad range of HF operating privileges.

Another likely part of the FCC restructuring plan will be the elimination of the Novice license, the HF entry-level license since the early 1950s. Now, everyone will have to enter ham radio through VHF. Six and two and 440 will become *the* pathways to HF as well as fun bands in their own right. This is, no doubt, fueling the manufacturers' drive to package VHF and HF in the same radio—and that enables you to buy one radio that will serve your VHF needs now and will *continue* to serve you when you upgrade. An investment in your future. But unlike the past, you won't have to leave VHF behind to operate HF.

"...6 meters, in particular, has seen an influx of new operators unlike anything in the past 40 years. And as many new operators are coming up from HF as are coming down from the higher VHF bands. The line is getting blurred."

The other FCC part of the equation is the re-emergence of amateur enforce-

(Continued on page 32)

VHF News

AMSAT: P3D May Fly by October

It is *possible* that the long-delayed launch of AMSAT's Phase 3D satellite may come as early as this October. According to Phase 3D Project Leader and AMSAT-DL (Germany) President Dr. Karl Meinzer, DJ4ZC, he is "in the final phase of working out the details of an agreement for the launch of Phase 3-D" with a yet-unidentified launch agency. He says the agency has identified several scheduled launches over the next year on which P3D might be able to fly as a secondary payload, and that a launch *could* come as early as October. However, he cautions that all of this is contingent on working out the last-minute details and signing a contract, and that, "even after our contract is closed, we will remain a 'stand-by passenger.' "

For a photo-tour of the Phase 3D satellite (along with an explanation of its name) and the P3D integration lab in Orlando, Florida, see "A Visit with P3D... or Is It C3PO?" on page 28.

License Restructuring: Maybe This Fall

An FCC source familiar with the license restructuring proceeding has told *CQ VHF* it's unlikely that there will be any action by the Commission until after Labor Day. The source said that, as of early June, the draft decision was waiting for review by Public Safety and Private Wireless Division Chief D'Wana Terry, and that there are a few equally important matters ahead of it in line. After Terry signs off on it, the draft must be approved by Wireless Telecommunications Bureau Chief Thomas Sugrue before being sent to the full Commission for final action. Because of summer vacations, the source said, "If it hasn't made it out of the bureau by Memorial Day, it probably won't happen over the summer."

VECs Postpone Conference

In a related matter, the National Conference of Volunteer Examiner Coordinators (NCVEC) has indefinitely postponed its 1999 annual meeting with FCC officials in Gettysburg. The NCVEC generally meets with FCC staff each July to discuss procedural matters and changes to the question pools planned for the coming year. FCC-mandated question pool updates were put on hold when the restructuring proposal was released, so the VECs apparently have very little to talk about until the FCC decides on restructuring. In a letter to VECs, NCVEC Chairman Win Guin said "We hope that developments in the restructuring of Amateur Radio...will mature to the point that we can plan our annual meeting to take place later in the year."

FCC Goes after Club Callsign Abuse

"Our licensing records indicate that you have 34 club call signs in various locations," begins a letter from FCC amateur enforcement chief Riley Hollingsworth, K4ZDH, to Motoaki Uotome, W9BO, of Saipan, in the Northern Mariana Islands. Twenty-six of the callsigns, which had been issued within 30 days of the May 11 letter, were immediately set aside, and Hollingsworth gave Uotome another 30 days to provide justification for each of the callsigns, including names, addresses, and telephone numbers of club members, meeting times and dates within the past year, meeting plans for the coming year, and meeting minutes from the past three months. (A search by *CQ VHF* on the "Callbook" CD shows that Uotome also holds six callsigns in Japan, two in Chile, and one in Uruguay, all with the same post office box in Tokyo listed as the address.)

Similar letters were sent to Steve Massey, N6TT, of Manhattan Beach, California, who holds at least 12 club callsigns, and Steven Nace, KN5H, of Chandler, Arizona, who had at least four club callsigns granted within 30 days.

We should note that, at this point, no one has been accused of any wrongdoing in connection with the multiple club callsigns, and it is possible that one person is legitimately the trustee of multiple club stations.

In other actions, the FCC canceled the license of at least one ham who did not appear as ordered for retesting, ordered several others to be retested, and modified the licenses of two California hams accused of interfering with the WA6SEK repeater to prohibit them for 90 days from operating above 30 MHz. A third operator, accused of operating and causing repeater interference before his license was issued, had his license application dismissed and was issued a second warning that continued unlicensed operation would result in criminal prosecution.

Hy-Gain Sold to MFJ

Telex Communications, Inc., has sold its Hy-Gain amateur antenna business, including the Hy-Gain name, to MFJ Enterprises. According to a Telex news release, its merger last year with microphone manufacturer ElectroVoice International set off an ongoing effort to focus entirely on its audio-related business. MFJ says Hy-Gain will move to Starkville, Mississippi, where MFJ is headquartered, but will remain a separate entity, with its own management, workers, and manufacturing facilities. MFJ also says it will continue manufacturing and selling the entire Hy-Gain product line and that it plans to add several new products as well.

Hollingsworth a Hit at Dayton

The FCC's Riley Hollingsworth, K4ZDH, was the star attraction at the 1999 Dayton Hamvention, speaking before standing-room-only crowds at two separate forums and receiving standing ovations for his enforcement efforts (see photos in "Picture This" on page 8). Hollingsworth explained that stronger enforcement in all FCC-licensed services is a top priority of new Commission Chairman William Kennard, who felt that, because of lax enforcement in the past, the FCC didn't get the same level of respect as other federal regulatory agencies, such as the Federal Aviation Administration or the Securities and Exchange Commission.

Speaking about amateur enforcement issues, Hollingsworth urged hams not to

Compiled by the CQ VHF Staff

take such matters into their own hands, but rather to refer problems to his office, and assured them that there would be follow-up. When questioned about free speech issues that hams had used in the past to block enforcement actions, Hollingsworth talked about an 11-year-old Extra class ham whose father wouldn't let him listen to 75 meters because of what he might hear there. Amateur radio, he said, "is not about the First Amendment, it's not about ridiculing people 10 kilohertz away, it's not about being a talk show or a forum for sharing your political views....Having a right to do something doesn't mean it's right to do it....Let's look at the bigger picture first and save the service."

Hollingsworth also spoke to his Dayton audience about the value of ham radio and its future, saying:

> As amateurs, we have the unique privilege of making everything a little better by our having something to do with it....When the going gets really tough, we know who will be doing the communicating—it's us....
>
> I want to challenge each of you to recruit one new ham, or help one ham to upgrade... and don't forget about recruiting young girls....
>
> Will amateur radio be enhanced and passed on to future generations? That's up to you. The best way to predict the future of amateur radio is to invent it yourself....If it's lost, it'll be our own responsibility.

Ionospheric Study Satellite Lost

A satellite built to study how changes in the ionosphere affect global communications was launched successfully in mid-May, but was soon lost in orbit. According to various news reports, the TERRIERS satellite, built at Boston University and launched by Orbital Sciences Corporation aboard a Pegasus rocket, was unable to properly point its solar panels at the sun, and it quickly exhausted its battery power.

TERRIERS was supposed to use a combination of radio, ultraviolet, and visible light sources to generate a three-dimensional map of the ionosphere, much as a CT scan creates a 3D picture of the inside of the human body. More than 60 B.U. students and faculty members had been working on the project since 1995. The satellite cost more than $6 million to build and its share of the launch costs added another $6 million to its overall cost. At press time, there was no word on whether the university plans to try again.

Operating in Europe and S. America Now Easier for U.S. Hams

FCC-licensed hams (except Novices) *who are U.S. citizens* may now operate in many countries in Europe and South America without having to secure a reciprocal license ahead of time. According to the ARRL, the FCC on June 7 issued the Public Notice necessary for full U.S. participation in the European CEPT reciprocal operating agreements. This allows U.S. hams, except Novices and foreign citizens, to operate in CEPT-member countries by signing that country's amateur prefix, slash, and their call-sign (for example, if W2VU goes to England, he may operate as G/W2VU). You'll need a copy of the FCC's Notice, your *original* FCC license, and proof of U.S. citizenship (such as a U.S. passport or birth certificate).

In addition, the ARRL has begun issuing International Amateur Radio Permits to simplify operation by U.S. hams in South American countries that are signatories to the CITEL Amateur Convention. In both cases, holders of U.S. Technician class licenses receive Class 2 (VHF only) privileges, while holders of Tech-Plus and higher class license receive Class 1 (all HF and VHF) privileges. There is no CEPT or CITEL equivalent to the Novice license, which is why they are excluded.

For additional information, visit the ARRL Web site's international operating page at <http://www.arrl.org/field/regulations/io/>. ■

Seeing Stars at Dayton

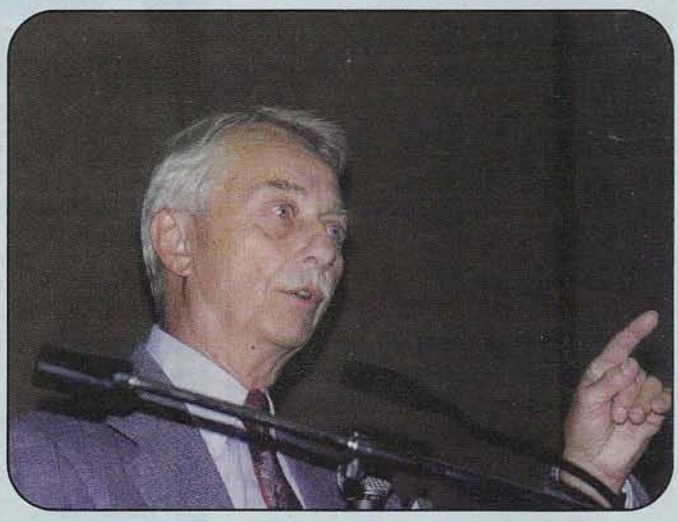
Rock 'n roll musician Joe Walsh might have been the star attraction at the 1999 Dayton Hamvention banquet, but the arena itself belonged to Riley Hollingsworth, K4ZDH, the FCC's new amateur enforcement chief. He played before a packed house at two separate forums, receiving a standing ovation from the audience.

Also appearing on the forum scene were the first ham to operate from space, retired astronaut Owen Garriott, W5LFL, along with former NBC News Correspondent Roy Neal, K6DUE, and AMSAT's Frank Bauer, KA3HDO, and Lou McFadin, W5DID. Their main goal was to promote ARISS, Amateur Radio on the International Space Station.

"Riley Rules!" reads the T-shirt presented to FCC amateur enforcement chief Riley Hollingsworth, K4ZDH, by the "Rain Report's" Hap Holly, KC9RP.

They never told him about it in law school or bureaucracy training, but K4ZDH's effort to clean up the ham bands were met not only by standing ovations wherever he spoke, but by hams asking for his autograph! In the background, on the right, is Bill Cross, W3TN, the main FCC staff person overseeing the amateur service.

Frank Bauer, KA3HDO, AMSAT's Vice President for Manned Space Flight, talks about the ham station being installed on the International Space Station, and demonstrates the flexible "tape" antenna that will be used there.



Owen Garriott, W5LFL, took ham radio into space for the first time in 1983. He came to Dayton this year to promote the permanent presence of amateur radio on the International Space Station.

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 Ham Radio Above 50 MHz

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Letters

Your Spot to Speak Out

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

Saving America

Dear *CQ VHF*:

This message is in regard to your editorial in the June '99 issue of *CQ VHF*, "Could Amateur Radio Save America?" My answer to this question is, yes, perhaps it could, if only by steering the America I live in in the right direction.

I acknowledge that Elmers are not always easy to find, and that not all young hams have the patience it takes to stick with the hobby: but this is true of any hobby that a person takes up. We all got over it once we had a dozen or so QSOs.

Personally, I agree with what you wrote in your column, but I blame the problem on the "pearls before swine" attitude which America seems to have developed about technical know-how in general, whether it's how to tune your transceiver's antenna or how to install a light fixture in your house. Apparently we seem to think that we need to belong to some special "scientist caste" to be privy to such deep, dark secrets, and our corporations do not help matters by snapping up every available bit of technical info as "trade secrets." No wonder we're so far behind other industrialized countries in scientific progress!

We have done it to ourselves, and it is up to us to undo the damage. I undid mine just a little more when I got my ticket and learned how to be a ham. 73,

Marty Goss, KE6WNH
Culver City, California

Pat on the Back?

Dear *CQ VHF*:

The March article titled "Training...In the Public Interest" was excellent. I think you guys hit the nail on the head with this one. The original purpose of ham radio was to help out with communications in the event of a disaster. If we don't prove our worth, the FCC might just turn our valuable spectrum into cash for their pockets! Not too long ago, hams were still making advancements to the radio art, but, in our present day, the commercial market has surpassed the hams by quite a margin. No longer are we the "mystical radio gurus" the general public once thought us to be. With all the technology we have around us, handling a message via radio is no longer a big deal. If we want to keep our hobby alive and retain all of our valuable spectrum, we need to market ourselves.

One of our greatest assets is our ability to improvise, to look "out of the box," if you will. Most hams have the ability to "make do" with whatever they find. In a time of emergency, this is a valuable talent. The right equipment may not be around when you need it most. This is were we stand out. If we couple this "make do" talent with good training, then we have an excellent group of emergency communicators, just what the FCC intended us to do. Even though the ability to communicate via radio now abounds in the general public, most folks have no idea what to do when "it" becomes unreliable. We *can* communicate in adverse conditions with less than satisfactory equipment.

The unfortunate part of this story is the lack of interest in disaster relief training. I live in Miami, Florida, a major city by all standards. Yet there's only a handful of hams active in emergency communications. The group of active disaster relief hams is so small that we all know each other! Those of us involved buy all our own gear, donate our time, and seek our own training. The county does not provide us with anything except an occasional pat on the back.

The county's lack of assistance makes it quite expensive for those of us who choose to be active and prepared. It does not help out the "lack of interest" situation at all. Being involved as a volunteer in emergency management really becomes a labor of love. On average, we have over $1,500 in emergency gear per person; I personally have enough radio gear to supply a team of six. Amongst our list of gear we have generators, solar panels, batteries, HF, VHF, UHF, CB, and cellphones with long range antennas. Some of us have specially prepared vehicles just for emergency communications. This gets expensive!

Who's to blame? The people or the government? I think we as hams need to prove ourselves as a valuable asset by getting trained and letting people know "we are here to help," but, by the same token, we need to have this training made available to us. From my experience in Dade County, Florida, if you want training, you need to go out and get it yourself. Sometimes that even means paying for it out of your own pocket. This is a very discouraging situation when you have to pay to get trained to help someone who won't help you get trained.

I would like to see more articles regarding free sources for disaster training. If ham radio is to survive, I think disaster relief is where we will shine once again. Any and all training is valuable.

Robert Cruz, KE4MCL
DCAT4955 Response Team
Miami, Florida

Robert—I congratulate you on your dedication to ham radio emergency communications and to being properly trained to "do it right" when the need arises. But I think you have a misconception about ham radio operators' roles and responsibilities, especially with regard to emergency communications and training.

First of all, emergency communication is only one of our reasons for existence. The others include advancement of the radio art; providing a pool of trained operators, technicians, and electronics experts; and enhancing international goodwill.

Second, I'm not sure where you get the idea that it's the responsibility of government emergency management agencies to provide hams with free training and/or free radios (implicit in your description of the expense involved). The FCC very clearly states that training is our *responsibility, and that we may not be compensated in any way for providing*

(Continued on page 44)

Product Update

ICOM Looking for "Vision"

ICOM America is looking for your ideas—and your judgment—on "the most unique, innovative, and executable way" to use the color LCD display on its new IC-2800H dual-band FM transceiver (see description, June, 1999, "Product Update"). One of the features of the color LCD display on this VHF/UHF mobile rig is its ability to accept a standard NTSC video signal from VCRs or video cameras. While it won't transmit or receive video signals over the air, the folks at ICOM are offering a $1,000 prize to the person who comes up with the best idea (in 150 words or less) for ways the video display *can* be used.

The contest ends on August 31, 1999, and all entries must be received at ICOM by September 10. ICOM will pick 10 finalists to be posted on its Web site at <http://www.icomamerica.com/amateur/IC_2800Hcontest>, and viewers will be asked to vote for their favorite. The idea that gets the greatest number of votes by the cutoff date of October 29 will be the winner. For more information or official entry forms, visit the ICOM Web site or your favorite ICOM dealer.

Alinco HT Offers Theft, Mosquito Protection

Alinco USA is breaking new ground in the ham radio marketplace with its new DJ-195T 2-meter handheld. The unit includes not only a theft alarm (which sounds when it's unplugged from an external power source), but also a "mosquito repel" feature that *may* (no promises here) keep the pesky bugs away by emitting a very high-pitched electronic tone. "It's a feature we added just for fun," noted Alinco USA Branch Manager Katsumi Nakata, KE6RD, adding with a smile, "The mosquito repel feature could make the DJ-195T the first radio capable of debugging a Field Day operating position!" The unit also offers up to 5 watts power output, 40 memories, alphanumeric display, CTCSS encode/decode, receiver coverage from 130 to 174 MHz, and other features. The price, while not set at press time, is expected to be competitive with other single-band HTs.

Circle 100 on reader service card

MFJ Offers Boom Mic/Headphone and "Small Wonder" Receive Antenna

The MFJ-5396 is a professional grade boom-mic/headphone set designed for comfortable operation during long hours of contesting, DXing, or running traffic nets. The leatherette padding is 3/4 inch thick over each ear and the headband is adjustable to keep out external noise. The flexible microphone boom is also adjustable to let you position it for the best-sounding audio. Both the microphone and the headphones are tailored for communication audio frequencies, and the set comes standard with an extra-long 9-2/3-foot cable so you can move around your ham shack while using it.

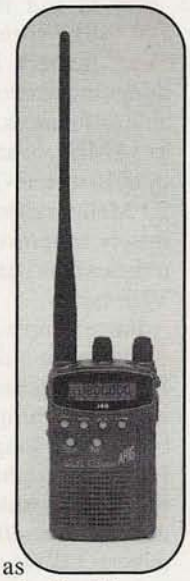
The unit comes supplied with a standard 1/4-inch plug for headphones and a 3.5-millimeter mic plug. You may build your own adapter or use one of MFJ's prewired adapters for different radios. List price is $14.95. Order MFJ-5396 Y/K/I (Yaesu, Kenwood, ICOM) for your type of input plugs.

MFJ's "Small Wonder" HT antenna is less than 1 inch tall, and won't get in your way while traveling or monitoring your receiver (*This is a* **receive** *antenna. Connect a standard-length antenna before transmitting!—ed.*). Designed for use on the 144-, 440-, and 1296-MHz ham bands, the tiny antenna is available with either a BNC (MFJ-1719) or an SMA (MFJ-1719S) connector, and sells for $19.95. Contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS (8-4:30 Central time, M–F) 39762; Phone: (601) 323-5869; Orders/Dealer Locations: (800) 647-1800; Fax: (601) 323-6551; Web: <http://www.mfjenterprises.com>.

Circle 101 on reader service card

AOR Pocket-Size Wideband Scanner

Imagine a receiver no bigger than a pager that covers 500 kHz to 1300 MHz (minus cellular, of course), with 500 memories and a scan rate of 20 channels per second. That's the new AOR AR16B "Wide-Range" pocket receiver, which also features both wide and narrow FM, along with AM receive, computer programming capability, S-meter, rechargeable NiMH batteries, and the ability to operate on standard AA alkaline cells. Memories are set up in five banks of 100 channels each, but can be subdivided into as many as 25 "search banks," with your choice of 12 selectable tuning steps. Incredibly, the radio, antenna, and batteries combined weigh a mere 5.4 *ounces*. List price for the AR16B is $299.95, but dealer prices are generally lower.



For more information, see your favorite AOR dealer, or contact AOR USA, Inc., 20655 S. Western Ave., Suite #112, Torrance, CA 90501; Phone (310) 787-8615; Fax: (310) 787-8619; E-mail: <info@aorusa.com>; Web: <http://www.aorja.com>.

Circle 102 on reader service card

The Sister Bands, 10 and 6 Meters: A Cross (Band) Training Guide

Ten meters is an HF band, right? Well, only sometimes. It often acts like a VHF band and can alert you to possible openings on 6 meters, so understanding propagation on ten can help make you a better VHF operator.

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

Six and 10 meters are somewhat like sisters (or brothers, for that matter), in that they have some things in common as well as some noticeable differences. Although 6 meters, at 50 to 54 MHz, is nearly double the frequency of 10 meters (28 to 29.7 MHz) and over 20 MHz higher, it's a lot closer to 10 meters in terms of propagation characteristics than it is to 2 meters and the other VHF bands.

For example, 6 and 10 meters both demonstrate a combination of VHF and HF characteristics, with many different modes of propagation seen on both bands. As a longtime 10-meter operator, I can tell you that there have been many instances in which observations made on ten can be useful to my operation on 6 meters. Likewise, observations made on six sometimes can aid in a better understanding of 10 meters.

Photo A. The author with his portable 10-meter station that he sometimes uses during lunch hour at work. His rig is wired directly to the car battery and the antenna is a stainless steel vertical with wires as radials. (Photos by the author)

Understanding Various Propagation Modes

It would be a good idea to review the various propagation modes that are seen on 6, 10, and 2 meters. The Table lists the frequency of occurrence of these propagation modes for all three bands. Notice that 6 meters sees all of the major modes of propagation from both the VHF and HF ranges. In addition, it's closer in propagation characteristics to the 10-meter band than to 2 meters.

These similarities can teach you about the propagation modes on one band as you observe the same propagation mode on the other band. For example, *Trans-equatorial Propagation*, or *TEP*, is very common on 10 meters. In a TEP contact, both stations are roughly equidistant from the magnetic equator, one in the northern hemisphere and one in the southern. This mode is common on 10 meters throughout much of the sunspot cycle, and, from my station location in Long Island, I can work into Argentina and Uruguay for much of the winter season. Since TEP is heard on 10 meters before

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

it's heard on 6 meters, I know that a strong TEP opening on ten *might* signal a similar opening on six.

On the other hand, TEP openings don't have as much range on 6 meters as they do on ten, and I'm too far north to make direct TEP contacts on six. Here's where what I call "Mix 'n Match Propagation"[1] comes into play, as a combination of sporadic-*E* (*Es*) and TEP can make New York-to-Argentina contacts possible on 6 meters.

Now let's investigate other ways we can use 10 meters to help us to do better on 6 meters.

An Early Warning System

Regular listening on 10 meters can give experienced 6-meter operators advance warning of potential propagation openings that may be climbing up in frequency. There are a number of ways to do this. Let's start with the beacon system. Both bands have dedicated segments for CW beacons. On 10 meters, it's from 28.200 to 28.300 MHz; on six, it's primarily from 50.060 to 50.080 MHz for the U.S., and anywhere from 50.000 to 50.090 MHz for the rest of the world. There are some exceptions to this plan, but, by and large, this is where you'll find most of the beacons.

Now, many 6-meter operators will tell you that listening for beacons on 6 meters will help you spot openings *on* 6 meters. But I feel that waiting to hear beacons on six can cause you to miss openings on the band. If an opening is weak, you might be able to make out higher-power stations, but not the low-power beacons. And if the opening is strong, by the time you hear those beacons on 6 meters, the band is already wide open and you may have missed the early parts of the opening while listening for weak beacon signals.

I've found that a better strategy for spotting potential openings on 6 meters is to monitor the *10-meter beacon band* for any loud beacons or loud signals coming in on the SSB portion of the band from 28.300 up. There's also the 6-meter liaison frequency—on 10 meters—on 28.885 MHz, where many 6-meter operators will announce reports and compare notes on 6-meter conditions (for more about this 10-meter meeting spot for 6-meter operators, see this month's "Magic Band Chronicles").

Monitoring 10 meters acts as an early warning system for potential *Es* and F_2 openings on 6 meters as the Maximum Usable Frequency (MUF) starts to climb in frequency. Often, the MUF for a propagation mode such as *Es* or F_2 stops in the 30- to 40-MHz region and never quite makes it to 6 meters. But it's always helpful to be aware of potential openings on six before they happen, and you do that by listening to 10 meters.

Table.

Propagation Mode	10 Meters	6 Meters	2 Meters
F_2	X	X	0
Sporadic-*E* (*Es*)	X	X	*
Transequatorial (TEP)	X	X	*
Meteor Scatter (Ms)	X	X	X
Tropospheric	X	X	X
Aurora (Au)	*	X	X

Key: X = common mode during certain seasons; * = rarely seen; 0 = never seen

Table. Propagation modes found on 10, 6, and 2 meters, and how often they are typically seen on each band.

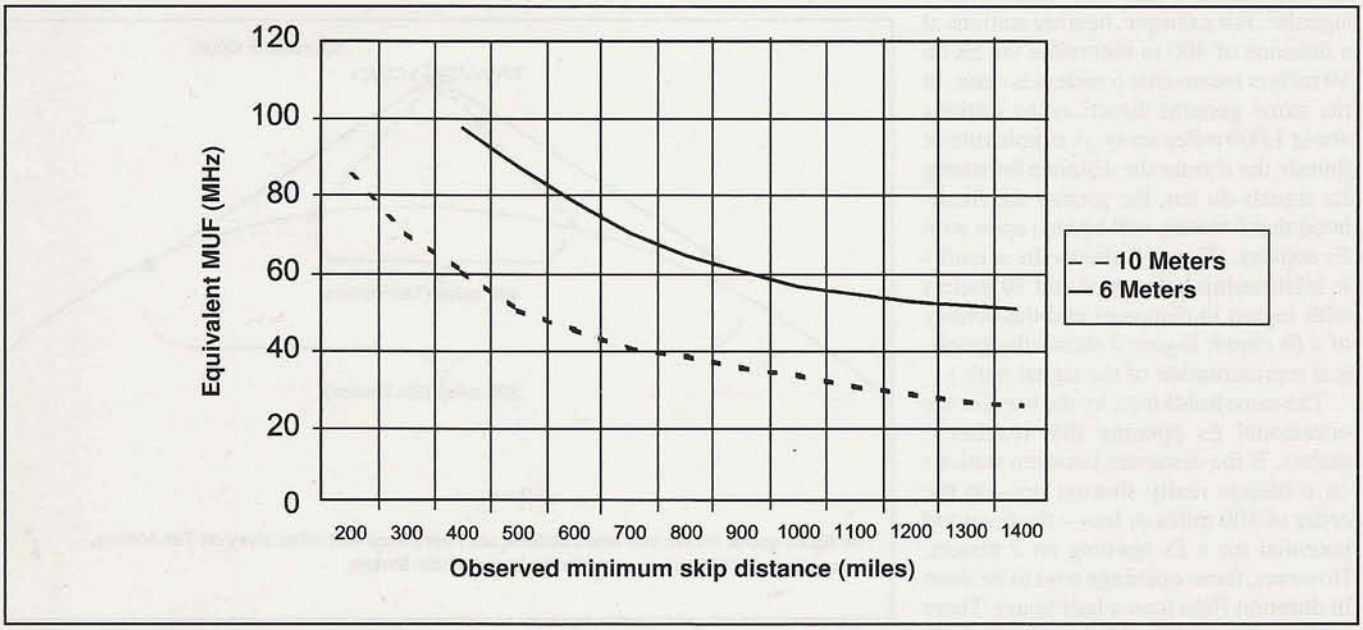


*Figure 1. Graphic representation of minimum skip distances for 10 and 6 meters during sporadic-*E (*Es*) *openings, based on the Maximum Usable Frequency (MUF) of the opening. Note that as the MUF increases, the minimum skip distances decrease. This is why "short skip" on 10 meters (less than about 500 miles) indicates a likely opening on 6 meters; and why short skip on six (below about 400 miles) suggests that an* Es *opening is possible on 2 meters as well.*

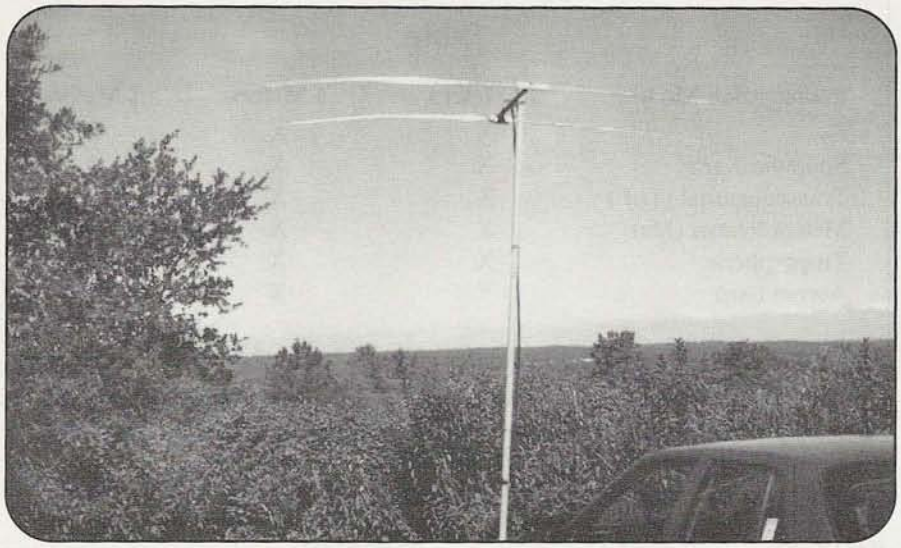


Photo B. Even beam antennas for 10 and 6 meters are small enough to travel most anywhere. This is a two-element 6-meter Yagi that Ken has used for hilltop operation in past contests.

When either very strong *Es* or F_2 openings occur, they tend to start on lower frequencies and work their way up. So strong *Es* openings on 10 meters are generally a tip-off that 6 meters should also be monitored. In fact, watching for short skip activity on 10 meters (distances of less than 400 to 500 miles) is probably more effective—once again—than waiting to hear the 6-meter beacons.

As determined almost 50 years ago by scientists Appleton and Benyon, there's a specific relationship between the frequency and the distance covered by radio signals[2]. For example, hearing stations at a distance of 400 to 800 miles via *Es* on 10 meters means that 6 meters is open, in the same general direction, to stations about 1,000 miles away. A simple rule of thumb: the shorter the distance for strong *Es* signals on ten, the greater the likelihood that 6 meters will be also open with *Es* activity. (Figure 1 shows the scientific relationship between 6 and 10 meters with regard to distances and the density of a *Es* cloud; Figure 2 shows the graphical representation of the signal path.)

The same holds true, by the way for the occasional *Es* opening that reaches 2 meters. If the distances between stations on 6 meters really shorten up—on the order of 500 miles or less—there's good potential for a *Es* opening on 2 meters. However, these openings tend to be short in duration (less than a half hour). There is also some relationship between certain types of *Es* openings on 6 meters and FAI (Field-Aligned Irregularities) openings on 2 meters, but more observations are needed to nail down the specific characteristics. Generally, look for FAI to develop on two as a strong *Es* opening on six is winding down.

Ten meters can also provide an early warning for 6 meters with regard to potential F_2 openings. This is not as accurate an indicator as *Es* openings, however, and the reliance on the 10-meter liaison frequency (28.885) is even greater. Here, 6-meter operators will compare notes on what's being heard. Quite often, you'll hear reports that TV video signals in the 40-MHz range are being heard from areas of the world, such as Europe and New Zealand, which have TV stations in this frequency range.

Working Backwards

Certain modes of propagation, such as aurora (Au) and Tropo, work in the opposite direction of *Es* and F_2. That is, they start out high in frequency and work their way down. Au is rare on 10 meters, but if you do hear the characteristic distorted signals of Au on 10 meters, you can bet that both 6 and 2 meters have some sort of decent opening going on. Likewise, if you start making Tropo contacts on 10 meters (beyond ground-wave range, but not out to *Es* distances, say 150 to 350 miles), then you should look for similar openings on six and two.

Contest Observations

Another way to see the effects of propagation on 10 and 6 meters firsthand is to participate in one of the on-air contests that involve these bands. I've been a regular participant in the ARRL 10-Meter Contest every December since the event began in 1973. As I put in a decent amount of time and effort, I can easily see how my final score reflects the general propagation conditions, particularly in the area of F_2 openings tracking with the sunspot cycle.

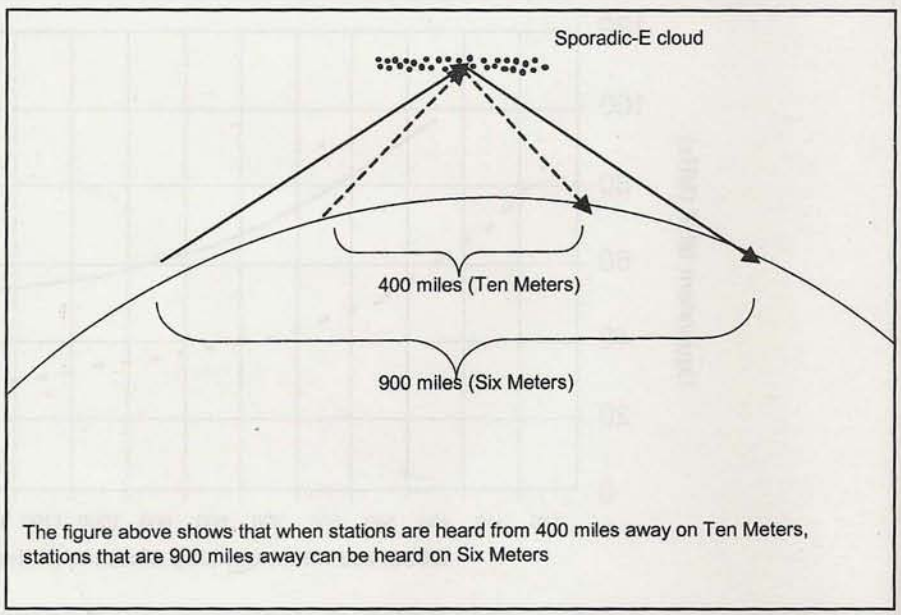


Figure 2. Illustration of the difference in distances that can be covered on 6 and 10 meters by the same Es opening (see Figure 1 for more details). Note that, as skip distance on 10 meters drops to about 400 miles, the MUF has climbed up to 50 MHz, allowing Es contacts of up to 900 miles to be made on 6 meters.

For example, during the sunspot peak years, I can make almost 500 contacts on CW during the two-day contest period, while during the quiet years, I'm lucky to make 50 contacts because of diminished F_2 propagation. Stations in the U.S. are hard pressed to work many DX stations during the solar minimum years, except for some Caribbean stations coming in via *Es*, or Argentina and Uruguay coming in via TEP. Contacts into Europe are very scarce then.

However, a strong *Es* opening can occur any year of the solar cycle and can help scores considerably (even though it won't get you into Europe or Asia, as F_2 can). After operating on 6 meters for a number of years, I now can look back at my old 10-meter logs and identify *Es* openings and see how prevalent they are in this frequency range. From 6-meter experience, I can also see that *Es* openings are unpredictable, particularly regarding their duration, so I work hard on contacting those stations coming in via this mode as quickly as possible.

By the same token, participation in the VHF contests shows how often *Es* openings can occur on 6 meters, even when 10 meters sounds somewhat quiet. Another good thing about VHF contests is that they encourage portable and rover operating, which leads to some additional observations for both bands.

Ease of Portable Operations

Before I fell in love with 6 meters in 1990, 10 meters was my favorite band. Compared to the busier HF bands, such as 15 and 20 meters, it seemed to take only a modest effort to work DX on ten.

A unique strategy I used during the last sunspot peak was to bring my HF rig and 10-meter vertical to work so that I could operate portable during my lunch break (Photo A); there was less competition from the U.S. gang at that time and there was some really exotic DX on ten, especially during the equinox periods. Nothing beats the feeling of working some of the rare countries in Africa and the Middle East, or working some really far away places, like India or Thailand, via long path at local noon time! Coming back to work after lunch, I'd feel like I'd been away on a short vacation to an exotic location. I would expect this to happen again on 10 meters, and occasionally on six as well, during the high sunspot count years that are approaching now.

"Monitoring 10 meters acts as an early warning system for potential Es and F_2 openings on 6 meters as the Maximum Usable Frequency (MUF) starts to climb in frequency."

Another thing this shows is the relative ease of portable operations on 10 meters as well as on six. Both bands have wavelengths that are small enough to allow for antennas suitable for portable or temporary use. When conditions are good, a simple mag-mount vertical or similar setup can be quite effective on either band. And for six meters, it's not all that difficult to set up a portable two- or three-element beam and really get out well (Photo B). I also find that I can learn more about antennas by making multi-element Yagis on 6 meters and taking this knowledge to 10 meters.

Final Thoughts

Hams interested in the different propagation modes that allow us to make long-distance contacts should observe conditions on both 10 and 6 meters to get a working knowledge of these modes. In a sense, listening to both bands on regular basis is like getting cross-training on the variations of propagation modes when they appear on either band.

There's a good opportunity for VHFers to expand their horizons into some of the HF bands with the proposed FCC changes in amateur licensing. However, in the meantime, obtaining the Technician Plus license, which requires knowledge of code at only 5 words per minute, would allow you to operate on 10-meter SSB and CW. I suggest that, for VHFers who do a lot of 6-meter operating, regular operating on 10 meters would be a logical step to help you make the most of the "Magic Band." ■

Notes

1. See Neubeck, "Mix 'n Match Propagation," *CQ VHF*, Feb., 1999, pp. 28–33.
2. Appleton and Benyon, "The Application of Ionospheric Data to Radio Communication Problems," Proc. Phys. Soc. 52, 518. (1940)

CQ VHF Review: Alinco DR-M03 10-Meter FM Mobile

Why review a 10-meter FM rig in a VHF magazine? Two reasons: First, 10 meters often behaves like a VHF band. Second, license restructuring may soon give many VHF-only hams new "low band" privileges, and 10-meter FM may be a perfect place to get started.

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

When the FCC finalizes its amateur radio restructuring plans—and there could be an announcement any day now—thousands of Technician Plus operators will be almost-instant candidates for a broad range of high-frequency privileges with what will most likely be a new, slower-code General class license.

Of course, you might want to jump right into the DX fray on 20 meters, but not all brand new Generals start off on HF with giant beams or thousand-dollar base stations. Many new General class operators ease into HF by starting on 10 meters, and then working down in frequency. On the 10-meter band, summertime skywaves will be almost an everyday deal for the next few years, and single-band, 10-meter equipment is a lot less expensive than buying a new all-band HF rig. And those who combine ham radio with CB may find that a couple of inches whacked off the CB antenna on the mobile will work 10 meters just dandy! And for many CB base station antennas, coming up on 10 meters won't be a problem either.

Photo A. The Alinco DR-M03 10-meter FM mobile transceiver is small enough to hold in one hand, but puts out a 10-watt signal that's more than capable of being heard when the band is open. There's a matching 6-meter version as well, the DR-M06. (WB6NOA photos)

The 10-Meter Band

Most traditional 10-meter activity is on CW and single sideband (SSB), with code found mostly between 28.000 and 28.300 MHz, and most SSB activity between 28.300 and 28.700 MHz. Current Novice and Tech-Plus privileges are all within these segments. But there's a lot more to the 10-meter band. Up in the middle of the band, around 29 MHz, is an area for amplitude modulation (AM), the satellite subband at 29.300 to 29.510, and way up at the top, from 29.510 to 29.700 MHz, the 10-meter "Fun-Mode"—frequency modulation, or FM—segment.

That's right, FM—just like what you're probably running right now on 2 meters—where signals are sparkling clear, background noise is totally suppressed with almost any kind of signal, and there are local repeaters to easily extend your range throughout an entire city. And then there is the 10-meter "repeater" in the sky—the ionosphere—to extend your simplex or repeater communications for literally thousands of miles, still using FM.

The Alinco DR-M03

I wanted to get back on 10-meter FM mobile, so I got a hold of the little Alinco

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

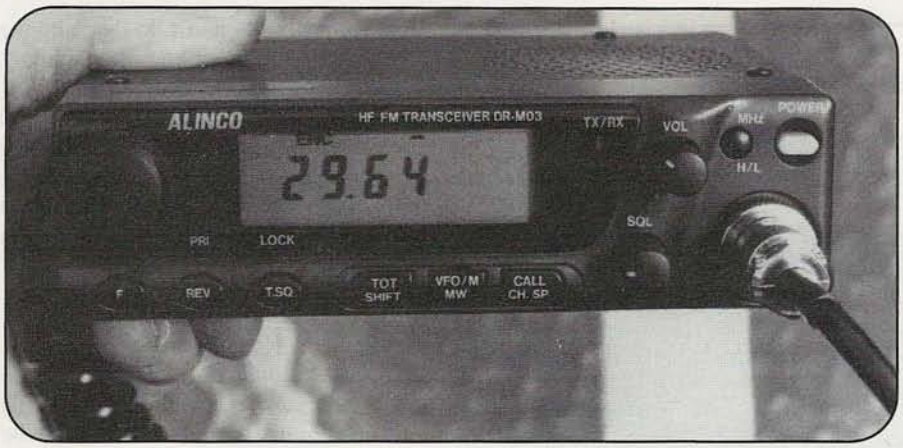


Photo B. The DR-M03 is designed for 10-meter repeater operation, with the standard minus 100-kHz transmit offset built in, along with a CTCSS tone encoder (see the "ENC" on the display) for tone access.

DR-M03 10-meter FM transceiver (Photo A). It runs 10 watts output, has 100 memory channels that can store simplex or repeater frequencies, and offers different CTCSS (Continuous Tone Coded Squelch System) tones for repeater access (more on this later). The radio is easily held in one hand, and its power consumption is lightweight as well. The DR-M03 draws 3 amps on high-power transmit and less than 1 amp on squelched receive.

Operation is simple and straightforward: you start off in the VFO mode, dial in 29.600 MHz, the national FM simplex frequency, hook on your 10-meter antenna, up the volume, set the squelch, and stand by for excitement (*actually, you should hook up the antenna* before *you turn on the power—ed.*).

After a few seconds of silence, your first call might break the squelch and sound as if you're listening to a 2-meter FM signal down the street...but it may actually be halfway across the country. "Helloooo ten FM, this is KB9SMG, Chicago." That's my friend, Pete. As soon as he drops his carrier, the squelch on the Alinco closes, just like on a 2-meter FM rig.

"KB9SMG, this is WB6NOA, Southern California. Hi, Pete!"

Then a 4 breaks in from Florida. He's mobile, but his signal still quiets all the background noise. Here comes a 5 from Texas. The band is open, and everyone is enjoying the sparkling quality of full-fidelity FM communications on the 10-meter band—and running only 10 watts!

Virtually all 10-meter FM simplex activity takes place at 29.600 MHz, right in the middle of the FM segment. Above 29.600, there are four repeater output frequencies, on 29.620, 29.640, 29.660, and 29.680 MHz. Their inputs are 100 kHz below, at 29.520, 29.540, 29.560, and 29.580, respectively. The Alinco is preprogrammed for the 100 kHz split; and, as long as the split feature is on, you can cycle tune through the repeater subband and hear a variety of 10-meter FM repeater stations throughout the country, along with all of the local base, mobile, and handheld units working through those stations.

"We must remember that 10 FM is not just for new Generals, but experienced ham operators with the top license, too."—Alinco's Katsumi Nakata, KE6RD

Most 10-meter FM repeaters require a CTCSS tone for access (see Photo B and note the "ENC" display that indicates the tone ENCoder is on). You'll need to look at your *ARRL Repeater Directory* to determine the correct tones for accessing the repeaters you're hearing. Sometimes, some of the faraway repeaters may share the same tone, so things get real interesting as you key up different repeaters throughout the country, being sure to give your callsign and the CTCSS tone you're using as you operate through the repeater. I always try to say my input tone so others hearing my signal can encode the same tone to reply back through that local or distant repeater.

Memory Overkill? Not Really

As I mentioned, the Alinco DR-M03 can store 100 channels in memory, and

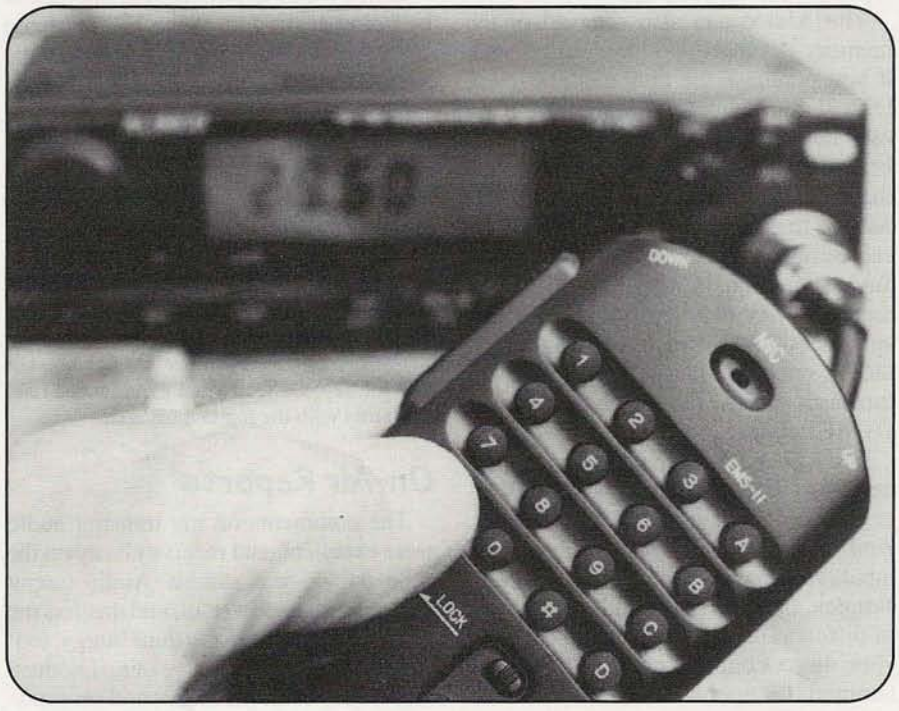


Photo C. The optional EMS-11 DTMF mic will enable you to access TouchTone®-controlled repeaters and make autopatch calls through repeaters with links to the telephone network. That will run you an additional $52.

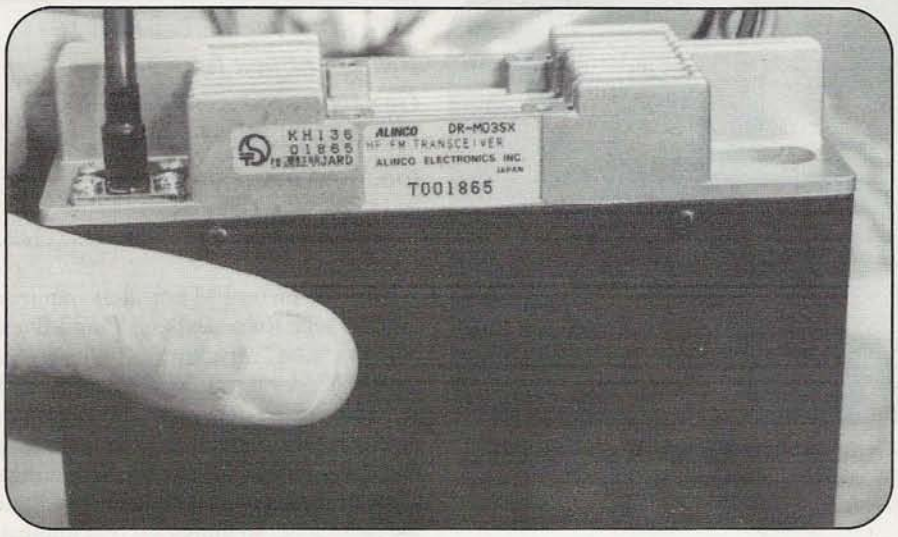


Photo D. The back of the rig is a solid heatsink that didn't even get warm on a short QSO. At 10 watts out, this rig should stay cool as a cucumber for even extended QSOs (but do spend at least as much time listening as talking...it's just good practice).

you might not think you could ever use this many channels with only one simplex frequency and four repeater channels available. But what I recommend is that you load 20 different memory channels for *each* repeater output frequency, all with a minus offset, and *each* with a *different* CTCSS tone. Now, with everything in memory, it's easy to drive down the road, turn the dial, and see what repeaters you can key up.

The Alinco can also scan all of the memory channels you have stored, and, if you purchase the optional EMS-12A DTMF microphone (Photo C), you can use the DTMF (Dual Tone Multi-Frequency, more commonly known by the AT&T trademark of TouchTone®) buttons to actually make a (local) phone call through any repeater that may have autopatch capabilities. Also, some repeaters may require a DTMF turn-on, and the optional Alinco mic will do this nicely, once you know what the proper turn-on code is. The stock mic has no DTMF buttons.

The Alinco DR-M03 also has a reverse key, and this allows you to sample another station's input signal to that repeater. And, if you can hear him or her on the input, you can then switch over to 29.60 simplex, or carefully straddle the *output* of different repeater stations to carry on your direct communications. (Don't be tempted to operate simplex between repeater *input* frequencies. You could accidentally key up repeaters both above and below you.)

Although the Alinco can tune from the very bottom of the 10-meter band to the top, you must restrict your FM operation to frequencies above 29 MHz. FCC rules permit FM bandwidth only above 29 MHz and repeater operation only above 29.5 MHz, so stick to the top of the band. And remember to avoid transmitting FM in the satellite subband between 29.300 and 29.510.

Don't worry about missing out on DX by being at the top of the band. Alinco USA Branch Manager Katsumi Nakata, KE6RD, related one of his experiences:

> I made a QSO with JA4AO on 28-MHz SSB, and then talked about the fun of 10 FM. We then switched up to 29.6 MHz FM, and this was his first FM QSO on HF. I am convinced that many operators don't realize all of the fun of FM up on the top end of 10.
>
> Many DXpeditions also run 10-meter FM, such as Palestine (E4), Rodorigues (3B9), Campbell Island (ZL9), and many other rare stations. We must remember that 10 FM is not just for new Generals, but experienced ham operators with the top license, too.

On-Air Reports

The comments on my transmit audio were excellent, and receive clarity on the little Alinco was superb. Audio output was extremely powerful, and this lets me run the equipment in my dune buggy, too!

About the only negative thing I noticed was a very faint hissing sound on transmit, inside on the test bench, within five minutes of warm-up. Alinco Sales Manager Doug Wynn, KB6YZD, said *their* sample units don't do this, and the problem with my unit was almost unnoticeable and goes away after it warms up. Other than that, it operated superbly. And speaking of warming up, the heat sink on the back of the DR-M03 (Photo D) is more than adequate to handle any heat buildup. On a short QSO, it didn't even get warm.

Start Exploring Ten

About the only thing you'll need to explore on your own is the nature of the ionosphere on 10 meters, and this can be great fun. You'll find that, except around the very peak of the sunspot cycle, skip usually occurs only during daylight and early evening hours, and usually in the direction of the rising or setting sun. It's fun to spend a full day on the band, watching the propagation shift from east to west as the hours pass.

You may also hear extremely strong signals go into a few seconds of distortion, in a pattern that recurs every 15 to 25 seconds during a long transmission. This is called "phase distortion," and occurs to any wide AM or FM signal being refracted by different layers of the ionosphere and arriving at the distant station slightly out of phase with itself and, thus, sounding distorted for a few seconds. This is not a problem with the radio—it's the nature of 10-kHz-wide FM or 6-kHz-wide AM transmissions coming off the ionosphere.

Ten FM is a great way to explore new privileges on the worldwide bands, or just to expand your operating horizons. So consider the tiny, new Alinco DR-M03—it's a fun little rig if you enjoy FM (dealers will probably sell this in the $249 area). Alinco also has a matching 6-meter FM rig, the DR-M06. To learn more about similarities and differences between 10 and 6 meters, see WB2AMU's article, "The Sister Bands—10 and 6 Meters," elsewhere in this issue. ■

Resources

For more information on the DR-M03, or its 6-meter twin, the DR-M06, see your favorite Alinco dealer or contact Alinco Electronics, Inc., 438 Amapola Ave., Lot #130, Torrance, CA 90501; Phone: (310) 618-8616; Fax: (310) 618-8758; Web: <http://www.alinco.com>.

Reader FEEDBACK!

No Motorola Surplus at 2-Way Shops

Dick Warren, W7TIO, writes:

This refers to comments about resources for commercial equipment in "Amateur or Commercial," by Larry Page, W5LEP (May, 1999, issue). A few years ago, I worked in a predominately Motorola shop that had contracts with various federal agencies as well as with nearby towns and counties. This, in addition to a myriad mixture of commercial companies and their fleets. Most of these contracts were as a result of the efforts of the local Motorola salesmen and of their decision of which of two local service agencies would get the installation and maintenance contracts. Trade-in equipment was *required* to go back to Motorola, and whom they sent it to from there of the many surplus dealers nationwide was *their* decision.

I was the only ham in the crew, and it didn't matter how much I might have wanted the used equipment, or who might have asked us for access to it, those were the rules. This made sense, particularly since we didn't own the equipment to begin with. Depending on their attitude towards secrecy, a two-way shop may or may not tell an inquirer who seeks used equipment who the contact persons are at the customer's offices. I certainly wouldn't depend on it, as they'd probably consider it none of the inquirer's business!

As to governmental agency-owned (city, county, or federal) equipment, these were sold at auction by the various agencies themselves, and went as "lots" of multiple units. It has been a few years since those days, but I have no reason to think that anything has changed, as the service agency *never* owns the equipment.

I now own my own company, but the rules remain. Like everyone else, anything I want I must buy on surplus from whomever has it, as I'm not a big enough firm to bid on large "lot" sales. *Mobile Radio Technology* by Intertec Publishing company is the surviving trade magazine of the land mobile radio service business, and that's where most of the surplus equipment is listed. But this magazine is primarily available to "qualifying" persons only.

Author Larry Page, W5LEP, replies:

Dick—Because of the breadth of the topics that I tried to cover in my article, it was not possible to discuss all of them in as much detail as possible. I would like to have given more attention to several issues, among them the sources of equipment, channel spacing, deviation, ordering parts, and programming. Unfortunately, there was simply not enough room.

In particular, buying used radio equipment is much like any form of collecting...the first step is to learn how to buy equipment that is in some usable form at a reasonable price; the second step is to learn how to avoid buying equipment which is stolen or otherwise not legitimately offered.

The various manufacturers have a range of approaches to doing business. Motorola appears to base its relationships largely around maintaining strict control. Your observations are generally correct for those shops doing Motorola repairs only. I have run across cases, however, where a repair customer was slow to pay and traded in a radio to settle repair costs. In other cases, radios have been repaired and not picked up by the customer in a reasonable time, then were sold to cover the repair costs.

My reference, which may not have been clear, was to larger shops which handle both sales and service. They quite often will accept trade-ins of older equipment against new. And a special case is how "Dead on Arrival" equipment is handled, especially among high-volume customers. Most of these customers will refuse to accept repaired equipment as satisfying an order for new equipment. Disposition this material varies widely, and, if you are in the right place at the right time, it is possible to get like-new equipment (albeit not functional) for very little.

I have also found that disposition by government agencies varies. Some agencies offer only prepackaged lots via sealed bid. Others, however, may sell individual items at preset prices or will allow a bidder to specify the quantity on which he wishes to bid. I have purchased lots as small as two radios this way and have also on occasion bid successfully as part of a group so that we could reasonably bid on larger quantities.

Mobile Radio Technology is a good source of monthly advertisements for used equipment, although I have generally found the prices in those ads to be prohibitively high. Transceivers which are targeted to go back into commercial service require a substantial amount of work to refurbish, and the price must also support at least some level of warranty coverage. I have generally found Internet searches to be best, then establishing good relationships with the best dealers I have found there.

Thank you for your comments. The article generated a surprising amount of feedback, and it is rewarding to have found an area of interest to a number of people.

CQ VHF Review: The Elecraft K2 Transceiver Kit

We continue our Special Focus on the VHF/HF Connection with a look at an HF transceiver kit that GM4PLM says can be just the ticket for driving a transverter on a portable operation.

By Simon Lewis, GM4PLM*
(emn@pacsat.demon.co.uk)

If you're anything like me, one of the main hurdles of building your own equipment is making the finished item look good. It's all very well having your latest masterpiece performing beautifully, but if it's housed in a poorly finished box, it will never be the object of joy that you want it to be, and that's a shame.

Those of you who remember the days of Heathkit will not forget the attention that was paid to the enclosures that were supplied as part of the kit. They made that homebuilt equipment look good enough to take a place of pride in the shack, as it did for thousands of amateurs across the world.

It was this memory that sprang to mind recently while I was browsing the Internet and discovering a new transceiver kit from a California company called Elecraft, which is managed by Eric Swartz, WA6HHQ, and Wayne Burdick, N6KR, both highly active amateurs. Their latest offering, the K2, is designed not only to compete with the latest top-of-the-line commercial HF radios in terms of performance and capabilities, but also to look as good as a commercial product, even when constructed at home by the average amateur.

Photo A. The Elecraft K2 Transceiver runs on 12 volts DC and puts out 10 watts on all HF bands, making it a perfect choice for driving a transverter during portable operations. (GM4PLM photos)

Why Review an HF Rig Here?

So why review an HF transceiver kit in *CQ VHF*? Well, the K2 has some interesting features that are useful not only to the HF operator, but also to the VHF weak-signal operator—and some that are missing from even today's top-line VHF transceivers. These features make the K2 the perfect transceiver for transverting up to the VHF/UHF bands, and certainly worthy of a review for *CQ VHF* readers!

The main thing to understand about the whole K2 project is that it has been designed to give the best possible performance under the most demanding of conditions. It has excellent sensitivity with high dynamic range, the best possible filtering for operation on crowded bands, and other features that you would expect from a top-range commercial transceiver. In short, it has been designed by operators who know what you want as operators on busy bands under the worst possible conditions. Not only that, but it has also been designed so that you, with no specialized test equipment beyond a standard digital multimeter, can build it at home and get the same great performance as if it were built in the workshops.

"Impossible," I hear you say. It's not impossible and it's here now! The K2 has arrived!

Transceiver Description

The K2 comes as a complete kit and contains everything you need to construct a high performance 10-watt HF transceiver. The only items you need to supply are a soldering iron, solder, some basic tools, and an optional DMM (digital multimeter) for final alignment. Oh yes, you will need some patience as well —it's a big kit! On the other hand, the finished radio is quite small, measuring 3 x 8 x 8 inches around and weighing about

Simon Lewis, GM4PLM, is Editor of European Microwave News *and a regular contributor to* CQ VHF.

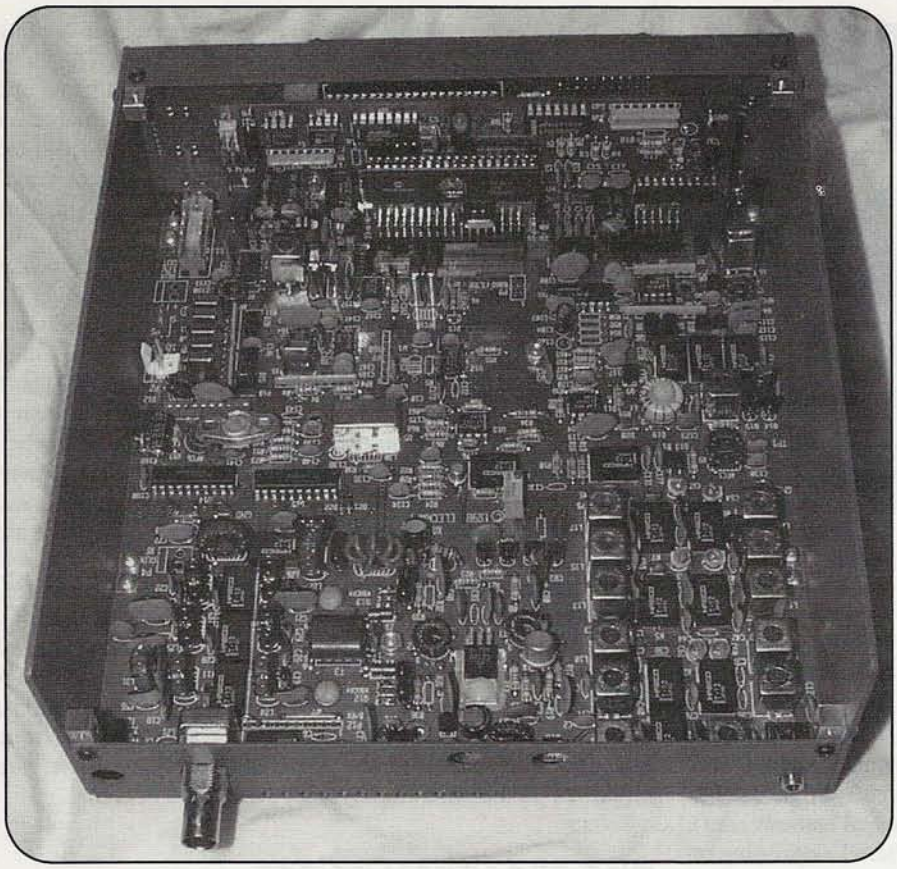


Photo B. Interior view of the completed K2 transceiver kit. Note that there are no wires. All components are mounted on circuit boards, and the three circuit boards plug together.

3 pounds when complete. The supplied case is olive green and the front panel is screen-printed in two colors to provide a pleasant and professional looking enclosure for the finished transceiver. Color coordinated control knobs are also supplied, as is a large, fluted, and weighted VFO knob. A bail arm to tilt the radio upwards when sitting on a flat surface is also supplied (See Photo A).

The transceiver is powered from 12 volts DC and consumes less than 100 mA on receive with the radio configured to its best power-saving settings. The radio consumes less than 2 amps on transmit at 10 watts out, making it the perfect low-power, rover radio.

The radio uses a no-wire construction and is based on interconnecting boards using a plug and socket arrangement (Photo B). The connectors join three panels that comprise the front panel (Photo C), control panel, and main RF boards. All connectors have gold plated contacts. The transceiver uses no surface mount components, which readily lends itself to home construction by the average amateur. The chassis is built on six interconnected parts with specially designed two-dimensional joiners. A full handbook is supplied that contains full instructions for building and operating the radio, component listings, and full interconnection details. Construction details and a description of the built-in test equipment (BITE) are described in their own section later in this article.

Transceiver Walk-Around

Taking a quick look around the front panel reveals some interesting features, some of which you generally only expect to see on top-of-the-line HF radios. There are also some features that I've never seen offered before, but I expect other manufactures to pick up on very quickly.

The first thing to note is the unusual way in which the functions are controlled from the keypads on the front panel (Photo D). Elecraft describes this technique as "tap/hold." A quick "dab" of a key gives you the top function, while a longer press accesses the bottom functions. I was very impressed with this and it's very easy to pick up. If you try to select a function associated with a missing module, you'll see a "NOT INST" (not installed) message on the LCD display (more on modules later).

The main radio functions are accessed from a menu system. The front panel menu key accesses the menu system and the menu item selected from a scrolling list, using the main VFO knob and band +/- switches. Again, all very simple. Two additional programmable function keys appear on the front panel and can be assigned to make any two menu items instantly accessible.

A bright LED S-/Power/ALC meter sits unobtrusively in the top left of the front panel. A keypad button also selects its function. I normally dislike LED S-meters, but I suppose something has to go when the radio is this small! It seems to work well enough anyway. The S-meter mode can be cleverly alternated between dot, bar graph, or off. The meter display intensity can also be changed, depending on operating conditions. The remainder of the buttons on the left side of the radio control band switching, display, S-meter, and noise blanker functions. Control knobs for keyer speed, RF power output level, and AF and RF gain are situated immediately to the left of the tuning knob, as is a standard 8-pin microphone socket.

While on the subject of the mic socket, it's interesting to note that the socket can be configured to Yaesu, ICOM, or Kenwood standards by using onboard pcb jumpers, so you can use any mic you have around without having to rewire it. Gets my vote!

A $^1/_8$-inch headphone socket that supports both mono and stereo plugs sits unobtrusively next to the mic socket. Oh yes, there is also an onboard speech processor, as well as VOX, again controlled from the front panel, plus a built-in memory keyer, one of the best I've seen on any radio. Turning the keyer speed control displays and adjusts the keyer speed in words per minute (wpm), anywhere between 9 and 50 wpm. The power control pot allows the transmit power to be altered in 0.1-watt steps from 0 to 12 watts. The RIT/XIT (receive/transmit incremental tuning) control is located to the lower right of the front panel and varies the selected function over a ±1.2-kHz range, in 10-Hz steps.

Above the main VFO knob is a large backlit LCD display. This is not only used to display frequency (down to 10 Hz resolution), but also to identify the state of

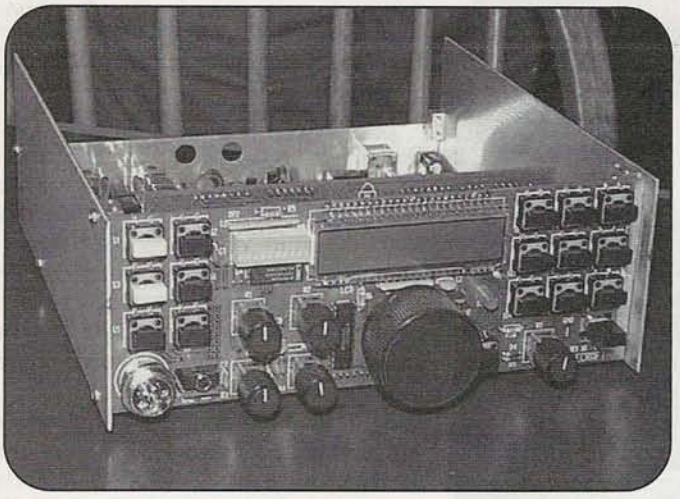


Photo C. The front panel is actually a circuit board onto which the various controls are directly mounted, eliminating the need for wires anywhere in the radio.

some transceiver functions (mode, antenna, RIT/XIT/preamp/NB/attenuator on/off, and VFO A/B). Again, all functions are controlled by either menu items or keypad buttons. The LCD is also used to display messages for firmware and hardware power-up checks, and to display information from the built-in test equipment (again, more about these unusual features later). The LCD backlight intensity can also be altered, depending on light conditions and power-saving requirements. You can even switch it, and the S meter, off completely for minimum current requirements for rover/portable operations.

The rear panel has a variety of connectors covering connections for antennas (up to two), transverter, external speaker, DC power, and code key. The key jack is a 1/8-inch stereo type that can be wired to support either an iambic paddle or straight key. Full or semi-break-in keying is available, with T-R delay adjustable between 10 milliseconds and 1.5 seconds.

As mentioned, a bail arm sits underneath the radio to tilt it upwards when used on a bench (see Photo A). A large speaker is mounted in the top cover.

Peak Performance

Particular attention has been paid to the RF performance of the K2, and the radio has been designed with the most demanding of operators in mind. The transceiver is microprocessor controlled, so it is relatively easy to add options and functions, and the Elecraft team has chosen some that make life on a busy band that much easier! The radio supports twin VFOs with split operation, plus 50 memory channels, each capable of storing modes, VFO A/B, split details, receiver sideband and filter selection, AGC setting and NB setting. These are stored on a "per band/per memory" basis. There are also functions for direct keypad entry of frequency, memory channels and key parameters.

The receiver is a single-conversion design using an unusual IF frequency of 4.915 MHz. The single conversion results in excellent CW and SSB performance and allows the use of the flexible variable bandwidth crystal filtering. It has three, onboard-software-switchable, IF crystal filters and uses full IF-derived AGC (highly unusual on kit or home built equipment). The AGC has fast, slow, or off settings, with the "off" setting being of particular interest to weak-signal operators. The transceiver has individual bandpass filters for each ham band, and they are relay-switched for the best possible performance. A built-in attenuator and preamp can also be selected from the front panel. The unit covers 160 to 10 meters, but is not general coverage. However, coverage beyond each specified band edge is substantial.

For CW operation an "adjustable" 5-pole variable bandwidth crystal filter is supplied as standard. This can be varied over the 200- to 1500-Hz range. An optional "fixed" narrow bandwidth filter, or a wider filter, can be fitted for tuning the bands. Either CW sideband can be selected for dodging annoying QRM, and the CW sidetone pitch can be adjusted, with the transmit sidetone tracking it. Fine-tuning capability is required when using narrowband filters, and the K2 can tune in 10-Hz steps (1 kHz per revolution), with 50-Hz and 100-Hz (10 kHz and 100 kHz per revolution) steps available as well. Step sizes are selected from the front panel.

One unusual feature that I really like but can't remember seeing for many years on a commercial unit is the inclusion of a "spot" function. This places a sidetone over your receiver audio, letting you net the receiver correctly against the incoming signal by matching the incoming CW tone to match the sidetone. It's particularly useful because of the K2's tracking sidetone feature described above. If you've changed the sidetone, you might not be matched exactly with the incoming signal.

SSB and Other Options

The K2 is supplied in its basic form as a high-performance CW transceiver (although it will still receive SSB/AM perfectly well). Then, why the mic jack? Well, if you add an optional module, the K2 turns into a high performance SSB transceiver as well. The SSB module is available as an option to hold down the cost of the basic radio. This way, a dedicated QRPer who is interested only in CW won't have to waste money on a good SSB filter! Flexibility is the name of the game here.

Additional options include RTTY/AMTOR (which, with the proper software, you can receive on the basic radio; the SSB module is required to transmit using AFSK, or audio frequency shift keying), with the ability to program and select a set of tailored filters for the mode; a variable-threshold noise blanker module; an automatic antenna tuner (which fits inside the transceiver case); a 160-meter band module, which also allows for a separate switchable receive antenna; an active AF filter module; and an internal gel-cell battery (3 AH) with charger. A high-power amplifier option, with 100 watts out, will be available shortly.

The designers have also thought about the VHF operator! In the works are additional modules for VHF transverters. These will fit inside the case, be selectable from the front panel, and will change the frequency display to suit the band in use. Now that's planning!

Until those modules are available, though, the weak-signal VHFer can purchase a module which adds a low-power transverter output with PTT outputs to drive external transverters. This module also adds some other interesting features! How about RS232 computer control and an onboard real-time clock? I did say this radio has everything!

So that's the radio! It's feature packed and a great transverter driver, with all of the features that a weak-signal operator

would want. Now, let's take a look at the construction side of the K2. After all, it's pointless having all of these great features if the radio is almost impossible to build and align.

Transceiver Construction

The K2 has not only been designed for great performance, but it has also been produced in such a way that the average amateur with only minimal test gear can produce a working transceiver with the same performance as one built in a workshop. The K2 uses modular-type construction and each module is tested and checked before proceeding to the next stage. The K2 differs from any radio on the current amateur market in that it has built-in test equipment and calibration circuitry, allowing the user to align the equipment using the radio itself. Now that's innovative! No surface mount construction is used, so the radio is easily constructed using only simple tools. A number of specialized tools are also supplied with the kit. Construction is sequential in that circuits completed at an early stage are used to test and align later sections of the transceiver.

Photo D. Close-up view of the K2's front panel. See text for descriptions of the various functions, and Elecraft's "tap-hold" method of getting double use out of most keys.

The manual supplied with the K2 is a monster! Its basic construction and operating sections run to a total of 70 pages. The whole manual totals around 100 pages and is a weighty item in itself. There are four annexes, which cover a complete component inventory of each module; full circuit and interconnection diagrams; additional diagrams and construction information; and pc board overlays. The standard and quality of the manual is beyond reproach and a self-confessed "labor of love," according to Eric and Wayne.

Microprocessors and memories form the integral heart of the radio. The use of

upgradeable firmware means that, as the software writers add new functions to the radio, they can be added simply by replacing the memory chip containing them. No more trading in to get the latest model here. The use of firmware also results in the transceiver carrying many unusual features, including the built-in test equipment and versatile memory keyer we've already mentioned, plus auto-calibration routines. Firmware upgrades will be available at low cost from Elecraft when changes are made.

As mentioned earlier, the main architecture of the K2 is modular and the *Auxbus* forms the core flexibility to achieve this. It allows the radio to send commands down a single wire channel to various modules to accomplish certain key tasks, for example, changing bands. This distributed command system allows future modifications to be made to option boards without changing the transceiver itself. Commands are sent over the communication lines only when required; otherwise the processors all "sleep," reducing RFI (radio frequency interference). To reduce computer noise, the receiver is also muted when commands are in progress.

The main processor is programmed in an 8K PIC16C77 microcontroller. It is self-contained and draws very little current. 2K of non-volatile EEPROM stores memory information, VCO and VFO lookups, and calibration filter information and CW messages.

Built-In Test Equipment

Unlike any other ham radio transceiver currently on the market, the K2 is supplied with some built-in test equipment (BITE) that is used to align the radio, or can also be used as stand-alone devices. A digitally controlled calibrator is used to align the receiver functions and crystal filters. A matching frequency counter is also contained within the transceiver and a short test cable is supplied to connect the counter to several internal K2 signals during the alignment and test phase. It's also possible to connect the counter and calibrator to external connectors for use around the shack. The BITE also supports a volt/current meter and digital power meter as standard.

In some cases, the K2 will automatically detect problem conditions using the BITE tests on power-up. If a fault is detected, then a three-digit code is displayed on the front panel LCD. A comprehensive breakdown of codes is contained in the manual.

Not for Engineers Only

Although the kit is aimed at experienced builders, there is no reason why anyone who can solder correctly, follow detailed instructions, and handle a few basic tools could not construct a working K2 transceiver, with little or no additional help. All construction follows a "step-by-step" assembly pattern and is accompanied by a small box which you can check off as each step is completed. Full component identifications are included in the annexes and texts of the manual, including resistor/capacitor-identifying marks, semiconductor markings, and pin outs. Even photographs of screw types are included.

Total time for construction for an average amateur is estimated at around 50 hours, which is not too bad considering its complexity. I managed to complete a working transceiver in around 40 hours, but I have been building electronics for many years, so Elecraft's assessment should be pretty close to the mark.

Full step-by-step alignment instructions are also included in the manual, which also details how the test equipment is used, so even an inexperienced user can make accurate readings from it.

I enjoyed building the K2 over a week's sick leave while trying to recover from a nasty bout of the flu. The radio went together quite easily, following the step-by-step guide in the manual. As each stage of the radio was completed, it was tested to ensure proper operation. This is essential, as much of the first section comprises control and test functions, which are used later to test and align the RF stages of the transceiver. This method of construction also boosts the constructor's morale, as he or she can actually see the K2 coming together in stages.

It was very satisfying to test the final stages, put the case lids on for the last time, and make that first QSO on the air. I can assure you that there is nothing more exciting than making your first contacts on a radio that you've built yourself.

On the Air

Once the radio was completed, I spent a happy evening simply browsing around the bands, playing with the radio. The RF performance is very impressive. The receiver is very selective and very sensitive.

The radio is very easy to use and exceedingly quiet. In fact, I wondered if I had a receiver fault when I first switched on the radio. It was just so quiet! My worries were unfounded however, as tuning across 20 meters revealed plenty of loud signals.

I had not taken delivery of the transverter board at the time of writing, but I did plug my 70-MHz transverter in and take a listen to the 4-meter band during one of the UK contests. Again, the K2 proved to be an excellent transverter driver and, as mentioned before, the functions designed for those busy HF bands proved to be invaluable on a busy VHF contest band. I am really looking forward to the 6-meter transverter module!

In Conclusion

I found many of the functions very flexible and the control system to select them very easy to use. The "tap-hold" function is easy to pick up, and the menu functions as easy to use as any commercial radio on the market.

The K2 offers full break-in keying on CW, but uses no relays in the transmit/receive sequence, so it moves smoothly and quietly from transmit to receive, with no clicking of relays.

Overall, the K2 is a tremendous little radio! It offers some great features and excellent RF performance. It is compact and lightweight, making it the perfect rover/portable radio. Interfacing to the outside world is easy, too, with plenty of scope and flexibility for most operators' setups. The ability to add only the modules required for your operating preferences makes it cost effective, too. It's easy to construct and brings back the ability to produce an excellent homebrew transceiver than really does look like it' a professional piece of equipment. I an very impressed by the K2 and I am sur that we will be seeing and hearing a l more of it over the coming months as i popularity increases. ■

Resources

Elecraft sells factory-direct. Th basic (CW-only) K2 sells for $54 add-on modules range from $29 $125 (the SSB module is $79). order, or for more information, cont Elecraft, P.O. Box 69, Aptos, C 95001-0069; Phone: (831) 662 83 Fax: (831) 662 0830; E-mail: <rad @elecraft.com>; Web: <http:// ww elecraft.com>.

CQ VHF Ham Radio Above 50 MHz

Reader Survey—August, 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, as part of our Special Focus on the VHF/HF connection, we'd like to hear your views on HF operating.*

1. Please indicate whether your current license class gives you HF operating privileges.	**Circle Reader Service #**
Yes, broad (General class or higher)	1
Yes, limited (Tech Plus or Novice)	2
No (Technician)	3
Not currently licensed	4
2. If you have HF operating privileges, please choose the statement that best describes your current operating habits.	
VHF/UHF only	5
Mostly VHF/UHF, some HF	6
About half VHF/UHF and half HF	7
Mostly HF, some VHF/UHF	8
HF only	9
Not currently active	10
3. Please indicate which statement best describes your overall feelings toward HF operating (choose only one).	
HF is an important part of my ham operating	11
HF is OK, but not particularly important to me	12
I've never operated there, but would like to	13
I can take it or leave it	14
I don't particularly like HF	15
I have no interest in HF operating	16
No opinion	17
4. If you have a Novice, Technician, or Tech Plus license, would a 5-word per minute code requirement for General (as the FCC is considering) motivate you to upgrade your license? (Choose one)	
Yes	18
No	19
Already motivated	20
Don't know	21
5. Please indicate whether you found the HF-related articles in this issue to be useful to you.	
Yes, very	22
Yes, somewhat	23
Not really	24
Not at all	25
Did not read the articles	26

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

What You've Told Us...

Our May survey asked about how you got your copy of *CQ VHF*, and whether the articles meet your needs and those of other hams. Eighty per cent of the readers who responded receive the magazine by subscription, and 3/4 of those readers got the May issue on time (16% got it early!). Of the remaining 20%, 3/4 bought the magazine at a bookstore or newsstand; 14% at a ham radio dealer; 2% directly from CQ; and 7% from "other."

As in past years, your perception of how well *CQ VHF* meets your ham radio needs differs from your perception of how well it serves others. Overall, 67% of you said *CQ VHF* meets the needs of newer hams, and 56% said it meets the needs of experienced hams. But 82% of you say it meets *your* ham radio needs. Asked the same question specifically about the May issue, the answers were: New hams, 57%; Experienced hams, 50%; You, 72%! Apparently, many of you consider yourselves somewhere in between new and experienced.

Finally, we asked about the mix of articles in *CQ VHF*. Forty-nine per cent of you want to see more beginner-level technical articles and projects (see this month's "Project Corner" and "How it Works"). The current mix is preferred by 41%, while 36% want more operating articles, 26% want more high-level technical articles, and 16% want more news/ opinion articles.

As always, thank you for your responses. This month's winner of a free 1-year subscription to *CQ VHF* is Bart Miller of Orange Grove, TX.

A Visit with P3D...or Is It C3PO?

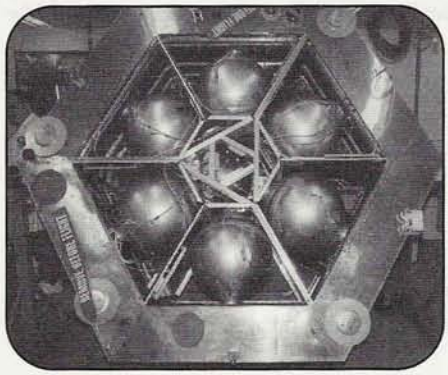
How can you confuse a ham radio satellite with a movie-star "droid"? It's easy if you try hard enough!

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

OK, OK, so the title of this article is a shameless ploy to capitalize on the popularity of the newest *Star Wars* movie. But then again...well, take a look at Table 1 and make up your own mind! Besides, the folks in the movie never seem to have trouble getting into space...

Just in case you've been off fighting intergalactic evil for the past 20 years, C3PO is a robotic co-star of the now quadlogy (?? Trilogy plus one!!) of *Star Wars* movies. P3D is an amateur radio "super-satellite," with operating capability on nine ham bands between 21 MHz and 24 GHz (see Table 2), whose launch has been mired in international politics for nearly two years. (There may finally be some light at the end of the tunnel. Check out this month's "VHF News" for the latest update.) It's also a film star in its own right, having been featured in several ham radio movies and on TV documentaries as well.

Rich Moseson, W2VU, is Editor of CQ VHF *magazine.*



The object of our visit—the AMSAT Phase 3D International Satellite. Housed in a "clean room" in AMSAT's P3D Integration Lab in Orlando, Florida, while awaiting launch, the satellite represents a worldwide effort. Different systems were designed and built by hams in a variety of countries, then brought together here and assembled into the P3D spaceframe.

"P3D is an amateur radio "super-satellite," with operating capability on nine ham bands between 21 MHz and 24 GHz."

A Visit to P3D

To most hams, and even most satellite-active hams, an amateur radio satellite is something "out there," something

Table 1. Comparison of C3PO and P3D

Feature/Capability	C3PO	P3D
Construction	Metal & wires	Metal & wires
"Brain"	Electronic	Electronic
Power Source	Unknown	Solar/Batteries
Communication modes	Multiple	Multiple
Communication hardware	Universal translator	Linear transponder
"Visual" abilities	Binary	JAMSAT Scope camera
Ability to function in space	Excellent	Presumed excellent
Responsiveness to controller commands	Excellent (occasional lapses)	Excellent
Independent decision-making capability	Limited (based on programming)	Limited (e.g., LEILA power reduction system)
Performance affected by international politics	Yes	Yes
Star performer in motion picture	Yes (multiple)	Yes (multiple)
Ability to help save universe from evil	Proven	Untested

Table 1. Despite surface differences (e.g., one is real, the other fictional), P3D and C3PO actually share many features in common, so it's not as difficult as you might think to "confuse" the two.

Two of our tour guides: on left is lab volunteer Rick Leon, KA1RHL; on right is P3D Integration Lab Manager Lou McFadin, W5DID.

A "Phased Array" of Satellites

What's in a name? And why did the folks at AMSAT come up with the totally nondescript name of "Phase 3D" for the most sophisticated amateur satellite ever built? Actually, the name goes all the way back to the earliest days of the amateur satellite program, when planners foresaw five "phases" of satellite construction, leading up to ham satellites in orbit around the moon or another planet!

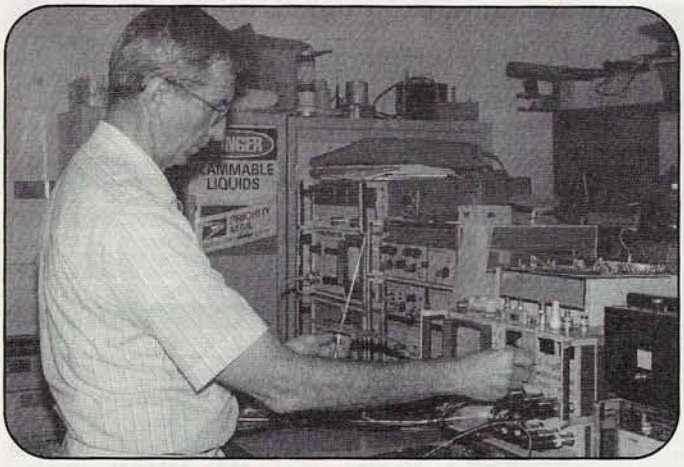
Phase 1 satellites were the early experimental "birds" that did not support two-way communications. Phase 2 satellites are in low-earth orbits, and include not only the early OSCARs (Orbiting Satellite Carrying Amateur Radio) 6 to 8, but also the current generation of low-orbit analog and digital satellites. These satellites have several brief (15-minute) passes each day over most locations on Earth.

Phase 3 satellites are designed for high-altitude elliptical orbits, providing lengthy passes and "footprints" (coverage areas) that cover up to half the globe. Phase 3A never reached orbit; the rocket on which it was launched failed soon after liftoff in 1980 and crashed into the ocean. Phase 3B was orbited successfully in 1983 and was renamed AMSAT-OSCAR-10, a satellite which is still in service today. Phase 3C was also successfully launched, in 1988, and was renamed AMSAT-OSCAR-13. It was the workhorse of long-haul amateur satellite communication until it reentered the atmosphere prematurely in late 1996. That brings us to the fourth Phase 3 satellite, Phase 3D, which is ready and waiting for an invitation to launch.

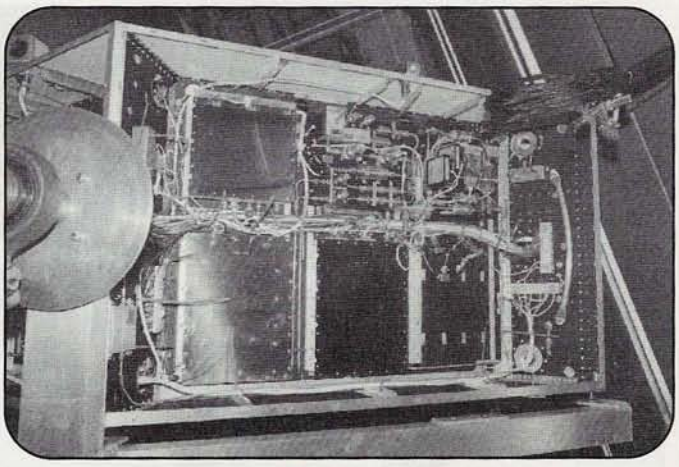
What about Phases 4 and 5? Phase 4 satellites would be launched into geostationary (appearing to remain in one spot in the sky at all times) or "drifting geostationary" orbit. OSCAR IV, launched back in 1965, was supposed to be in a drifting geostationary orbit, at a constant altitude of some 21,000 miles and drifting about 30 degrees per day. But a failure in the third stage of its launch vehicle deposited the satellite in a far different orbit and it operated only briefly—but long enough to support the first-ever direct satellite contact between the U.S. and the Soviet Union. To date, no other Phase 4 satellites have been planned or built, for a variety of reasons. But they continue to be discussed at "what shall we do next" meetings?

Finally, Phase 5 envisions ham satellites in orbit around the moon (or on the moon) or another planet, such as Mars. The closest we've come to this so far is the 70-centimeter transmitter on the Mars Global Surveyor satellite that was successfully monitored by many hams back on Earth.

(Source: Davidoff, Martin, K2UBC, The Radio Amateur's Satellite Handbook, *ARRL, 1998)*

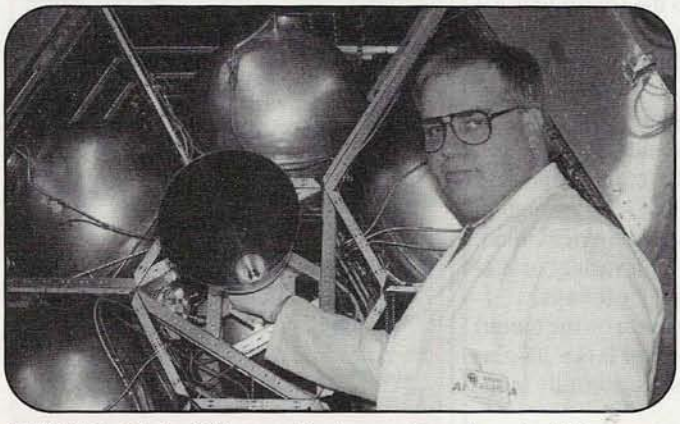


Tour guide #3: AMSAT-NA Engineering Vice President Stan Wood, WA4NFY. Here, Stan is at the lab's RF test bench, working on an antenna. Much of the test equipment has been donated.

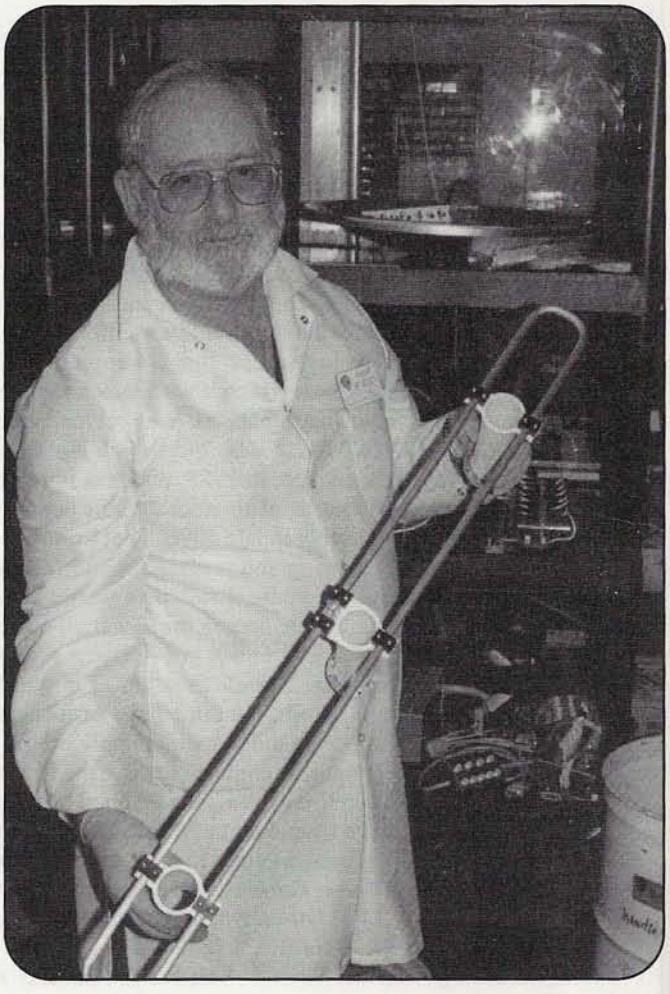


One of P3D's six equipment bays. Each metal enclosure contains some component of the satellite's communication and control systems, including receivers, transmitters, the SCOPE camera, and various circuits to control which frequencies are active and to monitor incoming signals and the satellite's internal conditions. Each bay will be sealed with a cover topped by a solar panel. Additional solar panels will be unfurled in orbit to provide a steady supply of energy for the spacecraft when it is in sunlight.

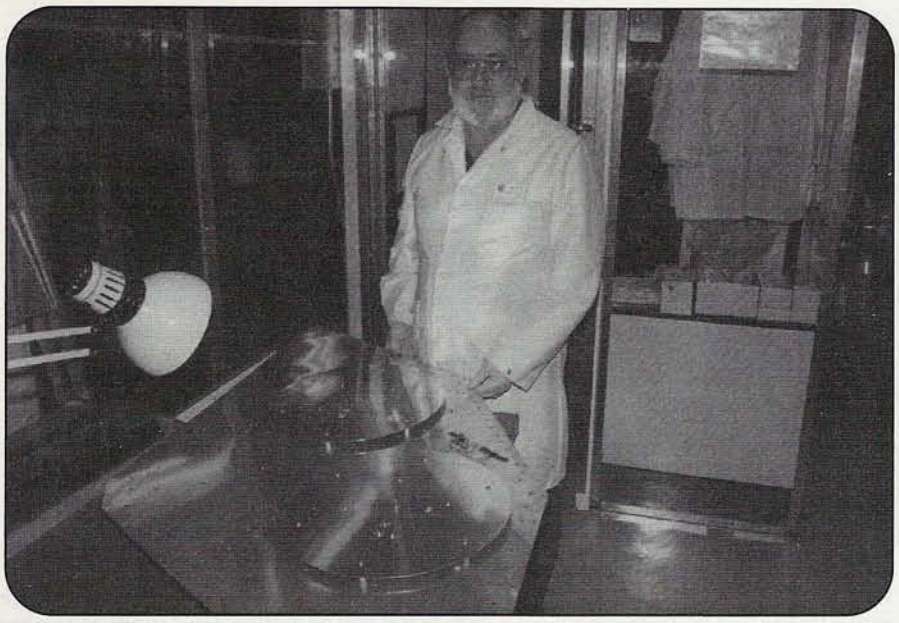
Rick Leon, KA1RHL, holds P3D's motor, which will propel the satellite to its final orbit and later be used for minor orbital adjustments. Behind the motor (mounted in the satellite beneath red plastic caps) are two of P3D's horn antennas for microwave frequencies. The white lab coats are necessary, by the way, for anyone entering the satellite's "clean room" and gloves must be worn in order to touch the satellite or any part of it.



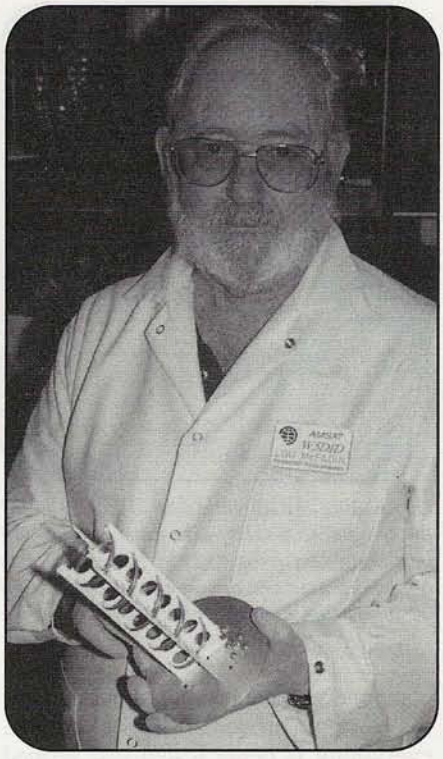
KA1RHL holds the P3D motor in place to show where it will be mounted on the satellite. The round tanks surrounding the motor will hold fuel for maneuvering the spacecraft in orbit.



Lou McFadin, W5DID, holds the satellite's V-band (2-meter) antenna.



W5DID shows us P3D's two U-band (70-centimeter) patch antennas. They are mounted on one of the panels that will eventually cover the top and bottom of the satellite.



W5DID with the satellite's S-Band (2.4 GHz) helix antenna. This will be used when the satellite is relatively close to Earth on its orbital track.

Table 2. Phase 3D Bands of Operation

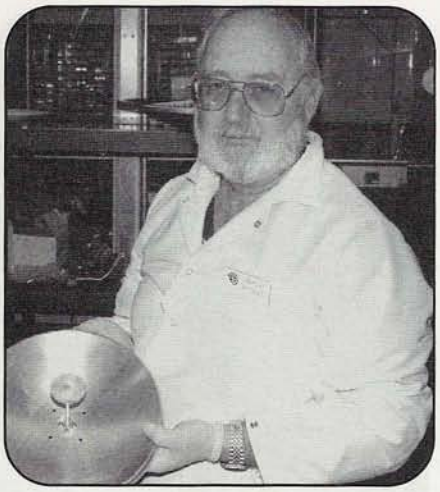
Band (Mode) Designator	Band in Meters/ Centimeters	Band in Frequency	Uplink	Downlink
H	15 meters	21 MHz	Yes	No
(None)	12 meters	24 MHz	Yes	No
V	2 meters	145 MHz	Yes	Yes
U	70 centimeters	435 MHz	Yes	Yes
L	23 centimeters	1269 MHz	Yes	No
S	13 centimeters	2.4 GHz	Yes	Yes
C	6 centimeters	5.6 GHz	Yes	No
X	3 centimeters	10 GHz	No	Yes
K	1.5 centimeters	24 GHz	No	Yes

Table 2. A wider-than-ever choice of operating frequencies is planned for Phase 3D once it reaches orbit, and a unique matrix aboard the spacecraft will allow ground controllers to select any combination of uplink (where you transmit) and downlink (where you receive) bands, except that no band may be used simultaneously for uplink and downlink. The greatest amount of frequency space will be available on the microwave bands. (Courtesy AMSAT-NA)

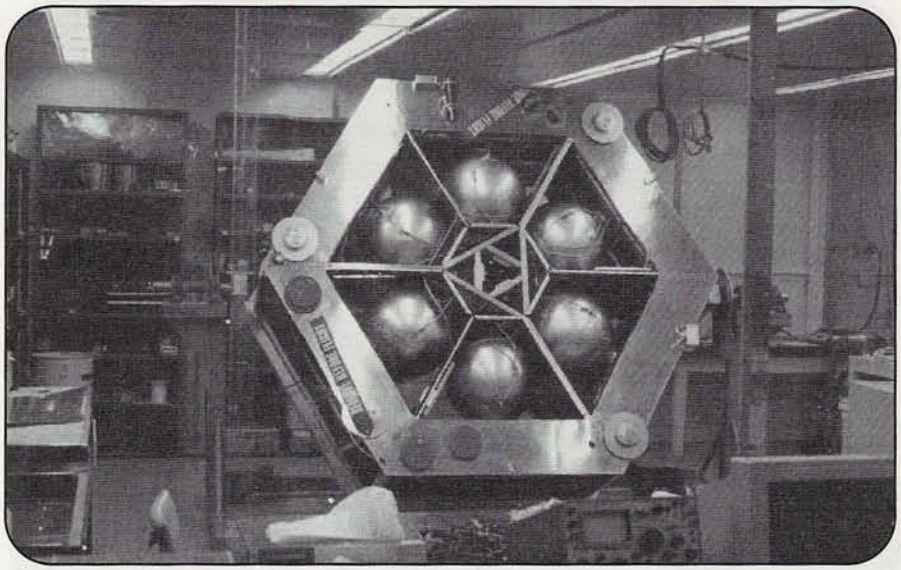
Here, W5DID is holding P3D's high-gain S-band dish antenna. This will be used for 13-centimeter communication when the satellite is in the portion of its orbit that is farther from the Earth.

you use for communicating. Most of us never get the opportunity to actually see one "up close and personal," unless we've taken the initiative to volunteer on a satellite project. I hadn't, so I jumped at the chance earlier this year to see P3D, formally known as Phase 3D (see "A 'Phased Array' of Satellites" for an explanation of the name) up close when I went to Florida for the Orlando Hamcation.

CQ VHF Advertising Manager Arnie Sposato, N2IQO, and I visited the satellite at its temporary home, the Phase 3D Integration Lab in Orlando. This is where all of the satellite's many systems and



Completing the antenna tour, W5DID holds the C-band (5.6-GHz) dish antenna that will be mounted on the spacecraft. Not included in our photo tour are the antennas for 15- and 12-meter uplinks, or for 10- and 24-GHz downlinks.



Wide view of the P3D satellite in its glass-enclosed "clean room." It is mounted on a huge rotisserie bar (not the technical name for it) so that it may be easily rotated to any convenient position for access.

components have been brought together into a single spacecraft, and it's where everything is being tested and refined while waiting for a launch date.

Arnie and I were welcomed and given the grand tour by Lab Manager Lou McFadin, W5DID; AMSAT-NA Engineering Vice President Stan Wood, WA4NFY; and P3D lab volunteer Rick Leon, KA1RHL. Rather than writing a few thousand words about what we saw, I thought I'd let the pictures do most of the talking. With thanks to AMSAT and the P3D Integration Lab team for letting us visit and take pictures, we're pleased to share a little bit of what Arnie and I saw on our Orlando visit with P3D...or was it C3PO? ■

Line of Sight *(from page 5)*

ment. Intolerable on-air behavior, both on HF and VHF, is now being dealt with decisively. Licenses are being pulled, operating privileges are being restricted, and the word is going forth from Gettysburg: "We're listening. Behave yourselves. Or else."

Our Special Focus

This convergence of VHF and HF is made clear in the articles we've chosen for this month's Special Focus on the VHF-HF connection. First, there's Ken Neubeck's feature on 10 and 6 meters as "sister bands," showing 6-meter operators how to use 10-meter band conditions to predict openings on six. Plus, Ken's "Magic Band Chronicles" this month looks at where the 6-meter bigwigs hang out when the Magic Band isn't open—yep, on 10 meters, on the "6-meter liaison frequency" of 28.885 MHz. (This isn't our first visit to 10 meters. Back in November of 1997, Arnie Coro, CO2KK, wrote about the VHF characteristics of 10 meters, and showed how 6-meter operating skills could be of benefit to the 10-meter operator.)

Next, we have two *CQ VHF* reviews. First, WB6NOA looks at Alinco's DR-M03, a 10-meter FM rig. What could be a better introduction to HF for a newly minted General than 10-meter FM? With the familiarity of FM and repeaters, of "splits" and CTCSS tones, a 2-meter FM operator will feel much more at home here than someone tuning up from 20 meters. Yet, there's the DX allure of 10 meters in a rising sunspot cycle. Here are repeaters on which you can make contacts across the ocean instead of across town. It's a natural extension from VHF. That line is getting blurrier all the time. Second, Simon Lewis, GM4PLM, reviews the Elecraft K2, an HF transceiver kit that's designed for operation in the field—and that can serve as an ideal IF rig for VHF transverters. In fact, Simon says the folks at Elecraft are working on transverter boards you can pop right inside the radio's case, and they'll even read out the correct frequency on the front panel.

Our Ulterior Motive

So why are we doing this? Do we want you to think about operating HF? You bet; it's fun. Do we want you to give up VHF in the process? No way; it's fun, too. Do we want HF operators to seek new challenges on VHF? Absolutely. Do we want to encourage you to get the most you can out of your ham radio hobby? That's the key, folks. That's our "ulterior motive." And the best part of it all is that you no longer have to choose between VHF and HF. You *can* have your cake and eat it, too.

So, if you're an FM operator looking to expand your horizons, or if you're looking for a construction challenge that can produce a field-portable HF/VHF transceiver, this month's issue has got you covered...along with a close-up look at the Phase 3D satellite and some tips about contacting hams in space. About the only thing we can't offer this month is a reason to block out half of ham radio from your "line of sight." ■

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.

ARRL UHF Contest Aug. 7–8, 1999

If 6 and 2 meters are too much like "DC" to you, then the ARRL's UHF contest, for 222 MHz and above, might be just what you're looking for.

Here are the complete rules for the 1999 ARRL UHF Contest, courtesy of the ARRL Contest Branch:

1. Object: To work as many amateur stations in as many 2 degrees by 1 degrees grid squares as possible using authorized amateur frequencies above 222 MHz and all authorized modes of emission.

2. Date and Contest Period: First full weekend of August. Begins 1800 UTC Saturday, ends 1800 UTC Sunday (August 7–8, 1999). Entrants may use as much of this time as they wish.

3. Entry Categories:

3.1. Single Operator.

3.2. Rover.

3.3. Multioperator.

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

4.1. Exchange of signal report is optional.

5. Scoring:

5.1. QSO points:

5.1.1. Count three points for each complete 222- or 432-MHz QSO.

5.1.2. Count six points for each complete 902- or 1296-MHz QSO.

5.1.3. Count 12 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 by 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. Example: W1AW works W3CCX in FN20 on 222, 432 and 1296 MHz. This gives W1AW 12 QSO points (3 + 3 + 6) and also three grid-square multipliers. Final score is 12 QSO points X 3 multipliers, or 36.

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. Partial QSOs do not count. Both calls, the full exchange and acknowledgment must be sent and received.

6.2. A transmitter, receiver or antenna used to contact one or more stations under one callsign may not be used subsequently during the contest period under any other callsign (with the exception of family stations). The intent of this rule is to accommodate family members who must share a rig, not to manufacture artificial contacts.

6.3. All equipment and antennas used by entrants must be owned and operated by amateurs. Use of non-amateur-owned gear is not prohibited, but use of such equipment places the entrant in a separate category, ineligible for awards.

6.4. Contacts made by retransmitting either or both stations, whether by satellite or terrestrial means, are prohibited. Frequencies regularly occupied by a repeater in a locality may not be used for contest work, even if the repeater is turned off.

7. Awards: Certificates will be awarded in the following categories:

7.1. Top single-operator score in each ARRL Division.

7.2. Top single operator on each band (222, 432, 902, 1296 and 2304-and-up categories) in each ARRL Division where significant effort or competition is evidenced. (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 achievement stickers.) For example, if K2SMN has the highest single-operator multiband score in the Atlantic Division and his 432-MHz score is higher than any other Atlantic Division single-operator's, he will earn both a certificate for being the single-operator Division leader and an endorsement sticker for 432 MHz.

7.3. Top multioperator score in each ARRL Division where significant effort or competition is evidenced. (Multioperator entries are not eligible for single-band awards.)

7.4. Additional certificates, such as for Novices, may be awarded where significant effort or competition is evidenced.

8. Other: See General Rules for All ARRL Contests and General Rules for ARRL Contests on band above 50 MHz (VHF). ■

SAREX Flies Again

If all goes according to plan, you'll soon have another opportunity to chat on 2 meters with a ham astronaut in orbit on the space shuttle. KC4YER has tips on making contact.

By Philip Chien, KC4YER*
(pchien@digital.net)

Hams will soon get their first opportunity since 1997 to contact NASA astronauts in orbit on the space shuttle. SAREX (Space Amateur Radio EXperiment) will fly on the STS-93 shuttle flight. The question is when STS-93 will fly.

While currently scheduled for a mid-July launch (around the time you receive this issue), this mission has already had more delays than any other shuttle flight due to problems with its primary payload, the $1.5-billion *Advanced X-ray Facility* (AXAF), a large astronomical telescope.

As we go to press, an investigation is being completed on the *Inertial Upper Stage* (IUS), the two-stage rocket which will thrust AXAF from the shuttle's orbit up to its operational orbit. On its previous flight on a Titan IVB rocket, the IUS's two stages failed to separate, leaving a military monitoring satellite in an incorrect orbit, and everybody wants to make sure that similar problems don't occur with the IUS scheduled to fly with AXAF. Currently, the STS-93 mission is scheduled for launch no earlier than July 22 and NASA considers that date "under review" and subject to additional slips—maybe even until next year.

A Long SAREX Drought

There hasn't been a SAREX flight since 1997. In fact, 1998 marked the only calendar year without any amateur radio activities aboard the shuttle since the shuttle started flying amateur radio on a regular basis in 1990.

Philip Chien, KC4YER, writes regularly about NASA and space flight. This is his second article for CQ VHF.

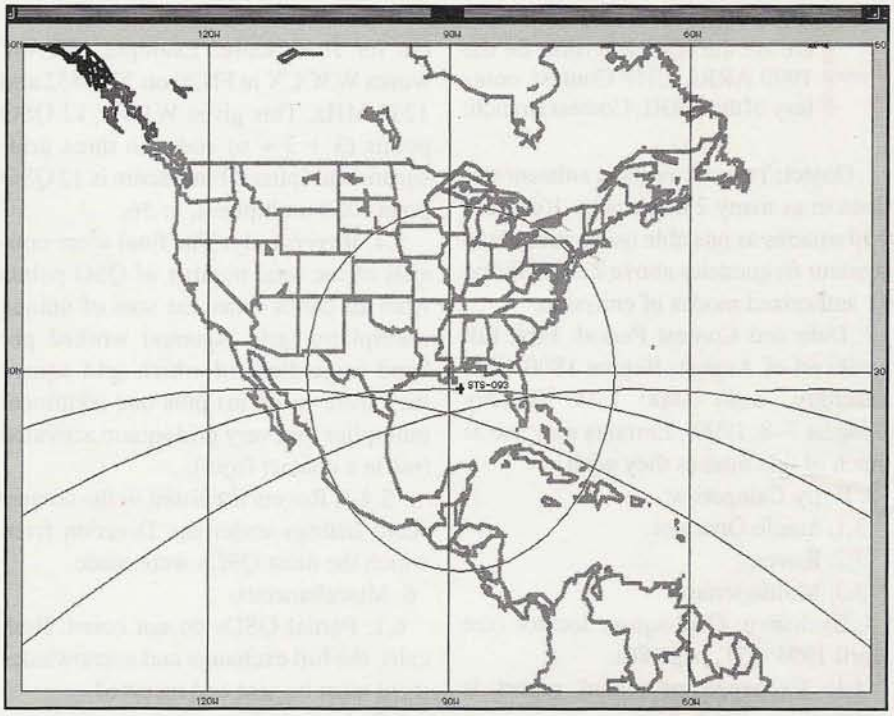


Figure. A typical low-inclination shuttle orbit over the U.S. While the shuttle itself never travels farther north than its launch site, its "visibility circle" includes some of the most heavily populated parts of the U.S. In theory, any ham within that circle could get through to the shuttle at that moment.

SAREX had been scheduled for the STS-95 mission last October. Unfortunately, that mission was overshadowed by the addition of former astronaut and Senator John Glenn (D-Ohio). NASA decided to remove SAREX, fearing that the school contacts would be more "publicity stunts" than true educational activities. And it's certainly understandable—imagine a school contact with local press pressuring students to ask about what John Glenn was doing on the shuttle instead of letting the students learn about the mission. Or a student's disappointment at "only" getting to talk to a full-time astronaut instead of the highly-visible national hero. When NASA made the decision to remove SAREX, five schools had been tentatively scheduled for STS-95 and had to be bumped to later slots.

SAREX has been flying less often for many reasons, including a lower shuttle flight rate and the construction of the International Space Station (ISS). The SAREX Working Group, the official ham radio/NASA coordinating group, has decided to concentrate on preparing for amateur radio operations aboard the ISS.

Table. Abbreviated STS-93 Flight Plan

Date/Time (UTC)	MET	Event
Jul-22/04:28	00/00:00	Launch
Jul-22/04:37	00/00:09	Main engine cutoff
Jul-22/11:45	00/07:17	AXAF deploy
Jul-22/15:28	00/11:00	Crew sleep begins
Jul-22/23:28	00/19:00	Crew wakeup
Jul-23/03:43	00/23:15	SAREX Setup
Jul-23/14:28	01/10:00	Crew sleep begins
Jul-23/22:28	01/18:00	Crew wakeup
Jul-24/13:28	02/09:00	Crew sleep begins
Jul-24/21:28	02/17:00	Crew wakeup
Jul-25/12:28	03/08:00	Crew sleep begins
Jul-25/20:28	03/16:00	Crew wakeup
Jul-26/05:28	04/01:00	SAREX Stow
Jul-26/11:28	04/07:00	Crew sleep begins
Jul-26/19:28	04/15:00	Crew wakeup
Jul-27/02:35	04/22:07	Deorbit ignition
Jul-27/03:35	04/23:07	Landing

Table. Abbreviated STS-93 flight plan. Mission Elapsed Time (MET) is in days/hours: minutes and is computed as time since launch. Presleep is the two-hour period before crew sleep begins; postsleep is the two hours after crew wakeup. Note that all times are based on a nominal (on-time and problem-free) launch and mission and are subject to change before and during the mission.

Unfortunately, the decision to concentrate on the ISS's ham shack has resulted in passing over several shuttle flights that would have otherwise been suitable for ham activity. With the delays in the space station construction schedule, this has resulted in no SAREX flights in over a year, and many SAREX enthusiasts have lost interest.

As a substitute, school contacts are being made via shortwave on 20 meters, with an astronaut sitting at the Johnson Space Center's (JSC) W5RRR ham shack in Houston, Texas. If the astronaut is unlicensed or doesn't have 20-meter privileges, then an HF-licensed ham from the JSC ham club acts as a control operator. In the past, SAREX astronaut Jay Apt, N5QWL, had made similar contacts on his own, but it's now being done formally by the SAREX Working Group.

It's not quite as good as talking to an astronaut who's actually in space, but the students at participating schools are still extremely excited to talk to an astronaut...even rookie astronauts who can't yet answer their standard question, "What's it like to fly in space?" Their usual response is: "I don't know yet, ask me after I've flown."

So everybody's anxious for a good SAREX mission on STS-93. Three of the five astronauts have ham radio licenses: Eileen Collins, KD5EDS, Michel Tognini, KD5EJZ, and Cady Coleman, KC5ZTH. The other members of the crew are Jeff Ashby and Steve Hawley.

The STS-93 Mission and Crew

While the media attention won't be as great as it was for Senator Glenn's flight, the STS-93 mission will set many important records. Eileen Collins is the first female shuttle commander; this will be the heaviest shuttle launch ever; the last time a shuttle is launched just to deploy a major satellite; and, probably most importantly for hams, the first flight on which the licensed female astronauts outnumber the males! Unfortunately it's also the shortest planned SAREX flight. The crew should deploy AXAF on the first flight day, leaving the rest of the mission free for amateur radio and other experiments (the Table shows a summary of the major mission events). But it's only scheduled as a five-day flight, with only three days available for hamming.

Eileen Collins was the first woman to attend the prestigious Air Force Test Pilot School. Before that, she had earned several thousand hours of flight experience in a variety of Air Force aircraft, including missions to Grenada. In 1990, she was selected as the first female pilot astronaut. Her first spaceflight was the STS-63 mission in February, 1995, which approached the Mir space station as a dress rehearsal for the upcoming docking flights. When she backed *Discovery* away from Mir, it was the first time the shuttle flew with a woman at the controls. Shortly after the mission, Eileen found herself off flight status—not for a disciplinary reason, but because she was pregnant. So her second flight was delayed by about a year. That flight took her back to Mir, the STS-84 mission in May, 1997, which marked the fifth time the shuttle docked with Mir. In January, 1998, it was announced at a White House ceremony that Eileen would command the STS-93 mission.

Cady Coleman was the first female astronaut with a Ph.D. on military duty to fly in space. So her full title is Dr. Cady Coleman, Major, USAF. Before becoming an astronaut, Cady was a materials scientist. Her first spaceflight was the 16-day STS-73 microgravity mission in October, 1995. In addition, she was the backup astronaut for the STS-83 mission, for which there was a possibility that another astronaut might not recover in time from a broken foot.

Michel Tognini is a French astronaut. He flew a two-week mission to Mir in 1992, so technically he isn't a rookie, even though this is his first shuttle flight. While on Mir, he used the callsign F5MIR. In 1995, NASA agreed to add two French astronauts who had flown to Mir to the incoming astronaut class, to help gain additional experience about working with the Russian space agency. So it seems strange that Michel didn't fly on one of the shuttle-Mir flights.

Making SAREX Contacts

Columbia will be launched due east from the Kennedy Space Center to maximize the shuttle's performance. This results in an orbit which "hugs" the equator and travels no further north than the launch site (28.5 degrees latitude). With a "low-inclination" mission, hams at higher latitudes will see the shuttle at low elevations and for shorter periods. Still, if you don't try, you definitely won't get through. On a similar altitude low-inclination flight, hams in New Jersey, Illinois, Vermont, and Long Island suc-

cessfully contacted the shuttle even though it was extremely low on the horizon. The Figure shows a typical orbit over the U.S. along with the shuttle's "visibility circle." In theory, any ham within that circle could get through to the shuttle at that moment.

The purpose of SAREX is education—period. Five schools have prescheduled contacts for this flight: Memorial Middle School in Pharr, Texas; Ponaganset Middle School in North Scituate, Rhode Island; Awty International School in Houston, Texas; Buzz Aldrin Elementary in Reston, Virginia; and Osceola Elementary School in Ormond Beach, Florida. Schools submit applications for educational contacts and it can take several years before they're selected due to the limited flight opportunities. In addition, the astronauts may choose to make random contacts with hams around the world if they have time.

It sounds unbelievable but you can really hear SAREX transmissions on a handheld radio with a rubber-duck antenna. I was astonished the first time I heard astronaut Bill McArthur, KC5ACR, working several stations and coming in on my handheld—especially after I calculated that he was over 1,000 miles away! The SAREX radio is low-power and uses an inside antenna, but it has incredible range (in space, there's never an obstruction and line-of-sight really does mean line-of-sight!). So even if you don't have a high-power setup, it's quite easy to listen to the shuttle's transmissions. Theoretically, you can also *talk* to the shuttle via a handheld and rubber duck, but only if there's no competition from other stations with stronger signals.

Certainly, the hams with the highest power transceivers and directional computer-controlled antennas will have the best chances of getting through. It's difficult to compete with an EME (moonbounce) station! However, you don't need a lot of power or even directional antennas to get through. I've successfully contacted the shuttle using a 45-watt mobile radio with a mag-mount antenna, and some lucky folks have gotten through with nothing more than a 5-watt handheld with a quarter-wave antenna. What you do need is persistence—try every time the shuttle's over your horizon.

Assuming you have a decent signal, it really isn't very difficult to make a contact if you follow the procedures properly. Listen to the 145.550-MHz downlink frequency. NEVER transmit on 145.550 when the shuttle's over your horizon. The shuttle will *never* monitor 145.550, so you'll only interfere with other hams trying to make contact.

If you hear packet, then set up your computer and packet modem to transmit on 144.490 MHz and receive on 145.550 MHz The shuttle uses standard 1200-bps AFSK AX.25, the same protocol used for terrestrial low-speed packet, chosen to make it accessible to as many hams as possible. Set up your packet program normally and connect to W5RRR-1. If your signal makes it through, the shuttle it will

Contacts by the Numbers

As we go to press (mid-June), NASA is targeting Columbia's launch for July 22 at 12:28 a.m. EDT (04:28 UTC). This is a relatively short shuttle mission, with landing scheduled on July 26 at 11:35 p.m. EDT. The crew should set up the SAREX rig about 23 hours after launch, and will put it away only three days later. If weather or technical problems keep the shuttle in orbit an additional day, the crew will have the option to take out the SAREX rig for random contacts during their extended mission.

Below are the predicted Keplerian elements, based on a launch on the previously scheduled July 9th launch date. These were generated by Gil Carman, WA5NOM, an engineer at the JSC and member of the SAREX team. While they're out-of-date, you can still use them to predict when passes will occur on a nominal (problem-free) mission, based on the amount of time since launch (Mission Elapsed Time, or MET). Note that dummy serial numbers are used since the real ones won't be known until after the launch actually occurs.

To bring these numbers up to date, just add in the amount of time from the original July 9, 12:19 a.m. EDT (04:19:00 UTC) launch date, for which these Keplerian elements were calculated, to the actual launch time. For example, a launch on July 22 at 12:28 a.m. EDT is a 13-day, 9-minute slip from the numbers generated by these elements.

The actual Keplerian elements, generated by data collected by radar tracking stations around the world, are posted to the NASA Shuttle Web site, <http://shuttle.nasa.gov/realdata/elements/index.html>, on a regular basis during the mission. (*For more about Keplerian elements, see this month's "Orbital Elements" column.—ed.*)

STS-093 Prelaunch Element Sets

Launch is on July 9 at 05:19:00 UTC, and the AXAF/IUS deploy is on orbit 6 at MET 0/07:17. The OMS-3 burn is at MET 0/07:32, raising apogee by 17 nm. The OMS-4 burn is on orbit 17 at MET 1/00:10, lowering apogee by 13 nm. The deorbit burn is on orbit 79 at MET 4/22:05.

JSC-001 (OMS-2 C/O)
Valid from 09-Jul-1999 06:02:19 UTC to 09-Jul-1999 12:52:05 UTC
(MET 00/00:43:19 to MET 00/07:33:05)
1 99093U 99190.27170527 .00468800 00000-0 10318-2 0 14
2 99093 28.4685 196.6233 0003157 298.3521 61.6958 15.94953184 27

JSC-002 (OMS-3)
Valid from 09-Jul-1999 12:52:05 UTC to 10-Jul-1999 05:29:26 UTC
(MET 00/07:33:05 to MET 01/00:10:26)
1 99093U 99190.64751749 .00237949 00000-0 75241-3 0 22
2 99093 28.4705 193.8100 0022232 83.1749 277.1572 15.89280656 82

JSC-003 (OMS-4)
Valid from 10-Jul-1999 05:29:26 UTC to 14-Jul-1999 03:24:00 UTC
(MET 01/00:10:26 to MET 04/22:05:00)
1 99093U 99191.27519200 .00098456 00000-0 25731-3 0 34
2 99093 28.4729 189.1194 0004759 88.5758 271.5576 15.93419322 184

Deorbit: 14-Jul-1999 03:24 UTC (orbit 79) MET 04/22:05
Landing: 14-Jul-1999 04:25 UTC (orbit 80) MET 04/23:06

respond with your callsign and a serial number. Please disconnect and don't try to make additional contacts after getting your serial number; that will only prevent others from getting through.

Obviously, if you hear an astronaut's voice on 145.550, then you shouldn't attempt to make a packet contact. Random voice contacts are a bit more challenging to make than packet. There are literally thousands of hams trying to contact the shuttle when it passes over populated regions. To spread out the load, the SAREX transceiver uses five receive frequencies: 144.910, 144.930, 144.950, 144.970, and 144.990 MHz. Separate uplink frequencies are used for Europe: 144.700, 144.750, and 144.800 MHz. The astronaut will randomly choose a receive frequency. Your chances of getting through depend first on luck in selecting the correct uplink frequency. The astronauts are told that, if a particular frequency becomes too crowded, they should switch to another—without announcing the change. Then another set of hams will have the opportunity to try to get through.

You should just transmit your callsign, clearly and using standard phonetics. Do not constantly transmit your call; instead, listen to see if the astronaut heard you. The astronauts will acknowledge callsigns heard and may occasionally ask for a clarification (e.g. "KC4 repeat the rest of your callsign"). The astronaut may choose to say "Hi" or chat for a while, but normally they want to give as many hams as possible the opportunity to make contact. Do not attempt to make additional contacts on any given shuttle mission. The time you spend trying to make multiple contacts prevents others from getting through at all.

When to Call

The best opportunities for voice contacts are during the crew's pre-sleep and post-sleep periods where they have the most free time. The crew's schedule is based on the time the shuttle launches. *Presleep*, appropriately, is the two hours before the crew's scheduled sleep time. During this period, the crew will eat dinner, perform personal hygiene, and wind down. *Postsleep* (the two hours starting with the crew's wakeup call) consists of breakfast, hygiene, dressing, and preparing for the day's activities. For STS-93 with a July launch, the crew will be on a nighttime schedule, typically sleeping from roughly 13:28 to 21:18 UTC (9:28 a.m. to 5:28 p.m. Eastern time), providing the best possibilities for contacts during the early-morning and early-evening hours in the eastern and central U.S. time zones.

"To spread out the load, the SAREX transceiver uses five receive frequencies: 144.910, 144.930, 144.950, 144.970, and 144.990 MHz....The astronaut will randomly choose a receive frequency. Your chances of getting through depend first on luck in selecting the correct uplink...."

Why such odd hours? Well, it helps to have the crew awake for important events like launch and landing. Plus, the desired deployment time for the AXAF satellite controls the rest of the mission's events. The first day is an extremely long one for the crew, with an early wakeup, launch, reconfiguring the shuttle for on-orbit operations, and deploying the AXAF spacecraft out of the shuttle's cargo bay. It isn't until after a good night's sleep that they'll get around to starting their secondary experiments, including SAREX.

Patience, Please

None of the crew members has any serious contesting or DXing experience (and this is the ultimate pileup), so be patient. Let *them* control the pace... remember, they're the hams in the unique location whom everybody wants to contact. This is standard DX practice—let the DX station set the pace.

If you succeed, you can get a souvenir QSL postcard. You should send reports to ARRL EAD, STS-93 QSL, 225 Main Street, Newington, CT 06111-1494, USA. Include the following information: STS-93, date, time in UTC, frequency, and mode (voice or packet). You must include a business-sized SASE (self-addressed stamped envelope) to receive a card. Be patient. The QSLs are processed by volunteers and it can take several months before they're distributed.

Keep Informed

The June issue of *CQ VHF* featured an article on how to receive NASA TV. A set of news conferences describing the mission's objectives, the AXAF primary payload, and the crew news conference will be scheduled approximately two weeks before the mission. If you can receive NASA TV between shuttle flights (e.g., via C-Band satellite dish or Dish Network), you can watch the briefings along with the media. The schedule for the STS-93 preflight briefings will be posted to the NASA TV Web page <http://www.nasa.gov/ntv/breaking.html> after it's announced.

So, once the shuttle is in orbit, remember to keep one ear tuned to 145.550 MHz, and be prepared to call on one of the uplink frequencies when you hear voices from space. ■

(Not So) Portable Power—Part 3

KF6FGB has shown you how to get more power from your handheld and how to provide hand-carried power for your mobile rig or HT amplifier. Now, he takes you inside the house with a way to stay on the air if the power's out—even if it's not very portable.

By Brent Walton, KF6FGB*
(kf6fgb@pacbell.net)

In the first two parts of this series, I showed how to build 12-volt power supplies that you can carry with you. This month, although sticking with the theme of supplying 12-volt power, I'll discuss a solution that's more stationary. While this solution could be mounted in a van or RV, its primary purpose is to keep you on the air at home in the event of a major power outage.

Fitting Personal Needs

Home requirements for emergency power might vary depending on the equipment being used. I want to be able to make repairs and communicate if ever the power fails. My personal requirements were to be able to power a soldering gun, a couple of power tools and 60-watt light bulbs, my radio and 30-watt linear amplifier—a much different requirement than for my portable setup!

Unlike some people, I don't have a room to dedicate as a "ham shack." Plus, in order to keep peace in my marriage, my ham equipment can't clutter the house. Even though my wife is also a ham, she doesn't like unsightly wires and clutter. So, another requirement was added: it had to look nice, too.

My basic plan was to use a deep-cycle marine gel-cell battery for the 12-volt power. It would be connected to a maintenance charger that would always be hooked up to house current. The battery would supply power to a couple of 12 VDC-to-110 VAC inverters (I chose to use two 300-watt inverters) and to two 12-volt automotive receptacles (i.e. cigarette lighter jacks.)

*Brent Walton, KF6FGB, lives in Pittsburg, California, and likes to combine his two favorite hobbies, bicycling and ham radio.

Photo A. Completed emergency-power cabinet posing as a nightstand. The two 110-volt AC outlets connect to DC-to-AC power inverters inside the stand. The two cigarette-lighter plugs connect directly to the 12-volt gel-cell battery inside. (Photos by the author)

Housing the Supply

I started off trying to design my own cabinet to house my power station. But, as I was pricing lumber at the local hardware store, I noticed a bathroom vanity of about the size I required—for less than $60. I carefully inspected the vanity and decided that, even with the few modifications it would require, it would cost less to buy and modify the vanity than to build the whole thing from scratch (see the completed unit in Photo A).

"My basic plan was to use a deep-cycle marine gel-cell battery for the 12-volt power....The battery would supply power to a couple of 12 VDC-to-110 VAC inverters... and to two 12-volt automotive receptacles (i.e. cigarette lighter jacks.)"

The vanity was designed for use in a small bathroom. It came with a sink (which I simply donated to a local thrift shop) that I replaced with a wood top. The front opened to reveal the empty insides. The back was completely open with a single 1 x 3-inch brace across the center for rigidity. To add rigidity and increase storage space, I added a shelf halfway up (Photo B) to hold battery chargers for my HTs and a nickel cadmium (NiCd) charger for flashlights and to store my mobile rig and linear when they weren't in use. A second shelf was added a few inches down from the top to hold the DC-to-AC power inverters.

On the bottom, I put the main battery, a 35 Amp-Hour (AH) gel-cell that cost me about $80; a 10 A/2 A battery charg-

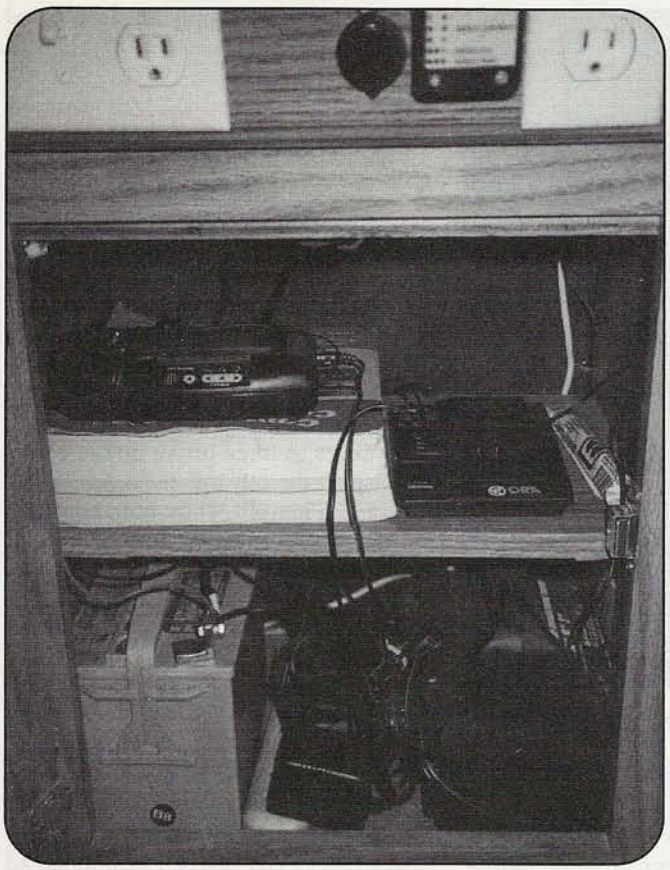


Photo B. Interior of power cabinet, showing added shelf (holding phone book and a couple of battery chargers) and battery/charger underneath.

Photo C. Base of emergency power unit. Deep-cycle marine gel-cell battery is on the left, an AC power distribution strip is in the center, and the 2/10-amp charger is on the right.

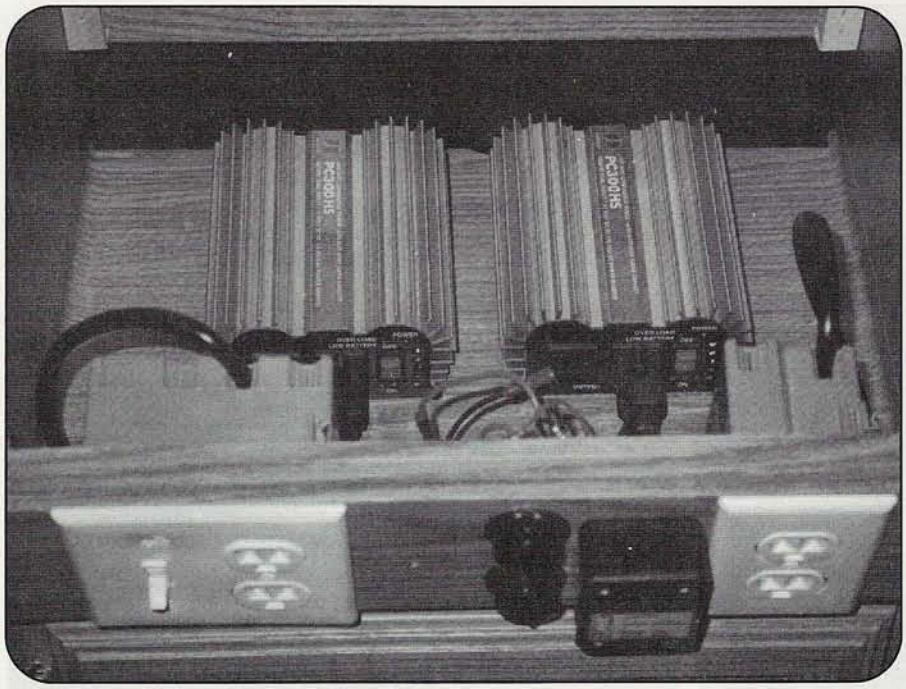


Photo D. The two 300-watt DC-to-AC inverters sit on a second added shelf. They are accessed by removing the wooden top.

er (for the gel-cell, costing about $40) that automatically switches off when the battery reaches full charge and back on when the battery level drops; and a power distribution strip for incoming AC house current (Photo C).

I made the top out of a scrap of plywood and covered it with wood-grain vinyl adhesive, then glued two long strips of $^3/_4$ x $^3/_4$-inch wood to the underside of the top to keep it from sliding around. The top lifts off, revealing a boxed-in area where the two 300-watt inverters are housed (Photo D). These inverters feed two 110-volt AC outlets on the front of the unit—one switched and one non-switched. Normally, I leave the inverters turned off. In the event of a power outage, I simply lift the top and turn them on.

Making the Connections

I hardwired the charger and four cigarette-lighter receptacles to the battery. Two of these receptacles are mounted on the front panel of the unit (Photo E), and the other two are inside the unit, serving as connection points for the two inverters. The power leads for the inverters run down the back of the enclosure (remember, the back of the unit is completely open). Next, I wired the two 110-volt AC receptacles to three-prong power cords, which plug directly into the output of the inverters (Photo F). Thus, both input and output for the inverters are plugged-in rather than hard-wired. I did this for two reasons: 1) safety, and 2) I didn't want to void the warranty of the inverters by hard-wiring something to them. (*As an additional safety measure, you might want to consider adding circuit-breakers between the outlets and the inverters and fusing all of the battery output lines.—ed.*)

To monitor battery level, I picked up a little 3-LED monitor at the local Radio-Shack (see "Parts List"). I then mounted it in a project box and mounted the box on the front of the unit (Photo E). To supply power to the monitor, I drilled a hole through the box into the cabinet, then connected its wires to the +/- leads of the cigarette-lighter receptacles, which are also mounted on the front of the unit (see

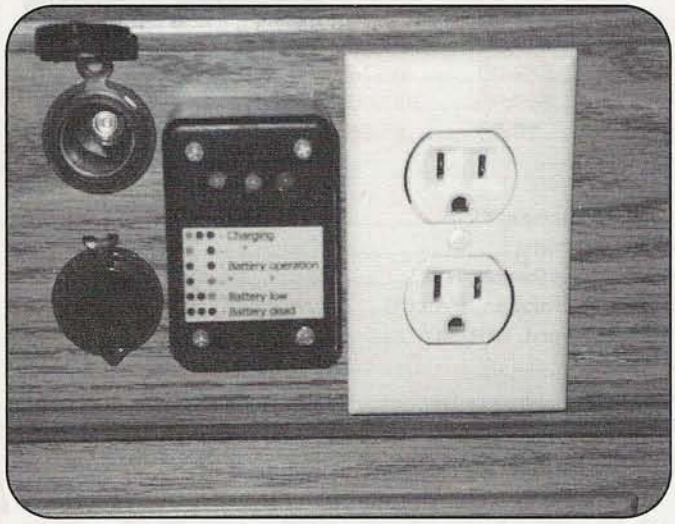


Photo E. LED battery monitor mounted to front of unit. (The chart showing the battery monitor's key was printed on an inkjet printer and then taped to the monitor's box.) Also visible are the two 12-volt cigarette-lighter receptacles that are brought out to the front panel along with the AC outputs from the inverters.

Photo F. Looking down from the top, you can see how the 110-volt AC receptacles plug into the inverters (right of photo), along with the back ends of the 12-volt receptacles with capacitors installed to block 60-cycle "hum."

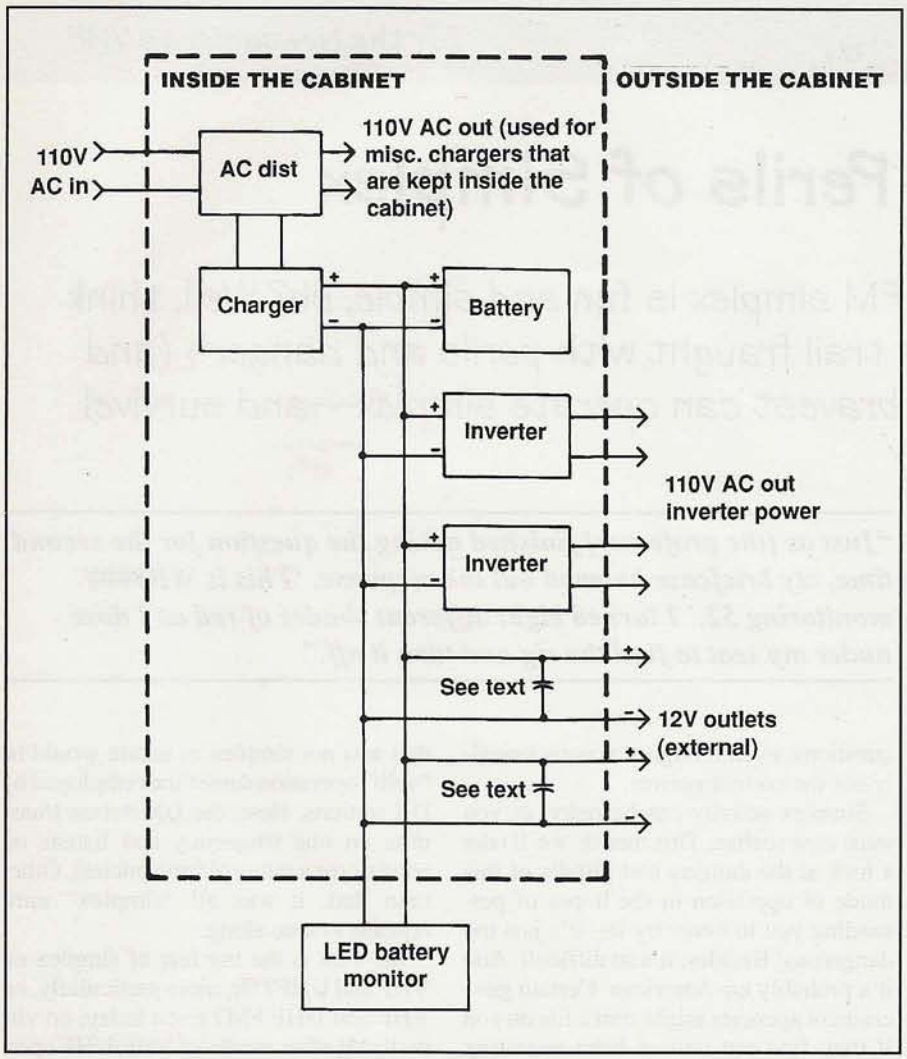


Figure. Block diagram of connections between components of the nightstand backup power unit.

Parts List

1	Bathroom vanity
3	Small sheets of plywood: inside shelf, top shelf (holds the inverters), and top of the cabinet
1	Deep-cycle marine gel-cell battery (30 or more AH)
1	Battery charger
1	DC-AC power inverter(s)
2	110-VAC grounded outlets with face covers
2	Junction boxes to mount the 110-V outlets
1	110-VAC wall switch (optional)
2	Chassis-mount cigarette lighter receptacles (for front panel)
2	Cigarette lighter receptacles with wire leads (for inside)
2	Capacitors (see text) 2200–3500 µF, 25 V or higher
1	4-outlet 110-VAC bus strip (connected to charger and various wall-warts for charging radio and other batteries)
1	12-V battery monitor**

***Unfortunately, RadioShack has discontinued these monitors. I have found similar items, which are both more sophisticated and more expensive, at the following Web sites: <http://d-mail.site.yahoo.net/d-mail/65795.html> and <http://www.pathcom.com/~graftec/prod17.htm>. You might also try checking out your local auto parts store.*

Figure for block diagram). This little unit displays a green LED when charging, yellow when the battery is at charge level, and red when the battery needs charging.

Because the charger I used produced a nasty 60-cycle hum, I connected a couple of large capacitors (2200 µF, 25 V) in parallel to each of the 12-volt receptacles. (see Photo F and the block diagram) You may or may not have to do this. But if you hear a loud hum when you power up your radio while the charger is charging, you'll want to add some capacitors. The larger your battery's capacity, though, the less likely you'll have hum.

Ready for Action

The completed unit now sits next to the bed in the master bedroom, where it doubles as a nightstand. Inside, I keep my NiCd charger, and there's space to stand up my HT and connect it to its charger. Altogether, the unit cost me less than $300 (not counting the radios). If you want larger inverters or a bigger battery, then you'll spend more. A nicer solid wood cabinet will also cost you more.

I may never have to use it. But, as they taught us in Boy Scouts: Be Prepared. ■

The Perils of Simplex

So you think operating FM simplex is fun and simple, eh? Well, think again, says Peter...it's a trail fraught with perils and dangers (and hazards, too)! Only the bravest can operate simplex—and survive!

A long time ago in a state far away...I was in grad school. Living about 10 miles from school, I would drive to a student parking lot, park my car, and catch a bus to campus. One day, I was deep in a conversation on 146.52 when I pulled into the parking lot. The bus was already there and would be departing in a moment. I'd have a 10-minute wait for the next one, and I was late already. This was a time when CB theft was still a major problem, so I yanked my TR-22* out of its bracket, disconnected the "quick connects," and threw it in my briefcase as I made a mad dash for the bus.

I don't know if you've seen the movie "Ferris Bueler's Day Off," but there is a scene in it where Ben Stein plays the role of a boooooorrrrrrring history teacher. I was taking advanced statistics from a character who made Ben Stein look frenetic. The only way you could be sure he wasn't dead was to hold a mirror under his nose and check for fogging. As in the movie, the students were in deep boredom-induced trances and the professor was asking a question and getting no response. Just as he finished asking the question for the second time, my briefcase boomed out the response, "This is WB8### monitoring 52." I turned eight different shades of red as I dove under my seat to find the rig and turn it off. The professor was deliriously happy because someone had finally responded to his questions, even though it was technically not the correct answer.

"Just as [the professor] finished asking the question for the second time, my briefcase boomed out the response, 'This is WB8### monitoring 52.' I turned eight different shades of red as I dove under my seat to find the rig and turn it off."

Simplex activity can be risky, as you must now realize. This month, we'll take a look at the dangers and pitfalls of this mode of operation in the hopes of persuading you to *never* try it—it's just too dangerous! Besides, it's so difficult. And it's probably un-American. Certain government agencies might start a file on you if they find out you've been operating simplex. Simplex operation may be one of the seven deadly warning signals of impending neurosis—or granulated eyelids, at the very least. Plus, it's much more expensive than repeater operation. And it's *not* fun. Besides, I have a bridge in Brooklyn you might be interested in...

What Is "Simplex"?

"Simplex" is a term made popular by the commercial services; it was not until repeater operation became prevalent that most hams ever heard the word. A "simplex" contact was just a contact—the normal, average, typical contact that most hams had, regardless of mode. "Simplex" simply means transmitting and receiving on the same frequency, and that you can't talk and listen at the same time (*many of us have that problem* off *the radio as well!—ed.*). Hams have been operating simplex from the earliest days. In fact, before repeaters, the only contact form that was *not* simplex in nature would be "split" operation sometimes employed by DX stations. Here, the DX station transmits on one frequency and listens on another (or a range of frequencies). Other than that, it was all "simplex" until repeaters came along.

So what is the big fear of simplex on VHF and UHF? Or, more particularly, on VHF and UHF FM? Even today, on virtually all other modes of VHF/UHF operation (except satellites), the contacts are simplex. So, how is it that FM differs from CW and SSB in this respect? Operating simplex is fun and easy. If you have an FM rig, you already have all the equipment you need. There's nothing extra to buy. Unless you happen to live in a box canyon, you'll be able to make a lot of contacts on simplex. And nobody's going to arrest you for it, either!

Getting Started

Never tried simplex? Or never thought about it seriously? I think the easiest way to get started is simply to listen to the input frequency of your local repeater and get an idea of what stations you can hear and what locations that might be dead spots for you. Most modern rigs have a "reverse" switch on them somewhere. Check your owner's manual, but, usually, all you have to do is push that button and it reverses the transmit/receive fre-

*The Drake TR-22 was a 1-watt, crystal-controlled 2-meter FM transceiver and was a very popular "first FM rig" in the 1970s. It could operate mobile—hooked to external power and antenna—or "over-the-shoulder," with its built-in batteries and telescoping whip antenna.

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

"Simplex activity can be risky....Besides, it's so difficult. And it's probably un-American. Certain government agencies might start a file on you if they find out you've been operating simplex."

quencies. When you hear one of your friends on the repeater, just flip the switch and listen for him on the repeater input. If you hear his signal, you can have a simplex contact with him. It's that simple!

Years ago, you could simply get on 146.52 and announce that you were monitoring (as the guy in my briefcase did). In most parts of the country, you had a pretty good chance of making a contact. That no longer seems to be the case. I can't recall when I had a contact that *began* on 146.52 or any other simplex frequency. The easy way to do it today is to make contact on your local repeater and then move to a simplex frequency. If you've been listening to the input for a few days, you should have a good idea of who you can hear and who's out of range. To start with, pick stations that are solidly in range. After exchanging pleasantries, just say something like this to the other station: "Hey, I want to do a little experimenting. Let's move over to 146.52 simplex" (or whatever other frequency you want to use).

Some stations will go along with you and some will not—you know, it is sooooo dangerous "over there" and *they* might come and get you for it! Also, it's expensive, remember? What if it doesn't work? Maybe it's illegal. You aren't some sort of Communist, are you?

But, once you're there, it's just a simple matter of one station calling the other, and away you go. If you're really unsure of yourself, arrange who'll call whom before you leave the repeater. Honest, I've heard two stations almost miss each other because each was waiting for the other to make the first call. Somewhat more rare are those times when both stations call simultaneously and neither realizes he doubled with the other. Arranging ahead of time who'll call whom takes care of these problems. All you need to do is add, "I'll call you" to the little speech outlined above. That way, you know to call as soon as you get there, and the other station knows to listen for you.

Also, once you've moved to simplex a few times with another station, you can shorten the whole setup conversation to something on the order of "Let's go to 52. Call me." Or "Let's go to 52. I'll call you." *This ain't rocket science.* However, until you've established the pattern with the other station, you'd better use the long form. There are too many hams today who just wouldn't know what you are talking about.

A Simplex Contact

The typical simplex contact will go pretty much like a contact on a repeater. Each of you takes turns talking, and you identify every 10 minutes. The big differences are that there are no relays to reset and there are no courtesy beeps. You're on your own, which means that the exchanges can be rapid fire if both parties are interested in operating this way. There's also no timer on simplex. So you could, in theory, talk non-stop for an hour if you wanted to (as long as you ID every 10 minutes and your friend hasn't fallen asleep). However, you may find that other curious souls begin to float along with you. So you'll probably want to keep your transmissions reasonably short and leave enough time between exchanges to allow another station to break in.

If both stations are at fixed locations, then you probably won't experience much change in signal strength. You can stay on frequency as long as you want. But if one station is mobile, then chances are that, sooner or later, that station will go out of range. Again, you can plan ahead with, "if we lose it here, just pop back over to the repeater," or something like that.

I can't tell you what kind of range you'll have, but it probably is more than you think. Years ago, when I was in Army MARS in Connecticut, we had a simplex net that operated just below the 2-meter band, on 143 MHz. I was really surprised at just how many of the other stations I could hear directly. There were a few whom the net control could hear that I couldn't, but not many. The deciding factor was the terrain.

The height of your antenna is critical for successful simplex operating, especially if the other station is not real close by. As I've mentioned here before, one of the most dramatic examples of the range of a simplex contact was when Roy Neal, K6DUE, listened to Owen Garriott, W5LFL, making the first contacts from space on board the space shuttle Columbia. Owen was 150 miles above the Pacific Northwest coast and Roy was on the sixth floor of a hotel in Houston. If you have a 150-mile-high tower, you can expect that kind of range with a 5-watt rig and a rubber duck! Chances are your tower/antenna is a little shorter than that, and so your range will be somewhat less as well.

Antennas and Amplifiers

Will a beam antenna help? Maybe. If you're talking about two fixed stations on each other's fringe, then a beam will definitely make a big difference. Just remember that a beam antenna takes the signal that would normally radiate in a full circle (360 degrees) from around your antenna and focuses it, ideally, in one direction. In short, your station (ideally) becomes deaf and mute in all the directions to which your antenna is *not* pointed.

My opinion is that the best setup is to have both a beam and a good omnidirectional antenna, with a coax switch so that you can jump back and forth as circumstances demand. If you choose this setup, be certain that you buy a good coax switch that's rated for 2-meter operation. Years ago, I tested some inexpensive ones and found that they were fine for HF operation, but at 2 meters they became very reactive and lossy. This advice be-comes even more important if your operation is on 222 MHz or higher. If you can only afford one antenna, or your circumstances limit what you can install, stay with a good omnidirectional antenna.

If you have a 25- to 50-watt base/mobile rig, you probably won't need an amplifier for simplex work. On the other hand, if your only rig is a handheld, then buying a 50– to 100-watt amp is not such a bad idea. Years ago, I knew a group of

" 'Simplex' is a term made popular by the commercial services; it was not until repeater operation became prevalent that most hams ever heard the word. A 'simplex' contact was just a contact—the normal, average, typical contact that most hams had...."

hams in the northeast. These guys were on the road five days a week and lived for simplex operation. Not too surprising, they each had 250-watt amps installed in their trunks.

Unless you're approaching this level of fanaticism, you just don't need that kind of power. Also, you'd start to annoy other hams in your area if you did run that kind of power and your signal was not squeaky clean. Besides, FCC rules require you to use the *minimum* level of power necessary to maintain communications. This is a rule that has not been enforced much in the past, but the whole enforcement scene has changed dramatically in the past few months. Less is more. Don't invite problems.

Frequencies

Throughout this article, I've used 146.52 MHz as "the simplex frequency." But if you pull out your *Repeater Directory* and look at the band plans, you'll find that there are several frequencies listed for simplex operation on each VHF/UHF band. Generally, these are between the frequencies designated for repeater inputs and outputs. Theoretically, 146.52 is the national FM simplex calling frequency. The idea is that you would make contact on 52, and then move to another simplex frequency. Good luck. If you're going to be the icebreaker in your area, move them from the repeater to 52. You'll get less resistance than trying to convince them to go to another simplex frequency. Once they get used to that, then get them to go to 146.55 or something in the 147 or 145 segments.

But be careful. As you continue to branch out to other simplex frequencies, you should check for repeaters on oddball splits. In certain parts of the country, local coordinators have assigned repeaters to some of the frequencies listed in the national band plan for simplex operation. This is their prerogative. If you have one of these setups in your area, you'll want to avoid those frequencies. Again, check your *Repeater Directory* and always listen before transmitting.

"The typical simplex contact will go pretty much like a contact on a repeater. Each of you takes turns talking, and you identify every 10 minutes. The big differences are that there are no relays to reset and there are no courtesy beeps. You're on your own...."

Hidden Dangers

Using relatively unused frequencies can be dangerous, though. Years ago, my ex-wife and I used a simplex frequency that seemed to be totally unused in our area. Over a period of time, we tended to forget that others might be listening in. Of course, someone *was* listening. Hams are *always* listening. And at just the right moment, in front of just the right people, some ham—let's call him Joe—might just repeat the content of one of those conversations. Are there nine shades of red? ■

Letters *(from page 10)*

communications. (The amateur service, according to FCC rules, is: "A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs...solely with a personal aim and without pecuniary interest.")

One of the great benefits that we offer any emergency management agency or other organization is a team of trained operators, with their own equipment, willing and able to provide communications at no cost to the taxpayers or to their organization. I think you need a more positive attitude and to reexamine what ham radio is really about.

More on Old Men...

Dear *CQ VHF*:

I just got through reading the "Line of Sight" editorial, "Old Men Making Lunch Plans," in the April, 1999 issue. Bravo, Sir, Bravo!

Ham radio has been very good to me. I have learned a lot of new things and even renewed an old friendship. All because of ham radio. But I am concerned about what I hear on the repeaters today. It's not the "old guys making lunch plans" that worries me. Heck, I've made lunch plans via the repeater myself and I'm not even old. What concerns me is the lack of interest in ham radio that I hear on the repeater. Nobody talks about ham radio. I've actually been discouraged from talking about ham radio. Everybody wants to talk about Windows and the Internet.

Don't get me wrong, I like computers and the Internet. They are both hobbies of mine. But how come there is no one who wants to talk about radio stuff? I have an interest in packet radio. I wrote to you a few months ago about the article addressing the combining packet and HTML. I still think it's going to be a good idea. Unfortunately, I'll have nobody to send and receive Web pages with. I was very excited after I after I read the article. You were very quick to get new Web addresses when the ones listed in the article didn't work. The response I got when I talked about it on my local repeater was, "Why would you want to do that? We already have the Internet." My answer was, "Because I can." What a great learning experience it would be to put up a WebPacket Server!

I am building a Ramsey 220-MHz FM radio. I don't dare talk about it on the air anymore. I was actually called "stupid" on the air for building a radio that was going to cost as much as a low-end store bought rig that has 100 more features. "And why the heck do you want to talk on 220? There is nobody there." My answer, again, is because I can. The hams on the repeater I normally use are very polite. We usually have several conversations going at once, with everyone waiting their turn to speak. Wouldn't it be nice to be able to QSY a quiet band so you could have a nice long conversation without feeling guilty about hogging the repeater?

Talking to people and making new friends is a great part of ham radio. But to me, the effort and the technology that goes into being able to talk to new people is as important as talking to them. I like the techie side and I like the learning side. Does anybody else?

Tate Jackson, N3BXZ
Glen Burnie, Maryland

Tate—I think it's time to find a new repeater! In June's "Digital Data Link," N2IRZ commented that maybe it's not such a bad thing that most folks who came to packet only for free e-mail have now moved to the Internet—because it leaves those who are truly interested in packet as the majority.

As for your "friends" who can't figure out why you'd possibly want to get on 222, you might want to pick up a couple of extra copies of last month's issue for them and suggest they read the three articles in there on 222. But, then again, it's hard to read unless your mind is open as well as your eyes. You're within range of at least a dozen repeaters (probably many more). I'll bet you can find one where people won't call you stupid for building a radio and wanting to get on a new band.

Hot Weather = Hot VHF Bands

Summertime...and the DXing is easy, not only on 6 meters, but across the VHF spectrum. There's still time to join in the fun!

Hot summertime DX is here—with sporadic-*E* openings on 6 and even 2 meters, tropo ducting on two and beyond (how's Hawaii from the west coast?), and meteor DX coming up from this month's Perseids meteor shower. Here's a sampling of what's been happening on the VHF bands from mid-May to early June (and it just gets better as the summer rolls along)...

"At times, it was like 75 meters on a Saturday night, with huge signals and even lots of QRM! This was a 'textbook' Es opening, beginning to the southeast, swinging west-southwest, and ending in north-south contacts."— James Kaplan, KG7FU, Oregon

It Starts...

From James Kaplan, KG7FU, Eugene, OR, CN84:

5/11—What a way to ring in the *Es* (sporadic-*E*) season! Between 0130 and 0600 Z, KG7FU worked 36 QSOs on 6 meters for 20 grids and 8 states: AZ, CA, CO, NM, NV, OR, TX & UT. Highlights were KY5N EM12 at over 2,500 km, K7RAT CN85 around 160 km on scatter, and KØDU in DM58 and DM59. Most were worked above 50.125. At times, it was like 75 meters on a Saturday night, with huge signals and even lots of QRM! This was a "textbook" *Es* opening, beginning to the southeast, swinging west-southwest, and ending in north-south contacts. Thanks to all who made this a very enjoyable evening!

From Bill Harrison, KK4XO, Ft. Lauderdale, FL:

5/11—An *Es* opening on 6 meters began in South Florida today at approximately 2300 and continues as this is being posted. Stations heard: 50.061 W1VHF/B FN41; 50.0685 K2ZD/B FN20; 50.070 W1RA/B FN41; 50.080 W3CCX/B FM29; 50.125 N8JGG EN71; 50.128 KO2OK FN20; 50.135 AI9L EN51; 50.140 KB2VXA FM29.

From Larry Jones, N1TLW, FN34:

5/15—Just worked LU6DRV (Argentina) from here in FN34 at 4:30 p.m. local time!

From Terrence Glass, NØYXE, Lawrence, KS, EM28:

5/15—I had my first 6-meter opening of the '99 season with a QSO with W4WT in EM74 at 1635 UTC. We exchanged 54s on both ends.

From Bill Harrison, KK4XO:

5/15-16—The following 6-meter openings are reported from EL96 in South Florida: Saturday, May 15, 1300 Z 50.076 KD4HLG/B EM73; 1301 Z 50.125 KB1HY FN31; 1314 Z 50.070 W1RA/B FN41; 1338 Z 50.060 K4TQR/B EM63. It was interesting to note that the band opened almost as short skip with KD4HLG/B, but then shifted quickly up to the New England states.

Sunday, May 16: 2025 Z CE (Chile) music on 47.9, 48.0, 48.3, 49.2 MHz; 2027 Z 50.0685 K2ZD/B FN20; 2040 Z 50.112 LU3DAO FF56 (Argentina); 2104 Z 50.080 W3CCX/B FM29. This appears to have been two openings...TE (transequatorial) into South America, combined with *Es* into the mid-Atlantic states. Although the TE opening only appeared to have lasted for 10 minutes or so, the TE-to-*Es* combination may have put South America into the mid-Atlantic states.

Additional May 16 loggings: 2140 Z 50.0685 K2ZD/B FN20; 2149 Z 47.9 & 49.2 CE music; 2234 Z 50.079 TI2NA EJ79 (remained audible until 0001 Z); 2245 Z 50.110 HP2CWB & WP4O; 2343 Z 50.110 TI2ALF; 2344 Z 50.110 WP4O FK68 (worked beaming Central America at 193 degrees).

From Alberto Petrucelli, LU2EG, Argentina:

5/16—Last Sunday, I received a big surprise when I turned on my 6-meter equipment. A lot of stations were calling from UK. This is a summary: 16/5/99 Between 17:00 Z to 17:30 Z worked G6ION, G8BCP/Port, G7BXS,M1CYQ, GØLCS, G1IOV,G4BWP, G3FPQ, G3WOS, G4IGO, G4HBA, G3COJ, G3NVO, G3IMV, G3WZT, G1YLI, GW7SMV, G3NSM, G4PCI, GW4EAI, G1RMN, and G4DEZ. Signal S5 to S9+. Also I worked between 20:10 Z to 20:39 Z KB8TEJ, W4RKR, KF4TCD, NO3I, KD4YIY, KB8ZMJ, W4SKD, AA4NC, WB8ZRV, W8PT, KE4GRP, W4TJ, WS4W, KE4TCD, K4ZOO, and K4RTS...NICE DAY!!! de L22EG Alberto (LU2EG).

From Paul, N8IEZ, EN82:

5/17—Just worked VE1IW in FN74 and also VE1EX in FN84 @ 21:30 on 50.125 and 50.135 MHz.

From Ev Tupis, W2EV, FN03:

5/17—Hearing VE1EX in FN84 (off the back of the beam) at the same time as plenty of 4-landers in Florida off the font. I'm in FN03 (Western New York). Don't forget to listen on 53.530 MHz for the Packet DX Network. If you decode anything, let us know.

From Arliss, W7XU:

5/17—NØQJM & W7XU (EN13) worked KH7R (BL01) in Hawaii via multi-hop *Es* at about 0400 Z 17 May. WH6XM (BK29) was heard but not worked.

From Jim, N1HOV, Maine, FN53 (via WB2AMU):

5/17—That was quite a rush, 70 QSOs in about 1 1/2 hours before the band dropped. It reopened a few minutes later and I could have worked others, but had "Honey-do's" to take care of. I usually don't get caught up in the pileups, I am usually spinning the dial looking for new western/west coast grids, many out there that I need. I did work two new grids, EL59 and EM40 (W5VAS), and two that I still need cards from, EM96 & EM97.

Here's the list: EL, 59 & 96 (2 Qs); EM, 40, 64, 66, 75, 76, 77, 78, 79, 84, 85, 89, 90, 94, 96, 97 & 98 (27 Qs); EN, 90 (1 Q); FN, 10, 11, 20, 30, 32, 42 & 43 (9 Qs); FM, 06, 07, 08, 09, 14, 15, 16, 17, 18, 19 & 28 (31 Qs). EH8BPX Avelino was spotted yesterday, I did not work him, was doing yard work. 15/05/99—Worked LU2FFD Tony for a new grid FF97. Heard LU8DIO and others but could not work them.

From Larry Hogue, W6OMF, CM98:

5/18—Last night was a great opening.... Kept hearing Bernice, KAØBAD, in and out all day. When it finally opened, it opened...hi hi around 0241 Lloyd, W7SAO and KØCL came rolling in from DM59 and DM69 and I heard a K4MRW in the background from EM64....I headed up band and parked on 50.145....And wow, it went from there...

"Worked four different stations in Argentina on Saturday. One was in for over an hour. Had a CX4 (Uruguay) call me but he faded before we could complete. Later I worked an HP (Panama)..."—K2DRH, EN41

0258—WB4WXE, DM73; KC7YZL, DN18; KC5JBO, DM65; KC5ZYU, DM65; N4IVA, EM63; KG4AJM, EM64; KAØBAD, DM57; N5XZM, DM65; NØSWV, DM79; N9BJG, EM57; NØKQY, DM98 20 over S-9; K4EHO, EM63; N9XHU, EM59; WØAGX, DM99 30 over S-9; N9OBE, EN50; KØFF, DM49; KRØI, EM29; KD7CYP, DN08 (weird); KBØPE, EM48; N9NJY, EM58; W7JAG, DM06; KBØUSF, DM79—0350.... Had a blast and thanks to all for the great time. The opening finished just as "Ally McBeal" came on. Funny, huh!

From Ed Rodriguez, WP4O, Puerto Rico, FK68:

5/18—Great band opening last nite on 6 meters. Date: 17/18 MAY 99 50.107, 50.106, VE2PEP/MM FN46 2343, K1BQT FN43 2349 Z, W1REZ FN55 2352 Z, VE3CTT 2354 Z, WT3A/MM 2355 Z, W2CNS FN13 0055 Z, WA2BPE FN12 0008 Z, W4WRL FM04 0008 Z, W9ZR EN80 0013 Z, K1GUP FN54 0014 Z, K1ZZ 0017 Z FN31, AF4CD 0020 Z FM16, KD4JRX FM14 0023 Z, K4WYS 0025 Z FM16, K8CU EN80 0028 Z, VE3MRH EN77 0031 Z, VE3DDR EN90 0034 Z, NG4C FM16 0035 Z, K4QI FM06 0047 Z, N3QCM FM28 0052 Z.

From Bob, K2DRH, EN41 (via Ken Neubeck, WB2AMU):

5/19—Worked four different stations in Argentina on Saturday. One was in for over an hour. Had a CX4 (Uruguay) call me but he faded before we could complete. Later I worked an HP (Panama) as my first sprint QSO! Last night I could just barely hear a few KP4 stations on, but they were right at my noise level. Just as one on 50.110 finally came up loud enough, KP2A also came up on frequency and I wound up working him instead! Who says EN41 is in a "black hole"?

From Chuck Griggs, W6KGF, DM06:

5/20—Double hop into DM 06 (Fresno) today on 6 meters. Started at 2045 for about 40 minutes then shifted for single hop for another hour or so. Worked Georgia and South Carolina. Heard South and North Carolina, Georgia, Alabama, and weak Florida. Sigs with QSB 54-58. Chuck, W6KGF (ex-W7KMS).

From Larry Hogue, W6OMF:

5/21—Some have asked of my LU9AEA contact here in CM98 on .125 and what was happening with other grids during that time...2059 to about 2012 on the 20th of May, I was hearing and working...excellent signal from DM92, 93, 94, EM04 and 00. I had just prior to that (2 min.) been hearing DM65, 64, 57...and then it went longer and that is when LU9AEA came in, building up to about a S-5...I have a (6M7 at 65 ft heading true of 125 degrees and no pre amp on a IC-575H) also dropped down to .110 and heard an LU7?? working someone in 9 land. Mixed single hop with TE???

E-Skip on Two!

From Russ Pillsbury, K2TXB:

There was a short *E*-skip opening on 2 meters on Sunday evening, 5/23/99. I was watching for it all day, and first noticed it when I started hearing Gary, NØKQY. I worked Gary, in DM98, and then NØLL in EM09, but did not hear any others for sure. Gary later said that he worked 10 stations in the opening. By the way, Gary is 1,430 miles distant from me and is the same station I worked on May 9 via high speed CW meteor scatter. It was lots of fun to work him again via SSB. I and others reported this opening immediately on the 144-MHz propagation Web page, <http://raven.cybercomm.net/~slapshot/dxing/144prop.html>, but I've not seen it reported on a reflector so far. It would be smart for all operators to monitor the propagation page(s), as well as the band, when they suspect an opening might occur. Of course, nothing beats listening to the rig!

From Larry, NØLL, Kansas, EM09:

5/24—K2TXB said it best: "nothing beats listening to the rig!" Sunday's 2-meter *E* opening started with 2313 K4RTS FM08; 2317 K3HCE FM19; 2317 K9OYD FM18; 2318 K4ZOO FM08; 2320 KC3WO FM18; 2322 K2TXB FM29; 2323 N8XA EM79; 2325 WA2FGK FN21; 2326 W2KV FN20; 2327 KB8YPU EM89; 2328 K3HZO FN20; 2328 WA1MKE EN70; 2329 KA8ROX EN80; 2331 WA3TT? EN90; 2332 W8ANS EN81. TNX to NØKQY for all the help during the opening.

From Wolfgang, DL5MAE (Germany):

5/25—Just read the mail from K2TXB about the *Es* on 2 meters. There was the first *Es* on 2 meters in DL (Germany) towards Spain (including EA9) and Portugal (CT). From England, I saw reports they worked into Italy and Sardinia (IS0). Northern Italy worked into Bretagne (western France). I worked about 10 stations from EA and CT (mainly into IN53). The opening happened today, 24th of May, between 1300–1430 UTC approx. Probably the main opening was going in middle of the Atlantic Ocean. (west of La Coruna/Spain). Vy 73 de DL5MAE, Wolfgang (JN58VF)

From Derek, GØNFA (England):

5/25—For those who missed it and were inquiring what was worked, here is my short list of stations that I worked on 144 MHz: F1BLL (JN23), F5ICN (JN23), F5LKW (JN23), F1PDI (JN23), F5NZZ (JN33) Times: 1400–1500. Also heard some IW5s, IS0s & EAs but not worked. Very patchy *Es*.

From Jeff Francis, KCØBWS, DM79:

5/26—Flipped on the radio to 6 meters late last night only to hear sixes and sevens booming in here in DM79 strong enough to bend the S-meter (well, OK, so it's an LCD, but who's counting?). W6OAL (SE of Denver) was talking with AC6TA out on the Left Coast. Both were S9+40, and things were going well, when suddenly, the band did something mysterious, and AC6TA could no longer hear W6OAL. They went back and forth a few times, trying to continue the QSO. I could hear both as strong as ever, but it seems they couldn't hear each other. They finally gave up, so I figured I'd give it a shot. W6OAL is probably less than 20 miles from my house, and has better and higher antennas than I do, so I didn't expect much, but sure enough, I got through just fine. Maybe three minutes later, the band did something else mysterious, and AC6TA dropped right down into the noise right in the middle of a sentence, and never came back. Six is strange.

From Dave Clingerman, W6OAL:

5/26—Just experienced a nice 6-meter opening from here in the Denver area to EN40, EN50, EN51, and EN56 and on 2 meters to DM98. The squelch broke here about 1530 Z with W9ALU on CW, signals built to 40 over and then everyone went away just as fast.

From Jose Hierro, EA7KW, IM67:

5/27—Long 6-meter opening from Spain to U.S./Canada last night in three different periods. 1st logged K1TOL at 18:30 (1st W/VE-EU QSO this season?). Latest W4MYA at 00:28. At 0130 W1s still having very loud EA/CT video. No big signals. Most stations were big guns. Farthest grid EN82, K8MD. Had F_2 to 5H (Tanzania), TEP to LU (Argentina), *Es* to central Europe, *Es* to NA, *Es* to EA8, and backscatter to EA/CT, all at the same time! 73 de Jose, EA7KW/EH7KW.

The Hawaii Duct Opens... Slowly

From Arnold Harding, KQ6DI:

5/28—The KH6HME beacon in BK29 (Hawaii) was heard here in CM97 at 12:00 local (19:00 Z) with only one loop antenna.

From Chuck, N6HKF:

5/28—I'm hearing the KH6HME (BK29) beacon 5/1 in DM13 03:00 local time, on 2 meters, 144.170 + or -.

From John Mitchell, KD6WVL, California, CM79:

5/30—Just worked AH6TM in BL01 (Hawaii) on 50.125; 100 watts, M^2 SQLOOP.

From Larry Hogue, W6OMF:

5/30—Talking now 2100 with Hawaii on 6 meters...50.125 has station AH6TM BL01, KH7U BL11, and KH7L BL11.

"Long 6-meter opening from Spain to U.S./Canada last night in three different periods...[Also h]ad F_2 to 5H (Tanzania), TEP to LU (Argentina), Es to central Europe, Es to NA, Es to EA8, and backscatter to EA/CT, all at the same time!"— Jose Hierro, EA7KW

From Chris, AH6TM, Hawaii, BL01:

5/31—WOW!! What an opening!!! Twice today, I found myself on the receiving end of a great opening on 6 meters. It is wonderful to be the rare DX!! About 2000–2200 hrs zulu 30 May I worked the following grids: CM87, CM88, CM89, CM97, CM98, CN 72, CN80, CN92, and BL11. I'd like to add that one of these was KA5S mobile in 7 land (CN72).

Then again about 0400–0600 zulu 31 May I worked the following new grids: CM99, CN84, CN85, DM03, DM04, DM06, DM13, DM14, DM34, DM57, and DN70. 57 QSOs total!!! Many thanks to all those I worked! Also thanks to those who posted me on the clusters or called your buddies and woke them up. Til next opening...73 and Aloha

Finally, Back to Europe... and 2 Meters

From Paulo Gomes, CT1FOH, Portugal, IN50:

6/1—This is my report for the first *Es* on 144 this year, from CT1FOH IN50RA, running IC-746 100 W 1 x 12 elem.: DL6WU 30/05/99 from 17:30 UTC to 20:00 UTC; 17:30 I5WBE JN53; 17:45 TK1CX JN42; 17:50 EA3CI JN11; 17:55 EA3ADW JN11; 18:10 IWØBET JN61; 18:13 I8OGP; 18:16 ISØDSU JM49; 18:20 I8MPO JN70; 18:22 IKØRWX JN61; 18:23 IKØRMR JN61; 18:25 IØAKP JN61; 18:27 IZØCOK JN??; 18:29 IKØYSL JN??; 18:31 IS9NGN JM78; 18:34 ISØGQX JM49; 18:40 IKØIXO JN53; 18:45 I4XCC JN63; 19:30 I7CSB; 19:40 IW8DUL JN70.

Join Us!

Thanks to all who sent in reports or posted their success stories on the Internet VHF reflector, and especially to WB2AMU for forwarding reports received elsewhere. Don't forget the Perseids, which are expected to peak this year on August 12. If you've never worked meteor scatter before, this is a good time to start! ■

Watch the Perseids on Packet Via PropNET!

If you have a packet station equipped with APRS (Automatic Position Reporting System) software, you can tune in W2EV's "PropNET" packet DX network to literally watch the Perseids meteor shower. Ev Tupis, W2EV, originally developed PropNET as a means of charting propagation and band openings on 6 meters, using the beaconing and mapping capabilities of APRS. When you see a callsign pop up on your screen from a particular area of the country, it means the band is open to that area. It's that simple. Ev collected various spots during 1998 VHF contests to generate the map in the Figure, which shows grid squares active on 6 meters during those events.

Plotting the Perseids

The system lends itself perfectly to meteor scatter communications because the packet transmissions of an APRS station are extremely brief. If a station is transmitting a beacon message when a meteor provides the ionization to open a path to your location, you'll see the call letters and location appear on your screen's map. Ev has come up with a slightly more sophisticated plan which permits the receiving station to "QSL" each station it hears (as long as you have a TNC that supports the feature used), and he'll be describing it in detail in an article in an upcoming issue of *CQ VHF* (these were not PropNET stations, but general loggings).

Meanwhile, if you want to watch meteor scatter signals during the Perseids (expected to peak this year on August 12), set up your APRS system to monitor 53.530 MHz on 6 meters (the main PropNET frequency) and 147.585 MHz on 2 meters. Please send reception reports to Ev at <evman@ix.netcom.com>. For more information, see the PropNET Web page at <http://www.rochesterny.org/PropNET> (be sure to type PropNET exactly as shown). And happy scatter-hunting!

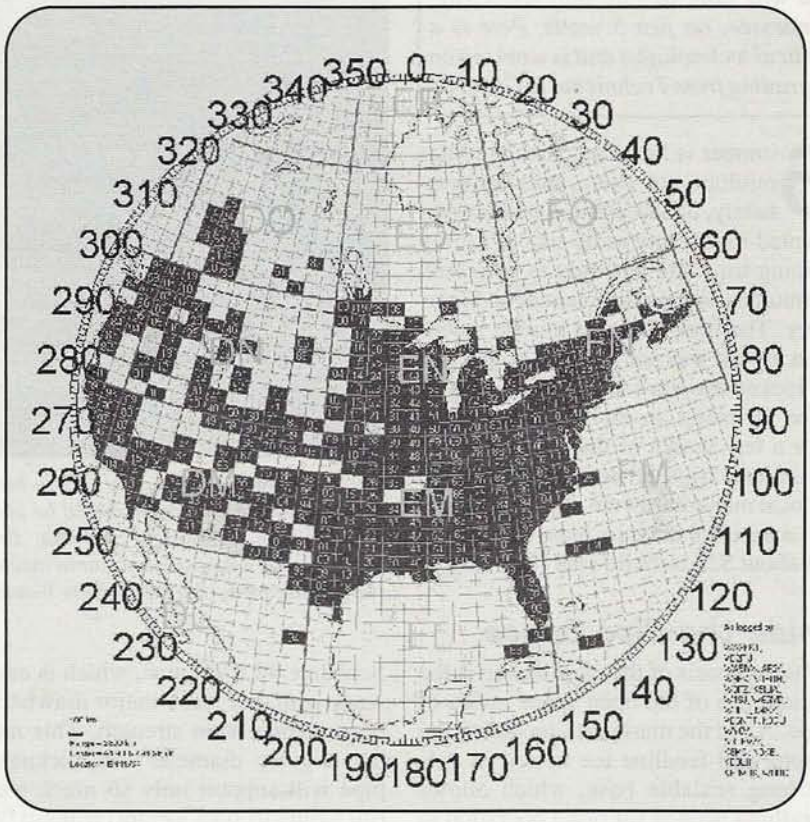


Figure. Ever wonder which grids do and don't have 6-meter activity? Here's your answer. This map is based on loggings by W2EV during 1998 VHF contests and is posted on the PropNET Web site at <http://www.rochesterny.org/PropNET/images/6mactivity.htm>.

A Portable VHF/UHF Antenna Mast

If the roof of your car just isn't high enough to let you put out a good signal from wherever you are, check out KF4VCC's portable mast project (you WILL have to stop the car to use it!).

Sitting in this month in the "Project Corner" is Pete Womack, KF4VCC, of Louisville, Kentucky. Pete has been a ham since late 1997 and is active on 2 meters and 70 centimeters, with a particular interest in weather-spotting. He used the mast described in this article while camping last summer in the Great Smoky Mountains of North Carolina and was able to talk into Knoxville, Tennessee, on just 5 watts. Pete is a medical technologist and is working on upgrading from Technician to General.

Summer is here, and with it comes outdoor activities and, unfortunately, bad weather. Last summer, I wanted to take my radio on our family camping trips and be ready to help with communications in the event of an emergency. The roof-mounted mobile antenna on my car was not going to do the job, so I looked for ways to get an antenna up in the air using an easily carried mast. After a few weeks of thinking on paper and several trips of wandering through the local mega-hardware store, I came up with a portable antenna mast design that cost about $25 to build (see Photo A).

Photo A. The author stands next to his 16-foot portable mast, which should be able to support any lightweight antenna. Entire setup may be collapsed and stored inside the large base pipe. (Photos by Kate Womack)

Inside-the-Pipe Space

The emphasis of the mast design is the efficient use of the open space inside of a pipe. All of the mast parts, including the antenna and feedline are nested in a 4-foot-long sealable base, which allows everything needed for radio operation to be carried to a remote site as a single unit. The material chosen for the mast was Schedule 40 PVC pipe, which is easy to work with, but has a major drawback of poor compression strength. This means that a given diameter and thickness of pipe will support only so much weight (including its own weight) without bending or breaking. This puts limits on how high a mast of a given diameter can raise an antenna in the air. I found an acceptable compromise: By using 4-inch and 1-inch diameter pipes (Photo B), I was able to put an antenna 14 feet into the air with a total weight of 16 pounds.

The basic concept here is that the 1-inch pipe will nest inside the 4-inch pipe, held in place by a 1-1/2-inch sleeve mounted inside the top of the big pipe (Photo C), and a 1-1/2-inch end cap screwed in about two feet down inside the pipe (see Figure). The antenna then attaches to the top of the 1-inch pipe.

Construction

PVC pipe is often sold in 10-foot lengths, so it's a simple matter of cutting the 4-inch and 1-inch diameter pipes to make the 4-foot lengths needed (you'll need one 4-foot length of 4-inch pipe and three 4-foot lengths of 1-inch pipe). Make three marks on the top rim of the 4-inch diameter pipe (look closely at Photo C). They need to be equally spaced around the circumference of the pipe, as they mark off the guy rope attachments. Now, measure 1 inch down from the rim of the pipe at each mark, make another mark, and drill two 1/4-inch holes 1/4-inch on either side of each lower mark. Use a rat-tail file to further shape the holes until one end of an S-hook can be pushed in one hole and out the other. Be sure to leave enough PVC material between the holes to prevent the S-hook from pulling through the pipe wall. If the holes are not spaced properly, or if the S-hooks do not fit, try again on the other end. Make sure the S-hooks can be easily inserted and removed, then remove them.

By Pete Womack, KF4VCC (kiminy@couriernet.infi.net)

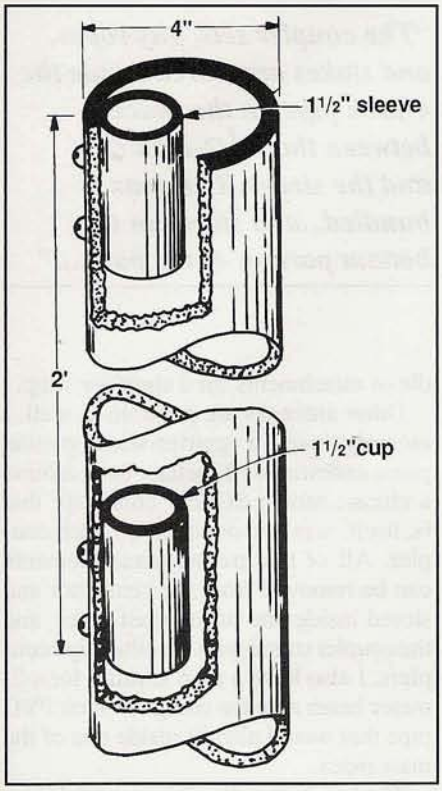


Figure. Detail of the placement of the 1-1/2-inch sleeve and end cap inside the 4-inch base pipe. Note that the closed end of the cap goes on the bottom and forms a cup that holds the 1-inch mast section in place.

Next, from the top of the 4-inch pipe opposite an S-hook hole (halfway between the other two; see Photo C again), measure and make new marks at 1 inch, 2 inches, 23 inches, and 23-1/2 inches. Make sure the marks are vertically true. Then, make two marks with 1/2-inch vertical spacing on the 1-1/2-inch end cap, and 1-inch vertical spacing on the sleeve.

Using a 1/8-inch drill bit, drill through all of the marks on the mast base, 1-1/2-inch end cap and sleeve. Drive in four screws from the outside of the 4-inch pipe until they're just sticking out into the inside of the pipe. Reach in with the cap, bottom down (it will form a cup to hold the mast) and align the holes in the cap with the bottom two screws. Hold the cap tightly against the inside of the pipe and finish driving the screws until the heads are tight against the outside of the pipe. Do the same with the sleeve at the top of the pipe (again, see Figure). The sleeve must be in line with the cup, so that the 1-inch mast pipe running through it will be held vertically in place.

If a flat end cap is available, fit it over the bottom of the 4-inch pipe. If one is not available, you can make a flat end-cap from a 4-inch diameter female-threaded clean-out end trap and end-trap cover. The cover has a square knob sticking out; this knob should face *in* when it is screwed into the female trap. The idea is to create a closed, flat end for the mast base. Next, screw together the threaded ends of the 1-inch couplers and set aside. Tie one end of the guy rope to an S-hook with a permanent knot, and fit the slack adjuster on the other end.

Assembly and Take-Down

Set the mast base (the 4-inch pipe) upright on the ground, and hook the S-hooks

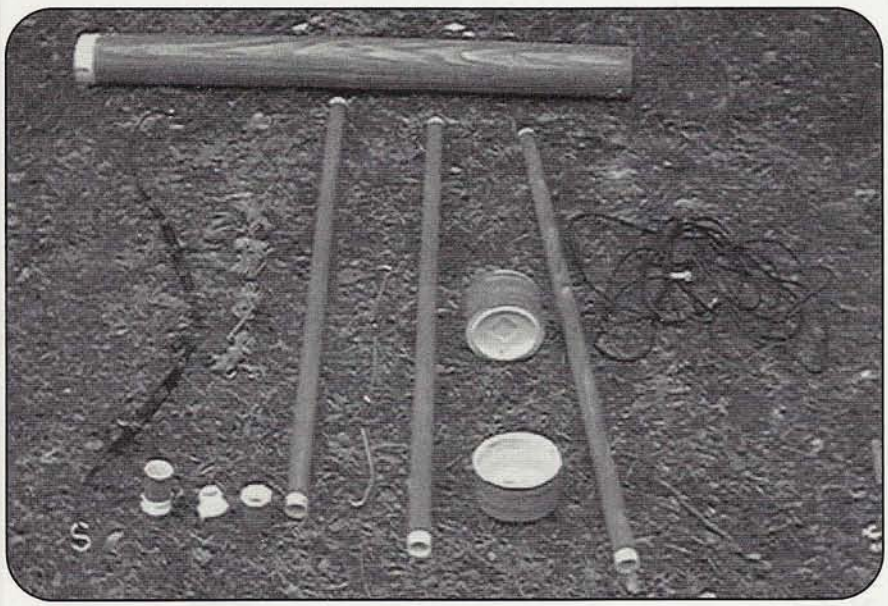


Photo B. All of the components of KF4VCC's portable mast system. See "Parts List" and text for details.

Photo C. Close-up view of the top of the 4-inch pipe section. Note the marks above the S-hooks that show where the hooks will go. The 1-inch mast pipe sits inside a 1-1/2-inch sleeve section and, 2 feet down in the pipe, a 1-1/2-inch end cap. These are both screwed into the base pipe. See text for details.

through the top holes. Push the stakes into the ground about 3 to 4 feet from the mast base, loop the guy ropes around the stakes, and adjust the tension of all three so that the base is secure. Put one of the 1-inch diameter pipes through the top sleeve and down into the cup. It should be vertical and extend 2 feet above the base. Fit one of the coupler sets onto this pipe, and connect the other 1-inch sections together using the second coupler.

Attach an antenna to the top (I use a homemade dual-band J-pole made from 450-ohm ladder line), and attach the feedline to the antenna. Hold this long section vertically, and carefully move it upward until it can be fit onto the coupler on the pipe section that's already on the mast. The mast may bend slightly from the weight of the antenna and feedline, but keeping the feedline next to the mast at the base will help eliminate that. With practice, the entire mast can be set up in about five minutes.

Taking down the mast is performed in the reverse order of setup, and leaving the base tied down with the guy ropes makes the take-down easier. The coupler sets, guy ropes, and stakes are stored inside the 4-inch pipe, in the space between the 1-1/2-inch cup and the sleeve. The coax is bundled (*carefully, so you don't stress the wires inside—ed.*) and stored in the bottom portion of the base by removing the flat end cap and pushing the coax into the open space.

Photo D. Everything packs up neatly inside the big 4-inch tube, and the whole mast system can be easily carried on your shoulder.

"The coupler sets, guy ropes, and stakes are stored inside the 4-inch pipe, in the space between the 1-1/2-inch cup and the sleeve. The coax is bundled...and stored in the bottom portion of the base...."

Going Further

Not wanting to have an ugly piece of white plastic in my campsite, I bought some wood-grain contact paper and covered the base and mast with it. This gives it a nice appearance that also blends in well with surrounding trees and bushes. If I get tired of carrying the base on my shoulder (Photo D), I can screw on a handle or attachments for a shoulder strap.

Other antennas are possible as well. I recently made a quarter-wave ground plane antenna for 2 meters, built around a chassis-mount SO-239 connector that is, itself, screwed down on a 1-inch coupler. All of the ground-plane elements can be removed from the connector and stored inside one of the mast pipes, and the coupler stored with the other pipe couplers. I also have a plan in mind for a 2-meter beam antenna using 3/4-inch PVC pipe that would also fit inside one of the mast pipes.

The key here is flexibility, portability, and ease of setup—especially in case of an emergency. This system works well for me, but with all of the different sizes of PVC pipes and hardware available, many useful configurations can easily be built. Figure out what will best serve your needs, and start building! ■

Parts List

Materials

1	4-inch diameter PVC pipe, Schedule 40, at least 4 feet long
2	1-inch diameter PVC pipe, Schedule 40, 8 feet long (cut into 4-foot sections)
1	end cap to fit a 1-1/2-inch diameter pipe
1	1-1/2-inch pipe section
2	2-1/2-inch pipe section (sleeve)
1	end cap to fit 4-inch diameter pipe
1	flat end cap to fit 4-inch diameter pipe (see text for alternative)
1	30-foot length of coax with connectors
3	guy wires with slack adjustment
3	S-hooks
3	ground stakes
4	machine screws, 1/8-inch x 1/2-inch
2	pairs of male and female threaded couplers to fit a 1-inch diameter pipe

Tools

Drill, with 1/8-inch and 1/4-inch drill bits
Rattail file
Screwdriver (to fit the machine screws)
Marker
Tape measure

ARRL 10-GHZ And Up Cumulative Contest Aug. 21–22 & Sept. 18–19, 1999

If you're one of the brave and the few who venture into the microwave spectrum (not counting your PCS phone or your satellite TV receiver), here's an opportunity—two, actually—to contact everyone you can on 10 GHz and higher.

Here are the rules for the 1999 ARRL 10-GHZ And Up Cumulative Contest, courtesy of the ARRL Contest Branch:

1. Object: North American amateurs work as many amateur stations in as many different locations as possible in North America on bands from 10-GHz through Light.

2. Date and Contest Period: Third full weekend of August and September. For 1999 the contest dates are August 21–22 and September 18–19. Operations may take place for 24 total hours during each contest weekend. Each weekend begins at 6:00 a.m. local Saturday and runs through 12:00 midnight local Sunday. Listening time counts as operating time. Times off must be clearly indicated in the log.

3. Entry Categories:

3.1. 10 GHz only.

3.2. 10 GHz and up.

4. Exchange: Six-character Maidenhead Locator (see April 1994 *QST*, p. 86).

4.1. Signal report is optional.

5. Miscellaneous:

5.1. Scheduling contacts is both permissible and encouraged.

5.2. Stations are encouraged to operate from more than a single location. For purposes of the contest, a change of location is defined as a move of at least 16 km (10 miles). A station may be reworked on each band for additional credit by either end of the contact moving to a new location.

5.3. Contacts may not be duplicated on the second weekend (that is at least one end of the QSO must be from a different location).

5.4. Contacts must be made over a minimum distance of 1 km.

5.5. A transmitter used to contact one or more stations may not be used subsequently under any other call during the contest period. The intent of this rule is to prohibit "manufactured" contacts.

5.6. Contacts with aeronautical mobiles do not count.

6. Scoring:

6.1. Distance points: The distance in km between stations for each successfully completed QSO is calculated. Distance = distance in km.

6.2. QSO points: Count 100 QSO points for each unique callsign worked per band. Portable indicators added to a callsign are not considered as making the callsign unique.

6.3. Total Score: Equals distance points plus QSO points.

6.4. There are no multipliers.

6.5. In making the distance calculations, a string (or ruler) and map may be used. However, calculations by computer program are preferred. Several such programs are available in the commercial market, including a basic program listing in The ARRL World Grid Locator Atlas ($5). For purposes of making calculations, stations are defined as being located in the center of the 6-character locator sub-square (most computer programs make this assumption).

6.6. Scoring example: On the first weekend, W9JJ operating from Mt Greylock, MA works W1VD (distance 97 km) and W1LJ/1 (distance 107 km) on 10 GHz; and W1LJ/1 (distance 107 km) on 24 GHz. On the second weekend, W9JJ operating from Pack Monadnock, NH works the following stations: W1VD (154 km), W1VT (205 km), W1LJ (157 km), and K1RO (147 km) on 10 GHz; and K1RO (147 km) on 24 GHz.

Distance points = 97 + 107 + 107 + 154 + 205 + 157 + 147 + 147= 1121

QSO points = 100 X 6 = 600 (10 GHz: W1VD, W1LJ, W1VT, K1RO; 24 GHz: W1LJ, K1RO)

Final Score = 1121 + 600 = 1721

7. Schedules:

7.1. Schedules may be set up by use of the HF calling frequency of 3818 kHz on the evenings of Tuesday, Wednesday and Thursday before the contest weekends starting at 7 PM local. Also, 144.230 and 146.55 MHz can be monitored during the contest to arrange schedules with other stations. Paired stations should move off these frequencies once contact has been made.

8. Reporting:

8.1. Official forms are at the ARRL Contest Web Page at <http://www.arrl.org/contests>.

8.2. Logs should indicate band, date, time, callsign, the exchange information plus distance of contacts in km.

8.3. Logs must be submitted no later than 30 days after the end of the contest (Oct. 19, 1999) to ARRL Contest Branch, 225 Main St, Newington, CT 06111.

8.4 Electronic entries consisting of the required summary sheet and an ARRL format electronic file format log should be submitted to: 10GHZ@arrl.org. Files may also be uploaded to the anonymous FTP server.

9. Awards: Suitable awards will be presented as designated by the Awards Committee

10. Other: See General Rules for All ARRL Contests and General Rules for ARRL Contests on bands above 50 MHz (VHF) (November 1998 *QST* or on-line at <http://www.arrl.org/contests>). ■

Building Other People's Antenna Designs

I'm not going to have any construction projects this month. Instead we're going to talk about how you can avoid trouble when building someone else's antenna design.

One of the most common questions I receive about building antennas from published designs is whether it's OK to substitute this for that, or to use a construction method that's different from what the author used.

Maybe it's a coincidence, but most of the construction errors I see in home-built antennas have resulted from making a change that shouldn't have been made. The main thing to remember is that the designer generally presents an antenna in a certain way because that's the way it was *measured* to produce the best results (see Photo).

Element Diameter

Perhaps one of the biggest pitfalls in Yagi construction is substituting different diameter elements.

In Figure 1, you see a scale drawing of different Yagi elements. Each is a tuned director for a 432-MHz Yagi. It's possible to shift the resonant frequency of a 432-MHz Yagi ±15 MHz *just by changing the diameter of the elements*. Always be sure to use the same diameter element material as the author uses. And this is also a warning to other authors and their editors: Don't use exotic materials in your designs, as your readers won't be able to duplicate the antennas. Now let's take a look at a couple of things people often do that change the diameter of the antenna elements.

Sleeves over the elements: I took advantage of this diameter/frequency ratio some years ago. We had some great 455- to 460-MHz commercial Yagis with an all-welded design and made to mount on the side of a tower in 200-mph winds with 20 pounds of ice on them. You know the type. But how to move them down to 445 MHz for some repeater links? Drill and tap the end of each element and put in a screw? Get out the welder and weld a little aluminum onto each element? Both of these "fixes" meant a lot of work.

I found some aluminum tubing that fit snugly *over* the elements and just increased their diameter. This moved the resonant frequency down about 10 MHz, not perfect, but close enough for what we were up to, and they've been in the air for years now.

Insulation on copper wire: In general, I remove the plastic insulation when using house electrical wire for elements. The

Antenna measuring at WA5VJB's QTH. Most published antenna designs are based on what works best in testing on an antenna range. (WA5VJB photo)

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

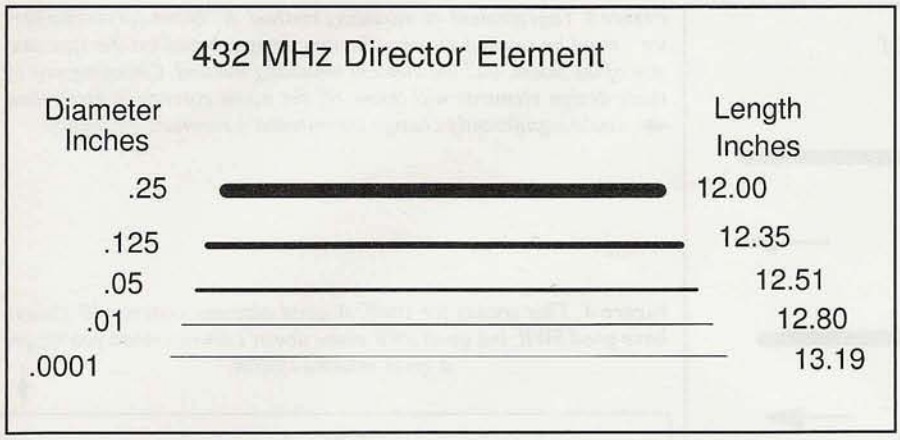


Figure 1. Yagi director length versus element diameter. Each of these elements is a tuned director for a 432-MHz Yagi. See how changing element diameter also changes electrical length and, therefore, resonant frequency.

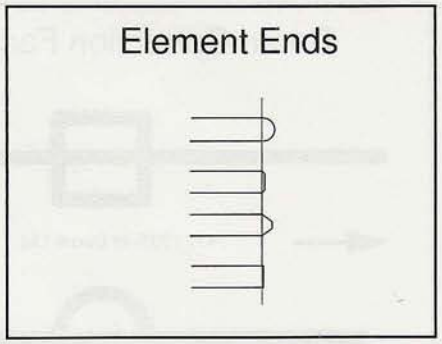


Figure 2. Element ends are also important. The effective length of an antenna element ends at the point where the diameter changes. All of the elements in this figure are of equal length, electrically speaking.

plastic coating does affect the resonant frequency a little bit, and the *Er*, or *dielectric constant*, of the insulation is not controlled at the factory. This means different electrical characteristics for different brands of house wire. I just avoid any uncertainty and strip off the insulation.

Here's another one of those little things we have to watch out for—even how you trim the end of the element makes a difference.

Electrically, all the elements in Figure 2 are the same length. The effective length of the element is to the point where the element diameter changes. You don't want to have any metal burrs on the ends of the elements, but you don't want to change the electrical length of the elements, either.

Just a slight chamfer (a beveled edge) of about 1/32-inch is all you need. I usually make the chamfer by turning the element while lightly holding it against a bench grinder. But I've been known to use a few quick strokes with a hand file, or even to rub the end of the element on the concrete floor of the garage. My friend W5ETG likes to use those grinding disks advertised on TV and often sold at Dayton. They work very well on aluminum. You can even use them to cut elements to size.

Changing the Style of the Driven Element

I would never have even dreamed of changing out the folded dipole used in my Cheap Yagi antennas for a gamma-match or other style of driven element. However, your mail indicates that a lot of you are thinking about this question. In short...don't! And if you know enough about antennas to re-engineer the driven element, you wouldn't have gone this route in the first place! Driven-element designs vary from 60 to over 300 ohms impedance. Substituting a different feed method can really throw the impedance match of the antenna into left field, with poor performance and a lousy pattern!

Boom Correction Factor

Another common construction error is changing how the element is mounted to the boom. The Yagi elements are sort of a linear inductor sticking out there, and, as explained earlier, changing the diameter of the element—or even the diameter of just part of the element—changes the resonant frequency of the element.

That big blob of aluminum in the middle, the boom, has less inductance than the thinner elements, so we have to make the elements longer to get the proper inductance back. *Boom diameter correction factor* is not much of a problem on HF. Let's say we have a 2-inch diameter boom on a 20-meter Yagi. The element is about 400 inches long, so the boom is 2/400, or only .5% of the element length. Now let's take a 432-MHz beam with a 1-inch diameter boom and a 12-inch element. Here, the boom is 1/12, or 8%, of the element length. A 16-times larger effect! Now you know why I used a wood boom on my Cheap Yagis.

Note how much the four different mounting techniques shown in Figure 3 change the physical length of the element. At 432 MHz, you can change the center frequency of a Yagi ±*50 MHz* just by using a different element mounting method than was used in the original antenna design.

Mounting the element through the boom can also spell trouble. Unless you have an aluminum welder, it's very hard to get a good electrical connection between the boom and the element. Time and time again, I have seen guys who have just used mechanical force or some

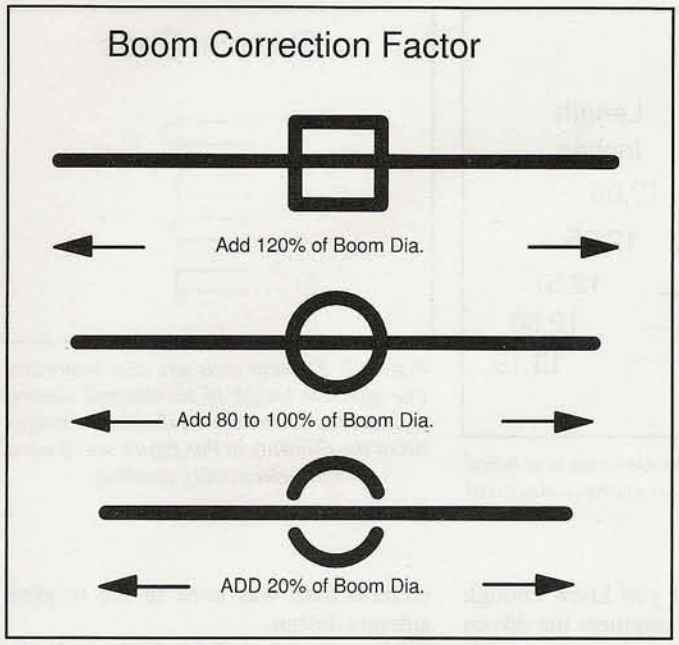
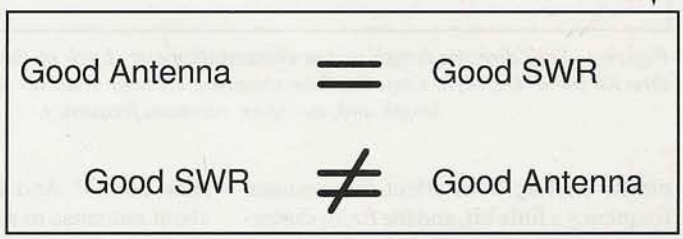


Figure 3. Yagi element vs. mounting method. A "boom correction factor" must be worked into an antenna design, based on the type and size of the boom, and the element mounting method. Changing any of these design elements will throw off the boom correction factor and could significantly change the antenna's resonant frequency.

Figure 4. This speaks for itself. A good antenna system will always have good SWR, but good SWR alone doesn't always mean you've got a good antenna system.



kind of force-fit to hold the element in the boom. That's OK for a while, but put it out in the weather for a few months, throw in a couple of rainstorms, and that press-fit connection starts to corrode. The connections lose their electrical contact. Now there's a new boom correction factor, and your 432-MHz beam becomes a poorly spaced 415-MHz beam! "Gee, I wonder why my beam doesn't work as well as it used to?"

Over the last 15 years, it's become very popular to mount Yagi elements though the boom, but using small plastic insulators to keep the elements electrically isolated from the boom. This actually works quite well. With the element electrically isolated from the Yagi boom, you don't have to worry about the electrical connection changing over time. Also the boom has less of an effect on the length of the individual elements.

The drawback is that this mounting method is highly hardware-dependent. Typically, the boom correction factor lengthening effect is about 20% of the diameter of the boom. So if you were using one-inch-diameter boom material, you would need to make the elements .2 inches longer to compensate for the effects of the boom and hardware—versus 100%, or 1 inch, longer when making the element part of the boom. But even this 20% depends on the diameter of the element holes, the kind of plastic used as an insulator, the diameter of the plastic, and the method of keeping the element in place. DL6WU, the guru of modern Yagi design, recommends actually measuring the detuning effects of your mounting hardware before building your 20-plus element Super Yagi. For less critical designs, we don't have to get that picky about dimensions.

Wood and Plastic

Normally, wood and PVC have little effect on the electrical length of a Yagi element when you use them as the boom. But this is not necessarily so with Fiberglas. When using something like a solid Fiberglas rod, you can have quite a bit of dielectric material around the element. I accidentally pulled a 2.4-GHz Yagi down to 2.1 GHz with too much Fiberglas. If you use a hollow Fiberglas tube or a solid rod with a diameter that's only 2 or 3% the length of the element (i.e., 1-inch rod on a 2-meter beam), you should be OK.

PVC seems to be a popular antenna boom material, but I've personally had trouble keeping PVC pipe in the air. Stress cracks, UV (ultraviolet) deterioration, etc., seem to kill the antennas at an early age. But if you like PVC, you're welcome to use it. Good luck!

Wood is cheap, easy to find, and easy to work with. There are detuning effects if the wood gets wet, so you need to use it only on sunny days (say, for rover operations, Field Day, contests, etc.) or mount the antenna indoors. I had 11 antennas mounted inside my attic at last count.

For outside use, I suggest protecting your antenna with a good grade house paint, spar varnish, or "Plastic Coat." I've never tried measuring the electrical effects of those waterproofing sealers—sounds like a future project—but I know that paint doesn't change the tuning of antennas. All my outside antennas are painted with spray epoxy paint. This kind of glues them together, slows down corrosion, and protects plastic parts from UV radiation. The color I use is "Machinery Gray," a light gray that makes the antennas virtually invisible at certain times of the day. No sense in advertising my antennas around the neighborhood. Years ago, I built a 3456-MHz loop Yagi antenna. Measured it, then painted it with two coats of spray epoxy paint with no measurable change. If I can't see the effects of the paint at 3456 MHz, I'm not going to worry about it on 2 meters!

One Last Point on SWR

So many times, I've heard someone say how good his antenna is because it has a low SWR. If a low SWR is so important, how come I can't work DX with my Dummy Load? Dummy Loads have great SWR! In a good antenna, we're looking for a good pattern, all the RF energy going where we want it to go, and a good impedance match. All this will result in a good SWR as well, but SWR is only one measure of a good antenna (see Figure 4).

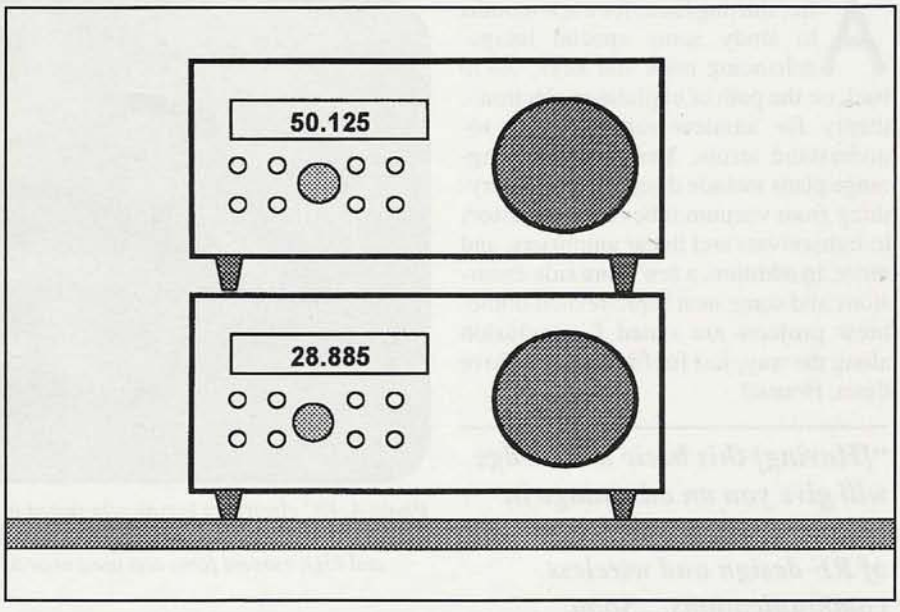
Next time we'll talk about some more high-performance Yagi designs and many common misconceptions. ■

The 28.885-MHz 6-Meter Liaison Frequency

If you want to find out what's happening on 6 meters, one good place to start looking is on...10 meters, the 6-meter "liaison" frequency on 28.885 MHz.

Have you ever wondered where all those hams come from when a dead 6-meter band suddenly opens? How did they know to be on six at that time? Part of the answer is that some of these hams monitor the various packet clusters or Internet spots. But a large percentage come by way of the 6-meter liaison frequency on the *10*-meter band at 28.885 MHz.

During much of the year, there's a moderate amount of activity on 28.885, where 6-meter operators either ask for, or give reports on, what's been happening on the Magic Band. You could literally work about 50 different countries on this frequency alone over the course of a few months, as many DX stations check in regularly. In fact, the roster of regular users on the liaison frequency reads like a list from the Six-Meter Operators' Hall of Fame (well, if there were one): CO2KK, GØJHC, GJ4ICD, K1TOL, KP2A, WP4O, VE9AA, W6JKV, and many more.



It pays to have two radios on in the background: one on 50.125 MHz, the 6-meter SSB calling frequency, and the other on 28.885 MHz, the 6-meter liaison frequency on 10 meters.

Comparing Notes

One of the neat features of this frequency is that you'll find many dedicated 6-meter operators from other parts of the U.S. (that you can't normally reach on six) and get a chance to compare notes. For example, it's hard for us in the northeast to talk to Alaska or Wyoming on six because, much of the time, the propagation conditions are not there. However, it's easy and fun to talk to these guys on the liaison frequency on 10 meters and find out what they're hearing on the Magic Band, as well as what they did during a recent VHF contest. The liaison frequency on 28.885 is like an open party line where anyone can drop in and say something about 6 meters. It's good to find others with the same interest in one place.

The liaison frequency is treated somewhat like the 6-meter calling frequency of 50.125 MHz. The usual protocol for using the 28.885 frequency is to call QRZ or ask for any reports. If you should hook up with someone to whom you want to talk for a while, it's best to move off frequency, generally to 28.880 or 28.900, to continue extended conversations.

Many operators keep 28.885 MHz as one of the important frequencies to be stored in their rig's memory bank, along with 50.125 and 52.525 (the FM simplex calling frequency). I find that it pays to have two radios turned on in the background, one on 50.125 and the other on 28.885. This lets me listen for activity while doing other things in the shack, and, every once in a while, I give a short shot on either frequency and see what happens. After all, you never know what's waiting for you on the Magic Band! ■

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)

A Mini Study of Voltage, Current, and Resistance

Power for our stations is a "hot" topic among our readers. So this month, we take a behind-the-scenes look at that stuff called "electricity" for a better understanding of...How It Works.

After shifting focus for a few months to study some special image-enhancing mics and keys, we're back on the path of explaining electronic theory for amateur radio in easy-to-understand terms. Yes, and our long-range plans include discussions of everything from vacuum tubes and transistors to transceivers and linear amplifiers, and more. In addition, a few more side excursions and some neat topic-related homebrew projects are slated for inclusion along the way, just for fun. You will love them. Honest!

"[Having] this basic knowledge will give you an advantage in the increasingly overlooked area of RF design and wireless communications....Soon, individuals with knowledge and hands-on experience in these areas will be in a position to name their own salaries."

The overall results should prove quite beneficial for both visualizing how your gear works and preparing for future license exams to upgrade. Further, this basic knowledge will give you an advantage in the increasingly overlooked area of RF design and wireless communications. Today's colleges and technical institutes are focusing on what the public considers big-money careers, namely digital electronics and computers. This is leaving a wide gap in the areas of analog technology and RF design. Soon, individuals with knowledge and hands-on experience in these areas will be in a position to name their own salaries. Being a radio amateur in today's world can truly have its rewards!

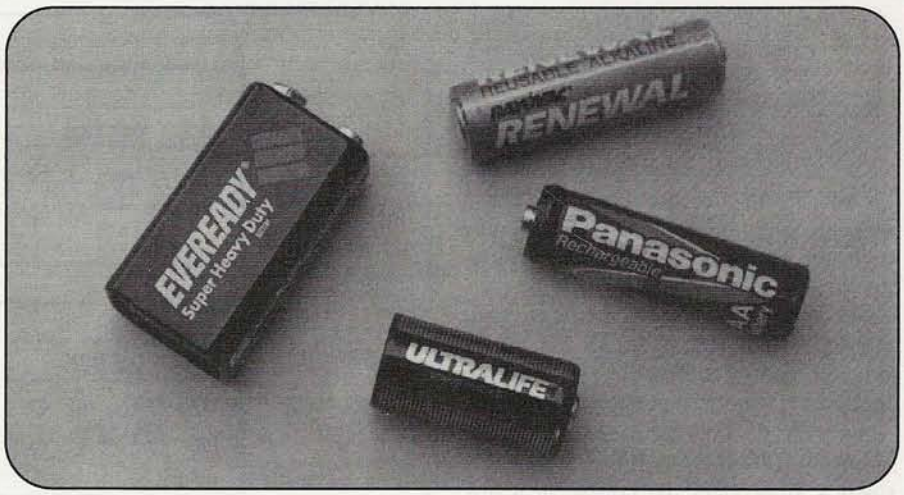


Photo A. DC electricity is typically stored in chemical form by batteries and released when a closed circuit is connected to its output terminals. DC is most efficiently stored in low-voltage and high-current form and used near its physical location to minimize wire losses.

This month's column establishes a solid foundation on which we'll build and expand in the upcoming months. It's also an introduction to next month's discussion of vacuum tubes and transistors which, in turn, is a prelude to a future column on transceivers. Now let's begin with a quick look at some familiar basics.

AC and DC, a Quick Review

As you know, there are two distinct types of electrical current: DC, for Direct Current, and AC, for Alternating Current. DC has a specific polarity and always flows from negative (-) to positive (+), assuming, naturally, that a complete circuit or two connections are present. DC is stored in chemical form in cells or batteries of cells (Photo A), or it may be produced by solar cells, or by *rectifying* and *filtering* AC into DC. AC does not have set positive and negative polarities or connections/terminals; it flows alternately in both directions. How frequently it changes directions/polarizes is expressed as its *frequency*, measured in Hz, kHz, MHz, etc. AC is usually produced by generators, but it can also be derived or synthesized from DC by using a "chopper" circuit to change its polarity.

When AC is applied to a coil, it produces a magnetic field that continuously changes in polarity or direction. If a sec-

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

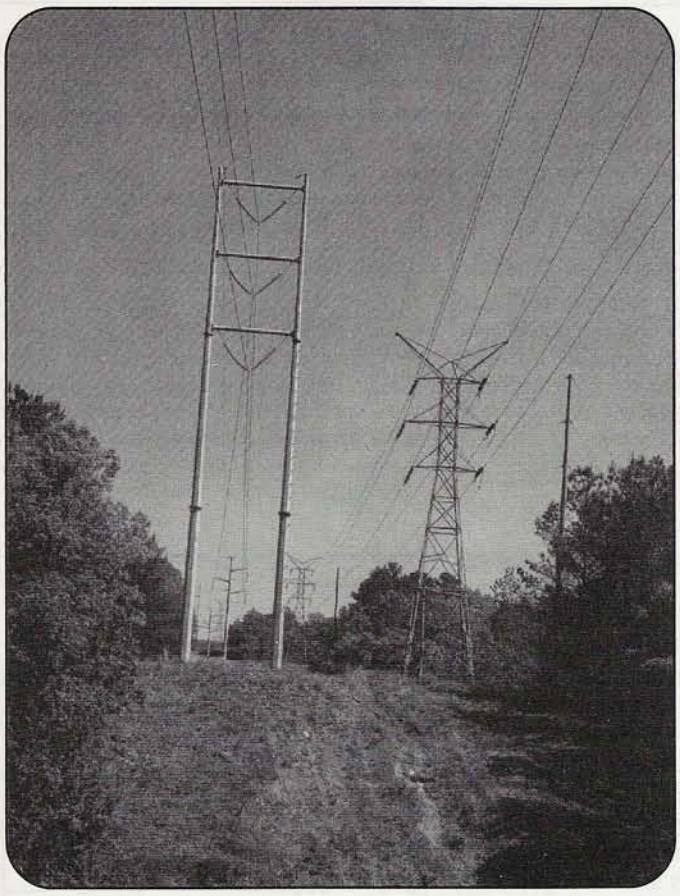


Photo B. AC electricity is normally produced by huge generators at dams near lakes or waterfalls, then transferred over long distances by high power lines dotting our countryside, like those shown here.

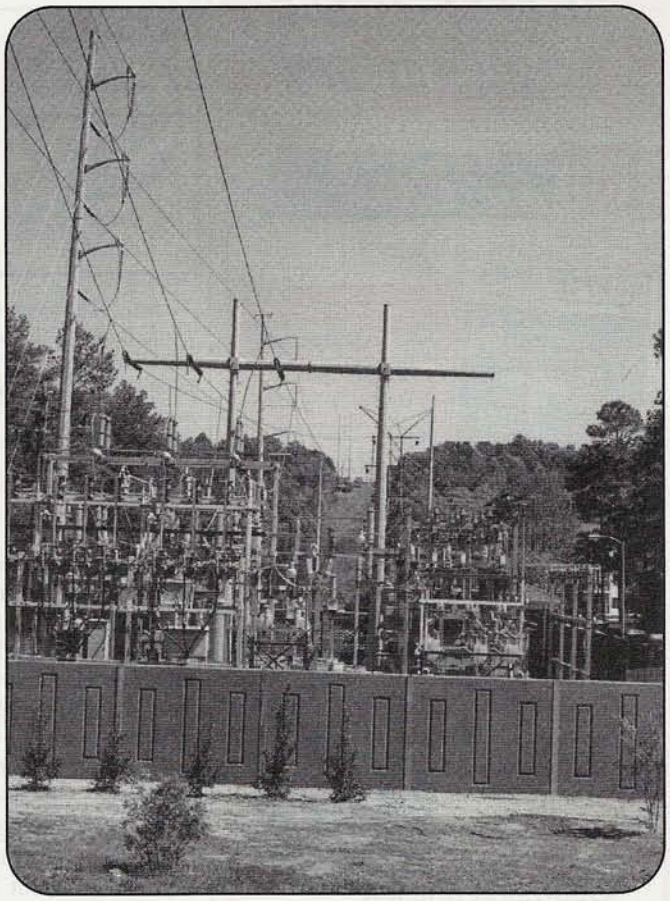


Photo C. AC power is most effectively transferred between cities in high-voltage and low-current form, then stepped down to lower voltage at high current by transformers in substations, like the one shown here, for distribution in local areas and neighborhoods.

ond coil is placed in close proximity to the first coil, *transformer action* will cause a voltage to be *induced* in the second coil. The amount of voltage induced into that secondary coil will depend on the transformer's *turns ratio*. Assuming a ratio of 4:1, a primary coil of 200 turns, a secondary coil of 50 turns, and 480 volts at 1 ampere applied to the primary coil, output from the secondary coil will be approximately 120 volts at 4 amperes ($^1/_4$ the voltage at 4 times the current). Theoretically, that equates to 480 watts input (480 volts x 1 ampere) and 480 watts output (120 volts x 4 amperes). In reality, output will be closer to 120 volts at 3.9 amperes (468 watts), with 12 watts dissipated as heat. Everything in electronics equates. There is no hidden magic.

Incidentally, when DC is applied to a coil, it produces only a stationary magnetic field and becomes an *electromagnet*. Have you ever noticed those large cranes lifting autos in salvage yards? The crane's large pickup disk is nothing more than a huge electromagnet.

Since AC power is often generated near dams or in other out-of-the-way places, it is *stepped up* to a higher voltage at lower current for more efficient transmission between geographical areas or cities. Some rural power lines carry 14,000 to 17,000 volts (Photo B). In cities, power substations containing large transformers then step the voltage down and the current up for distribution in parallel-connected neighborhoods (Photo C).

Radio signals are also AC voltages, which are produced by *oscillator circuits* in communications equipment. The difference between these AC voltages and those distributed by power lines are their frequencies and power levels. AC for home and office (utility) power is 60 Hz at levels greater than 1 volt. AC signals transmitted through the air—radio waves—are on frequencies between 300 kHz and several GHz, at levels below 1 volt (millivolt and microvolt range). Aren't you glad you followed our discussion of metric measures a few months ago in this column?

Voltage, Current, and Resistance Simplified

One of the first applications of electronic theory we learn when studying for an amateur radio license is the interrelation of voltage, current, and resistance, or Ohm's Law (Figure 1). We use its associated formula to solve several of the test questions on license exams of all classes and to calculate numerous technical details of circuits.

Now let's take a closer look at each of its associated variables (which will prove even more beneficial when we study vacuum tubes, transistors, and transceivers). *Voltage* is a level or amount of *electronic pressure* or *force* and is measured in *volts*. *Current* is the *quantity of electrons*

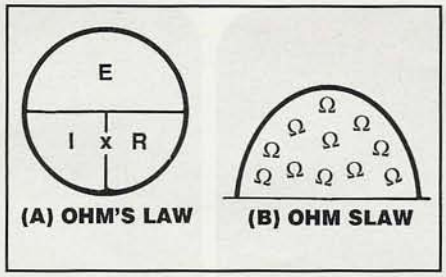


Figure 1. The three variations of Ohm's Law, I = E/R, R = E/I and E = I x R, are all combined in this easy to remember and use circle formula ("A"). The dish in "B" is a different matter! Ohm Slaw is similar to Alaskan mush, except different.

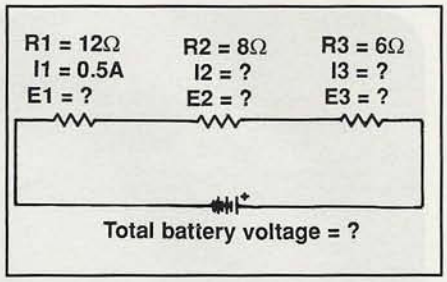


Figure 2. A series circuit is characterized by its single path for current flow. Also in a series circuit, current is the same through each component while voltage divides. Use those facts plus Ohm's Law to calculate our missing values. Then assume each resistor is 10 ohms, the battery is 180 volts, and repeat your calculations. Compare your answers with the text.

moved by an applied pressure or voltage and is measured in *amperes*. *Resistance* is the *opposition to current flow* and is measured in *ohms*. Every circuit exhibits some amount of resistance. The greater that resistance, the less the current flow in the circuit, and vice versa.

One quite effective means of visualizing these "big three" parameters is by making an analogy to a more tangible substance or quantity, such as water. In this case, current is akin to a particular amount of water moving through a pipe, voltage is comparable to the force pushing that amount of water, and resistance is analogous to the size of the pipe or hose through which the water must flow. The larger the hose's diameter, the lower its resistance and the more water it will pass in a given length of time. The smaller the hose's diameter, the higher its resistance and the less water it will pass in that same amount of time. Similarly, a low-resistance circuit (like a closed switch or conducting tube or transistor) will pass much more current than an open circuit (or non-conducting tube or transistor).

A fourth unit of measurement, *power*, also warrants mention at this point. Power is used to describe an *amount of energy* and is typically specified in *watts*, which, in turn, is the product of *voltage times current* (E x I) for input power, or *current squared times resistance* (I^2 x R) for output power. A primary law of physics states that energy cannot be created or destroyed, but only changed in form. Applying that law to amateur radio, we can say everything from a transformer (which converts one voltage to another) to a handheld FM transceiver (which converts battery power to intelligence-modulated RF power) is an energy converter.

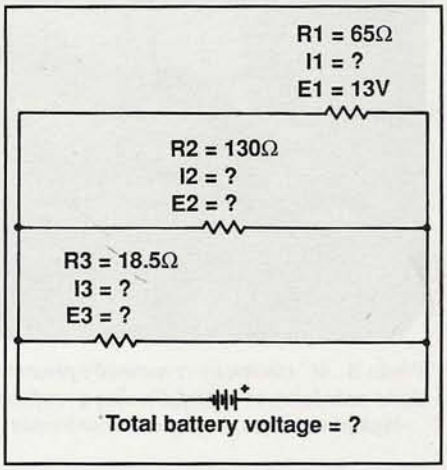


Figure 3. A parallel circuit is characterized by its multiple paths for current flow. Also in a parallel circuit, voltage remains the same across each component while current divides. Use Ohm's Law to calculate missing values, then assume each resistor is 12 ohms, the battery is 12 volts, and repeat your calculations. Compare your answers with the text.

Yes, and regardless of what form of energy is being converted, there is always some resistance or loss between input and output that is dissipated as heat or some other form of energy.

As a real-life example, let's say we use a 13.0-volt/8-amp DC power supply with our 50-watt 2-meter rig for home operation. Input power to the DC supply is 120 volts AC times 1 amp (approximate), or 120 watts. Output from the DC supply is 13 volts at 7 amps, or 91 watts, which, in turn, is the input power required for the 2-meter rig to produce 50 watts output. The difference between the DC supply's 120 watts in/91 watts out (29 watts worth) is dissipated as heat in the transformer

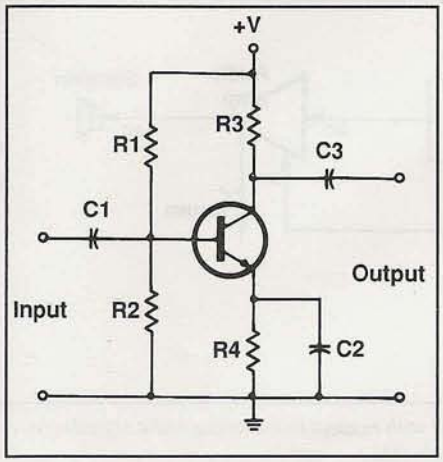


Figure 4. This "streamlined" version of an RF amplifier circuit illustrates how it is equivalent to five resistances wired in a combination series-parallel circuit. Where is the fifth resistor? It is the internal emitter-to-collector resistance of the transistor itself...and its resistance changes according to the input signal. More details next month!

and output/regulator transistor. The difference between the rig's input and output (41 watts) is likewise dissipated as power transistor/heatsink loss. As I pointed out earlier, everything in electronics equates, or balances out. (*You can also see that the power supply uses energy more efficiently than the radio.—ed.*)

Series and Parallel Circuits

Whether a transceiver (or any piece of electronic equipment) is solid state or vacuum tube, all-mode or FM-only, its inner workings are comprised of numerous *series* and *parallel* circuits. Visualizing how these circuits work plays an important role in understanding how related equipment works. In light of that, let's quickly discuss some series and parallel circuits (plus consider how our simple circuits can also represent stages in gear as "seen" by its power supply, etc.).

Let's begin by pointing out and comparing the differences in series and parallel circuits, as illustrated in Figures 2 and 3. Notice a series circuit has only one path for current flow, whereas a parallel circuit has two or more paths for current flow. If the path is broken or a resistor opens in a series circuit, the complete circuit stops working. If a path or resistor opens in a parallel circuit, only the open branch stops working. A series circuit might be compared to a string of old-fashioned Christmas tree lights: if one goes out, they all go out. Lights wired in parallel are the opposite: when one goes out, the rest stay lit.

Now refer to Figure 2, and commit the following facts of life to memory—*for* life. *In a series circuit, total resistance is always equal to the sum of all the resistances ($R_T = R_1 + R_2 + R_3$, etc.) and is always greater than the highest value resistor.* In Figure 2, that means R_T will always be more than 12 ohms. Also in a series circuit, *VOLTAGE DIVIDES among the resistances while current stays the same* (current is our "reference factor"). Additionally, *the highest measured voltage drop will be across the highest resistance.* Finally, if we know two parameters of a circuit or any of its components, we can use Ohm's Law to calculate the third/unknown parameter.

Next, *in a parallel circuit, total resistance is equal to the reciprocal of the resistances,*

$$RT = \frac{1}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} \ldots}$$

and is always less than the lowest value resistor. In Figure 3, that means R_T must be less than 18.5 ohms. Also, *in a parallel circuit, CURRENT DIVIDES among the resistances while voltage stays the same* (voltage is our "referencing factor"). Additionally, *the most current will flow through the lowest resistance*, just like our previously discussed water analogy. Yes, and once again, Ohm's Law works for calculating unknown parameters.

"AC for home and office (utility) power is 60 Hz at levels greater than 1 volt. AC signals transmitted through the air—radio waves—are on frequencies between 300 kHz and several GHz, at levels below 1 volt (millivolt and microvolt range)."

Now for clarification and practice, let's calculate the unknown parameters in Figure 2. Since R_1 is 12 ohms and passes 0.5 amps, the voltage across it must be 12 x .5, or 6 volts. Since current is the same in a series circuit, R_2 and R_3 must

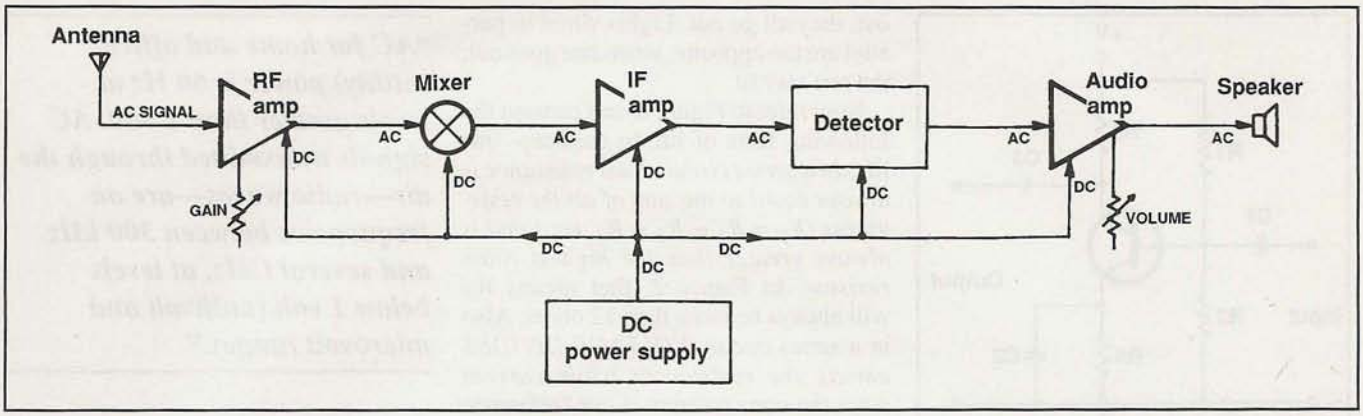


Figure 5. This simplified block diagram of a radio illustrates how its stages are series-connected with respect to incoming radio signals (AC), but wired in parallel with reference to its DC power supply (DC).

also be passing 0.5 amp. R_2 is 8 ohms, so 8 x 0.5 = 4 volts. R_3 is 6 ohms, so 6 x 0.5 = 3 volts drop across it. Total battery voltage (E_T) must thus be 6 + 4 + 3, or 13 volts. We can double-check this by multiplying R_T (total resistance, 12 + 8 + 6) times I_T (total current, 0.5). If 26 x .5 = 13, we are correct. If desired, incidentally, we can also multiply E_T (13) times I_T (.5) to tally total power (6.5 watts).

Now, suppose all three resistors in Figure 2 are 10 ohms each. What will be the total resistance? You're right, 30 ohms. Assume the applied voltage is 180 volts: what will be the current through R_3? Yup, 6 amps—the same as R_1 or R_2—because it's a *series circuit.*

Next, let's calculate the unknown parameters in Figure 3. Since R_1 is 65 ohms and 13 volts are across it, the current through R_1 is 13 divided by 65, or .2 amp. Voltage is the same in all branches of a parallel circuit, so R_2 and R_3 must also have 13 volts across them, and that will also be E total. R_2 is 130 ohms, so 13/130 = .1 amp. R_3 is 18.5 ohms, so 13/18.5 = .7 amp. I total is thus .2 + .1 + .7, or 1 amp. R total is 13/1 or 13 ohms (I will let you double-check it using the reciprocal formula. You should tally 13.0 ohms).

Now suppose all three resistors in Figure 3 are 12 ohms each. Quick, what will be the total resistance? It's easy. Since all values are equal, it's 12 ÷ 3, or 4 ohms). If applied voltage is 12 volts, what is the total current? Say 12/4 is 3 amps, and you are right. If you said 1 + 1 + 1 = 3 amps, you are also right.

"A primary law of physics states that energy cannot be created or destroyed, but only changed in form."

Silly calculations, you say. Not at all! With a few value changes, the three resistors in Figure 2 could easily represent the DC-equivalent circuit for a transistor amplifier. The three resistors in Figure 3 could also represent parallel-connected loads or stages in a rig as "seen" by its DC power supply. Every little piece of information we're sharing with you is beneficial now and for years hence.

We're almost out of space, so I'll close by quickly sharing two real-life examples of series and parallel circuits in actual use (Figures 4 and 5), then continue expanding our studies next month. Fair enough?

Conclusion

Some readers may say this month's column almost hit the "too complex" level, some may say it was almost too basic, and others might think it was almost boring. *Heads up, all three groups!* Remember what I said earlier. We're only at the beginning; we're establishing a solid background and a foolproof way to understand electronic circuits. Stick with me. The discussions will get even more interesting, and you'll eventually become a sharp Tech! 73,

—Dave, K4TWJ

Public Service Around the World

Amateur radio operators around the world continue to provide communications in the public interest of their communities. This month, we take a look at hams helping out after people are left homeless by violent weather in this country...and by military conflict in Europe.

May rolled in like a lion as hams in Oklahoma, Kansas, and Tennessee prepared to serve in the public interest. Severe tornadoes devastated entire communities in the Oklahoma City and Wichita areas. In Oklahoma alone, 46 people were killed, hundreds were injured, and thousands left homeless as entire towns were leveled or destroyed (see Photo A).

Peter Laws, N5UWY, at the National Severe Storms Lab in Norman, Oklahoma, reports that the National Weather Service office there was in contact—mostly via 2 meters—with various ham radio weather-spotting nets to the south and west of the Oklahoma City metropolitan area. "Skywarn is a regular, everyday occurrence here, and hams are a vital part of the warning process," Laws said. The storms wiped out thousands of houses. Meteorologists said that the worst tornadoes appeared to be F5 storms packing winds of 260 mph (Photo B; see the "Fujita Scale of Tornado Intensity" Table for an explanation of tornado "F" numbers).

After the twisters, the Salvation Army and the American Red Cross placed calls for additional amateur radio operator assistance. ARRL Oklahoma Section Emergency Coordinator Bennett Basore, W5ZTN, ran emergency nets and radio amateurs handled "tons of health and welfare traffic."

Thomas Webb, WA9AFM, the state's ARRL Public Information Coordinator, reported that during the first few days, "amateur activity was rather light....However, by the weekend, hams would be going into the damage area with assessment teams to provide communication."

Photo A. Hams were ready to help following the devastation left in May by tornadoes in Oklahoma. (Photo courtesy KC5TRR Web site)

Photo B. Unable to get out of the way, Skywarn volunteers provided crucial advance warning to help save lives. (Photo courtesy KC5TRR Web site)

Ken Runyon, KC5PNO, reported that the Red Cross requested at least 50 amateur operators to begin damage assessment. "Hams will start working with damage assessment teams at 7:30 a.m. and will be moving from home to home through the disaster area," he said. Runyon said the operators would need good footwear, a 2-meter radio, and batteries which would last at least 10 hours.

ARRL Oklahoma Section Manager Charlie Calhoun, K5TTT, reported that the Salvation Army requested amateur operators for about a week. "They need hams to act as shadows and transport units in addition to manning the (40) canteens." Calhoun said much of the activity went through the Edmond, Oklahoma 147.135-MHz repeater, which can be difficult to access with handheld transceivers, so volunteers were asked to bring mobile transceivers with external antennas and power sources instead of HTs.

Calhoun said volunteers were told to plan to stay in the field for at least four hours. No private vehicles were allowed in the damage area, and officials shuttled hams in and out. Hams from the Tulsa area went to Oklahoma City to assist, and volunteers from as far away as Minnesota offered to help, but then decided not to make the two-day drive since it was unclear how long ham assistance would be necessary.

Webb, WA9AFM, added that "Based on the excellent warning, most of the vic-

"Skywarn is a regular, everyday occurrence here, and hams are a vital part of the warning process."—Peter Laws, N5UWY

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

Table. Fujita Scale of Tornado Intensity

F0	Gale tornado	40–72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73–112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113–157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped/uprooted; light object missiles generated.
F3	Severe tornado	158–206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207–260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261–318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.
F6	Inconceivable tornado	319–379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

Source: The Tornado Project <http://www.thetornadoproject.com>

Table. Tornadoes are ranked in intensity from F0 to F6, based on the Fujita Scale reproduced above. The higher the number, the more severe the damage the storm is likely to cause.

tims appear to have left the disaster area prior to the strike and were in contact with friends or family or were in shelters with adequate communications."

The Salvation Army Team Emergency Radio Network (SATERN) established an amateur radio link with Oklahoma City and accepted requests via the Internet for information about the health and welfare of loved ones in the area. Once the forms were filled out on the Internet, local hams processed the health-and-welfare inquiries on amateur frequencies, which were sometimes the only means of getting messages into or out of the disaster area.

Jim Leist, KB5W, who chairs the Central Area Staff of the ARRL's National Traffic System, said the storms hit telephone services hard, and officials were asking that cellular telephone usage be restricted to emergency services personnel. "Amateur radio resources in the area are heavily involved with support to those agencies," Leist said. "On-site support is the first priority for hams in the affected areas."

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:
  - "Yaesu FT-100 HF/VHF/UHF Transceiver," by Ken Neubeck, WB2AMU
  - "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
- "Truly Portable Packet," by Ray Rischpater, KF6GPE

Plus...

- "The RF Attenuator," by Peter Ostapchuk, N9SFX
- "Communicating with Your Computer," by Lew Ozimek, N2OZ
- "Solid-State Guy Lines," by Mike Baker, W8CM

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

Next Stop, Tennessee...

With last January's unusual tornadoes still fresh in their minds, amateur radio operators in Tennessee were ready to respond when severe weather hit the Volunteer State on May 5. Some counties activated emergency nets just in case. In Montgomery County, hams were asked to have mobile units ready to go to specific areas to check on flooding. In addition, the Red Cross asked hams there to stand by to assist. Hank Koebler, N3ORX, reported that 49 amateur radio operators provided 294 man hours of support to the county Emergency Manage-

ment Agency and the Red Cross before and after the tornadoes hit:

A Skywarn net was activated at 1836 and amateurs began providing weather information to the National Weather Service office in Nashville, Tennessee. At 1846, a tornado touched down in nearby Stewart County and a tornado warning was issued for Montgomery County. At 1855, the Emergency Management Agency requested that an emergency services net be activated and that the designated operator report to the Emergency Operations Center. At the same time, the Red Cross requested that amateur operators stand by to assist if needed. As the storm intensified, operators continued to provide tracking data, and prepared to perform damage assessment once storm danger had passed. As the cell passed through at about 1915, a preliminary damage assessment revealed only spot flooding in normal low lying areas. In view of an anticipated second storm front coming through, the net was placed in standby mode to allow for meals, etc. at 1940.

At 2100, the net was reactivated as a second storm front moved into the area, bringing severe thunderstorms, heavy rains and high winds. One tornado was reported to have touched down on I-24 in Montgomery County, but no damage was noted. As soon as it was safe, mobile units were dispatched at the request of the EOC and Red Cross to determine areas where flooding, standing water and/or damage had taken place. Operators were dispatched to Red Cross headquarters to stand by for the opening of a shelter if needed.

Although several areas of flooding were found, and several streets near construction areas had washed out and become dangerous, there was no major damage and no injuries. Amateur operators stood by to assist a resident on a washed out street who was 8 months pregnant, but that situation soon stabilized. By 2300, all damage assessment except for one area had been completed and it was determined that a shelter would not be needed. At 2345, the net was deactivated and remaining operators were secured.

Yugoslav Update

The rest of this month's column is devoted to updating our report from last month on "Ham Radio in the Balkans," including Pentagon confirmation that Yugoslav hams are monitoring NATO aircraft and feeding information to their government. However, a report received at press time from Agence France Presse suggests that these may not be hams at all, but Yugoslav intelligence officers posing as hams. We may never know the full truth.—W2VU

Pentagon Confirms: Serbian Hams Supplying Info to Milosevic

In last month's issue, WA3PZO, reported on ham radio activity in and around Yugoslavia (see "Ham Radio in the Balkans," July, 1999). His coverage of ham radio's role in the conflict there continues this month with U.S. government confirmation of reports that Serbian hams are listening to NATO pilots and relaying information to their government.—W2VU

Ham radio continues to play a role in the military conflict in the Balkans (see Map). We are holding back the identity of all amateur radio operators in the conflict area. In last month's issue, I passed on a British newspaper report that hams in Yugoslavia were serving in *their* country's public interest by monitoring NATO pilots on bombing runs and passing along information to their government. The U.S. government subsequently confirmed that report and expanded on it.

At a daily press briefing at the Pentagon in May, a reporter asked: "You have no indication at all that [Yugoslav President Slobodan] Milosevic may know in advance, may have some information in advance, as to what the NATO targets might be? And is there anything new on the reports of several weeks back that there may be a 'mole' involved in passing along information?" The reporter was referring to speculation that Serb forces knew beforehand that warplanes would target a site near Korisa, where 87 ethnic Albanians were killed by NATO bombs.

Pentagon spokesman Kenneth Bacon replied:

First of all, we have no information that he knew about this target in advance. Second, we do know that some of the aviators' conversations can be heard, which may give him advance warning of some targets, but I don't know whether that gave him any advance warning of this target. *We do know that he has a network of ham radio operators who monitor, as best they can, communications among aircraft and try to pass on information to central sources about where these aircraft may be going and what they may be doing. Despite that, we've been able to fly with, I think, remarkable safety, given the type of informal network of ham radio operators and others he set up.* [Emphasis added] Beyond that, I can't speculate if he knew anything about this particular target. In terms of a mole, we found no evidence that there is a mole, and I think that report may have been speculation.

However, a Canadian pilot disagrees with these reports. In an interview with Jerry Ward, of the Edmonton (Alberta) *Sun* newspaper, the pilot, who can't be identified for security reasons, says claims by the U.S. that amateur radio operators are intercepting NATO pilots' communications is unlikely.

"I'd be very surprised if they were able to pick up the stuff that we're working because we're always working the VHF frequency range, which is different from a ham radio operator," said the pilot, who has been in Aviano, Italy, with 280 other Canadian personnel since the bombing began. Pilots of the 18 Canadian fighters speak in codes to ensure safety, he added. (*Apparently, this pilot has a lot to learn about the frequencies used by hams.—ed.*)

Behind the Lines...

We spoke recently with George Pataki, WB2AQC, who visited Serbia a few years ago, and who writes regularly for *CQ* magazine about ham radio in eastern Europe (no, he's not the same George Pataki who is Governor of New York). George provided some background about the state of amateur radio in Yugoslavia today.

Map. NATO forces continue (as of this writing) to bomb targets in Yugoslavia in an effort to force President Slobodan Milosevic to allow ethnic Albanians to return to their homes in the province of Kosovo. (From the Internet)

Photo C. Bomb damage to a village in Yugoslavia. A Serbian ham (see text) wonders if he will survive and notes that "I don't hate anyone because of his nationality or color of the skin....We are just like all the people in the world, some good and other bad." (Photo from a Yugoslav Web site)

Years ago, the YU hams had the best equipment in eastern Europe because they had more freedom of travel. Thousands of Yugoslavs worked in western countries, especially in Germany. They could afford modern radio equipment. In recent years, however, the economic situation of the country deteriorated because of the war in Bosnia and the blockade that followed. The sales tax is now 26%. Despite all the difficulties, many Yugoslav hams have managed to obtain foreign-made transceivers, build lots of equipment, participate in contests, even go on DXpeditions.

In Yugoslavia, there are six categories of licenses, from the highest, "A," to the lowest, "F." The maximum allowed power is 1.5 kilowatts; on the WARC bands and on 6 meters, only 300 watts. The minimum age for personal calls is 18, but younger people and hams

Photo D. This is a recent but undated handout picture made available on Monday, May 3, 1999, which NATO says is a radio relay station in Veliki Jasterebac, Yugoslavia, after airstrikes. (NATO photo)

without personal calls, after passing a test, may operate radio club stations, under the supervision of a licensed amateur. The test for the "A" license requires code operation at 20 words per minute, and the "A" hams have all band privileges. The no-code "E" licensees can use a maximum of 30 watts on 2 meters and 70 centimeters.

George also told us that the amateur radio association in Yugoslavia is the SRJ, Savez Radio-Amatera Jugoslavije, and that it publishes a bi-monthly magazine called *Radio*.

From a Ham in Serbia...

I also recently had the opportunity to have a conversation with a Serbian ham in the conflict area (Photo C). Here is what he told me, without editing, so please excuse his English:

It is always a big pleasure to confirm that, as much as we radio-amateurs around the globe are concerned, there are no borders dividing the people. I visited your magazine's Web page, and I found it very interesting. Sadly, it is not possible for me to purchase anything from U.S. I would like to tell you more about our hobby in my country, repeater network, my friends, our activities and interests, but I can't because our countries are in war. When all this madness is over (if I survive), I will contact you again, so you can help us with your knowledge in promoting interests of radio-amateur community, which are (as you pointed it out) similar in all the world....I am a Serb, and I am proud of it, but I don't hate anyone because of his nationality or color of the skin. A lot of people in the west (especially English) think of us as some kind of savages, animals that only kill and rape. We are just like all the people in the world, some good and other bad. Please pray for the peace in my country. MNI 73

Communications within and out of the conflict area continue to get worse as NATO aircraft bomb satellite and telephone links (Photo D). NATO is also using graphite bombs to disable Yugoslavian power plants. In mid-May, President Clinton signed an executive order which forbids the provision of services to the Federal Republic of Yugoslavia (Serbia and Montenegro). One immediate effect was the disabling of satellite feeds for Internet Service Providers (ISPs). While many ISPs are still in operation, the ability to communicate is becoming more difficult. One e-mail posting commented that it was even difficult to obtain batteries for portable radios.

On the Cover

The AMSAT Phase 3D Satellite Integration Lab in Orlando, Florida, may soon be without a satellite! The latest report from Phase 3D Project Leader Dr. Karl Meinzer, DJ4ZC, President of AMSAT-DL (Germany) is that he is in the final phase of working out an agreement for the long-delayed launch of this ham radio super-satellite—perhaps as early as this October. Specifics cannot be released, however, until the agreement is signed (see this month's "VHF News," page 6, for additional details). Meanwhile, final testing and tweaking continues at the lab in Orlando.

In our cover photo, former AMSAT volunteers Ralf Zimmermann, DL1FDT, and Klaus Peter, DG1SDO, work at computer terminals outside the "clean room" containing the satellite itself. Earlier this year, *CQ VHF* Editor Rich Moseson, W2VU, and Advertising Manager Arnie Sposato, N2IQO, had the opportunity to tour the Orlando facility and get a close-up look at the P3D satellite before it goes "out to launch." Rich's photo essay on the visit begins on page 28. (Cover photo by Larry Mulvehill, WB2ZPI)

Oops...

Bob Nelson, N5EW, of Kerrville, Texas, caught us being "out of rithm"...

The world doesn't need a lot of nit pickers, but there is a nit in your June issue that needs to be addressed. Page 35 ("Q&A") mentions the "logarithms" built into ICs used in battery charging. A *logarithm* is the exponent needed to raise a base number to arrive at a given number. The term needed here is *algorithm*, which is a procedure for solving a mathematical problem.

Right you are, Bob, and thanks for the catch.—W2VU

Correcting a Correction...

We ran a correction in our June issue, supposedly giving an updated Web site where you could download software for running TCP/IP on a TNC using a Windows-based computer. Well, we really blew it—and reprinted the original, incorrect Web site! Here, trying again, is the most current Web site information we have, courtesy of Andy Nemec, KB9ALN, whose own e-mail address, by the way, was also wrong. Andy's e-mail address is <kb9aln@juno.com>, and the Web site address is <http://www.mv.com/users/grebus>.

Network Hardware for Weather Extremes

Your network node site is outdoors, on a mountaintop, with limited access and limited power. Can a regular computer provide control and storage functions without—literally—freezing up? N2IRZ says "yes."

As packet networks become ever more complex, the need for computing power at node sites has increased dramatically. Simple switches and routers have been implemented for the TNC-2's Z-80 processor, but with the latest flavors of such networking protocols as NOS, FPAC, G8BPQ, and FlexNet, it's become more common to see a PC running DOS or Linux in network service. We've examined this in past columns, but some newer developments merit another glimpse.

Before we get started, however, I want to make mention of North America's premier packet radio technical event. This year's ARRL/TAPR Digital Communications Conference in Phoenix, Arizona, promises to be the best one ever. If it's at all possible, I urge you to make your way to Phoenix at the end of next month. See "1999 ARRL/TAPR Digital Communications Conference" for details.

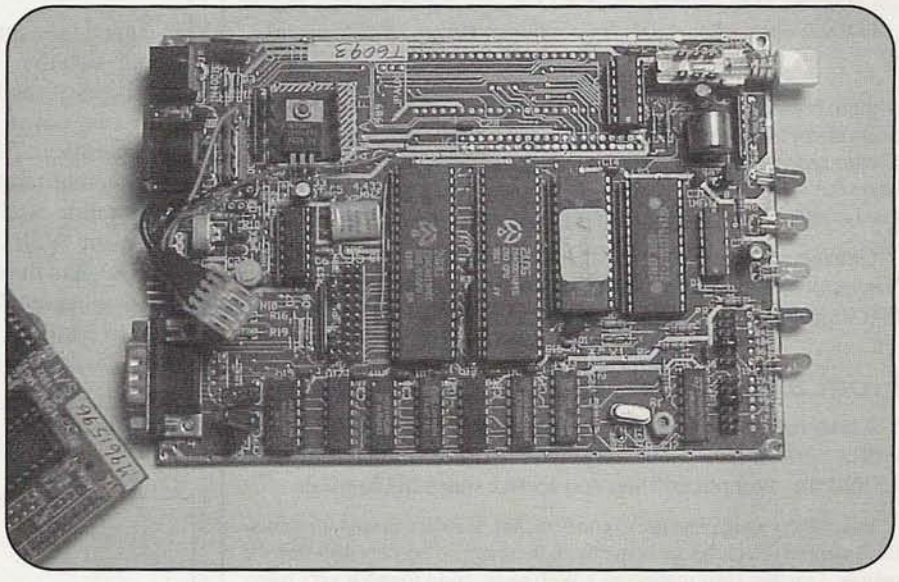


Photo A. The "guts" of the venerable TNC-2 as produced by PacComm Packet Radio Systems. This workhorse, along with the MFJ-1270 from MFJ, is used in more network facilities than any other equipment. Note the 6PACK EPROM installed to make this TNC usable with a computer running FlexNet.

Computers as Network Resources

Using a computer as a network resource is a relatively new idea. Back in the early days of packet, PCs were simply too expensive and, in many cases, not as powerful as the stand-alone Terminal Node Controller (TNC). Standardized TNCs, combined with a need for real networks (the Internet wasn't ready yet), spurred software developers to generate a plethora of networking firmware, the first being Software 2000 with its Net/ROM system.

Today, with 386-class PCs available for free, it's just so much easier to develop software for the PC platform. A 386 is much more powerful than the venerable Z-80 processor used in the TNC-2 (see Photo A), something that wasn't necessarily true when comparing a TNC-2 with an 8086 processor at 4.77 MHz. The logical result is that all of the latest software for packet, including all of the networking software, has been written for higher-level computers.

Now, a computer at the user's station isn't anything new. Sure, some of us started with dumb terminals, but once we got hold of a PC, the dumb terminal collected dust. But we don't really need a special computer for a user station, which is generally in an environment where the temperature hovers around 72° F. Network facilities are a bit different.

While many networking facilities (node sites) are in someone's house or atop a tall office building, there are also some that are simply outdoors, high on a mountain (Photo B). Some are accessible in winter, some not. Some have AC power with backup, some don't. Let's take nearly the worst case, something like the node site atop Mt. Tom in Massachusetts. Mt. Tom has AC power, but in limited supply. Once the snow falls, usually in early December, you simply cannot get up there until early March or so without a

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

"The most fragile parts of a PC are the moving parts. In a typical PC, these include the hard disk, floppy drive, and power supply fan. It's easy to avoid using the floppy drive, and the power supply fan, particularly in a 386 with a minimum of peripherals, is somewhat redundant."

great deal of difficulty, the options being helicopter or Sno-Cat. Understandably, there is a degree of skepticism when asking the site sysop to install a computer up there. If it fails, so does the network. What can we do?

Eliminate Moving Parts

The most fragile parts of a PC are the moving parts. In a typical PC, these include the hard disk, floppy drive, and power supply fan. It's easy to avoid using the floppy drive, and the power supply fan, particularly in a 386 with a minimum of peripherals, is somewhat redundant. The purpose of the fan is to keep the power supply cool, but this isn't a major concern if the supply is operating well below its rated power. While the motherboard draws some current, the expansion cards and other peripherals are the big current hogs, so we can assume that if the fan fails, it won't be a major problem. Don't forget, it's cold outside, too!

The next point to consider is the hard disk. While a typical hard disk has a mean time between failures of hundreds of thousands of hours, operation at temperatures below 0°F is questionable. Luckily, we have a few options here: *embedded PCs*, *disk emulation*, and *solid-state disks*.

Embedded PCs are small, self-contained computers intended to control some machine or system as a stand-alone. Many companies make and sell these, and there are a number of size and interconnection standards. With all the necessary interface drivers on-board, including VGA video, serial, and solid-state hard disks, these would be excellent choices for a network facility, with one drawback: they are relatively expensive. A simple 386 with 4 MB of flash hard disk, 2 MB of RAM and two serial ports costs about $300 in single quantities.

Disk emulation is considerably less expensive, but depends upon your system having a non-volatile, bootable device (*non-volatile* means it doesn't lose its data when the power is switched off, and *bootable* means the computer can load its operating system from it). A program named RAMDRIVE.SYS is included with Microsoft's MS-DOS 6.22. This program allows you to use a portion of the computer's RAM to emulate a hard disk. The main use of this program is to create a disk drive which is many orders of magnitude faster than a conventional disk drive, allowing the computer to read and write data much more quickly.

In our case, we want to use it to replace the mechanical disk drive. The PC operates with RAMDRIVE, and we use something else—say, a floppy drive—as the bootable disk. Of course, the floppy is a mechanical item, prone to failure, but it's likely to operate when we need it to, which should be almost never. If we add some sort of battery back-up to the PC, it can really be never; but, regardless, the floppy should work well enough to boot the PC once a month or so, even at 20

1999 ARRL/TAPR Digital Communications Conference

The 18th annual ARRL and TAPR Digital Communications Conference (DCC) will be held from September 24 to 26, 1999, in Phoenix, Arizona. This year's conference location is just minutes away from the Phoenix Sky Harbor International Airport (PHX).

The DCC is an international forum for radio amateurs in digital communications, networking, and related technologies to meet, publish their work, and present new ideas and techniques for discussion. Presenters and attendees will have the opportunity to exchange ideas and learn about recent hardware and software advances, theories, experimental results, and practical applications. The DCC is not just for the digital expert, but for digitally oriented amateurs of all levels of experience.

Not only is the DCC technically stimulating, it offers a weekend of fun for all who have more than a casual interest in any of the ham digital communications modes. This includes networkers, sysops, software writers, modem designers, and digital satellite communications enthusiasts. The DCC is for all levels of digital operators—a must conference to attend to get active on a national level. Now, more than ever, amateur radio needs this great meeting of the minds, since it's important that we demonstrate a continued need for the frequency allocations we now have by pushing forward and documenting our achievements. The ARRL/TAPR DCC is one of the few ways that we can record our accomplishments and challenge each other to do more.

As in years past, an entire session strand will be offered with beginning, intermediate, and advanced presentations on selected topics in digital communications, including APRS, satellite communications, TCP/IP, digital radio, and spread spectrum. Come to the conference and hear these topics presented by the experts!

In addition to the presentation of papers on Saturday, three symposia/seminars will be held on Friday and Sunday. These sessions allow those with additional time and interest to make the most of the DCC. On Friday, the Third APRS Symposium will be a gathering of all the APRS developers and users. A half-day technical seminar will be held on Friday night, and the Sunday morning seminar will be focused on PIC (peripheral interface controller) development, design, and programming.

The guest speaker at the Saturday evening banquet will be Geoff Baehr, N6LXA, who is the Chief Network Officer at Sun Microsystems, which developed the Java programming language, and has been doing some interesting things in networking.

PRUG (Packet Radio User Group of Japan) will be the international co-host for a second year running. PRUG will be hosting an informal social on Friday evening before their seminar and symposium is held.

Visit <http://www.prug.or.jp> for more information about the organization.

Full information on the conference and hotel rooms may be obtained by contacting 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>.

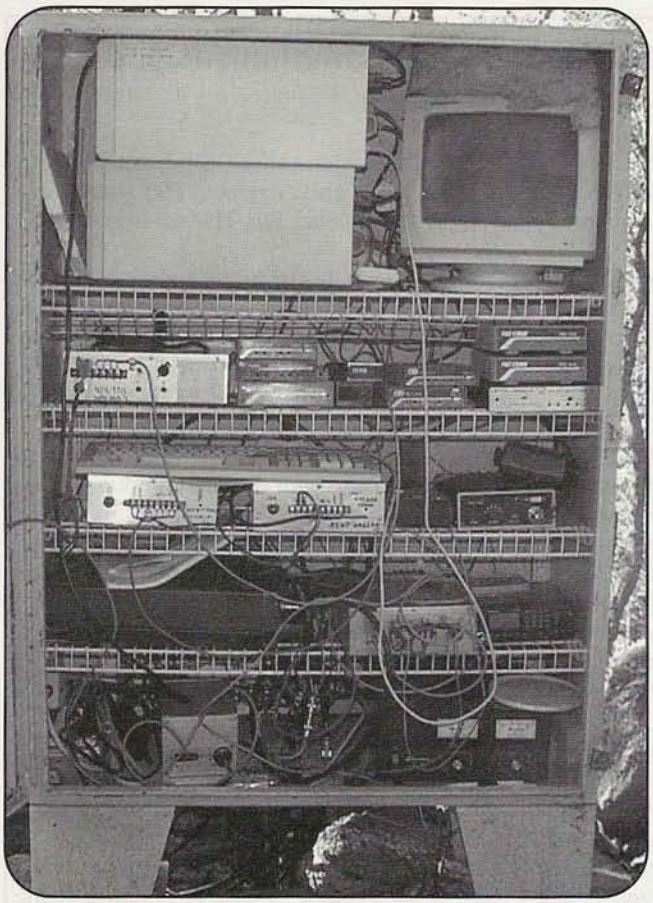
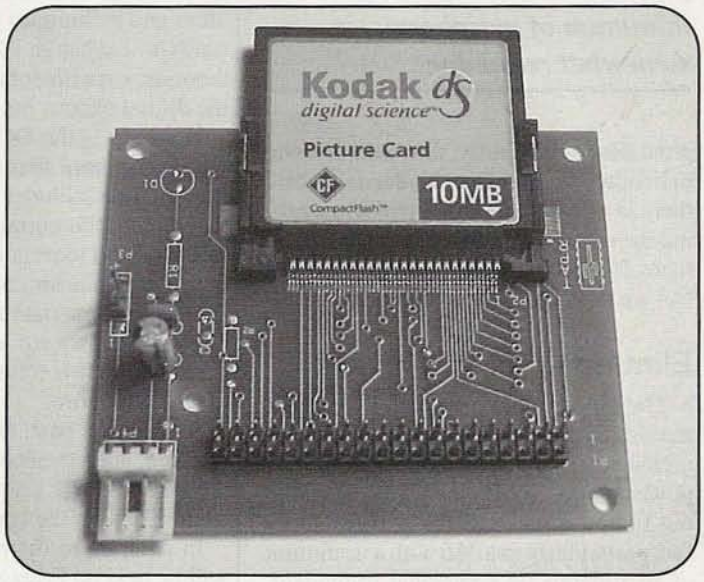


Photo B. The mountaintop network node site of the Ramapo Mountain Amateur Radio Club, WA2SNA. This cabinet has AC power and is easily accessible, even in winter. Some node sites aren't as lucky. One of the computers here runs the FlexNet node, the other runs NOS. Neither computer is modified for outdoor operation, and both have survived for a few years without problems.

Photo C. The TAPR CompactFlash Adapter Card, with a 10-MB Kodak CompactFlash card. The adapter card turns the CompactFlash card into a 100% IDE-compatible solid-state hard disk, able to operate from -25°C to +75°C...perfect for those cold mountaintops.



below zero. Of course, a little creativity might bring other ways of booting the PC.

To set up the disk emulation, you load RAMDRIVE.SYS with a DEVICE command in the CONFIG.SYS file. Assuming you want to run RAMDRIVE in extended memory (memory above the 1-MB level), you first have to run HIMEM.SYS, then RAMDRIVE.SYS. As an example, to run RAMDRIVE from the boot directory, with a 4-MB hard disk emulation and in extended memory, use the following line somewhere after HIMEM.SYS in the CONFIG.SYS file:

DEVICE=RAMDRIVE.SYS 4096 /E

The **4096** is the size of the disk in kilobytes, and the **/E** switch causes it to be placed into *extended memory*. If you want to run **RAMDRIVE.SYS** from some other drive and/or directory, then that needs to be specified after the "="; and to run it from *expanded memory,* such as that created with EMM386 or similar, you can use the **/A** switch. For much greater detail on RAMDRIVE.SYS, use the online help utility provided with MS DOS: From the **C:>** prompt, simply type **HELP**, and select the topic in which you are interested.

Another possibility is to use a *solid-state hard disk*. Our friends at TAPR (Tucson Amateur Packet Radio) have designed and built a nifty item known as the *CompactFlash Adapter Card* (Photo C). This is a passive adapter which uses commonly available *CompactFlash (CF)* modules—used in many devices, particularly digital cameras, as an alternative to floppy disks or other storage media—to create a solid-state hard disk which is 100% IDE compatible. This means that as long as you set the parameters in the computer's BIOS correctly, it *is* a hard disk, plain and simple. The size is limited only by your available cash.

Nothing could be simpler to use, either. After setting the drive's parameters in BIOS (a table of parameters is included in the instruction manual), you connect the card like any other IDE drive, plug in the power connector, and boot the PC from a floppy. Then, you run FDISK to create a DOS partition and make it bootable, format it, and load all the necessary software. The adapter card is small, so it will fit anywhere, and draws very little power. For details, browse <http://www.tapr.org/tapr/html/Fcfa.html> (*note that the filename "Fcfa" is case-sensitive and must be entered exactly as printed. The Web site will not recognize "fcfa" or "FCFA"—ed.*).

How Long Will It Last?

In discussions, the question was brought up of the CF card's longevity. Like all solid-state, non-volatile storage devices, it has a finite lifetime in terms of read/write cycles. For those running FlexNet, which updates the HEARD.FPR file every minute or so, how long can we expect a CF card to last? I asked that question of Bill Frank, a technical representative at the CompactFlash Association, an industry group dedicated to promoting CF technology (<http://www.compactflash.org>).

He says that each memory cell in a CF card has a lifetime of hundreds of thousands of cycles, and CF cards use *intelligent wear leveling routines*, which ensure that no particular area of the CF card is worn out prematurely. The lifetime depends upon the percentage of the CF card that is rewritten each time, so writing a 500-kB file to a 48-MB CF card once a minute would result in a lifetime of about 36 years, and this number increas-

es as the file size decreases. In other words, for a 10-kB "Heard" file, the card would easily outlast the computer in which it's installed. The TAPR adapter card costs $49 for members and $59 for non-members, plus shipping and handling (this does *not* include a CF card.) The TAPR Web page referenced above will let you place an order.

Another technology worth mentioning is an *embedded IDE flash drive*. It's similar to that described above, but integrated into a single unit. One vendor I deal with, EMJ, sells a 4-MB IDE flash disk for $71 in single quantities (May 1999 price). They offer a multitude of capacities, up to a 1792-MB SCSI flash disk, priced at a reasonable $21,327! Visit them at <http://www.emjembedded.com>. I haven't looked, but I'm certain that there are many other suppliers of similar products. EMJ also sells embedded PCs, which we discussed earlier.

In closing, most of us don't have to worry about the weather conditions for our computers. But, if you're one of those few who do, there *is* something you can do. Solid-state disk drives can eliminate one major problem by eliminating the hard disk. If you're on a budget, you can use a disk emulator, one of which is supplied with later versions of MS-DOS. FlexNet has an optional application module named SERV.EXE, which offers the ability to control any DOS PC running FlexNet remotely, as if you were at the console. If you still aren't convinced, just try an experiment—run a PC at your site this coming winter (but not as a network facility, or perhaps with TNC-based backup) and see what happens.

SIG Delay

Last month, I promised a look at the Special Interest Groups (SIGs) sponsored by TAPR, but there was so much valuable information I wanted to share this time, that we'll have to wait until next month. In case you've never heard of them, the SIGs are not political action coalitions, but a loosely-knit group of hams who share common technical interests. Most of each SIG is simply an e-mail reflector, where subscribers post messages for everyone to comment upon. There are hardly any flames (negative comments), and no question is too basic. This is possibly the most comprehensive packet radio resource in the world. More on them soon. Until then, 73,

—N2IRZ

Q & A

Questions and Answers About Ham Radio Above 50 MHz

Q: I have read the ARRL autopatch recommendations and I am still a little confused. While I was able to conclude that it was OK for me to make a phone call to a boat dealer to see if my outboard repairs have completed, I was unable to determine whether, if I purchased a telephone interconnect, the dealer would be able to call me using a phone number that would ring my radio through the interconnect in my car at a later time and tell me that my motor was indeed fixed.

Thanks,
Cliff Watts, KCØESZ

A: This is a very gray area, which is why you're confused. In fact, the whole area of simplex autopatches, or simpatches, is very gray. One of the main problems is having a control operator at the point at which the interconnection between the phone and the amateur station is made. I'd say that if you have another option, such as a cellphone or an answering machine (which you may check via autopatch), use that instead.

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

Q: The "cheap" 6-meter Yagi antenna (June '99 "Antennas, etc.") is probably going to be my next project. Where can I get ferrite beads like the ones shown in the photo? I've been using coils of coax and would prefer to use the beads but just don't know where to get them. Keep up the good writing.

Larry Clark, KD5FOY

WA5VJB replies:

A: These ferrite beads that you're interested in are also used on computer cables. They're those big lumps near the end of power and printer cables. Any of those can be used, as can the power line beads sold at RadioShack, although I find RS a bit expensive. You might want to check around at local computer and electronics stores.

Q: I subscribe to your magazine and really enjoy the articles pertaining to antenna building. What is the easiest way to match a quad or beam? I had my best success with a gamma match, but I find it hard to construct. I have tried a gamma match, delta match, and T-match with very little success. Also what is the easiest balun to build? I want to use coax for the feedline, so I will need a balun of some sort. I have two good books on antennas, but find them hard to understand. Any help would be appreciated. Thanks,

<Robbe62719@aol.com>

A: Matching networks are more a matter of personal preference than anything else. And, depending on what type you build, you may not need a balun. A gamma match, for instance, accepts a direct coax feed. I'm not sure which books you have, but I'd suggest that you look for a copy of Joe Carr's *Practical Antenna Handbook*, by TAB Books. It is much easier to understand than the *ARRL Antenna Book* and is nearly as comprehensive. Plus, I'd recommend the CQ Library's *Building and Using Baluns and Ununs*, by Jerry Sevick, W2FMI. It will tell you everything you ever wanted to know about baluns.

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

Analyzing Keplerian Elements—Part 1

Most satellite operators just use Keplerian elements in automatic satellite tracking programs. But you can tell a lot about an orbit from Keplerian elements and some relatively simple mathematics.

Most amateur satellite operators use Keplerian elements for pass predictions and in real-time satellite tracking software. But to some of us, orbital parameters are mysterious mathematical things that take a "rocket scientist" to understand. You might be pleasantly surprised to find out that the Keplerian elements tell you some very useful things about a satellite's orbit, including how high the satellite orbits, what the longest distance is that you can communicate via the satellite, and whether or not you can expect communications opportunities with the satellite at any given time.

All of these things can be computed with some relatively simple equations I've included in this article. WAIT—don't stop reading! These equations are simple enough for a basic scientific calculator, and I also posted an Excel® spreadsheet on my Web page (<http://www.mindspring.com/~n2wwd>; see Figure 1) that you may use to do the same computations that I do in this article and in next month's Part 2. All you need to do is input the satellite's Keplerian elements and your own latitude, and the spreadsheet will do the rest. The next section of this article will show you how to read the Keplerian elements so you can either do the calculations or put them into the spreadsheet.

Keplerian Element Input

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:	0.00E+00	rev/day^2
Epoch Rev:	11735	
Checksum:	279	

Orbital Characteristics

Orbital Period	699.5	minutes
Semimajor Axis	26102	kilometers
Apogee Altitude	35421	kilometers
Perigee Altitude	4040	kilometers
Ground Range	7128	kilometers (Maximum Communications Distance)
Guaranteed Coverage	79.2	deg - Latitude (North or South)
Maximum Coverage	90.0	deg - Latitude (North or South)

Coverage	
42.4	(%) at Apogee
19.4	(%) at Perigee

Figure 1. Sample of the Excel® spreadsheet posted on N2WWD's Web site (<http://www.mindspring.com/~n2wwd>), which you may use to calculate characteristics of a satellite's orbit, based on its Keplerian elements. Again, the figures given are for AMSAT-OSCAR-10.

What Are Keplerian Elements?

We first discussed Keplerian elements in the August, 1998, "Orbital Elements" column. This discussion included the illustrations in Figure 2 and Figure 3, which show the "physical" meaning of the Keplerian elements and how they relate to Kepler's laws of orbital motion.

By Ken Ernandes, N2WWD (n2wwd@cq-vhf.com)

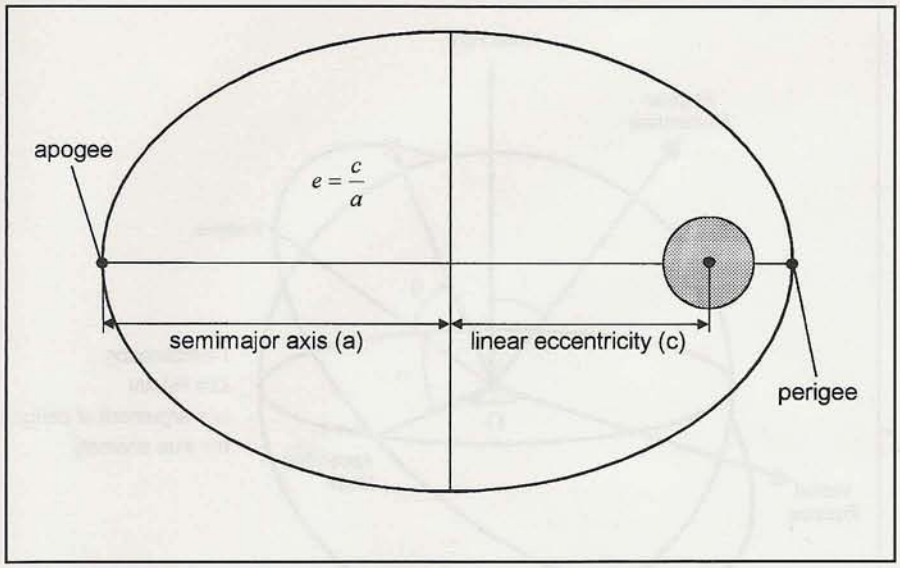


Figure 2. Kepler's First Law says satellites orbit in elliptical paths, with the Earth at one focus, or special off-center point, of the ellipse. The first two Keplerian elements, the semimajor axis and the linear eccentricity, describe the size and shape of the ellipse.

"A satellite's Earth surface coverage increases as the altitude increases; high-altitude satellites approach 50% Earth coverage....In general, the more surface coverage a satellite has, the more communications and long distance (DX) opportunities there are."

That column also included a discussion of the common NORAD/NASA Two-Line Element (TLE) format, and the more verbose AMSAT Keplerian element format, in which the elements are distributed. Since that was a year ago, we'll briefly recap here before digging in.

Kepler's First Law states that satellites orbit in elliptical paths with the Earth at a special off center point along the ellipse's longest dimension (known as a *focus*). Figure 2 illustrates the *semimajor axis (a)* as half the longest dimension of the ellipse. The *eccentricity (e)* 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 3 shows that the remaining four elements are angles that orient the orbital ellipse relative to the Earth. Two of the angles orient the plane of the orbital ellipse. The *inclination (i)* is the angle between the ellipse's plane and the equator. Consequently, the inclination also tells you the northernmost and southernmost latitudes over which the satellite will directly fly. The other planar angle is the *right ascension of the ascending node* (Ω), or *RAAN*. This 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 other two angles are orientations within the plane of the orbital ellipse. The *argument of perigee* (ω) is the angle from the ascending node to perigee in the direction of satellite motion. The *true anomaly* (θ) is the angle from perigee to the satellite's position at the *epoch time* listed in the Keplerian elements. Keplerian elements actually use a variant of true anomaly called *mean anomaly* (with "mean" meaning "average" in this context). Using mean anomaly makes it a little bit easier to compute the satellite's position for a desired time. *Epoch time*, by the way, refers to standard calendar date and time.

As noted above, Keplerian elements are generally distributed in either or both of two formats, TLE (see Table 1) and AMSAT (see Table 2). Both the TLE and AMSAT Keplerian parameters are known as *mean* elements; they are similar, but not exactly identical, to the physical parameters known as *osculating* elements, shown in Figures 2 and 3. This distinction, while relatively unimportant to the computations performed in this article, is *very important* when choosing an orbit computation technique (i.e., orbit propagator) in a satellite-tracking program.

High and Low: Apogee and Perigee

Given an osculating mean motion, you can compute the orbit's semimajor axis and orbital period (the time it takes a satellite to make one complete revolution around the Earth). From the semimajor axis and eccentricity, you can in turn compute the orbit's highest altitude, or *apogee*, and its lowest altitude, or

Table 1. Two-Line Element (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
```

Table 1. The TLE, or Two-Line Element, format in which NASA releases Keplerian elements for various satellites. The one shown in this example is AMSAT-OSCAR-10. This format is ideal for entering into computer tracking programs, since you don't need to know what all the numbers mean (the program does).

Oops...

In last month's Part 2 of KF6FGB's "Portable Power" series, we forgot to include one supplier of high-capacity 12-volt gel-cells designed for ham use (so you won't have to figure out what to do with the jumper cables on the ones designed for cars!). So, in addition to your local auto parts store, you might want to check out The Ham Contact, P.O. Box 4025, Westminster, CA 92684; Phone: (800) 933-4264; Fax: (714) 901-0583; E-mail: <n6yyo@sprynet.com>.

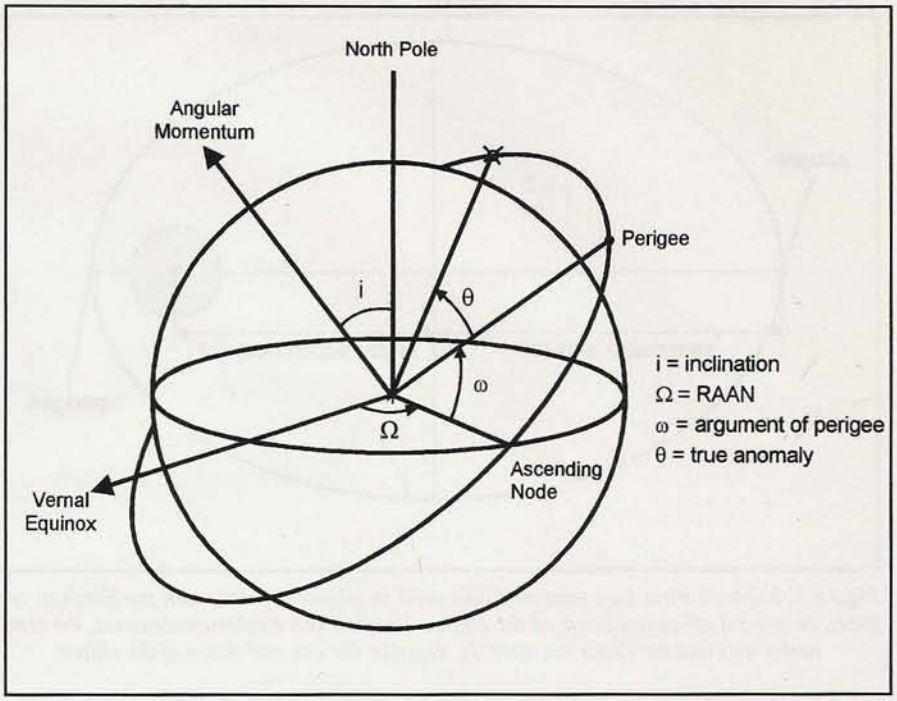


Figure 3. The remaining four Keplerian elements (beyond the two shown in Figure 2) are angles that orient the orbital ellipse relative to the Earth.

Table 2. AMSAT Keplerian Element 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
```

Table 2. The longer AMSAT format for Keplerian elements offers an explanation of each set of numbers. By reading this column, you should now know what most of them mean! This is useful for both computer and manual satellite tracking.

perigee. In the previous section, I made it a point to distinguish the *mean* elements given in the TLE and AMSAT formats from the purely physical (*osculating*) quantities. The purpose was to let you know that the computations we're making here are not exact. The differences between mean and osculating elements are small enough that the computations we make here, while not accurate enough for precision tracking, are "close enough" for the characterizing descriptions we're making about the orbit.

The mean motion is the orbital frequency in revolutions per day. Since there are 1,440 minutes per day (24 hours per day x 60 minutes per hour) the time (in minutes) to make one revolution (the period) is easily computed:

$$Period = \frac{1440}{Mean\_Motion}$$

We need to know the value of the semimajor axis in order to compute the apogee and perigee heights, using the following formula (*remember, folks—you can use a scientific calculator or the spreadsheet on Ken's Web page to actually* do *these calculations.—ed.*).

$$Semimajor\_Axis = \sqrt[3]{\frac{7.537122734 \times 10^{13}}{Mean\_Motion^2}}$$

The apogee and perigee altitudes (in kilometers) can be computed using the semimajor axis, the eccentricity, and subtracting the mean Earth radius, since we know the geometry of an ellipse:

$$Apogee\_Altitude = Semimajor\_Axis \cdot (1 + Eccentricity) - 6371$$

$$Perigee\_Altitude = Semimajor\_Axis \cdot (1 - Eccentricity) - 6371$$

A satellite's Earth surface coverage increases as the altitude increases; high-altitude satellites approach 50% Earth coverage. You can compute the percentage of Earth surface coverage using the satellite's altitude (in kilometers); and you can compute the coverage extremes using the apogee and perigee altitudes. The percentage of Earth surface coverage is computed by:

$$Coverage\_\% = 50 \cdot \left[\frac{Altitude}{Altitude + 6371} \right]$$

In general, the more surface coverage a satellite has, the more communications and long distance (DX) opportunities there are.

Latitude Coverage by Inclination

An orbit's *inclination* determines the most northern and southern latitudes over which the satellite will directly fly. By also considering the satellite's altitude at these extremes, we can determine the latitude limits in which stations will have some coverage for the satellite. This is most easily done for nearly circular orbits, since the altitude is more or less constant. It's more difficult for elliptical orbits because we would need to make some calculations using the orientation of the apogee-perigee (*apsidal*) line (i.e., argument of perigee) to determine the actual altitude at the most northerly and southerly latitudes (we'll defer these computations until Part 2).

For now, we'll compute the limiting cases, which are (a) latitudes *guaranteed* to have some coverage, using the perigee altitude, and (b) latitudes that could *never* have coverage, using the apogee altitude.

"An orbit's* inclination *determines the most northerly and southerly latitudes over which the satellite will directly fly. By also considering the satellite's altitude at these extremes, we can determine the latitude limits in which stations will have some coverage...."

The maximum latitude for satellite access is computed by the following three steps:

1) Determine the maximum overflight latitudes using the inclination. If the inclination is 90 degrees or less, that's the maximum overflight latitude. Otherwise, the maximum overflight latitude is 180 degrees minus the inclination.

2) Determine the footprint latitude range for the satellite's altitude (in degrees), using the following equation:

$$Footprint\_latitude\_range = \cos^{-1}\left(\frac{6371}{Altitude + 6371}\right)$$

3) Determine the most northerly and southerly possible latitudes for the given altitude by adding the footprint latitude range to the maximum overflight latitude. (Note that if the sum of the footprint latitude range and the maximum overflight latitude exceeds 90 degrees, the satellite has full global coverage at that altitude.)

The above procedure needs to be done only once for nearly circular orbits. For elliptical orbits, you should do the computation twice: once at perigee and once at the apogee altitude. Stations at any latitude below the result computed for perigee are guaranteed to have some pass opportunities for the satellite. Stations at any latitude above the result computed for apogee could never have any pass opportunities. Stations between the results computed for perigee and apogee might or might not have pass opportunities, depending on the orientation of the apsidal line.

"There's one other piece of useful information to obtain from these calculations: how far you can communicate. The longest distance you can communicate through the satellite can be derived from twice the footprint latitude range."

There's one other piece of useful information to obtain from these calculations: how far you can communicate. The longest distance you can communicate through the satellite can be derived from twice the footprint latitude range. We already saw that the footprint ground range depends on the satellite's altitude, so the longest possible communications distance is computed from the footprint latitude range:

$$Maximum\_communications\_range = 2 \cdot \frac{\pi}{180} \cdot Footprint\_latitude\_range$$

In Summary

This article was, in part, a refresher on the Keplerian elements, emphasizing what they tell you about the satellite's orbit. We also learned to compute how long it takes the satellite to orbit the Earth (i.e., period) and how to compute the satellite's highest (apogee) and lowest (perigee) altitudes. We learned how to compute the longest possible line-of-sight communications distance (footprint diameter) and saw how this gives us bounds on the satellite's latitude coverage. These calculations will be expanded upon a little next month. ■

Hamfest Calendar

The following hamfests are scheduled for August, 1999:

August 1, 49th Annual Berryville Hamfest, Clarke County, Ruritan Fairgrounds, **Berryville, VA**. Talk-in: 146.820, W4RKC. For information, contact Jane Barb, KD4IET, at (540) 955-1745; E-mail: <ibarb@visuallink>com>; Web: <http://www.Vvalley.com/svarc/hamfest>, sponsered by Shenandoah Valley Amateur Radio Club, P.O. Box 139, Winchester, VA 22604. (exams)

August 1, Annual Land of Lakes Hamfest, Steuben County 4-H Fairgrounds, Crooked Lake, **Angola, IN**. Talk-in: 147.180-444.350. For information, contact Land of Lakes Amateur Radio Club at (219) 475-5897 or write Bill Brown, 905 W. Parkway Dr., Pleasant Lake, IN 46779; E-mail: <sharon.1.brown@gte.net>. (exams)

August 7, "Hamfest 99," Weedsport Speedway/Fairgrounds, **Weedsport, NY**. Talk-in: 147.000 (-600) W2QYT. For information, contact Joe Kahler, WA2NGX,3476 Route 90 North Aurora, NY; Phone: (315) 364-5135; E-mail: <htx@usa.net>. (exams)

August 7, 60th Anniversay Hamfest & Swapmeet, Chico State University Farm Pavilion, **Chico, CA**. Talk-in: 146.850-. For information, contact Ray Watkins, KO6TW, at (530) 865-9623 (after 5 p.m.); E-mail: <ko6tw@w6rhc.org>; Web: <www.w6rhc.org>. (exams)

August 7, JVARC Hamfest & Antique Radio Swap Meet, Decatur Township Fire County Grounds, **Lewistown, PA**. Talk-in: 146.910. For information, contact Richard Yingling at (717) 242-1882.

August 8, 65th Annual Hamfest, Will County Fairgrounds, **Peotone, IL**. For information, contact Tom Davis, KB9NUQ, 14914 Washtenaw, Harvey, IL 60426; E-mail: <tdavis@internetplus.net>.

August 8, TSRAC 22nd Annual Hamfest, Red Mens Picnic Grounds, **Martins Ferry, OH**. For information, contact Triple States Radio Amateur Club, 2011 St Hwy 250 Adena, OH 43901; Phone: (740) 546-3930: Fax: (740) 546-3685; E-mail: <k8an@aol.com>.

August 8, Greentown Hamfest, Greentown Lions Club Fairgrounds, **Greentown, IN**. For information, contact L.B. Nickerson, KA6NQW, 517 North Hendricks Avenue, Marion, IN 46952; Phone: (765) 668-4814; E-mail: <ka6nqwnick@netusal.net>; Web: <www.netusal.net/~ka6nqwnick/hamfest.html>.

August 14, TARA Hamfest & Computer Show, Veterans Memorial Field House, **Huntington, WV**. Talk-in: 146.64, 146.76. For information, contact Jerry Stickler, KA8TUD, TARA President, P.O. Box 4120, Huntington, WV 25729; Phone: (304) 736-2664. (exams)

August 14, BARC Hamfest '99, Burford Fairgrounds, **Burford, Ontario**. Talk-in: VE3TCR, 147.150+. For information, contact Bob McKellar, VA3BIK, Hamfest Co-Chairperson, at (519) 442-4699, or send e-mail to <va3bik@rac.ca>.

August 15, Tailgate Electronics, Computer & Amateur Radio Fleamarket, Albany & Main St., **Cambridge, MA**. Talk-in: 146.52 & 449.725/444.725 - pl2A - W1XM/R. For information, contact Steve Finberg, W1GSL, P.O. Box 397082 MIT Br., Cambridge, MA 02139-7082; Phone: 617-253-3776. Handicapped Accessible

August 15, Ham and Computer Swapfest & Fun Auction, York Vo Tech School, **York, PA**. For information, call (717) 741-1780; E-mail: <ad3e@aol.net>.

August 15, Hamfest & Computer Show, National Guard Armory, adjacent to Lexington airport, **Lexington, KY**. Talk-in: 146.760-. For information, contact John Barnes, KS4GL, at <KS4GL@juno.com>, (606) 253-1178 (evenings), or send S.A.S.E. to John Barnes, KS4GL, 216 Hillsboro Ave., Lexington, KY 40511-2105. (exams) Handicapped accessible building.

August 21, Kosciusko Co. Hamfest & Computer Show, Kosciusko County Fairgrounds, **Warsaw, IN**. Talk-in: 146.985-. For information, contact Loren Melton, WB9OST, at (219) 858-9374 eves; E-mail: <WBØOST@WAVEONE.NET>. (exams)

August 21, Finger Lakes Hamfest & Computerfest, Tompkins County Airport, Taughannock Aviation Hanger, **Ithaca, NY**. Talk-in: 146.97 (-600). Attn: Pilots Fly into our Hamfest! Tower 119.60, Ground 121.80, ATIS 125.175, Unicom 122.95. For information, contact Tompkins County Amateur Radio Club, Richard Spingarn, AA2UP, or Dave Flinn, W2CFP, at <richard@eagleprint.com> or <dave@starflinn.com>; Web: <www.compcenter.com/~tcarc>. (exams) Handicapped accessible.

August 21, Roanoke Valley Hamfest & Computer Show, William Byrd High School, **Vinton, VA, (town w/Roanoke, VA)**. For information, contact Mike Marsh, KF4MUB, at Roanoke Valley ARC, P.O. Box 2001, Roanoke, VA 24009, or call (540) 389-3056; E-mail: <mikekf4mub@aol.com>. (exams)

August 21, 8th Annual Ham Radio, Computer & Electronic Equipment Swapmeet, Cowlitz County Expo Center (Fairgrounds), **Longview, WA**. Talk-in: 147.26+, pl 114.8. For information, contact Bob Morehouse, KB7ADO, at

Operating Notes

For Late July & August, 1999:

July	
29	Delta Aquarids meteor shower peak
31	Good EME conditions
August	
1	Good EME conditions
7–8	ARRL UHF contest (see rules, this issue)
12	Perseids meteor shower peak
21–22	ARRL 10 GHz Cumulative Contest, 1st wknd

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

(360) 425-6076 evenings, or write to LCARA Swap Meet, P.O. Box 906, Longview, WA 98632; E-mail: <kb7ado@aol.com>; Web (link to flyer): <www.qsl.net/nc7p/>.

August 21–22, 1999 Duke City Hamfest, National Guard Armory, **Rio Rancho, NM**. Talk-in: 147.06 + 100 Hz tone. For information, contact Marcus Lieberman, KM5EH, at (505) 836-1724; E-mail: <buckml@lobo.net>.

August 22, Annual Fleamarket, Millard Social Hall, **Omaha, NE**. Talk-in: 146.94. For more information, contact Ak-Sar-Ben ARC, Gerry Gross, WA6POZ, PMB 142, 643 N. 98th St., Omaha, NE 68114-2342; Phone (leave message) or Fax: (402) 891-2481; E-mail: <WA6POZ@arrl.net>; Web: <http://www.qsl.net/k0usa>.

August 28, 7th Annual Hamfest, Mohawk Drive-in Theater, **Gardner, MA**. Talk-in: 145.370 RPTR. For information, contact Paul, W1SEX, at (978) 632-9432 (eves.), or John, AE1B, at (978) 249-5905 (eves.).

August 28, Hamfest, La Porte County Fairgrounds, **La Porte, IN**. Talk-in: 146.52. For information, contact Neil Straub, WZ9N, at P.O. Box 30, La Porte, IN 46352; Phone: (219) 324-7525; E-mail: <nstraub@netnitco.net>; Web: <www.geocities.com/siliconvalley/byte/1653>.

August 28, Hamfest, Gainesville Civic Center, **Gainesville, TX**. For information, contact James K Floyd, N5ZPU, at (940) 668-7511; E-mail: <jfloyd@cooke.net>, or John Clausing, at (940) 665-2285; E-mail: <ks6ez@texoma.net>. (exams)

August 28–29, MARC Camp/Swapfest, Colorado Lions Club Camp, **Woodland Park, CO**. Talk-in: 146.820 repeater. For more information, contact Mountain Amateur Raido Club, Wes, KØHPZ, at (719) 687-8758, or <wlw@prodigy.net> or mail to P.O. Box 1012, Woodland Park, CO 80866.

VHF Conferences

August 27–29, 25th Anniversary Eastern VHF/UHF Conference, Harley Hotel, **Enfield, CT**, immediately off I-91 Exit 49. Informal gathering on Friday; registration, talks and technical sessions, lab demonstrations, noise figure measurements, and banquet on Saturday; VHF+ fleamarket and antenna gain measurements on Sunday. Special conference hotel rate at host hotel. Call (800) 321-2323 or (206) 741-2211 for Harley Hotel reservations and mention Eastern VHF/UHF Conference. For general conference information, contact Chairman Bruce Wood, N2LIV, 3 Maple Glen Lane, Nesconset, NY 11767-1711; Phone: (516) 225-9400 (work); (516) 265-1015 (home); E-mail: <bdwood@erols.com>. For fleamarket information, contact Mark Casey, K1MAP, 303 Main Street, Hampden, MA 01036; Phone: (413) 566-2445; E-mail: <map@map.com>. For updates, check out the NEWS Group Web page at: <http://uhavax.hartford.edu/~newsvhf>.

Sept. 18–19, Weinheim (Germany) VHF Conference (*We're running this early due to the extra time needed to make arrangements should you want to go.*) 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. Speakers should confirm that they will be attending by June 30, 1999. Any contributions for the VHF Convention Script (Proceedings) must be submitted by July 25, 1999. For additional information, please visit the Weinheim VHF Conference Web site at <http://www.hamradio.de/weinheim>. ■

Call for Papers, 18th Annual ARRL/TAPR Digital Communications Conference

The 1999 ARRL/TAPR Digital Communications Conference (DCC) will be held September 24–26 in Phoenix, Arizona, and will feature programs for digital communication beginners and experts alike. Papers for the conference proceedings are invited, and may be on any topic dealing with digital communications. Papers are due by August 9, and should be submitted to Maty Weinberg, ARRL, 225 Main St., Newington, CT 06111, or via e-mail to lweinberg@arrl.org. Paper submission guidelines are available online at <http://www.tapr.org/dcc>.

More Responses to Ryan

Our April editorial, "Old Men Making Lunch Plans," and the two pages of responses that we printed in June, continue to draw thoughtful comments from readers. Here are two additional points of view, from Gwendolyn Patton, KB3DVJ, and Dave Ruth, KC2AFK.

Patience...That's the Key

I am a new ham and have some viewpoints on the whole "Ryan" issue. I am also "into computers," having been a programmer since before IBM PCs were invented. I was doing online stuff long before the Internet became what it is. I was sending e-mail across the country using Fidonet, the landline equivalent of packet bulletin boards, years before the Internet was made available to the public.

"[T]hings don't happen on the air at Internet speed....Things take* time *in ham radio, from studying for tests to making contacts. You can't do everything all at once like you can in computers."—KB3DVJ

I have also been interested in ham radio for years, since I was a small child. My father picked up an old Navy shortwave receiver from the old man across the street, and he and I made it work. It lived in my room for many years, and I used to spend hours tuning in shortwave from all over the world. I used to go to bed listening to that radio. I just had trouble mastering code or I would have gone for a Novice ticket. Later, when the code requirement on a Technician license went away, I still didn't try for it—too busy, too little spare money, and the computer stuff was just too seductive.

A couple of months ago, I decided to try again. But this time, I used the Internet as my resource tool and surfed up a few dozen Web sites, including question pools and testing sites. I cranked myself up and took my test. I got my callsign a week later, my new Yaesu VX-5R arriving the same day. I had been listening on a scanner for weeks beforehand, and knew a lot of the voices already, and I knew who I would try to talk to before I keyed the mic for the first time.

"On the [Inter]net, an activity that takes a week is a lifetime.... It took that long for me just to get my license after passing my test, and that is unusually fast, even nowadays. It used to take* months.*"—KB3DVJ

My lifepartner is also going for her ticket. She takes her test tonight, and may well have her ticket before anyone reads this. But she said something very pertinent to the "Ryan" situation: "This ham radio thing may well teach me patience."

Patience. That's the key. How long did Ryan try to get involved with local hams? How much did he expect and how soon did he expect it? I went through a few days of fumbling before people would talk to me, aside from a couple of "welcome to the hobby" QSOs. They didn't know me, and wanted to see if I would hang around before they would open up to me. Now they have, and I'm being welcomed quite warmly. But one thing I noticed is that things don't happen on the air at Internet speed. It's more like the old Fidonet days: post a message, wait a couple of days to see if someone replies, then post a rebuttal that would take another couple of days to be seen by everyone. Things take *time* in ham radio, from studying for tests to making contacts. You can't do everything all at once like you can in computers.

With the Internet, you simply call up Dell or Gateway, they send you a PC with everything in it, you plug in the phone line, and you're on the Net. There are plenty of portals to hand-hold you onto the Web, including AOL, which bills itself as "easier than programming your VCR." Everything happens at light-speed, with pages popping up in seconds. There are even "instant" messages blipping back and forth, shortening the time gap even further.

On the net, an activity that takes a week is a lifetime. Intimate relationships can start, live, and die online in that time. It took that long for me just to get my license after passing my test, and that is unusually fast, even nowadays. It used to take *months*.

Ryan should take a little time to copy the CW (figuratively, if not literally) before he gets all cranked up that it isn't revolving around him. Ham radio is an awful lot of "waiting to see" between moments of serious fun.

Gwendolyn Patton, KB3DVJ
King of Prussia, PA
<wendy_lyn@unforgettable.com>

It Takes Two to QSO

I read your editorial about Ryan (April) with interest and the letters in response (June) with even more interest. While the letters certainly are not a valid statistical study of hams and their attitudes, I suspect you chose them because they were typical of the letters you received. Let's see what you got: two letters which basically agree with Ryan, one offer of help, and three writers who seem to feel Ryan should be thankful he is among the "deserving," and should go off and find the "magic" himself. A quick check of the *Call Book* shows that those who agree or want to help are Technicians, and those who do not all hold Advanced class licenses. Probably a message here, but I'm not going to touch it.

I suspect that much of the animosity toward Ryan is due to his use of "old men." I'll bet it was deliberate to grab the attention of those who have apparently been ignoring him. Instead of help, Ryan is offered "2 meters is the most popular band"; "you've got to give back, not just take"; and "maybe you'll be lucky enough to socialize with your friends some day."

"I think the lesson is that a major problem in ham radio today is not* getting *new hams but* keeping *them."—KC2AFK

So what if what Ryan has seen on 2 meters doesn't interest him? Surely someone can show him something that does. He can't give anything back until he has had a chance to learn something to give back. And if he drops out of ham radio, he will never find those ham friends he may want to socialize with later in life. I think the lesson is that a major problem in ham radio today is not *getting* new hams but *keeping* them. Here we have four hams (Ryan, his brother, and two supporters) whom we may lose to neglect. The supposedly hard work—getting them licensed—is done. All that needs to be done is to provide a little guidance, which they have apparently taken the trouble to ask for.

Let's face it, it takes at least two people to make ham radio work. Calling CQ is boring. The "magic" starts when you hear your call come back to you. It looks to me like Ryan is calling CQ but no one is answering. And that is a shame.

73,

Dave Ruth, KC2AFK
Millbrook, New York
<druth@ibm.net>

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.*

Basics

What Are "Nets" All About?

Ham radio "nets" have more in common with "safety nets" than "fishing nets," so don't worry if you're caught in one!

Chances are, if you've listened to a repeater (any repeater) for more than a week or two, you've heard some reference to a *net*, or maybe even heard one in operation. Depending on the net, you may or may not have been able to follow what was going on. This introduction to net operation will try to demystify them at least a little bit.

What's a Net?

Simply stated, a net—short for network—is any on-air meeting of hams for a specific purpose. Nets may be formal or informal, "controlled" or "uncontrolled," regularly-scheduled or called up to meet a need. Let's take a look at some of the most common types of nets and some basics of net procedures.

Regularly Scheduled Nets

Traffic nets—Most of these have nothing to do with cars on the highway. Their purpose is to relay written messages ("traffic") from one place to another via ham radio. Many traffic nets are part of the American Radio Relay League (ARRL) *National Traffic System*, or *NTS*, which provides for the orderly flow of traffic from wherever it originates to wherever it's heading.

Emergency preparedness nets—These are training nets for hams involved in emergency communications. They may be sponsored by *ARES* (the ARRL's *Amateur Radio Emergency Service*), *RACES* (the *Radio Amateur Civil Emergency Service*), a local club or a "served agency," such as the Red Cross or the National Weather Service's *SKYWARN* program.

Club nets—These may be on-air club meetings, "swap 'n shop" nets, or gatherings of groups within a club who share common interests, such as technical nets, women's nets, kids' nets, and computer nets.

Most of these nets meet on a regular schedule, daily, weekly or monthly, on a specific frequency at a specific time. They're often promoted on the air by club members or recorded announcements from a repeater controller.

As-Needed Nets

Emergencies and public service events generally don't happen on a predictable schedule, so the nets required to respond to these needs are called up on an *ad-hoc* basis. Here are some of the most common types of as-needed nets:

Nets can be regularly scheduled or as-needed, such as the one conducted during this California earthquake drill. (Photo courtesy AC6EN)

Emergency nets—Something *real* has happened—a destructive storm, a chemical spill, a major accident or some other disaster. Hams respond by starting up a net to marshal resources, deploy stations to where they're needed, and provide necessary communications. This is where all the training in the regularly-scheduled emergency preparedness nets is put to the test.

Public service event nets—Your town is having a parade, a bikathon, or perhaps a swimathon. Hams have been asked to help with communications. They form a one-time net (sometimes more than one) in order to keep all the information flowing smoothly and efficiently.

Weather nets—Not quite a preparedness net, but not yet an emergency net, hams in many parts of the country help track changing weather conditions when severe weather is expected. These nets generally function under either *SKYWARN* or *ARES*.

Net Organization

The structure of a net depends in part on its size, its complexity and whether it is linked to other nets. The simplest form of net is the informal, "uncontrolled," or "non-directed" net. If your club is helping out at a small event in which only three or four stations are participating, there's not too much traffic. Then all participants monitor the same frequen-

cy and call a specific station or location whenever necessary.

If the event is any larger than this, the communication organizers will probably opt for a "directed" or "controlled" net. In a directed net, there is a *Net Control Station (NCS)* who's in charge. All other stations must follow the NCS's procedures and directions (more on this later).

Most "event" nets and many emergency nets allow unstructured, or *tactical,* messages. An example of this would be: "Checkpoint 6 needs more water." Other nets, such as traffic nets and RACES nets, require that messages follow a specific format. These are known as *formal* messages, as they often become part of the written/printed record of an event. Formats vary slightly, depending on what organization is in charge of the activity. Becoming familiar with these message formats is part of your training, along with instruction in net procedures.

Net Procedures

If you're operating in a controlled net, you must follow net procedure. While that procedure may vary slightly from net to net (again, depending on its purpose, size, and complexity), there is one basic rule that covers them all, regardless of type: *Always listen to Net Control.*

In general, all transmissions should be directed to Net Control. If you need to talk with another station, you should get permission from the NCS before calling.

Another basic rule of net operation is to transmit only when necessary and to keep all transmissions brief and concise. If Checkpoint 6 needs more water, just say so. There's no need to explain that one of the big vats that had been filled earlier by the wonderful volunteers from the local fire department had been knocked over by an out-of-control roller-blader, creating a mud pond behind the checkpoint, etc., etc. Nets are also not the place for idle chit-chat with your friends. The net is there for a *purpose* and all communications should pertain to that specific purpose.

Finally, don't leave your post or leave the net without getting permission from the NCS. If you're not there when you're needed, and no one knows where you went, an important message may not get through, and you'll harm ham radio's reputation for dependable, professional-quality communications.

Again, specific procedures may vary with different types of nets, but you'll always be in good shape if you remember the basics: Always listen to NCS, address all transmissions to NCS, wait patiently until you're recognized (unless you have a *true* emergency), transmit only when necessary, be concise, and be sure to tell the net control if you have to check out.

Give It a Try!

While some of this may sound intimidating, it's really just a matter of "learning the ropes," and most experienced hams will be happy to help you out and answer your questions. The NCS is a good person to start with. But unless you're in a training net and questions have been invited, it's usually best to hold your questions until after the net ends.

So, if you want to learn more about the world of ham radio public service and emergency communications—or just to meet some of the hams who live near you—find some of the nets in your area. Listen for a while, then check in. After you get the butterflies out of your stomach, you'll find yourself learning a lot and (hopefully) having fun. ■

Resources

The American Radio Relay League (ARRL) offers several publications that can help you learn more about nets, net operating, and public service/emergency communications. They include: *The ARRL Operating Manual*; *Public Service Communications Manual*; *Special Events Communications Manual*; and the *ARES Field Resources Manual.*

All are available from ARRL, 225 Main St., Newington, CT 06111; Phone: (860) 594-0200; Fax: (860) 594-0259; Internet: <http://www.arrl.org>

In addition, *CQ VHF* regularly covers events and activities in which net operations take center stage.

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 abd 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. Rptr1446.655/70cm. 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 Couty Amateur Radio Club: Meets second Monday of everymonth at Greenfield High School small auditorim, 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. RPTR 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 at <gsara@monmouth.com>, <http://www.monmouth. com/~gsara>, 145.485 -600 pl 151.4. Or call Bob, N2XR, at (732) 495-3437 for further 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, Ohio. June, July, and August, "Picnic Meetings" are held at the Cuyahoga County Metropolitan Park. Repeaters are on 146.82(-), 443.825 & 444.75 (+), 53.83 & 53.01 (+), plus digipeater at 145.07, and 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 Citzens 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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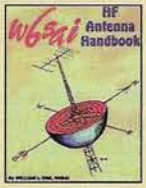

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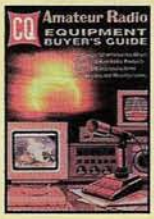

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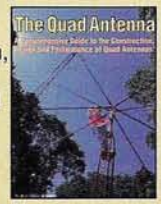

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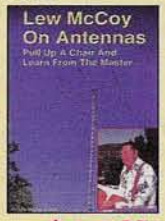

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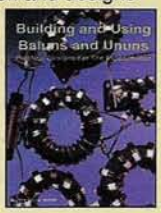

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ble public service-oriented ham club for gay and lesbian hams. Monthly newsletter, HF skeds, Internet listserv and IRC, hamfest meetings, chapters, DXpeditions. Lambda Amateur Radio Club (ALRC), P.O. Box 56069, Philadelphia, PA 19130-6069; E-mail: 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 p.m. at the Tooele County Courthouse, 47 S. Main St. 84074. Meeting room is in Tooele County Emergency Management Conference Room located in the basement of the Courthouse. Access is via the Public Safety Entrance at the Sheriffs Department off of 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: the 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 p.m. at Mt. Vernon Governmental Center, 2511 Parkers Ln., Alexandria, VA. Repeater frequency is 146.655. If interested, write to P.O. Box 7234, Alexandria, VA 22307, or contact Bob, KT4KS, at (703) 765-2313.

WV, Charleston, Kanawha Amateur Radio Club (KARC): Meetings held 1st Friday of each month at 7 p.m. at the South Charleston City Hall Annex, 4th Avenue and D Street in South Charleston. Weekly Sunday net at 8:30 p.m. local on 145.35 W8GK club repeater. Mail to KARC, P.O. Box 1694, Charleston, WV 25326. For more information, contact N8TMW, Jim Damron, Publicity Director, at: <n8tmw@arrl.net>.

WV, Plateau Amateur Radio Association (PARA), Oak Hill, WV: 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 at 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

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>.

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